

# More than just friends? School peers and adult interracial relationships \*

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## Abstract

This paper investigates whether interracial contact in childhood impacts adult romantic relationships. We estimate the impact of quasi-random variation in the share of black students across cohorts within US schools on the probability that a white student goes on to have a black partner. We find that more black peers of the same gender lead whites to have more relationships with blacks later in life. These effects cannot be explained by an increase in meeting opportunities since they are persistent across time, space and social networks. This suggests that interracial contact improves attitudes towards blacks and has important economic consequences.

*JEL classifications:* J15, J12, I20.

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## 1. INTRODUCTION

Interracial marriage rates are important indicators of social integration and the health of race relations (Fryer, 2007). It may therefore be concerning that in many countries the rate of interracial marriage between blacks and whites is low—for example, in the US, according to the 2015 American Community Survey (Ruggles et al., 2015), only 7.8% of married blacks intermarry with whites. Racial preferences appear to play an important role in explaining this (Wong, 2003; Fisman et al., 2008; Hitsch et al., 2010). Yet little is known about what determines these racial preferences, nor to what extent they are influenced by individuals’ experiences.

Social interaction has long been postulated as a potential means of reducing racial prejudices (e.g. Williams, 1947; Allport, 1954). Indeed, recent studies have shown that white students and teachers exposed to a greater number of black students adjust their stated attitudes or choose to interact more frequently with blacks in schools (Boisjoly et al., 2006; Marmaros and Sacerdote, 2006; Dobbie and Fryer, 2015; Carrell et al., 2015). Baker et al. (2011) find evidence, however, that this effect may be limited, since it doesn’t impact students’ broader social networks. Moreover, these papers study the impact on stated attitudes or limited interactions such as emailing or sharing a dorm. Hence it is yet to be demonstrated that such changes in attitudes affect economically important decisions such as the race of romantic partners.

This paper investigates whether exposure to racial diversity at a young age explains assortative matching by race. In particular, we explore how plausibly exogenous variation in a white student’s school peer group influences the romantic relationships they later undertake as an adult. To do so, we use the National Longitudinal Survey of Adolescent Health (Add Health), which collects information on the race of all students within surveyed schools in the US and then over a decade later surveys a sample of these students on their romantic partners. This data allows us to exploit idiosyncratic variation in grade composition within schools, a methodology pioneered by Hoxby (2000) and widely used to identify causal peer effects (Sacerdote, 2014).<sup>1</sup> A number of tests confirm that the variation we use is indeed random and uncorrelated with other variables that might influence adult relationships. Moreover, we show that a higher share of black students in a grade stimulates diversity in social interactions both within and outside the classroom.

The main contribution of this paper is to provide evidence that the racial composition of students’ school cohorts impacts romantic relationships later in life. This

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<sup>1</sup>See, for instance, Bayer et al., 2009; Bifulco et al., 2011; Lavy et al., 2012; Carrell et al., 2016; Patacchini and Zenou, 2016. The Add Health data has been used to study peer effects by a number of papers including Calvó-Armengol et al. (2009), Bifulco et al. (2011), Fletcher et al. (2013) and Patacchini and Zenou (2016).

is not simply the result of students having more potential black partners in school, since the cohorts which impact adult relationships are students of the same sex in the same grade. The magnitude of the effect is important—going from the average of 8 percent blacks in the cohort to 10 percent would increase the probability of dating a black by approximately 0.6 percentage points, which is about a quarter of the standard deviation in our sample. The result is robust to several robustness checks, including the introduction of grade-school fixed effects. Furthermore, we find no evidence that our results are driven by measurement error in the way outlined in Angrist (2014). We therefore conclude that school racial composition has an important impact on adult interracial relationships.

We then demonstrate that the most likely mechanism behind this impact is a change in racial preferences or attitudes. First, we find significant effects on reported attitudes in several waves of the survey. Second, we document evidence suggesting that an increase in indirect meeting opportunities through friends met in school is unlikely to play a major role. In particular, if our result stemmed mainly from increased meetings with blacks through school-based social networks, we would expect it to be stronger for those relationships formed in school, at a younger age and geographically closer to school. We find no evidence for such a differential impact. Finally, we show that any impact of cohort racial composition on educational performance or labor market outcomes would unlikely be large enough to explain our measured effect. Overall, therefore, our results suggest that racial diversity in schools impacts individuals' attitudes or beliefs which in turn affect their decisions regarding relationships.

