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ALLOCATION OF RESOURCES WITHIN MIXED FAMILIES

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Is Parental Love Colorblind? Allocation of Resources within Mixed Families

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Abstract

Studies have shown that differences in wage-determinant skills between blacks and whites emerge during a child's infancy, highlighting the roles of parental characteristics and investment decisions. Exploring the genetics of skin-color and models of intrahousehold allocations, I present evidence that, controlling for observed and unobserved parental characteristics, light-skinned children are more likely to receive investments in formal education than their dark-skinned siblings. Even though not denying the importance of borrowing constraints (or other ancestry effects), this suggests that parental expectations regarding differences in the return to human capital investments may play an *independent* role on the persistence of earnings differentials.

Keywords: intrahousehold allocations, skin-color and racial differentials, parental investments in children.**JEL codes:** D13, J13, J15, J71.

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Disclaimer: Throughout the text the terms *mulato* and *miscegenation* are used despite their negative connotation. They are used to reflect historical and contextual conventions and not a political statement by the author or institutions to which he is affiliated.

"My father was also belligerent toward all of the children, except me. (...) I've thought a lot about why. I actually believe that as anti-white as my father was, he was subconsciously so afflicted with the white man's brainwashing of Negroes that he inclined to favor the light ones, and I was the lightest child. Most Negro parents in those days would almost instinctively treat any lighter children better than they did the darker ones. It came directly from the slavery tradition that the mulatto, because he was visibly nearer to white, was therefore better."

excerpt from The Autobiography of Malcom X as told to Alex Haley, Chapter 1.

1 Introduction

A number of studies detect significant association between individual characteristics used to infer ethnic ancestry and various measures of socioeconomic success.[1] In the United States, Brazil and South Africa, for example, the intense trade of African slaves by English and Portuguese colonizers, and the Dutch displacement of indigenous populations made the color of one's skin an indicator of European ancestry and play a key role in social stratification.[2] This historically-rooted stratification remains stark in those three countries, particularly in the case of labor markets, despite the sharp differences in patterns of economic development, institutional arrangements regarding racial segregation, and observed rates of miscegenation.[3]

[1]Bertrand and Mullainathan (2004) provide experimental evidence that (randomly selected) firms in the United States are less likely to interview job-applicants with distinctively black names (see also Fryer and Levitt, 2004a). Using cross-sectional observational data, Goldsmith et al (2005), Gyimah-Brempong and Price (2006), Hersch (2006), Hunter et al. (2001) and Keith and Herring (1991) all find suggestive evidence of a complexion gap in terms of wages, legal punishments, education and unemployment among African Americans. Hammermesh and Biddle (1994) and Biddle and Hammermesh (1998) find evidence of appearance premia. Their reasoning could also be applied to hair curliness, nose width, lip thickness, steatopygia, and to any of the physical traits that can be linked to membership in the black or white ethnic groups. In fact, when the Apartheid regime was introduced in South Africa, skin color and physical traits were used in combination to establish the classification system imposed by government officials.

[2]There is anecdotal evidence that skin color also plays a role in social hierarchization among Latin Americans of indigenous decent (*mestizos*) as well as among populations in South and Southeast Asia. Most studies are specific to the experience of those populations in the US (see Herring et al. 2004 and Allen et al. 2000). Hall (1995) mentions in passing the role of skin color among the Indian Hindus. The present study is solely focused on the color gradation originated by the mixing of European whites and African blacks, and remains silent with respect to the impact of skin color among those populations.

[3]See Alexander et al. (2001) for a three-country perspective. See also Herring et al. (2004) and Telles (2005) on the North-American and Brazilian experiences. Analysis of US historical data can be seen in Bodenhorn (2003),

There are a number of factors that could explain skin-color differentials in the labor market context. It is possible that dark-skinned individuals receive lower wages, are less likely to be employed, or have limited access to certain jobs due to discrimination. Alternatively, observed differences may be the result of darker-skin individuals' relatively lower investment in the accumulation of skills, which translates into a scarcity of economic opportunities. These are not mutually exclusive. If skills are not fairly rewarded, members of the group discriminated against have less incentives to invest in them.[4]

Findings from recent studies tend to emphasize the role of human capital investments, showing that differences in skills between blacks and whites emerge during infancy, affecting both cognitive and non-cognitive aspects of child development.[5] Since such early investments reflect the decision of parents, if knowledge about the interplay of achievement differences and differential investments in human capital is to be advanced, patterns of familial investments on young children need to be better understood.

Those findings also highlight the fact that differences in labor market performance are likely to persist across generations, either because minority parents face constraints that non-minority parents do not, or because the former have, in relative terms, negative expectations regarding the usefulness of investments in human capital. Policy prescriptions are likely to be different if racial differences are explained by family background, such as borrowing constraints, or if they are explained by differences in expectations regarding returns to investment (see Lazear, 1980). If the explanation of the relatively low levels of schooling rests on imperfect capital markets, subsidized loans for minority education should be prescribed. If the source is differential returns, subsidized loans would not be the adequate policy, and the government action should be concentrated on policies to curb labor market discrimination.

Empirical applications targeted at identifying the forces behind minority parents' underin-

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Bodenhorn and Ruebeck (2005), Dollard (1937), Freeman et al. (1966), Hill (2000), Ransford (1970), Reuter (1918) and Seeman (1946).

[4] See Carneiro et al. (2005), Heckman (1998) and Neal and Johnson (1996).

[5] See Carneiro et al. (2004) and Levitt and Fryer (2004b).

vestment in human capital are plagued by the fact that predictions derived from different assumptions are, in general, observationally equivalent. Take the case of borrowing constraints, for example. Minority parents may face borrowing constraints that limit their ability to invest in their children. Current racial differentials on income from labor are then transmitted across generations via under-accumulation of skills. If it is assumed that employers statistically discriminate (disadvantaged groups are considered less likely to have invested in skills), this equilibrium is self-reinforcing. Employers' beliefs regarding reduced productivity among minority workers are, on average, confirmed by draws from the respective population (as elegantly modeled by Antonovics, 2006 and Blume, 2006). Notice, however, that the same implications can be derived from models in which, instead of borrowing constraints, the focus is on parental expectations of employers' discriminatory behavior, or even genetic transmission of tastes and cognitive ability. This is because in these models wage determination is related to ancestry, with family connections unambiguously determining membership in different ethnic groups. Hence, any empirical examination of differences in human capital investment *across* families is bound to capture the role of *all* family-level characteristics, be they observed or not.

In the present paper I attempt to untangle some of these effects by considering the following thought experiment. Employers are assumed to, at the time of a job interview, base their expectations on appearance (phenotype) and its connection to ancestry. In particular, skin color is a noisy signal used to infer family background. Of course, in the case of complete segregation in marriage markets and totally endogamic marital associations, skin color and race are expected to be perfectly matched. In a contest of significant miscegenation in marriage markets, however, connections between ancestry and appearance are less straightforward. In particular, identical family backgrounds (genetic, social, or financial) are shared by siblings of different appearance. Therefore, mixed-race families offer an interesting laboratory for the examination of the persistence of skin-color-based differences in labor market outcomes.[6] I explore this insight on the analysis that follows.

[6] See Campbell and Eggerling-Boeck (2006) and Lopez (2003) for a discussion on the rapid growth of mixed-race families in the United States. See also Fryer (2006).

In essence, the present paper is based on the examination of how mixed-race families, through parenting practices and decisions, mediate the impact of society-wide skin color differentiation ("pigmentocracy system") over their children. The analysis has to consider different conceptual ways by which welfare optimizing parents may generate systematic differences in the patterns of investment depending on skin color:[7] i) they may respond to differences in expected returns to human capital investments; ii) they may respond to differences in the costs of those investments (including opportunity costs); iii) parents may simply prefer one skin color over another (evaluate identical outcomes differently). The interesting questions here are: Do parents operate so as to maximize or minimize the effects of genetic endowment of "whiteness" on earnings? Do parents fully compensate darker-skinned kids for the steeper social ladder they face?

This discussion clearly resonates with the ongoing debate within the United States regarding the future of racial and ethnic inequality. How are multiracials going to fit into what Campbell (2007) calls the North American system of "racial privilege and oppression?" Is the growth in the number of multiracials triggering a stratification system that resembles the Latin American three-tiered system based on skin color (with the addition of a honorary white group), or would they be incorporated on the binary system that prevails today?[8] Motivated by this Latin Americanization discussion, I focus my analysis on data from Brazil containing specific information on skin-tonalities within and across families.[9] These are unique features of the Brazilian racial classification system and data collection that, combined with random aspects of the genetics of skin color, can be used to shed light on the inner workings of skin color differentiation.

Moreover, Brazil is an interesting case on its own. Even though the high rate of interracial

[7] This reasoning follows the case of intrahousehold gender differentials. See Behrman et al. (1986).

[8] See Bonilla-Silva (2002), Campbell (2007), Gans (1999), and Yancey (2006).

[9] There are data sets in the United States that contain information on skin color. Historical censuses (1850 to 1930) use the mulatto classification. Most variations within families in those data come from children fathered by different men, however. Others like the National Survey of Black Americans collected information on three generations: child, parent and grandparent. These do not provide information on siblings that I explore in the present study. More recently, the National Survey of Adolescent Health (Add Health) has collected skin color information on their main teen-respondent, again not providing information on siblings' color. Finally, the New Immigrant Survey of 2003 also collected information on skin color. I have identified 182 children (brothers and sisters) in that sample that have different skin tonalities. The small samples have prevented me from applying the analysis that follows to those data.

marriages and the consequent high proportion of mixed-race individuals in the population (*mulatoes* or *browns*) are frequently cited indicators of racial tolerance, there is evidence that they coexist with pertinent differences between whites and non-whites in terms of wages and other measures of living standards (see Arias et al., 2004; Campante et al., 2004; and Telles, 2005). A recent publication by the World Bank (see Perry et al., 2006) extended that analysis and presents evidence that returns to schooling (in terms of wages) among dark-skin individuals are 1 to 3 percentage points lower than among whites. These findings have put racial inequality on the forefront of the Brazilian policy agenda. In fact, a recent Human Development Report (United Nations, 2005) states that skin-color differences in economic achievement is the main social challenge facing Brazil, suggesting that anti-discrimination policies should be a central component of any poverty reduction program implemented in that country. As with many governmental interventions, the effectiveness of these redistribution policies will ultimately depend on the variation of individual characteristics within and between families, and on intrafamilial rules regarding the allocation of resources (which may either reinforce or attenuate their impact).[10] This is particularly relevant when mixed-race families represent a large fraction of the population, since they introduce intra-family variation in skin tones into the picture.[11]

Using data from the Brazilian 1991 Census of Population, I find that light-skinned children (ages 5 to 14) are 0.6 percentage points more likely to be enrolled in school or pre-school during a particular year than their siblings of darker skin tones. A dark-skinned five-year old child is approximately 2% less likely to the enrolled in school or pre-school than his/her lighter-skinned biological sibling, for example. These figures amount to 49.3% of the raw difference between white and non-white children in mixed-color sibships. Back of the envelope calculations also suggest that the compound effect of this difference would be that, at age fifteen, a child of light skin tone is

[10]See Sheshinski and Weiss (1982) for an insightful exposition.

[11]Interest on the intrafamily impact of phenotypic differences goes beyond socioeconomic studies, however. Psychologists have shown that the sense of identity and group membership for children at young ages is a very important aspect of their non-cognitive development. In mixed-race families variations in skin color may directly impact children and their identification with respect to different cultures and peers. See Brunsma, D. L. (2005), Rockquemore and Laszloffy (2005), and Shih and Sanchez (2005).

approximately 6.5% more likely to have completed primary school than his/her darker-skinned sibling (assuming no differential grade retention and time-independent enrollment probabilities). This long term effect in the accumulation of human capital is confirmed by examination of attainment among co-residing older siblings (ages 17 to 25). These data reveal that dark-skinned young adults are 5.7% less likely to have concluded primary school than their light-skinned siblings. These effects are particularly strong for boys, following particularities of the observed returns to schooling. Even though not denying the importance of borrowing constraints (or other ancestry effects), this novel result suggests that parental expectations regarding differences in the return to human capital investments (according to skin color) may play an *independent* role on the persistence of education and earnings differentials.

Using an alternative (but much smaller) data set, from the 1989 Brazilian Survey of Nutrition and Health, I also find evidence that, conditional on enrollment, light-skinned children are more likely to attend private schools. On the other hand, there is no evidence of differences in nutrition and disability, in particular for birth outcomes that are determined before the child's skin color is "revealed" to parents. Suggestive evidence on intrafamilial contracts that compensate darker kids for the underinvestment in human capital, as proposed by Becker and Tomes (1976), was also found. Lighter-skin individuals are more likely to host (in their independent household) darker-skin siblings later in life (age 21 and older), which I interpret as compatible with compensatory transfers denominated in housing services. Moreover, according to data from the 1985 Brazilian Household Survey (PNAD), non-white 10 to 17 year-olds are more likely to coreside with their mothers than their white siblings, once again increasing darker children consumption of home and board (relative to their lighter siblings). These results point to the importance of family economics for the understanding of racial and skin color differences.

The remainder of the paper is organized into four sections. In Section 2, I present a simple conceptual framework and discuss empirical implications. Section 3 discusses the genetics of skin color and describes the data set. Section 4 presents the econometric evidence and assesses the robustness of the findings. Section 5 concludes and discusses extensions left for future research.