We proceed in the following way. Section 2 details the dataset and estimation strategy, and provides evidence for the validity of our main identification assumption. In Section 3 we analyze the extent to which a higher black share in a given cohort increases interracial exposure and friendship. In Section 4 we then present the benchmark results before proceeding to undertake a number of robustness checks, including adding additional controls, looking for bias driven by measurement error and considering alternative specifications. We then investigate our results further in Section 5 in an attempt to shed light on the mechanisms that may potentially be driving the result. Finally, Section 6 concludes and makes suggestions for future research.

## 2. DATA AND ESTIMATION STRATEGY

### 2.A. *Data*

We use data from the National Longitudinal Survey of Adolescent Health (Add Health).<sup>2</sup> The survey selected 80 nationally representative high schools and 54 feeder schools in the US and first gave a questionnaire to all students in the schools in grades 7-12 in 1994-95. This in-school survey was self-administered and collected basic information from around 90,000 students, including their gender and race. Within each school a sample of students was then interviewed at home and asked many detailed questions on topics including family background, health behaviors, friendships and romantic relationships. This in-home survey was administered to around 20,000 students and these students formed the sample for the following waves, administered in 1996 (Wave 2), 2001-02 (Wave 3) and 2008-09 (Wave 4).

In a first step, we use the in-school survey to construct information about school peers. In particular, we construct our main independent variables, the shares of students in peer groups who are black.<sup>3</sup> We consider three alternative peer groups: the cohort of all students in the same grade, students of opposite sex in the same grade and the cohort of same sex students in the grade. A key advantage of using the in-school sample is that it is close to a census of students within the grade, and hence we reduce measurement error in cohort composition differences.

Our analysis then uses the Wave 4 in-home survey to measure outcomes in terms of relationships. Within this survey, respondents were asked to give basic information on a list of current and past romantic partners. This list included their current or most recent romantic partner as well as any person who they had been married to, had lived with for more than one month or had had a relationship with that resulted in pregnancy. With this information, we construct our two dependent variable: a binary variable indicating whether an individual reported any black partners and the share of an individual's reported romantic partners that are black.

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<sup>2</sup>The Add Health project was designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris, and funded by a grant P01-HD31921 from the National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Persons interested in obtaining data files from Add Health should contact Add Health, Carolina Population Center, 123 W. Franklin Street, Chapel Hill, NC 27516-2524 (Add Health@unc.edu). No direct support was received from grant P01-HD31921 for this analysis.

<sup>3</sup>In the in-school survey, race is self-reported and students could define themselves as being of more than one race. In the analysis that follows the black share is defined as the share of students who defined themselves to be black only. For romantic partners, individuals can only report one race. We consider alternative definitions of race in the robustness checks (Appendix C.4).

Of the original Wave 1 sample, around 12,500 are white. We restrict our attention to white students since the relatively small size of other racial groups makes robust inference difficult. For most of our analysis we then focus on the subset of these students who were interviewed and assigned sample weights in Wave 4, of which there are 9,353.<sup>4</sup> Of this sample, we were unable to match 405 respondents with information on their school cohort, and we dropped a further 69 for whom we observe less than five students in the in-school survey of the same gender.<sup>5</sup>

In terms of attrition, Harris (2013) suggests that attrition bias in Wave 4 is small in magnitude for demographic, behavioral, health and attitudinal variables after study estimates were adjusted with final sampling weights. Moreover, Bifulco et al. (2011) find no evidence that attrition is correlated with minority shares within cohorts. In our sample, there is no systematic relationship between one's cohort black share and the probability to be in Waves 3 or 4 (columns 1 and 2 of Appendix Table C5). We discuss in more detail the robustness of our results to attrition in Section 4 and provide additional tests in Appendix C.2.

Summary statistics of the main variables we use in our analysis are reported in Table 1, along with other characteristics that help to describe our sample. We report the estimated population mean of a range of variables along with the estimated population standard deviations both between and within schools. Variable definitions are given in Appendix A.