2 Conceptual framework

This section describes, in simple theoretical terms, major aspects of decision-making regarding intrahousehold allocations of investment in the human capital of children with different phenotype (skin color in particular). I draw from the literature on intrahousehold allocation of resources and gender differentials, in particular from the seminal contributions of Becker and Tomes (1976), Behrman et al. (1982) and Rosenzweig and Schultz (1982).[12] I use the conceptual framework, which is based on the impact of investments in the quality of children for a given quantity, to guide the reduced-form empirical analysis that follows.[13]

Consider the case in which parents are concerned with the distribution of earnings among their children.[14] Investment decisions are taken exclusively by parents in an environment under complete certainty regarding returns and costs of education, but formal credit is not available. Children are assumed not to have any decision-power within their families. Finally, parental consumption is assumed separable from children's future earnings, so that investments in schooling (s_i) are chosen in order to solve the following optimization:

$$\begin{aligned} & \max \quad V\left(c_t; k\right) + \beta\left[V\left(c_{t+1}; k\right) + U(e_1, ..., e_n; k)\right] \\ st \quad : \quad & \sum_{i=1}^{n} p_i s_i = I - c_t \\ : \quad & c_{t+1} = \sum_{i=1}^{n} e_i \\ : \quad & G(e_i, s_i; d_i, x_i, \phi) = 0 \end{aligned} \tag{1}$$

[12] See also Berhman et al. (1986) and Behrman (1988).

[13] I return to the discussion on quantity of children in the conclusion.

[14] Even though I refer to these as earnings, what I have in mind is what Behrman et al. (1986) considers "human-capital-dependent income." This concept captures the impact of human capital investments on assortative mating in the marriage market (more education increases the chance of marring a high-earnings individual), for example.

where c is consumption, e_i represents child-i's (potential) earnings, where β is a discount factor, and κ summarizes family characteristics that influence tastes. In terms of constraints, p is the price of schooling investments (which may include school fees or wages from the sale of child labor, for example), I is exogenous parental income, x represents child characteristics, d is the phenotype and ϕ summarizes technical relations that may be family-specific or basically reflect genotype's role on such convex technology. Implicitly, I assume that there are no options in terms of savings aside from investment in the education of children.

First order conditions for interior solutions indicate that the optimal allocation of investments between child i and child j should follow:

$$\frac{p_i}{p_j}\frac{\frac{\partial e_i}{\partial s_i}}{\frac{\partial e_j}{\partial s_j}} = \left[\frac{V'\left(\sum_{k=1}^{n} e_k\right) + \frac{\partial U}{\partial e_i}}{V'\left(\sum_{k=1}^{n} e_k\right) + \frac{\partial U}{\partial e_j}}\right] \tag{2}$$

where V' is the marginal utility of consumption, and $\frac{\partial e}{\partial s}$ depends on the transformation function $G(.)$.

The outcome of the decision process ultimately depends on assumptions regarding the form of utility functions (in particular regarding the differential treatment of offspring), differences in costs/prices and technical relations (differences in returns to education). Diagrams 1A to 3A, represent possible outcomes regarding the distribution of earnings between child i and child j, for the case of identical net-returns. The diagrams depict an earnings possibilities frontier and the parental iso-utility curve. Diagram 1A represents parental utility that is symmetric, Diagram 2A represents parents that are inequality averse, and Diagram 3A depicts parents that happen to favor child i. In these three cases, investment will only be differential in case 3A, when child i will be more likely to receive investments in education than her/his sibling.

One can also consider the case when net-returns may be different when siblings have different skin tones. Consider for example that child i is white and child j is non-white. Diagram 1B to 3B depict three cases considering the parental utility functions introduced in the examples above.

These diagrams suggest that, except in the case of parents that exhibit inequality aversion (2B), families will end up with the white child earning more than the non-white, as observed in the general population. In this case, however, such an observation does not necessarily imply that parents prefer to treat children differently. It could imply that the same educational investments yield different earnings due to differences in returns. Parents face in this case an equity-efficiency trade-off. In Diagram 2B, for example, families averse to inequality are forced to invest more in the education of the non-white child in order to counterbalance the differential way in which labor markets treat their children. In the case of parents in Diagram 1B, efficiency considerations generate differential investments that favor the white child.

a) *On the role of non-human-capital transfers*

Parents may also consider the distribution of non-labor income. That is to say, decisions of investments that influence the accumulation of human capital (which affect earnings) may be complemented by the ones regarding the allocation of non-human capital. In contrast with the version seen above, consider that parents care about their children's living standards. Improvements in well-being can be reached either by increasing their earnings (via investment in human capital) or by transfers of non-human capital (see Becker and Tomes, 1976). In this case, parents may devise strategies to maximize the returns to their investments in human capital and target equity using non-human capital, bypassing the efficiency-equity trade-off. In the present case, these can be achieved with transfers via implicit contracts between siblings (with or without parental intermediation).

The child-welfare portion of the parental utility function can be re-written to reflect that possibility:

$$U^w = U(e_1 + \delta t_1, ..., e_n + \delta t_n; \kappa) = U(w_1, ..., w_n; \kappa) \tag{3}$$

where t represents non-human capital transfers and δ represents its conversion into units of earnings.[15] Maximization is subject to the same constraints as above. Since I have ruled out other

[15]An interesting variation here would be to allow siblings to be different in their "ability" to convert assets into non-labor income (i.e., child-specific δ's).

assets, this basically corresponds to a redistribution of resources among siblings via taxing and transfers (and, therefore, sum up to zero in the budget constraint).

Diagram 4 summarizes the result of the maximization process for parents with symmetric preferences. The interesting implication in this case is that, independent of preferences, parents will maximize returns to investments in human capital. Equity considerations, or preferential treatment for that matter, are undertaken through transfers of non-human capital. The inclusion of transfers allow parents to operate beyond the autarkic solution derived in the separable case.

b) *On the role of risk*

It is well know that the decision of how much to allocate to education is taken facing considerable risk. In fact, there are reasons to believe that investments in human capital are riskier than in physical capital, specially considering that the former cannot be traded separately from its owner.[16] There are a number of channels that can be activated in the simple model presented above in order to illustrate the role of uncertainty. In particular, consider three major sources of riskiness faced by parents: i) input-effectiveness risks: resulting from imperfect knowledge about an individual child's ability that determine the impact of additional education on earnings; ii) market-return risks: resulting from uncertainty regarding how future demand conditions will affect returns to each additional year of schooling, and; iii) default risk: children favored by human-capital investments may default on the agreement to reallocate resources later in life.[17] Of course, considering differences by skin color, the important aspect to keep in mind is to what extent those risks are correlated with the darkness of a child's skin.

A simple parametrization of the model above that emphasizes riskiness of investments in darker skin children due to expectations regarding some level of demand-side color discrimination

[16]See seminal contribution by Levhari and Weiss (1974). Differential riskiness of investments in human capital within the family, and its impact on intrahousehold allocations have not been considered by the literature.

[17]This is also relevant when investments in children are targeting old-age security. Social norms defining the role of first-born children or daughters as "providers" for elderly parents may be the only enforcement available, for example.

can easily be implemented.[18] The message of such model is simply that expected discrimination, or increased variance in returns for darker children, may depress investments in their education. Parents that have concave preferences in consumption will prefer to invest relatively more on the lighter child, even if the average return is the same for every child. Default risk will operate in a similar fashion, but will produce the opposite effect. In the case of average returns that favor lighter individuals, default risk will tend to favor increased human-capital investments on the darker child. Some exploratory evidence on skin-color differences in the riskiness of investments in human capital is presented below.

3 Data, genetics of skin color, and descriptive statistics

3.1 *Data*

The main data set used in the present study is the 1991 Brazilian Census of Population (*Censo Demográfico, Instituto Brasileiro de Geografia e Estatistica - IBGE*). The public use data, available for purchase from the IBGE web-site, consists of 10 percent samples of the population for localities with more than 15,000 inhabitants and 20 percent samples otherwise. The interviews were undertaken on private households, and collected information on the dwelling's construction, general living standard measures related to access to basic public services, and to the ownership of assets and durable goods. With respect to individual characteristics of each household member, a knowledgeable adult (most frequently the spouse of the household head) was asked to report basic demographics, migration, school enrollment and educational attainment, fertility history (for women 10 and older) and sources of income.

Considering the particular interest of the present study, the 1991 Census maintained the structure used in other editions and asked respondents to report individual members' "skin-color or race," reflecting the Brazilian social norm that skin-color and race are interchangeable concepts.[19]

[18] See appendix.

[19] In fact, until the 1990's, on both censuses and household surveys the question was literally phrased as "what is your skin-color?," without any explicit reference to race.

For the skin color question, respondents were given five options: white, black, indigenous, yellow (Asian), and brown. Indigenous and Asians are a very small fraction of the overall population (0.6%), and geographically concentrated in the North and Sao Paulo regions, respectively. In the analysis that follows I have dropped any household in which at least one member was reported to be in either of these two groups. Moreover, in order to reduce confounding effects from individuals of mixed indigenous descent being classified as brown, I have dropped data collected from the Northern sector of the country. Finally, since individuals classified as blacks amount to 5% of the population, I include them in the non-white group and use this dichotomous classification in most of the empirical exercises below.[20] The samples used in the main analysis are focuses on biological children of the household heads between ages 5 and 14.

These data allow for two distinct definitions of mixed families. The first considers mixed families the ones that result from marriage of individuals of different skin-color groups or of two individuals of mixed decent themselves (*mulatoes*), independent of the skin-color of their children. The second definition does not take into consideration the skin-color of parents and is solely based on the existence of siblings at different points of the color classification spectrum. In what follows, I refer to these as mixed-families and mixed-sibships, respectively. Even though these two definitions may be combined, the main empirical strategy in this paper is based on the second.

In order to assess the robustness of the findings, I have also examined data sets from alternative sources, such as the 1989 Brazilian Survey of Nutrition and Health (BSNH), available for download from ICPSR-University of Michigan; the 1985 wave of the Brazilian Household Survey (PNAD, IBGE);[21] the 1995 Data Folha Survey on Skin Color and Race Issues (Pesquisa 300 Anos de Zumbi, Data Folha); and the socioeconomics questionnaire attached to the 2005 Brazilian National High-School Examination (ENEM, INEP).

[20]Descriptive statistics presented below further justify this dichotomization.

[21]As in the case of census data, PNAD is available for purchase from the IBGE web-site.

3.2 *Miscegenation and socioeconomic differentials*

One of the most striking features of the Brazilian racial context is that it is based on somewhat contradictory observations. On one hand, there is widespread miscegenation in marriage and housing markets. On the other hand, and in sharp contrast with the image of tolerance portrayed by miscegenation, there are stark and persistent inequalities in socioeconomic outcomes among skin-color groups. Telles (2005) provides a detailed description of this contradictory evidence. In this section I present some overall patterns based on my working sample from the 1991 Census data.

a) *Miscegenation in marriage markets*

Rates of marriage between individuals of different skin color is remarkably high in Brazil. Raw numbers for male and female heads of household are presented in Table A1. Quite different from the case of the United States and South Africa, mixed marriages correspond to approximately 20.4% of all marriages listed in 1991 for women and men between ages 21 and 45 (with two children or more). These data indicate that 21.6% of married white women were matched to non-white men, while 18.9% of non-white women were married to white men. These figures are approximately twenty times the ones observed in the United States.[22] Most mixing in marriage markets tend to happen for groups next to each other in the color spectrum (white-mulato/mulato-black) and reveal some limits to the image of miscegenation, however.

Haloing the same lines, Table A2 presents the results of miscegenation in terms of progeny color diversity. Looking at child-level observations in the working sample, around 10.7% of the white children have a non-white sibling. The corresponding figure for non-white children is 12.3% and 3.3% for mulatoes and black children, respectively. It is this within-sibship mixing that allows the estimation of skin-color differences I discuss below.

b) *Color differentials in socioeconomic outcomes*

[22] See Charles and Luoh (2006) and Fryer(2006).

Figure 1 depicts the cumulative distribution function for years of formal schooling for whites. browns and blacks. The evidence is based on educational attainment for men and women between the ages of 25 and 70. The bulk of the sample, for both men and women, has eight years of education or less (i.e. at most completed primary). This is particularly true among non-whites: only 10% of the colored population study beyond primary school. The corresponding number among whites is approximately 26%. In fact, in terms of high school completion the gap between whites and non-whites was widening among more recent cohorts (not shown). Figure 2 presents disparities in log-hourly-wages. Once again, differences are quite stark. The wage gap ranges from .5 to .7 log points for most of the cohorts. A remarkable feature of this evidence is that in pretty much all cases level-outcomes for browns and blacks seem indistinguishable. This suggests that the analysis of socioeconomic differences can be pretty much summarized in a dichotomous classification (white/non-white). This is, in fact, the standard procedure among labor economists and other social scientists studying racial differentials in Brazil (see Campante et al, 2004 and references therein).

Figure 3 turns to a slightly different aspect of wages and educational differentials. It presents (somewhat naive) estimates of returns to schooling using simple gender and skin-color specific regressions of log-wages on a second-order polynomial on age and educational attainment dummies (sample of individuals 30 to 55). For each year of completed education, the average wages for whites and non-whites are reported (age is held constant at 35). In addition, the difference between the average for these two groups is also plotted (right-axis). The patterns reveal that differential returns favoring whites are particularly prevalent among males. In fact, for a range of education accumulation (1 to 7 years), returns to non-white females are actually higher than for white females.[23] No corresponding pattern is found among males. These findings seem very much in line with results presented by Arias et al. (2004) and Perry et al. (2006). Using more sophisticated models and also controlling for parental education and school quality, they show that the returns to an additional year of education is 1 to 3 percentage points higher for white than for non-white males.

[23] A possible explanation for the difference between males and females in terms of skin-color differentials is the occupational structure of the Brazilian economy.

I have also assessed differences in riskiness in ex-post returns to schooling. Estimation of Mincerian equations at each percentile of the wage distribution are combined to form the sample density function for the observed returns to schooling. I then take the difference between the 90th and 10th percentile of this distribution to reflect riskiness in the returns to each additional year of education (implicitly, this assumes that individuals cannot predict the section of the wage distribution they will be at). The results are quite suggestive. White males face a 2.2% range in returns to education, compared to 4.2% among non-whites. Among females the picture is different, with white women facing a 4.2% while non-white face a 3.7% interquartile range.[24] I interpret this simple estimates as indicating risks in returns to schooling that are relatively higher for non-white men, but not different for white and non-white women. Therefore, not only non-white men face lower returns on average, they also face higher risks. This should depress incentives to investment in education among members of this group.