The relative scarcity of interracial relationships is immediately apparent—less than 5% of our sample report having had a relationship with a black. Whereas the average students' cohort is 8% black, only 3% of their reported partners are black. The average within-school standard deviation in the grade black share is around 1.3 percentage points. If we restrict individuals' cohorts to be only those students of the same gender, this standard deviation increases to 1.9 percentage points.

Individuals range between the ages of 11 and 21 when surveyed in Wave 1, with 21 percent attending a middle school and 59 percent attending a high school.<sup>6</sup> At Wave 4 individuals are aged between 24 and 34 and have had 1.8 romantic partners on average.

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<sup>4</sup>The in-home surveys sampled students with unequal probability, partly due to attrition. Hence, we use sampling weights in our analysis. For more details on the Add Health data, see Chen and Chantala (2014).

<sup>5</sup>This is done in order to reduce noise stemming from the extreme values of our independent variable that these observations produce. Results are robust to the inclusion of these observations.

<sup>6</sup>We define a middle school as one containing no grades higher than grade nine, and a high school as one containing no grades lower than grade nine. Among those schools that contain both grades eight and ten, three schools show abnormally large increases in the number of students between the two grades (above 100 percent). In the analysis, we follow a conservative approach, splitting each of these schools in two. Our results are however robust to not splitting these schools.

TABLE 1: SUMMARY STATISTICS

|                                 | Mean | Within<br>school<br>s.d. | Between<br>school<br>s.d. | N    |
|---------------------------------|------|--------------------------|---------------------------|------|
| <i>Main variables</i>           |      |                          |                           |      |
| Any partners black              | .046 | .19                      | .04                       | 8879 |
| Share of partners black         | .03  | .13                      | .029                      | 8696 |
| Grade black share, both genders | .083 | .012                     | .12                       | 8879 |
| Grade black share, same gender  | .082 | .019                     | .12                       | 8879 |
| <i>Other Wave 1 variables</i>   |      |                          |                           |      |
| Age                             | 16   | 1.2                      | 1.2                       | 8879 |
| Female                          | .52  | .5                       | .075                      | 8879 |
| Hispanic                        | .14  | .19                      | .26                       | 8879 |
| Family income                   | 50   | 38                       | 24                        | 7073 |
| Grade size                      | 225  | 28                       | 159                       | 8879 |
| Grades in school                | 3.9  | 0                        | 1.3                       | 8879 |
| In middle school                | .21  | 0                        | .41                       | 8879 |
| In high school                  | .59  | 0                        | .49                       | 8879 |
| Lives in urban area             | .45  | .18                      | .42                       | 8795 |
| Region = Northeast              | .18  | 0                        | .39                       | 8879 |
| Region = Midwest                | .3   | 0                        | .46                       | 8879 |
| Region = South                  | .36  | 0                        | .48                       | 8879 |
| Region = West                   | .16  | 0                        | .37                       | 8879 |
| <i>Other Wave 4 variables</i>   |      |                          |                           |      |
| Age                             | 29   | 1.2                      | 1.2                       | 8879 |
| Number of recorded partners     | 1.8  | 1.3                      | .24                       | 8879 |
| Number of cohabiting partners   | 1.4  | 1                        | .24                       | 8879 |
| Number of marriages             | .63  | .56                      | .18                       | 8696 |
| Attended college                | .67  | .44                      | .14                       | 8878 |
| Employed                        | .66  | .47                      | .07                       | 8875 |

*Notes:* Summary statistics are calculated using the Wave 4 cross-sectional weights, which aim to produce a representative sample from individuals who are surveyed in both Waves 1 and 4.

## 2.B. Estimation strategy

We cannot simply regress dating behavior on cohort composition since cohort composition is likely to be correlated with a range of other omitted variables that impact dating behavior—not least, the composition of the population that lives nearby the school. Moreover, self-selection of individuals might further bias results if those who are more inclined to date blacks choose to enroll in schools with a larger share of black students.

In order to control for these omitted variables, we exploit variation in the share of black students across cohorts within an individual school.<sup>7</sup> In other words, we assume that families do not select schools based on the differences between the average school composition and their child’s school specific cohort and that these differences are not correlated with other important omitted variables.