Next, I examine returns to educations in terms of increases in employment probability. In this case, the differences between men and women are even more striking. Each additional year of education help male whites 0.25% relatively more on average (significant at 1% level), while for women more education has a higher return among non-whites: 0.75% per year (also significant at 1% and possibly reflecting outcomes in the marriage market that may favor white women or the simple fact that the latter are less likely to participate in the labor force). I also find, however, that education reduces the probability of single household headship among non-white women by more than among their white counterparts, particularly until the conclusion of primary school.

I conclude the analysis in this section by presenting cumulative changes in relative returns to education using a finer definition of skin color groups. In particular, relative returns are measured for whites versus mulatoes and for mulatoes versus blacks (Figure 4). Interestingly, what emerges from this analysis is similar to what is seen on the comparison of levels of education and wages:

[24]These differences conform with the ones in terms of coefficient of variation. White males face a 7.6% variability while non-whites face a 11.6% one. Among women the contrast is more muted, with variability being 8.2 and 9.8% for whites and non-whites, respectively.

whites have advantage over mulatoes, but outcomes for mulatoes and blacks are quite similar.

Taken together, the descriptive statistics presented in this subsection suggests two particular hypotheses that can be confronted with patterns of skin color differentiation within the household. First, sisters should be less likely to be treated differently than brothers. Second, white-mulato sibships should reveal bigger discrepancies than mulato-black sibships. Below, I find evidence that is compatible with both observations and, therefore, also with the child-investment characterization discussed in the conceptual section.

3.3 *The genetics of skin color*

Skin color is determined by facultative and constitutive factors. The first have to do with variations in the environment and exposure to sunlight. These factors are mostly studied by anthropologists interested in the evolution of human populations at different parts of the globe and by medical researchers focusing on ethnic differences in patterns of skin cancer, and photo-chemical breakdown of folic acid in the blood or regulation of vitamin D storages.[25] Constitutive factors represent the genetic endowment but, even though they have intrigued biologists for centuries, the most significant knowledge about its workings have only been gathered since the early 1990's (see Barsh, 2003; Ress, 2003; and Sturm et al., 1998).

Skin color genetic make-up is the result of the concentration of three pigments: melanin (the brownish *eumelanin* and the yellowish *pheomelanin*), hemoglobin on red blood cells in superficial vasculature, and carotenoids (controlled by dietary intakes). Melanin is the most important of the three, particularly in the case of inferred association between skin color and European/African ancestry studied in the present paper. Melanin synthesis happens within cells named *malanocytes*, and in organellles called *melanosomes*, from where is secreted into the epidermis. The quantity of *malanocytes* is fairly constant across individuals of different ethnic origins, so that genetic variation in skin color is determined almost exclusively by type, size, shape and concentration of *melanosomes*.

[25] See Diamond (1994), Dunn and Dobzhansky (1958), King (1971), Parra et al. (2004), and Relethford (1997).

While type, shape and distribution of these elements are fully determined genetically, their size can be affected by environmental conditions (sunlight incidence in different geographic locations).

Most scientists believe that the synthesis of melanin is controlled by three to six genes with two alleles each.[26] This means that simple notions of genetics can be applied to the analysis of skin color variation. Polygenic inheritance guarantees, however, that alleles are not truly dominant or recessive and may generate a large number of intermediate cases. Most interestingly, heterozygotic individuals when interbreeding may generate offspring that are either lighter or darker than themselves. As an example, I present in Diagram A1 possible skin-color outcomes when two parents of intermediate color procreate.

In general, the probability that two parents of same skin color having kids that are either darker or lighter than themselves ranges from 50% to 67.5% (except for the ones that are either 100% black or 100% white, of course). One could also examine other patterns of matching and procreation. When mothers of different skin colors (yet neither white nor black) have children with fathers of intermediate skin tone, the probability that a child is outside the interval limited by each parent's color ranges from 12.5% to 35%, for example. Partners of different skin colors have children with 0 to 17.5% chance of being lighter than their mothers (assuming that mothers are the lighter parent) when individuals intermarry across adjacent tonalities. In sum, these figures indicate that mixed-color marriages are likely to generate quite elaborate skin-color distributions among their children.

Of course, most of the variation predicted by the genetics of skin color is based on correct assessment of skin color in first place. This is unlikely to be the case, since reports of skin tones in a survey context are also determined by social conventions. In fact, recent research based on Y-chromosome and mitochondrial DNA (mtDNA) of self-declared male whites in Brazil indicate that 60% of their matrilineal genes are from African origin.[27] In essence, Brazilian whites are

[26] Most recent breakthrough in this area was published in December 2005, see Lamason et al. (2005) - Science Vol 310, pp.1782-1786. The article presents evidence that the gene *SLC24A5* accounts for between 25 and 38 percent of the skin color differences between Europeans and Africans.

[27] See Carvalho-Silva et al. (2001) and Pena et al. (2000).

expected to actually be, in genetic terms, very light Mulatoes. In the analysis that follows I assume that, since an individual respondent assesses all members of the household, skin color classifications reflect meaningful differences between children and/or parents. One should not expect, however, that distributions predicted by the genetic inheritance examples above be exactly observed in the data. Nonetheless, they are expected to provide reasonable guidance on the realm of possibilities.[28] Concerns regarding biases on the report of skin color in the data used in the present study are thoroughly examined in the empirical session below.

3.4 *Descriptive statistics*

Table A3 presents general observed characteristics of families of two or more children by sibship skin-color mix. It also reports individual characteristics of parents. In general the figures in the table reproduce the skin-color differences in living-standards suggested by previous education and wage differentials. In this case, however, mixed-color sibships can be considered a distinct group. All-white sibships have better housing conditions and more access to public services. All-non-white sibships lag far behind, while the mixed-color group is at intermediate levels. Non-white and mixed sibships are more likely to be concentrated in the Northeastern region of the country, which is consistent with historical patterns of mixing and settlement of population originally from Africa. For all four groups, husbands are on average 37 years old while wives are three years younger. In all cases except all-white, the average female education is higher than male's, reflecting a characteristic that distinguishes Brazil from other developing countries (in particular in Asia and Africa): women are more educated than men, and this difference in educational attainment has consistently widened since the 1980's (see Beltrao, 2002).[29]

Most importantly, in a significant number of cases, families have children classified as having different skin colors. This occurs more frequently among mixed-color couples, but also among

[28] See Rangel (2007) for a general discussion on skin color misclassification.

[29] Notice that in the case of literacy rates women have advantage with respect to their husbands even amomg white-only couples. This suggests that the differences in average years of education among whites are affected by outliers.

same-color ones. This reflects the fact that skin-color information gathered through surveys does not correspond to genetic-based measures. Two white individuals can reproduce to have white and non-white children if they happen to be genetically non-white in first place. The data also shows that two mulato individuals are more likely to have children of different skin colors. Considering these facts, the numbers presented in Table A3 seem to conform with predictions from genetic endowments.

The characteristics of children in these different families are presented in Table A4. In general, the pattern observed for adults is reproduced in this case. Children in all-white sibships are more likely to be enrolled in school as well as to have more years of schooling than their counterparts in all-non-white sibships. Children in white/non–white sibships are in between these two groups in terms of the education outcomes, while mulato/black sibships resemble all-black sibships. The figures in the table also reveal that white children in mixed-color sibships are more likely to be enrolled but have less years of education than their non-white siblings. A word of caution on the interpretation of the latter numbers is necessary, however. Non-white children in these families are also more likely to be older, so that it is not clear if in a multiple-variable analysis these differences would be confirmed.[30] In fact, Telles (2005) presents evidence that in a sample of mixed-color sibships, a test of difference of means reveals that the grade-for-age score is higher for whites than for non-whites.

[30]Some biology studies suggest that female and younger children are more likely to be lighter than males and older children. This may very well reflect conscious decisions by parents, using specific stopping rules and targeting a particular color composition of their progeny (I further discuss this in the conclusion and in a companion paper). There is also evidence that only after the 6th month of age children will have their adult-life skin color defined. See Sturm et al. (1998) and Park and Lee (2005). Although mothers reporting skin color for their children would most likely report and "average" tone against a common standard, in the empirical exercises below, when comparing children of white and non-white skin, I always control for age and gender in order to net out the impact of the latter on skin color classification.

4 Econometric results

4.1 *Basic setup*

I explore reduced-form demands for schooling of children motivated by the conceptual framework presented in section 2. Consider the following linearized version in the case of child i in household h:

$$s_{ih} = \alpha_0 + \alpha_1 d_{ih} + \alpha_2 X_{ih} + \mu_{ih} \tag{4}$$

where d is the skin-color (1 is white), and X is a vector of individual characteristics (gender and age). In this formulation, the indicator of child skin color captures all the impact from returns or costs of investments in schooling, as well as confounding factors originated by the omission of parental and familial characteristics that have a direct impact on schooling decisions and are correlated with one's skin color.

The specification is then augmented to include observed household-locality factors such as income, parental characteristics and regional prices (Z_h):

$$s_{ih} = \alpha_0 + \alpha_1 d_{ih} + \alpha_2 X_{ih} + \alpha_3 Z_h + \xi_{ih} \tag{5}$$

I finally turn to a more elaborate model including controls for unobserved parental characteristics, which may include better measures of permanent income (and borrowing constraints), parental tastes and parenting ability. In order to implement this formulation I assume that unobserved characteristics can be decomposed in two parts: $\xi_{ih} = \eta_h + \varepsilon_{ih}$. The first represents ancestry effects that are common for all siblings, the second is an idiosyncractic term specific to each child (although possibly correlated within the sisbship). Therefore, exploiting the fact that some families report children with different skin color one can estimate the models including a family fixed-effect:

$$(s_{ih} - \bar{s}_h) = \alpha_1 \left(d_{ih} - \bar{d}_h\right) + \alpha_2 \left(X_{ih} - \overline{X}_h\right) + (\varepsilon_{ih} - \bar{\varepsilon}_h) \tag{6}$$

where only the within-household variation is explored, with variables being expressed in deviations from family-level averages.

An alternative way of exploring within household variation is the first-difference estimator:

$$(s_{ih} - s_{jh}) = \alpha_1 (d_{ih} - d_{jh}) + \alpha_2 (X_{ih} - X_{jh}) + (\varepsilon_{ih} - \varepsilon_{jh}), \ i > j \tag{7}$$

where i indexes year of birth. The comparison of first-differences and fixed-effects estimates are useful because they are likely to have different precision depending on the presence of autocorrelation of residuals (or child-level unobservable characteristics, such as ability and/or motivation).

Instead of completed schooling, the models estimated below employ a binary enrollment indicator as dependent variable (linear probability models). This reflects the focus on younger children, while they are still of school age. In the regressions, child-level controls are included semi-parametrically using age, gender and birth order (first and lastborn) dummies. Household-level controls include husband and wife indicators for skin-color (indicator is one if white), completed education (less than elementary, elementary and some middle, middle and some high, and high school or more), a second-order polynomial on age, geographic location of household (region, urban sector, and metropolitan area indicators), measures of living standards (material on walls and roof, sewer system, water pipes, exclusive-use lavatory, ownership of dwelling), and logarithm of number of household members.

4.2 *Main findings*

Table 1 presents standard measures of differences in enrollment rates between white and non-white children after controlling for child-level demographics (column [c]). The results indicate that whites are 7.5 percentage points more likely to be enrolled than non-whites in the overall sample of mixed families of two children or more (Panel A). This difference is still significant when comparing children for a sample of mixed-color sibships (Panel B). The magnitude is dramatically reduced (now 1.2 percentage point), reflecting the fact that, along a myriad of factors, mixed-color families are more similar to each other than families in the general sample. Incidentally, this reflects the large role of household characteristics on explaining such differentials.

These differences are further reduced when controls for family characteristics are included in column [d], but differences remain significant. In column [e], family fixed-effects are included. The results indicate that family-level characteristics (even when not observed) cannot entirely account for the differences between white and non-white children. That is to say, even when comparing siblings, the probability of a white child being enrolled in school is 0.6 percentage points higher than for a non-white child. This corresponds to 49.3% of the raw skin-color difference in enrollment rates observed among children of mixed-color sibships or 8% of the difference among mixed families.[31] According to this estimates, a dark-skinned five-year old child is approximately 2% less likely to be enrolled in school or pre-school than his/her lighter-skinned biological sibling, for example. Finally, columns [f] and [g] present the comparison between fixed-effects and first difference estimates for a subsample of sibships with three children or more. The results indicate that the two methods yield very similar results, but reveal the impact of within-sibship autocorrelation of child-level unobservables on the efficiency of estimates.

Therefore, based on this evidence, one should consider that parental choices may play a role on the observed skin-color differences.[32] I investigate the possibility that this reflects an income maximization strategy, following the differences in returns to schooling according to skin color. In order to delve into this reasoning, I need to assess alternative explanations for why differential

[31] For the sake of comparison I have examined the case of gender differentials using the same data. In this case, for families with boys and girls, the difference in enrollment rates is 2.28% in favor of girls (with or without family controls). Family fixed effects only reduce this difference to 2.18%, indicating that 96% of the original difference is accounted for intra-family discrimination in schooling investments. Studies of gender differentials in Brazil have consistently pointed to differences in opportunity costs as an explanation for these findings (active child-labor market induces boys to drop-out of school to work). See Psacharopoulos and Arriagada (1989).

[32] I have investigated if the difference was a function of parental color mixing. In an fully interacted regression, color mixing, as oppose to same-color parents, imply no significant (yet negative) differential impact on the measured differences between white and non-white siblings.

enrollment is observed within the family.

4.3 *Sensitivity*

It is possible that skin-color differences captured in the Census data are correlated with unobserved measures of relationship to the household head. This may happen if children are incorrectly coded as offspring of the head, even if not biologically attached to him/her, for example. In this case, differences according to skin color would be reflecting the fact that stepchildren receive less investments, a hypotheses backed up by many studies (see Case et al., 1999; Daly and Wilson, 1998; McLanahan and Sandefur, 1994; and Zvoch, 1999). To address this concern I have re-estimated the original model including children known to be stepchildren of the head in the sample (and not identifying them as such). In Table 2 the results of the model show that the inclusion of these observations does not have an impact on the estimated differentials. I have performed the same exercise for white and non-white fathers separately (Panels B and C), since biases are expected to go in opposite directions. A white father would have a stepchild coded as non-white while a non-white dad would have a white stepchild. For the former, skin-color differences would be reinforced by the biological disconnect, while for the latter they would be counterbalanced. In both cases the differences observed are opposite to what is expected if biological connect is the main explanation for the skin-color differences.

Nonetheless, one can still argue that estimates on Panel B are larger than on Panel C. These differences are an artifact of the partial interaction produced by stratification solely based on the skin color of the male head of household, however. When I estimate fully interacted models, with the effect of other parental characteristics being accounted for on the estimate of child-level color differentials, the impact of white male head is actually negative (holding constant mother's skin color).[33]

[33]Moreover, the impact of lightening the skin color of the male head is differentially negative when compared with lightening the mother's skin color. This means that lighter male heads tend to favor darker children, while the opposite is true when mothers have lighter skin. Estimates available upon request.

A second alternative explanation rests on the possibility that the costs of sending dark-skin children to school are higher because of school-level discrimination. Social norms in place at schools may imply relative discomfort to dark skin children. Parents would then respond by being relatively less likely to enroll their dark-skin children. Iit is important to take into consideration that these social costs may be counterbalanced by the effect of opportunity costs. If stigmatization is a reality within schools, it is most probably also significant in the market for child labor (which is quite large in developing countries, particularly in Brazil). Therefore white children should be, all else equal, less likely to attend school because the opportunity costs of not selling labor at the market is higher for them than for their darker skin siblings. It is likely, therefore, that social costs and opportunity costs balance each other out. In fact, when estimating the same model as above for children between 5 and 11 years of age, and for children between ages 10 and 17, I find stronger results among the former. In part, this may reflect the fact that older kids are more likely to be subject to the impact of labor-force-originated opportunity costs to schooling over enrollment decisions.

Another way of addressing this concern is based on the observation that schooling's social costs would imply that non-whites fall behind in school due to grade repetition, school changes, or unsuccessful school experiences in general. If that is the case, controls for total education attainment (holding age constant) should have large impact on currently observed differences in enrollment.[34] When I replicate the estimates of the basic models with fixed effects including dummies for years of education completed before the current school year point estimates are virtually unchanged (0.561 with 0.169 standard-error). This supports the idea that differential social costs of enrollment are not the main driving force behind the results.

A final piece of evidence contrary to the hypothesis of school discrimination as the main source of differences is the fact that the results are different for boys and girls, even though schools are not segregated by gender. Table 3 indicates that skin color differentiation among siblings is only observed for boys (Panel A) and adult men (Panels B, C and D). These results conform with

[34]This strategy is similar to the inclusion of the lagged dependent variable in cross-sectional analyses as a proxy for unobservable characteristics.

differences in the rates of return to education discussed on Section 3.4 above, which indicate that returns are relatively higher for white males but not for white females.[35]

Since one cannot guarantee that even in mixed-gender school system school-level social networks are not gender specific, it is important to investigate if these differences in relative returns to education depending on gender do not coexist with gender differences in reports of discrimination episodes by students and adults. Using data from the 2005 Brazilian National High-School School Examination (ENEM, INEP), I find that non-white boys are the ones *less* likely to report that classmates, friends and neighbors are racist (4.9, 2.5, and 9 percentage points, respectively). They are also *less* likely to report being victims of or seeing a racism incident (difference of 1.6 percentage points) but are still *more* likely to report that racial/color discrimination will be a major issue in their lives.[36] These numbers indicate that school-level discrimination, and its potential social costs imposed over enrollment may be pertinent for schooling decisions, but they seem incompatible with the gender differences in skin-color differentials observed in the Census data.

Finally, there is the possibility that estimated skin color differences reflect reverse causality or simultaneity.[37] Since mothers are the ones reporting the skin color of children, it may be the case that their reasoning for skin color classification is based on measures of child success. Therefore, unsuccessful children (i.e., the ones with poor performance at school) are the ones more likely to be coded as non-white. Simultaneity will come about if mothers' report reflect tanning differences. If reports are based on seasonal observed skin color, it can be the case that the white child is the one that spends most of the time indoors (in school) while the non-white one is the one that spends

[35]It may also reflect differences in marriage market competitiveness that tend to favor non-white women rather than non-white men (i.e., non-white women have more sex-appeal in Brazil). Data from the 1995 Data Folha Pool on Skin Color and Race Issues (Pesquisa 300 Anos de Zumbi, Data Folha) indicates for example that 40% of male whites report non-white women as more desirable sexual partners (versus 44% indiferent) while the corresponding numbers for female whites are 22% and 64%. The corresponing numbers for the overall population (including non-white choices) are 52%/41% among men and 38%/55% among women.

[36]All the comparisons between non-white males and females are based on within school-graduation cohort variation.

[37]One could imagine that skin color or older siblings could be used as instruments on a first-difference estimation of within family differentials. I am reluctant to assume that such instrument is valid because child-level unobservable characteristics are likely to be correlated among siblings. In any case, when I attempted such strategy results were the same as the ones presented, with first-stage having t-stats for the instrument of around 8.

time outdoors (idle or working). The fact that educational attainment controls did not affect the current enrollment difference is the first evidence against both arguments, however.

In order to further examine these issues, I have focused on the Census measures on the incidence of genetically determined disability and at-birth health/infrastructure measures from the Brazilian Survey of Nutrition and Health (BSNH-1989). The idea is that these variables indicate the quality of a child and directly impact school enrolment, but should only be impacted by the skin color measure if mothers adapt their reports to reflect a ranking of child quality. In particular I estimated models as the ones used for enrollment having blindness, deafness, prematurity, c-section, hospital delivery and low/high birth weight indicators as the dependent variables. The results in Table 4 indicate that no significant differences were found between white and non-white siblings.

In order to further examine the simultaneity issue, I estimated the model for white-mulato and mulato-black siblings separately. If differences in skin color reflect differences in activities performed by the children, within-family differences in enrollment should be prevalent among both types of sibship. Table 5 suggests that this is not true. Observed differences are only pertinent for white-mulato sibships. Incidentally, this also conforms with findings that returns to education are different for whites and mulatos, but not for mulatos and blacks. I take this as further evidence in favor of the proposed investment channel for within-family differences.

4.4 *Further aspects*

4.4.1 *Compensatory investments?*

I have used BSNH data to examine other aspects of human capital investment estimating models having weight-for-age and height-for-age as the dependent variables. No differences were found between white and non-white siblings (results not shown). One may consider, therefore, that differences in enrollment are not exclusively reflecting parental preferences for one child over another. Moreover, they also indicate that parents do not use investments in these other aspects of human capital to compensate dark-skin children for the lower investments in their education.

Finally I have investigated BSNH information on enrollment in private and public schools in order to assess if non-white children would be compensated on the quality-of-education dimension. There is a well know disparity between the quality of education provided by the two systems in Brazil. When I estimate the intra-family regressions using data on 518 siblings ages 7 to 14 enrolled in school, I find that lighter kids are 2.1 percentage points more likely to attend a private institution than their darker siblings (significant at the 10% level). When estimating using 165 brothers, that difference is estimated to be 6.0 percentage points, significant at the 5% level. The corresponding number for sisters is not available due to insufficient sample. I conclude that this reinforces the argument for differential investment by parents according to returns to education, specially considering that returns are most likely a function of the quality of schooling provided.

4.4.2 *Compensatory transfers?*

As discussed by Becker and Tomes (1976), and in Section 2 above, an interesting aspect of parental decision-making is the possibility of addressing equality concerns by utilizing non-human capital transfers to compensate children that received less education. Compensatory transfers can either be directly implemented by parents or via schemes ensuring that children transfer resources among themselves. That is to say; either parents offer non-human capital transfers to dark skin children or they devise implicit contracts in which white children transfer accumulated resources to their non-white siblings.

Data on inter-vivos transfers between parents and children or between siblings are not available in this case, nor is information on inheritance patterns. As an alternative way of exploring this compensatory transfers idea, I examine the parental supply of housing to their children. I employ data from the 1985 wave of the Brazilian Household Survey (PNAD). This wave contains a special module in which mothers were asked about all the children ever born. They were instructed to determine skin color, age and gender of each one of the children, including the ones not currently coresiding. The age interval is limited to children under 17, however. I conjecture that mothers attempt to compensate dark skin children by offering shelter for longer than in the case of white children. In practical terms this would mean that non-white children in mixed-race sibships are more likely to be found within the mothers's household than their white siblings. Results from a sample of 1,558 children between 10 and 17 years of age is compatible with such hypothesis. Non-white children are 1.80 percentage points less likely to have left the mothers' household (significant at 10%).

In a second exercise, the 1991 Census stratum of coresiding adult siblings is further explored. The hypothesis to be tested here is that white individuals compensate their non-white siblings by offering them a chance to coreside. This is not an estimation of the probability of a white individual offering shelter to a non-white sibling relatively more often than to a white one (since such information is not available). Instead this means that, conditional on coresidence, the white sibling is more likely to be the head of the household in which I observed the coresidence status (i.e., the white sibling is the major household provider). The figures indicate that, when two siblings of different skin color coreside, the white person is 2.2 percentage points (or 5%) more likely to be the host than his/her non-white sibling. Notice however that, as in the enrollment differentials case, all the difference is coming from the comparison among brothers (5.6 percentage points) and not among sisters (0.9 percentage points, not significant).

5 Conclusion

This paper examines how mixed-race families, through parenting practices and decisions, mediate the impact of society-wide skin color differentiation over their children. Data from Brazilian surveys are used and indicate that parents reinforce, or at least do not fully compensate for, phenotype-based differences within their progeny. That is to say, investments in human capital follow an efficiency maximization principle, with skin colors favored by employers also being favored by parents. I find that light-skinned children (ages 5 to 14) are 0.6 percentage points (or 1%) more likely to be enrolled in school or pre-school during a particular year than their siblings of darker skin tones. I also find evidence that (conditional on enrollment) light-skinned children are 2.1 percentage points more likely to attend private schools. These results are confirmed by the study of older siblings, for whom the primary school graduation differential is 5.7% (favoring whites), being particularly prevalent among brothers.

Families seem to undertake some compensatory actions, however. Parents use non-human capital resources to (at least partially) address differences in well-being between their light- and dark-skinned children, corroborating notions of intrafamilial contracts suggested by Becker and Tomes (1976). Evidence presented above suggests that lighter skin individuals are more likely to host darker skin siblings later in life (age 21 and older). Moreover, non-white 10 to 17 year-olds are more likely to coreside with their mothers than their white siblings. Home and board may be used as the currency for compensation. These patterns highlight the value of family economics for the discussion of racial and skin-color differentials.

The evidence presented, even though not denying the importance of borrowing constraints (or other ancestry effects), suggests that parental expectations regarding differences in the return to human capital investments (according to skin color) may play an *independent,* albeit small, role on the persistence of earnings differentials. In other words, parental love may very well be colorblind. It happens that, as long as society is perceived as not being, parents may make use of such information in order to maximize the welfare of all family members. This very decision may fuel the persistence of market–level differentiation. As Rosenzweig and Schultz (1982) discuss in the case of gender differentials, a clear implication of these findings is that an intervention that reduces the white advantage in differential returns to schooling will have reinforcing effects across generations, as more and more skilled minority individuals reach the labor market and debunk statistical discrimination mechanisms.

The analysis presented in this paper is based on the impact on investments in the quality of children for a given quantity. Of course, if lighter skin individuals are considered more valuable in the labor market, parents may adjust their fertility behavior in response to those incentives. Presumably, families will target a bigger number of white children if these are more valuable. Selective abortion is useless in this case, since skin color cannot be predict using such technology. This does not rule out color-oriented marriage market search or differential stopping rules, however.[38] I leave for future research the investigation of these marriage market and fertility issues.

References

[1] Alexander, N.; A Guimarães; C. Hamilton; L. Huntley and W. James (2001); "Beyond Racism: Race and Inequality in Brazil, South Africa, and the United States," L. Rienner Publisher, Boulder, CO.

[2] Allen, W.; E. Telles and M. Hunter (2000); "Skin Color, Income and Education: A Comparison of African Americans and Mexican Americans" National Journal of Sociology, Vol (12), pp. 129-180.

[3] Antonovics, K. (2006); "Statistical Discrimination and Intergenerational Income Mobility," Unpublished manuscript, University of California at San Diego.

[4] Arias, O.; G Yamada and L.Tejerina (2004); "Education, family background and racial earnings inequality in Brazil", manuscript, Inter-American Development Bank, Washington, DC, USA.

[5] Barsh, G. S. (2003); "What Controls Variation in Human Skin Color?" PLoS Biol 1(1): e27.

[6] Becker, G. and N. Tomes (1976); "Child Endowments and the Quantity and Quality of Children" The Journal of Political Economy, Vol. 84(4), Part 2: Essays in Labor Economics in Honor of H. Gregg Lewis, pp. S143-S162.

[7] Behrman, J. (1988); "Intrahousehold Allocation of Nutrients in Rural India: Are Boys Favored? Do Parents Exhibit Inequality Aversion?," Oxford Economic Papers, Oxford University Press, Vol. 40(1), pp. 32-54.

[8] Behrman, J.; R. Pollak and P. Taubman (1986); "Do Parents Favor Boys?," International Economic Review, Vol. 27(1), pp. 33-54.

[9] Behrman, J.; R. Pollak and P. Taubman (1982). "Parental Preferences and Provision for Progeny," Journal of Political Economy, University of Chicago Press, Vol. 90(1), pp. 52-73.

[10] Beltrao, Kaizo, "Acesso a Educacao: Diferenciais entre os Sexos," IPEA Texto para Discussao No. 879, May, 2002.

[38] A particular difference between the present case and stopping rules and sex preferences is that parents may update their beliefs regarding the probability of having light children as they procreate (since the exact racial mix is not perfectly know by all parts involved).

[11] Bertrand, M. and S. Mullainathan (2004); "Are Emily and Brendan More Employable than Latoya and Tyrone? Evidence on Racial Discrimination in the Labor Market from a Large Randomized Experiment", The American Economic Review, Vol 94 (4), September, pp. 991-1013.

[12] Biddle, J. and D. Hamermesh (1998); "Beauty, Productivity, and Discrimination: Lawyers' Looks and Lucre," Journal of Labor Economics, University of Chicago Press, Vol. 16(1), January, pp. 172-201.

[13] Blume, L. (2006); "The Dynamics of Statistical Discrimination", The Economic Journal, Vol 116, November, pp. F480-F498.

[14] Bodenhorn, H. and C. Ruebeck (2005); "Colorism and African-American Wealth: Evidence from the Nineteenth- Century South," forthcoming in Journal of Population Economics.

[15] Bodenhorn, H. (2003); "The Complexion Gap: The Economic Consequences of Color among Free African Americans in the Rural Antebellum South," in Kyle D. Kauffman, ed., Advances in agricultural economic history. Vol. 2. Amsterdam: Elsevier Science North-Holland, pp. 41–73.

[16] Bonilla-Silva, Eduardo (2002); "We are all Americans!: The Latin Americanization of racial stratification in the USA,"Race & Society, Vol 5, pp. 3–16.

[17] Brunsma, D. (2005); "Interracial Families and the Racial Identification ofMixed-Race Children: Evidence from the Early Childhood Longitudinal Study", Social Forces, Vol. 84(2), pp.1131-1157.

[18] Campante, F.; A. Crespo and P. Leite (2004); "Wage Inequality across Races in Brazilian Urban Labor Markets: Regional Aspects." Revista Brasileira de Economia, Vol. 58 (2), pp. 185-210.

[19] Campbell, Mary E. (2007). "A Rainbow Divide? Racial Stratification in a Multiracial Context," unpublished manuscript, University of Wisconsin at Madison.

[20] Campbell, Mary E. and Jennifer Eggerling-Boeck (2006). "What about the Children? The Psychological and Social Well-Being of Multiracial Adolescents," The Sociological Quarterly, Vol. 47(1), pp. 147–173.

[21] Carneiro, P.; F. Cunha and J. Heckman (2004); "The Technology of Skill Formation," 2004 Meeting Papers 681, Society for Economic Dynamics.

[22] Carneiro, P.; J. Heckman and D. Masterov (2005); "Labor Market Discrimination and Racial Differences in Premarket Factors," Journal of Law and Economics, Vol. 48(1), pp. 1-40.

[23] Carvalho-Silva, D.R.; F.R. Santos; J. Rocha and S. Pena (2001); "The phylogeography of Brazilian Y-chromosome lineages," American Journal of Human Genetics, Vol. 68, pp. 281–286.

[24] Case, Anne, I-Fen Lin and Sara McLanahan, "Household Resource Allocation in Stepfamilies: Darwin Reflects on the Plight of Cinderella," American Economic Review, Vol. LXXXIX (1999), No. 2, 234-248.

[25] Charles, K. and M. Luoh (2006); "Male Incarceration, the Marriage Market and Female Outcomes." Unpublished Manuscript.

[26] Daly, Martin and Margo Wilson, The Truth About Cinderella: A Darwinian View of Parental Love (New Haven, CT, Yale University Press, 1998).

[27] Diamond, J. (1994); "Race Without Color", Discover, Vol 15(11).

[28] Dollard, J. (1937); "Caste and Class in a Southern Town", Yale University Press.

[29] Dunn, L. C. and T. Dobzhansky (1958); "Heredity, Race and Society: A Scientific Explanation of Human Differences," Mentor New American Library Publisher.

[30] Freeman, H., D. Armor, J. M. Ross and T. J. Pettigrew (1966); "Color Gradation and Attitudes among Middle Income Negroes." American Sociological Review, Vol.3 (1), pp. 365-374.

[31] Fryer, R.(2006); "Guess Who's Been Coming to Dinner? Trends in Interracial Marriage over the 20th Century." forthcoming in Journal of Economic Perspectives.

[32] Fryer, R. and S. Levitt (2004a); "Causes and Consequences of Distinctive Black Names," The Quarterly Journal of Economics, MIT Press, Vol. 119(3), pp. 767-805

[33] Fryer, R. and S. Levitt (2004b); "Understanding the Black-White Test Score Gap in the First Two Years of School," The Review of Economics and Statistics, MIT Press, Vol. 86(2), pp. 447-464.

[34] Gans, Herbert. (2006); "The Possibility of a New Racial Hierarchy in the 21st-Century United States," in M. Lamont (ed.) The Cultural territories of Race: University of Chicago Press, Chicago, pp. 371-390.

[35] Goldsmith, A.; D. Hamilton and W. Darity Jr. (2005); "From Dark to Light: Skin Color and Wages among African-Americans." Unpublished manuscript.

[36] Gyimah-Brempong, K. and G. Price (2006); "Crime and Punishment: And Skin Hue Too?" The American Economic Review, Vol 96(2), pp. 246-250.

[37] Hall, R. (1995); "The Bleaching Syndrome: African Americans' response to cultural domination vis-a-vis Skin Color ," Journal of Black Studies, Vol. 26, pp. 172-184.

[38] Hamermesh, D. and J. Biddle (1994); "Beauty and the Labor Market," The American Economic Review, Vol. 84(5), pp. 1174-1194.

[39] Heckman, J. (1998); "Detecting Discrimination" The Journal of Economic Perspectives, Vol. 12(2), Spring, pp. 101-116.

[40] Herring, C.; V. M. Keith and H. D. Horton (2004); "Skin Deep: How Race and Complexion Matter in the Color-Blind Era", University of Illinois Press, Chicago, IL.

[41] Hersch, J. (2006); "Skin Color and Wages Among New U.S. Immigrants" Unpublished manuscript.

[42] Hill, M. (2000); "Color Differences in the Socioeconomic Status of African American Men: Results of a Longitudinal Study." Social Forces, Vol. 78(4):1437-1460.

[43] Hunter, M.; W. Allen and E. Telles (2001); "The Significance of Skin Color among African Americans and Mexican Americans." African American Research Perspectives, Vol. 7(1), pp. 173–184.

[44] Keith, V. and C. Herring (1991); "Skin Tone and Stratification in the Black Community," American Journal of Sociology, Vol 97, pp. 760-778.

[45] King, J. (1971); "The Biology of Race," Harcourt Brace Jovanovich Publisher

[46] Lazear, E. (1980); "Family Background and Optimal Schooling Decisions," The Review of Economics and Statistics, Vol. 62 (1), February, pp. 42-51.

[47] Levhari, D. and Y. Weiss (1974); "The Effect of Risk on the Investment in Human Capital," The American Economic Review, Vol. 64 (6), december, pp. 950-963.

[48] Lopez, A. (2003); "Mixed-Race School-Age Children: A summary of Census 2000 data." Educational Researcher, Vol. 32 (6), 25-37.

[49] McLanahan, Sara and Gary Sandefur, Growing Up with a Single Parent: What Hurts, What Helps. (Cambridge, MA, Harvard University Press, 1994).

[50] Neal, D. and W. Johnson (1996); "The Role of Premarket Factors in Black-White Wage Differences," Journal of Political Economy, University of Chicago Press, Vol. 104(5), October, pp. 869-895.

[51] Park, J. and M. Lee (2005); "A Study of Skin Color by Melanin Index according to site, gestational age, birth-weight and season of birth in Korean neonates," Journal of KoreanMedical Science, Vol. 20, pp. 105-108.

[52] Parra, E. J.; R. A. Kittles and M. D. Shriver (2004); "Implications of Correlations Betweeen Skin Color and Genetic Ancestry for Biomedical Reserach" Nature Genetics Supplement, Vol. 36(11).

[53] Pena, S.; D. Carvalho-Silva; J. Alves-Silva; V. Prado and F. Santos (200); "Retrato Molecular do Brazil," Ciencia Hoje, Vol 27 (159).

[54] Perry, G.; O. Arias; J. H. López; W. Maloney and L. Servén (2006); "Poverty Reduction and Growth: Virtuous and Vicious Circles" The World Bank.

[55] Rangel, M. (2007); "Measurement and Mismeasurement of Skin Color, Racial and Ethnic Differentials: Socioeconomic and Health Outcomes" manuscript, University of Chicago.

[56] Ransford, E. (1970); "Skin Color, Life Chances and Anti-White Attitudes." Social Problems, Vol. 18, pp.164-178.

[57] Rees, J. (2003); "Genetics of Hair and Skin Color," Annual Review of Genetics, Vol 37, pp. 67-90.

[58] Relethford, J. (1997); "Hemispheric Difference in Human Skin Color," American Journal of Physical Anthropology, Vol. 104, pp. 449-457.

[59] Reuter, E. (1918); "The Mulatto in the United States: Including a Study of the Role of Mixed-Blood Races throughout the World". Richard G. Badger Publisher.

[60] Rockquemore, K. and T. Laszloffy (2005); "Raising Biracial Children." Altamira Press.

[61] Rosenzweig, M. and T. P. Schultz (1982); "Market Opportunities, Genetic Endowments, and Intrafamily Resource Distribution: Child Survival in Rural India," The American Economic Review, Vol. 72 (4), pp. 803-815.

[62] Seeman, M. (1946); "Skin Color Values in Three All-Negro School Classes." American Sociological Review, Vol 11, pp. 315-321.

[63] Sheshinski, E. and Y. Weiss (1982); "Inequality Within and Between Families" The Journal of Political Economy, Vol. 90 (1), pp. 105-127.

[64] Shih, M. and D. Sanchez (2005); "Perspectives and research on the positive and negative implications of having multiple racial identities." Psychological Bulletin, Vol. 131, pp. 569-591.

[65] Sturm, R.; N. Box and M. Ramsay (1998); "Human Pigmentation Genetics: the difference is only skin deep," BioEssay, Vol. 20, pp. 712-721.

[66] Telles, E. (2005); "Race in Another America: The Significance of Skin Color in Brazil." Princeton University Press.

[67] United Nations (2005); "Brazil: National Human Development Report", New York and Brasilia, Brazil.

[68] Yancey, George (2006); "Racial Justice in a Black/Nonblack Society," in D. Brunsma (ed.), Mixed messages: Multiracial identities in the Color Blind Era: Boulder, CO; Rienner, pp. 49-62.

[69] Zvoch, Keith, "Family Type and Investment in Education: A Comparison of Genetic and Stepparent Families," Evolution and Human Behavior, Vol. XX (1999), 435-464.

Appendix

Consider the following parametrization for the case of families with two children (one-white, one non-white):

$$V\left(c_t\right) = a - \frac{b}{2}c_t^2 \tag{8}$$

$$U(e_W, e_{NW}) = 2 \cdot \sqrt{e_W e_{NW}} \tag{9}$$

$$e_i = \left(\alpha_0 + \widetilde{d}_i \epsilon_i\right) s_i \tag{10}$$

where $\widetilde{d}_i$ is an indicator for a non-white child, and $\epsilon_i \sim N\left(0, \sigma^2\right)$ introduces riskiness in the returns to education (for the non-white child).

These yield the following first-order conditions:

$$s_W : V'\left(c_t\right) p_W = \beta E\left[V'\left(c_{t+1}\right) \cdot \frac{\partial e_W}{\partial s_W} + \sqrt{\frac{e_{NW}}{e_W}} \cdot \frac{\partial e_W}{\partial s_W}\right]$$
$$s_{NW} : V'\left(c_t\right) p_{NW} = \beta E\left[V'\left(c_{t+1}\right) \cdot \frac{\partial e_{NW}}{\partial s_{NW}} + \sqrt{\frac{e_W}{e_{NW}}} \cdot \frac{\partial e_{NW}}{\partial s_{NW}}\right]$$

Hence, substituting the returns to education and the budget constraint in th emarginal utility of consumption:

$$\begin{aligned} \frac{p_W}{p_{NW}} &= \frac{\alpha_0 E\left\{\left[a - b\left(e_W + e_{NW}\right)\right] + \sqrt{\frac{e_{NW}}{e_W}}\right\}}{E\left\{\left[a - b\left(e_W + e_{NW}\right)\right]\left(\alpha_0 + \epsilon_i\right) + \sqrt{\frac{e_W}{e_{NW}}}\left(\alpha_0 + \epsilon_i\right)\right\}} \\ &= \frac{\alpha_0\left\{\left[a - b\alpha_0\left(s_W + s_{NW}\right)\right]\right\} + \alpha_0 E\sqrt{\frac{(\alpha_0+\epsilon_i)s_{NW}}{\alpha_0 s_W}}}{\alpha_0\left\{\left[a - b\alpha_0\left(s_W + s_{NW}\right)\right]\right\} - b s_{NW} E\left[\epsilon_i^2\right] + \alpha_0 E\sqrt{\frac{(\alpha_0+\epsilon_i)s_W}{\alpha_0 s_{NW}}}} \end{aligned}$$

Therefore, in the absence of risk, maximization implies that families choose s_W and s_{NW} such that the following condition is attained:

$$\frac{p_W}{p_{NW}} = \frac{\alpha_0\left\{\left[a - b\alpha_0\left(s_W + s_{NW}\right)\right]\right\} + \alpha_0\sqrt{\frac{s_{NW}}{s_W}}}{\alpha_0\left\{\left[a - b\alpha_0\left(s_W + s_{NW}\right)\right]\right\} + \alpha_0\sqrt{\frac{s_W}{s_{NW}}}}$$

as opposed to the result when risk is present:

$$\frac{p_W}{p_{NW}} = \frac{\alpha_0\left\{\left[a - b\alpha_0\left(s_W + s_{NW}\right)\right]\right\} + \alpha_0 E\sqrt{\frac{(\alpha_0+\epsilon_i)s_{NW}}{\alpha_0 s_W}}}{\alpha_0\left\{\left[a - b\alpha_0\left(s_W + s_{NW}\right)\right]\right\} - b s_{NW}\sigma^2 + \alpha_0 E\sqrt{\frac{(\alpha_0+\epsilon_i)s_W}{\alpha_0 s_{NW}}}}$$

which necessarill implies that s_{NW} needs to be smaller than in the riskless case, being decreasing in the variance of returns' idiosyncrasies.

TABLE 1: Skin-Color Differentials in School or Pre-School Enrollment (percentage points), Children ages 5 to 14

	Enrollment rates non-whites		OLS with child-level controls	OLS + family-level controls	Within-estimator family fixed-effects	Within-estimator family fixed-effects	Within-estimator sibling first-differences
						Sibships of 3 children or more	
	at age 5	average					
	[a]	[b]	[c]	[d]	[e]	[f]	[g]
Panel A: All children in mixed families							
White *versus* non-white	25.45	68.22	7.508 ***	0.651 ***	0.615 ***	0.536 **	0.551 ***
			(0.132)	(0.135)	(0.170)	(0.216)	(0.199)
Panel B: Children in mixed-skin-color sibship							
White *versus* non-white	28.45	75.10	1.199 ***	0.513 ***	0.592 ***	0.526 **	0.561 ***
			(0.188)	(0.178)	(0.171)	(0.217)	(0.199)

Notes: Sample is restricted to couple-headed households with at least 2 children in the 5 to 14 (inclusive) age range. White, brown or black wives and husbands between ages 21 and 45 (inclusive). Robust standard-errors clustered at household level in parentheses, except for first-differences estimation for which Eicker-Hubber-White robust standard-errors are reported. Number of children in the regressions amount to 910,170 (PANEL A), and 169,982 (PANEL B), except for columns f and g (restricted to sibships with 3 children or more).which have samples of 589,470 and 119,558 children, respectively. Child-level controls included semi-parametrically using age, gender and birth order (first and lastborn) dummies. Household-level controls include husband and wife indicators for skin-color, completed education (less than elementary, elementary, middle, and high school or more), second-order polynomial on age, geographic location of household (region, urban sector, and metropolitan area indicators), living standard measures (material on walls and roof, sewer system, water pipes, exclusive-se lavatory, ownership of dwelling), logarithm of sibship size (5 and 14). Estimation use sample weights in order to reflect the Brazilian population in 1991. Significance levels are 1% (***), 5% (**) and 10% (*).

TABLE 2: Skin-Color Differentials in School or Pre-School Enrollment, Children ages 5 to 14

Family Fixed-Effects Estimation among children in mixed-skin-color sibships including stepchildren

	Base sample [a]	Stepchildren included [b]
Panel A: All fathers		
White *versus* non-white children	0.592 ***	0.600 ***
	(0.171)	(0.168)
Panel B: Only white fathers		
White *versus* non-white children	0.644 ***	0.631 ***
	(0.269)	(0.266)
Panel C: Only non-white fathers		
White *versus* non-white children	0.555 ***	0.577 ***
	(0.221)	(0.217)

Notes: See notes in Table 1. Samples are 169,982 and 177,594 (PANELS A and D); 62,636 and 65,292 (PANEL B); 101,610 and 106,267 (PANEL C). Significance levels are 1% (***), 5% (**) and 10% (*).

TABLE 3: Skin-Color Differentials in School or Pre-School Enrollment and Education Attainment (percentage points)
Within-household estimates, differential effects by gender

	Baseline Averages for Non-whites				All sibships, partial interactions		All sibships, stratified samples		Same-sex sibships, stratified samples	
	All children	Males	Females	Males and females	Males	Females	Males	Females	Brothers only	Sisters only
				[a]	[b]	[c]	[d]	[e]	[f]	[g]
Panel A: School and Pre-School enrollment, Children ages 5 to 14 in mixed-skin-color sibship only										
White *versus* non-white	75.10	73.02	76.09	0.59 ***	0.96 ***	0.23	0.56 *	0.34	0.55 *	0.32
				(0.17)	(0.27)	(0.26)	(0.31)	(0.30)	(0.32)	(0.30)
Sample	*169,982*	*49,312*	*50,575*	*169,982*	*169,982*		*85,226*	*84,756*	*49,312*	*50,575*
Panel B: Completed Primary Education, Young Adults ages 17 to 25 in mixed-skin-color sibship only (still living with parents)										
White *versus* non-white	34.07	28.02	46.97	1.95 **	3.14 **	0.40	3.11 **	0.36	3.11 **	0.40
				(0.77)	(1.26)	(1.70)	(1.25)	(1.70)	(1.26)	(1.70)
Sample	*11,685*	*4,019*	*2,417*	*11,685*	*11,685*		*6,646*	*5,039*	*4,019*	*2,417*
Panel C: Completed Primary Education, Adults ages 21 to 75 in mixed-skin-color sibship only (non-parental household)										
White *versus* non-white	31.89	26.26	38.92	1.40 ***	1.84 ***	1.06 *	1.95 **	1.53 **	1.98 **	1.54 **
				(0.40)	(0.70)	(0.62)	(0.83)	(0.69)	(0.83)	(0.69)
Sample	*37,288*	*7,987*	*12,313*	*37,288*	*37,288*		*16,547*	*20,741*	*7,987*	*12,313*
Panel D: Completed High-School Education, Adults ages 21 to 75 in mixed-skin-color sibship only (non-parental household)										
White *versus* non-white	18.06	11.95	25.20	1.38 ***	2.36 ***	0.61	2.64 ***	0.91	2.68 ***	0.93
				(0.35)	(0.58)	(0.56)	(0.66)	(0.64)	(0.66)	(0.64)
Sample	*37,288*	*7,987*	*12,313*	*37,288*	*37,288*		*16,547*	*20,741*	*7,987*	*12,313*

Notes: See Table 1. Complete primary education corresponds to 8 years of schooling. Significance levels are 1% (***), 5% (**) and 10% (*).

TABLE 4: Skin-Color Differentials in Genetically Inherited Disabilities, Birth and Early Infancy Outcomes

Within-household estimates, mixed-color sibships only

	Children 5 to 14		Children 6 to 48 months				
	Deaf (per 10,000)	Blind (per 10,000)	Underweight at birth (%)	High weight at birth (%)	C-section baby (%)	Born in a hospital (%)	Premature Birth (%)
Panel A: 1991 Census							
Average in non-white population	7.16	2.45					
White *versus* non-white	1.08	0.16	-	-	-	-	-
	(1.64)	(1.01)					
Sample	*169,982*						
Panel B: 1989 Brazilian Survey of Nutrition and Health							
Average in non-white population			17.90	12.51	14.27	50.46	1.79
White *versus* non-white	-	-	4.20	0.68	-0.40	-1.78	0.08
			(12.76)	(5.34)	(3.00)	(7.11)	(0.11)
Sample			*119*	*119*	*207*	*207*	*207*

Notes: The American Academy of Otolaryngology indicates that around 60% of deafness ocurring in infants and children are caused by inherited genetic effects. The same rate was recently reported for the case of blindness by the Research Institute of the McGill University Health Centre (American Journal of Ophtamology). For the 5 to 14 sample, regressions include same regressors as the child-level variables described inm Table 1. For regressions in the sample of children 6 to 48 months, dummies for first and last born, a secon-order polynomial on age and a male dummy are used as controls. Significance levels are 1% (***), 5% (**) and 10% (*).

TABLE 5: Skin-Color Differentials in School or Pre-School Enrollment (percentage points)
Within-household estimates, differential effects by skin tonality pairing

	Baseline Average For darker children	Within-estimator family fixed-effects
Panel A: School and Pre-School enrollment, Children ages 5 to 14 in mixed-skin-color sibship only		
White *versus* mulato	75.41	0.515 ***
		(0.172)
Sample	*165,630*	*165,630*
Panel B: School and Pre-School enrollment, Children ages 5 to 14 in mixed-skin-color sibship only		
Mulato *versus* black	65.45	-0.047
		(0.587)
Sample	*18,491*	*18,491*

Notes: See Table 1. Significance levels are 1% (***), 5% (**) and 10% (*).

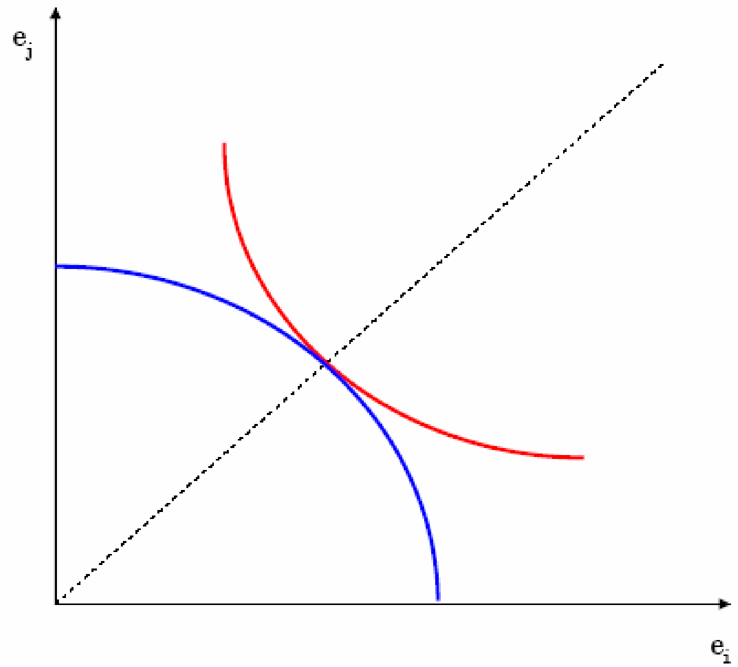

DIAGRAM 1A: No differential net-returns to education investments and symmetrical preferences

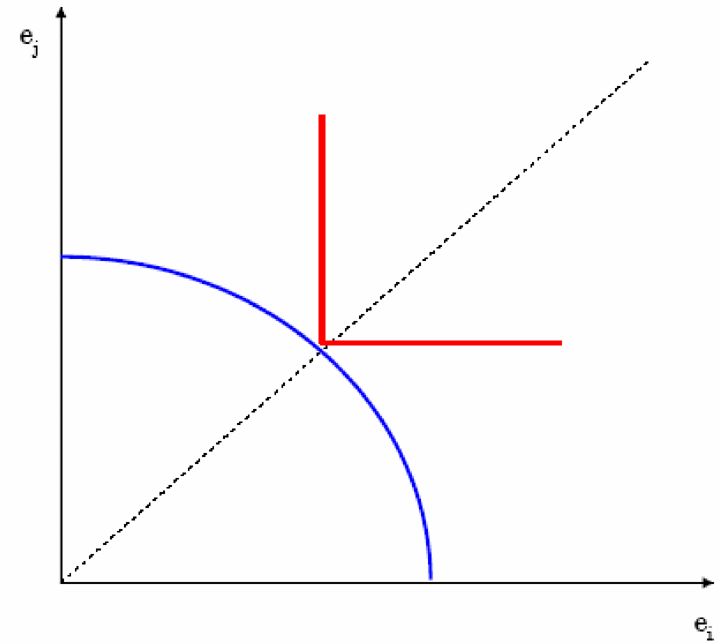

DIAGRAM 2A: No differential net-returns to education investments and inequality aversion

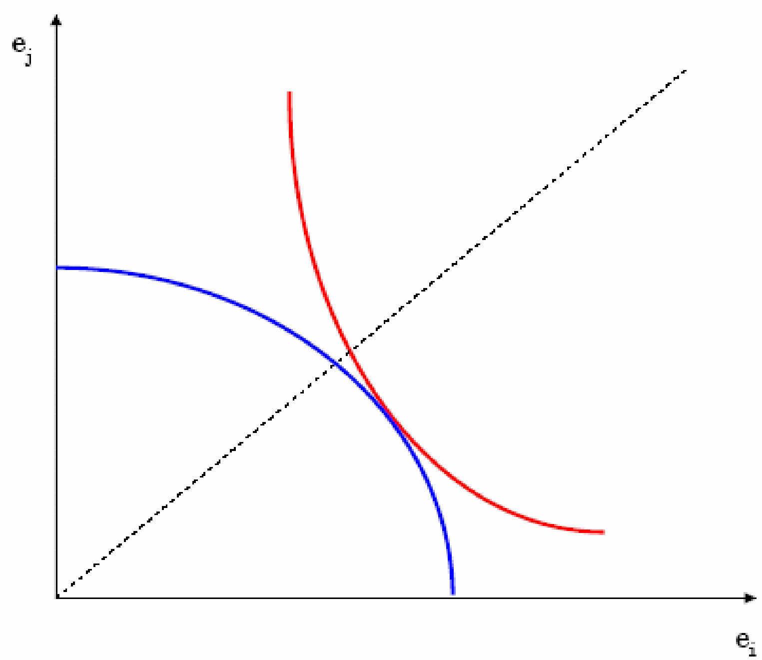

DIAGRAM 3A: No differential net-returns to education investments and preferences shifted towards child *i*

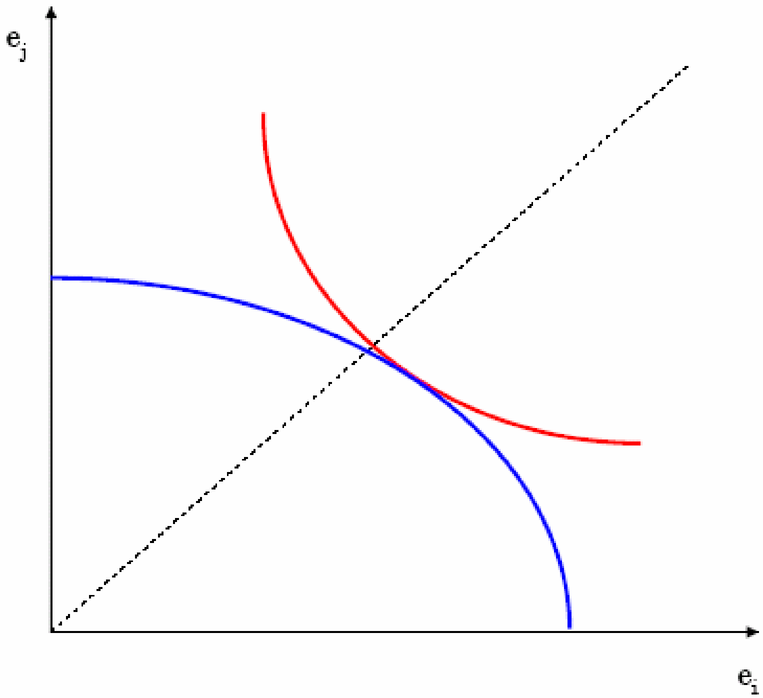

DIAGRAM 1B: Differential net-returns to education investments favoring child *i* and symmetrical preferences

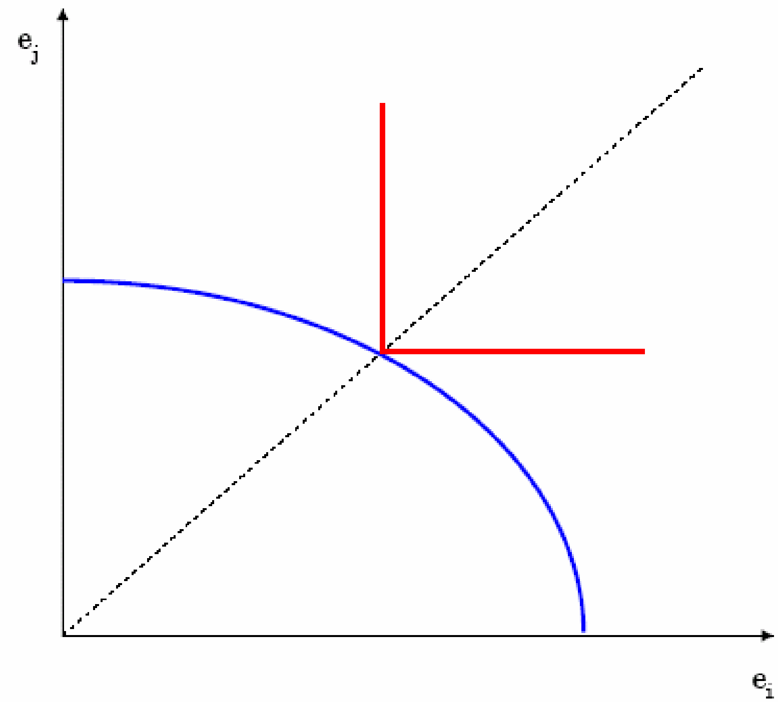

DIAGRAM 2B: Differential net-returns to education investments favoring child *i* and inequality aversion

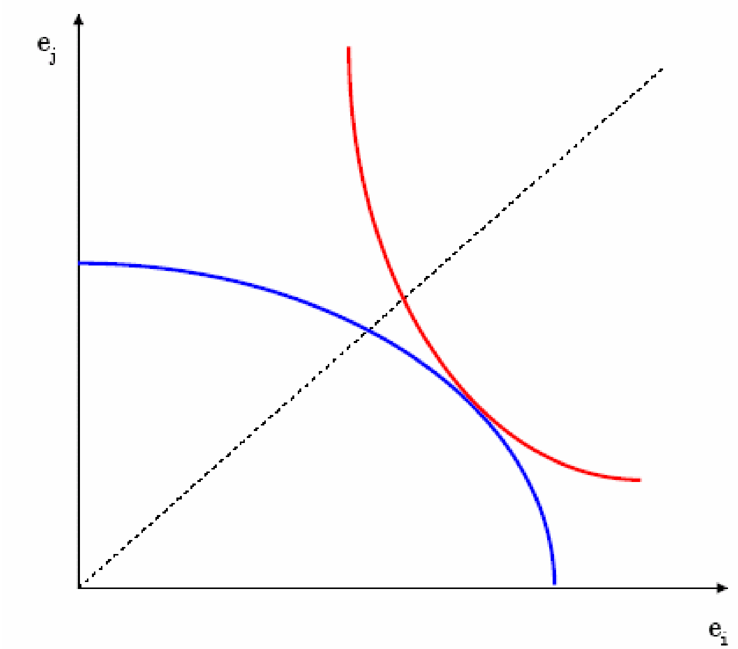

DIAGRAM 3B: Differential net-returns to education investments favoring child *i* and preferences shifted towards child *i*

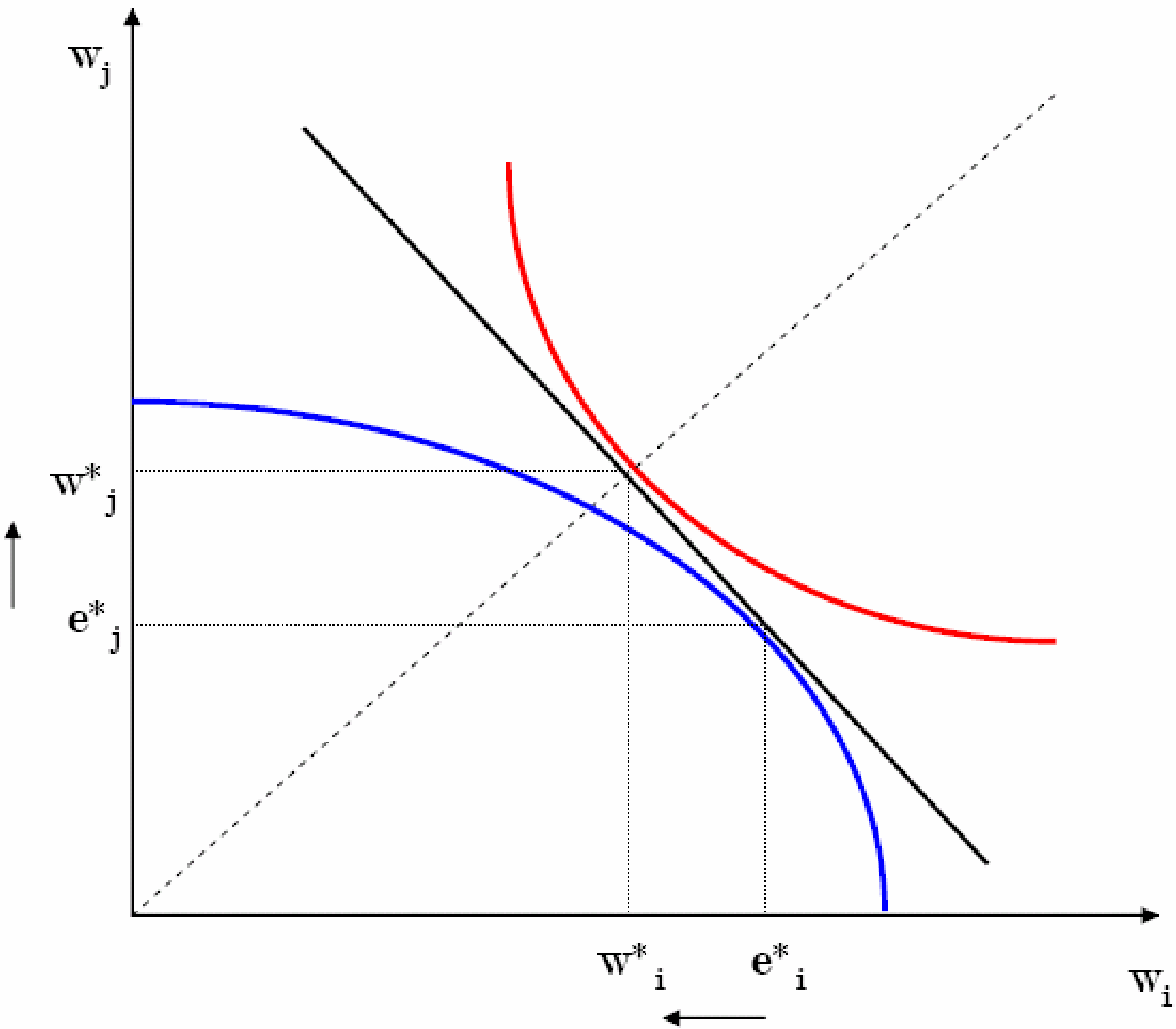

DIAGRAM 4: Non-separable model and the equalizing role of transfers.

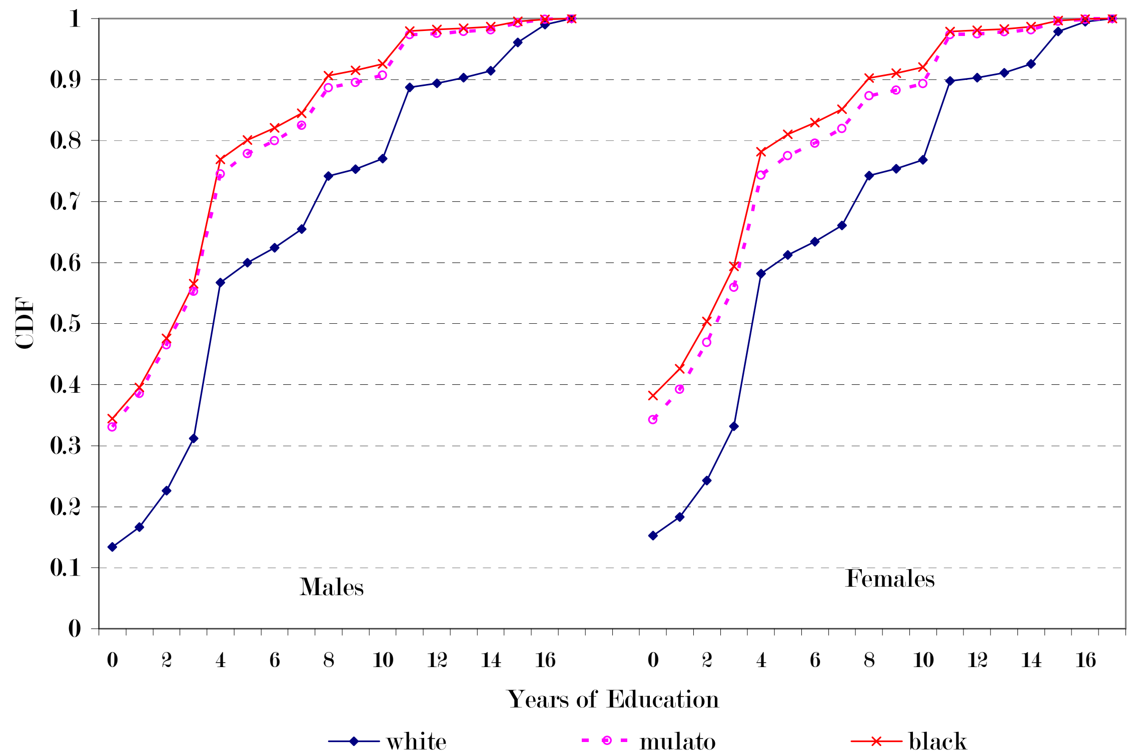

Figure 1: Cumulative Distribution Functions for Years of Education, Adults ages 30 to 70

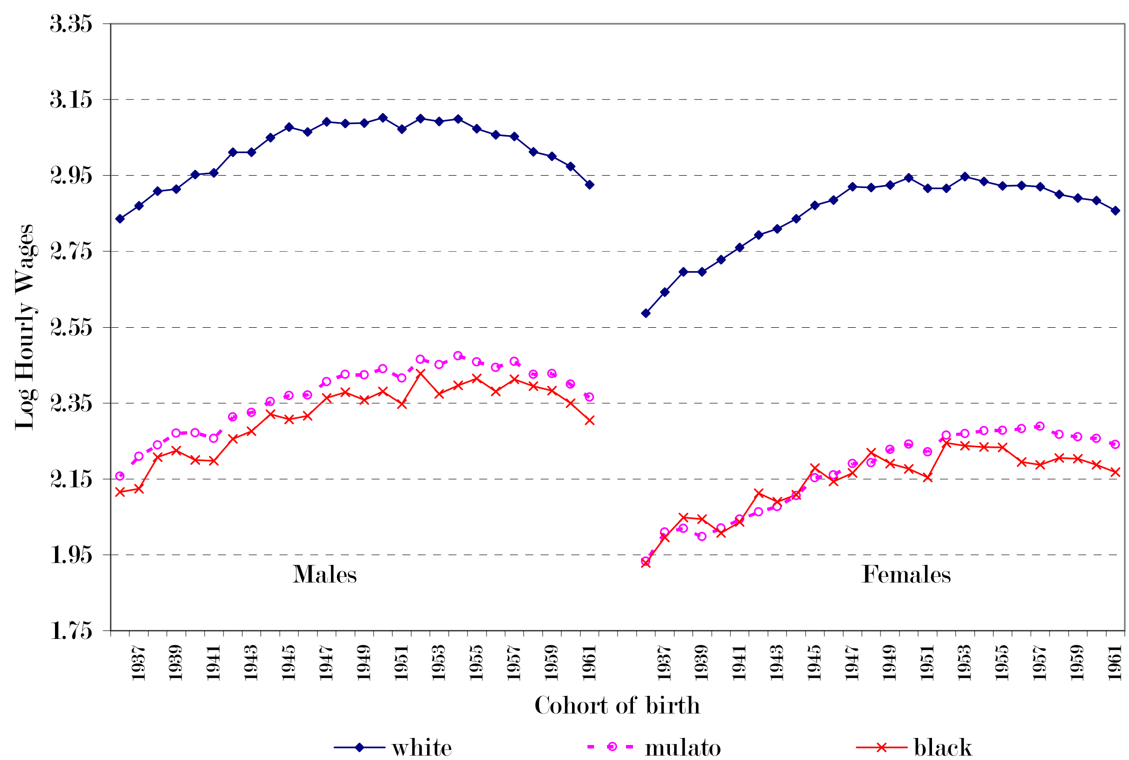

Figure 2: Log Hourly Wages across Cohorts

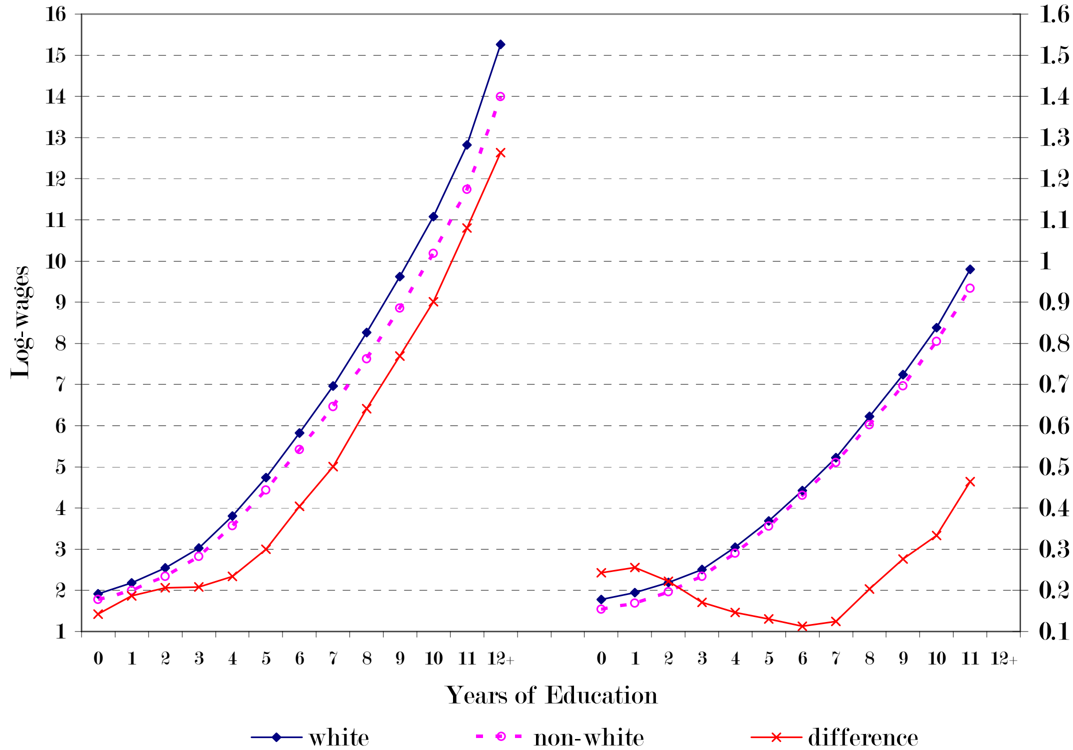

Figure 3: Log Hourly Wages by educational level by skin-color

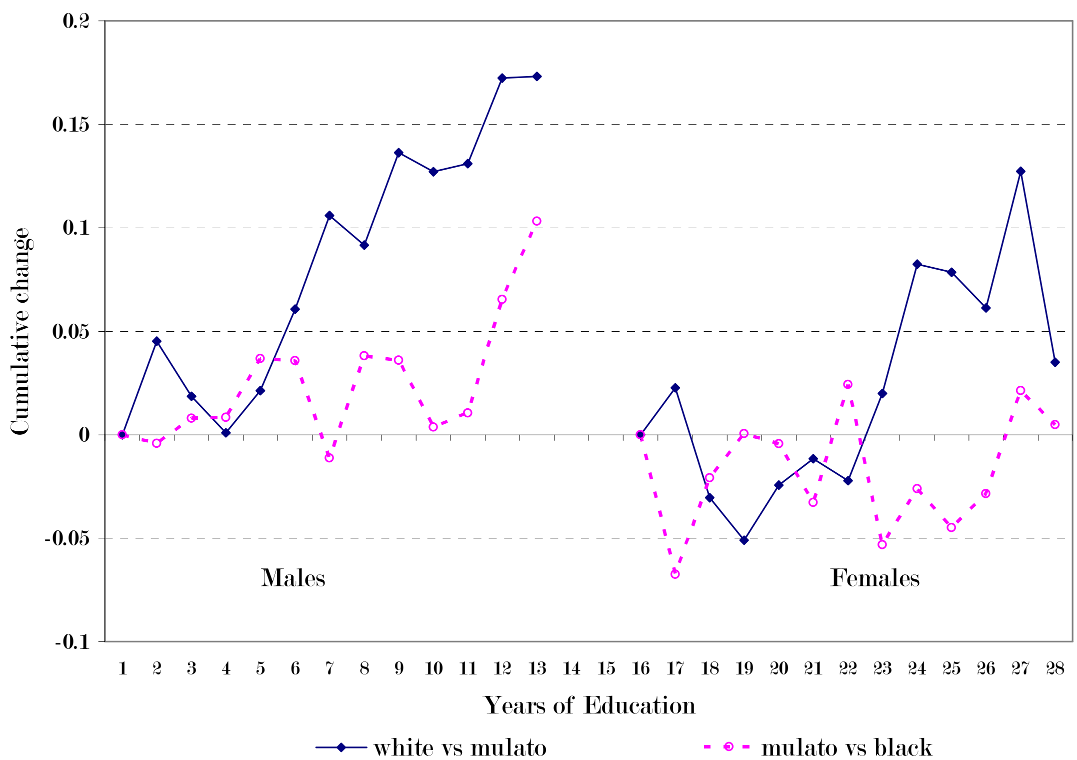

Figure 5: Cumulative relative returns to education

TABLE A1: Miscegenation in Marriage Markets, Brazil 1991, Men and women ages 21 to 45 with two or more children between 5 and 14

	Female head skin color			
	White	Brown	Black	Line total
Male head skin color				
White	82.91	15.81	1.28	**100.0**
	42.29	*8.06*	*0.65*	*51.0*
Brown	24.64	72.83	2.53	**100.0**
	10.67	*31.53*	*1.10*	*43.3*
Black	17.50	32.56	49.94	**100.0**
	1.00	*1.86*	*2.85*	*5.7*

Note: Overall sample percentages in italics.

TABLE A2: Sibships' Color Composition, Brazil 1991, Children ages 5 to 14

	Sibship composition					
	All white	White and Non-white	All Brown	Brown and Black	All black	Line total
Child color						
White	89.23	10.70	-	0.07	-	**100.0**
	44.76	*5.37*		*0.03*		*50.2*
Brown	-	12.29	86.21	1.50	-	**100.0**
		5.63	*39.47*	*0.69*		*45.8*
Black	-	3.32	-	14.10	82.58	**100.0**
		0.13		*0.57*	*3.35*	*4.1*

Note: Overall sample percentages in italics.

TABLE A3: Descriptive statistics, household-level characteristics by progeny's skin-color mix

	All-white sibship mean (se)	Mixed-color white/non-white sibship mean (se)	All-brown sibship mean (se)	Mixed-color brown/black progeny mean (se)	All-black progeny mean (se)
Living standards and asset holdings					
Rustic-material walls (%)	2.19 (0.03)	7.19 (0.11)	13.49 (0.07)	16.82 (0.48)	13.32 (0.25)
Rustic-material roof (%)	1.34 (0.02)	3.22 (0.07)	6.54 (0.05)	7.37 (0.33)	6.10 (0.18)
Water pipes (%)	85.19 (0.07)	64.27 (0.19)	52.14 (0.11)	43.11 (0.66)	57.09 (0.36)
Sewer pipes (%)	38.62 (0.09)	24.18 (0.17)	17.26 (0.08)	15.27 (0.48)	23.05 (0.31)
No sewer system (%)	7.94 (0.05)	20.64 (0.16)	31.43 (0.10)	33.03 (0.60)	28.11 (0.33)
No exclusive-use lavatory (%)	14.22 (0.06)	27.18 (0.18)	39.24 (0.10)	40.75 (0.63)	36.86 (0.35)
Two or more exclusive-use lav. (%)	20.66 (0.08)	10.14 (0.12)	5.78 (0.05)	2.43 (0.22)	3.73 (0.14)
Own dwelling (%)	70.29 (0.09)	70.34 (0.19)	70.94 (0.10)	67.15 (0.61)	68.09 (0.34)
Household has source of non-labor inc (%)	20.85 (0.08)	16.79 (0.15)	14.05 (0.07)	14.47 (0.46)	16.53 (0.27)
Geographic location					
Urban sector (%)	73.70 (0.08)	69.95 (0.19)	60.96 (0.10)	59.35 (0.65)	64.24 (0.35)
Metropolitan area (%)	25.23 (0.08)	22.97 (0.17)	20.45 (0.09)	26.41 (0.57)	27.53 (0.33)
Mid-West region (%)	6.88 (0.05)	12.96 (0.14)	10.62 (0.07)	6.24 (0.33)	5.02 (0.16)
Northeast region (%)	12.06 (0.06)	42.27 (0.20)	52.91 (0.11)	48.14 (0.65)	33.90 (0.35)
Southeast region (%)	51.46 (0.09)	37.00 (0.20)	31.06 (0.10)	36.31 (0.63)	49.76 (0.37)
South region (%)	29.60 (0.08)	7.12 (0.10)	5.42 (0.05)	2.61 (0.22)	11.33 (0.23)
Characteristics of parents					
Husband age (in years)	37.17 (0.01)	36.80 (0.02)	36.80 (0.01)	34.60 (0.13)	36.95 (0.04)
Wife age (in years)	34.12 (0.01)	33.65 (0.02)	33.64 (0.01)	31.93 (0.12)	34.19 (0.04)
Husband literate (%)	89.74 (0.06)	74.83 (0.18)	65.17 (0.10)	55.67 (0.66)	65.29 (0.35)
Wife literate (%)	90.97 (0.05)	78.78 (0.17)	69.13 (0.10)	58.11 (0.66)	66.63 (0.35)
Husband completed education (in years)	5.98 (0.01)	4.05 (0.02)	3.13 (0.01)	2.47 (0.04)	3.04 (0.02)
Wife completed education (in years)	5.93 (0.01)	4.30 (0.02)	3.39 (0.01)	2.55 (0.04)	3.10 (0.02)
Husband has non-labor income source (%)	15.25 (0.07)	11.29 (0.13)	9.28 (0.06)	8.95 (0.38)	11.60 (0.24)
Wife has non-labor income source (%)	3.60 (0.03)	3.27 (0.07)	2.36 (0.03)	3.13 (0.23)	3.21 (0.13)
Parents' skin color					
White couple (%)	83.76 (0.07)	10.96 (0.13)	0.83 (0.02)	0.00 (0.08)	0.20 (0.03)
White/Non-white couple (%)	14.65 (0.07)	61.04 (0.20)	18.05 (0.08)	10.33 (0.44)	5.99 (0.17)
Brown couple (%)	1.51 (0.02)	25.98 (0.18)	75.55 (0.09)	20.69 (0.53)	1.36 (0.09)
Brown/Black couple (%)	0.05 (0.00)	0.84 (0.04)	5.11 (0.05)	45.00 (0.63)	14.85 (0.26)
Black couple (%)	0.02 (0.00)	0.53 (0.03)	0.46 (0.01)	17.60 (0.48)	77.60 (0.31)

Notes: Sample of 593,230 couples with at least two children in the 5 to 14 age interval. Males and females ages 21 to 45 only. Jacknifed standar-errors in parentheses next to estimated means. Source: Brazilian 1991 Census 10-20% sample.

TABLE A4: Descriptive statistics, child-level characteristics by sibship's skin-color mix

	All-white sibship	White/Non-white sibship		All-brown sibship	Brown/Black sibship		All-black sibship
		White child	Non-white child		Brown child	Black child	
	mean (se)	mean (se)	mean (se)	mean (se)	mean (se)	mean (se)	mean (se)
Age (in years)	**9.28 (0.003)**	**9.18 (0.009)**	**9.41 (0.009)**	**9.13 (0.003)**	**9.16 (0.026)**	**9.36 (0.029)**	**9.20 (0.012)**
Completed education (years)	**1.91 (0.002)**	**1.36 (0.006)**	**1.42 (0.006)**	**1.09 (0.002)**	**0.92 (0.014)**	**0.99 (0.016)**	**1.08 (0.007)**
Enrollment (proportion)	**79.07 (0.048)**	**73.77 (0.151)**	**73.60 (0.146)**	**65.28 (0.060)**	**61.87 (0.466)**	**62.37 (0.510)**	**63.46 (0.209)**
	707,792	*84,855*	*91,087*	*624,198*	*10,853*	*9,045*	*52,979*

See Notes in Table A3.

DIAGRAM A1: Punnett square with possible offspring of a intermediate skin-color parentage combination
(Assuming 3 genes as determinants of skin color)
Capitalized: Dark-skin alleles
Non-capitalized: Ligh-skin alleles
Numbers are counts of dark-skin alleles from combination of maternal and paternal gametes.

	Male gametes (skin-color 3)							
Female gametes (skin-color 3)	ABC	ABc	AbC	Abc	aBC	aBc	abC	abc
ABC	6	5	5	4	5	4	4	3
ABc	5	4	4	3	4	3	3	2
AbC	5	4	4	3	4	3	3	2
Abc	4	3	3	2	3	2	2	1
aBC	5	4	4	3	4	3	3	2
aBc	4	3	3	2	3	2	2	1
abC	4	3	3	2	3	2	2	1
abc	3	2	2	1	2	1	1	0

Color spectrum:

0 1 2 3 4 5 6