To implement our identification strategy, we estimate the following regression equation:

$$Y_i = \alpha \text{ShareBlack}_{cs} + I_{gm} + I_{sm} + \varepsilon_i, \quad (1)$$

where  $\text{ShareBlack}_{cs}$  is the share of blacks within cohort  $c$  in school  $s$ ,  $I_{gm}$  are grade-gender fixed effects,  $I_{sm}$  are school-gender fixed effects, and  $\varepsilon_i$  is a random error term.<sup>8</sup> We split school and grade fixed effects by gender since much of our analysis uses gender-specific cohort shares, and we are concerned about systematic differences in cohort shares across gender at the school and grade level. Standard errors are clustered at the school level.

Our main dependent variable  $Y_i$  is whether an individual reports in Wave 4 at least one relationship with a black partner. This embeds the idea that contact with blacks might affect the probability of a first interracial relationship. This ‘extensive margin’ is probably the most affected by attitudes towards blacks, but it may also be the case that contact with blacks impacts the ‘intensive margin’ of how many relationships an individual has with black people. Indeed, a number of closely related studies such as Boisjoly et al. (2006), Marmaros and Sacerdote (2006), Camargo et al. (2010), and Baker et al. (2011) use shares as dependent variables, either exclusively or in addition to the extensive margin. Hence, we also estimate equation (1) with the dependent variable being the share of individual  $i$ ’s reported romantic partners that are black.

In our regressions, we start by considering an individual’s peer group as the

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<sup>7</sup>Schools with no black students therefore do not affect our results. To examine the characteristics of the schools that contribute most to our results, Table D12 in Appendix D provides summary statistics for schools that have within-school variation in the black cohort share above median.

<sup>8</sup>An alternative specification would use the number of blacks in the cohort, rather than the black share. In most of our analysis we use the black share since we believe this more likely to be quasi-random, but we consider the alternative specification in Appendix Table C7.

cohort of students in the same grade within the school. We then split grades in two, considering separately those students of the opposite gender and those of the same gender. On the one hand, we may expect opposite sex peers to have the largest impact on romantic relationships, since this group forms a pool of potential partners. On the other hand, same sex peers may be more important if this is the group from which close friends are most likely to be drawn.

### *2.C. Identification assumption*

Our methodology relies on the assumption that variation in cohort composition within schools is essentially random once we control for grade-gender fixed effects. We can test three important implications of this assumption.

First, we can test whether within-school variation in the share of black students is correlated with predetermined individual level variables—a type of balancing test. In particular, we regress a range of predetermined student characteristics on the black share of their peer group, while controlling for school-gender, grade-gender and race fixed effects. Each characteristic is regressed first on the black share of students in the whole grade, and then simultaneously on the black share of students of opposite and same sex in each grade. The corresponding results, presented in Table 2, support our main identification assumption—only one of the pre-determined variables, grade size, is significantly different from zero at the 0.10 level. Though we believe the correlation with grade size to be spurious, we control for this variable in all of our regressions.

Second, we can test for non-random clustering of black students across grades within schools. The simple intuition is that, if variation is random, then an individual’s race should be uncorrelated with that of their peers. As noted by Guryan et al. (2009), however, one cannot test for this by simply regressing an individual’s race on that of their peers, because each individual is present in many others’ peer groups but necessarily not their own. We therefore undertake a number of tests designed to avoid this problem, including those proposed by Guryan et al. (2009), Stevenson (2015) and Caeyers and Fafchamps (2016). Details of these tests and results can be found in Appendix B. Overall, none of the tests reject random clustering, and we therefore conclude that the distribution of blacks after controlling for fixed effects is consistent with quasi-random variation.

Third, we investigate whether differences in black shares across grades are symmetric. If changes in grade black share were driven by blacks dropping out disproportionately, then we might observe that black shares were systematically lower in later grades. In Appendix B we therefore plot the distribution of differences in the black share between grades. We find the distribution to be very symmetric, consistent with differences across grade being essentially random.



TABLE 2: BALANCING TESTS FOR COHORT COMPOSITION MEASURES

|                                    | N     | Independent variable:                       |  |  |
|------------------------------------|-------|---|--|--|
|                                    |       | Grade<br>black<br>share,<br>both<br>genders | Grade<br>black<br>share,<br>opp.<br>gender | Grade<br>black<br>share,<br>same<br>gender |
| Age                                | 8,879 | -0.690<br>(0.564)                           | -0.0373<br>(0.314)                         | -0.693<br>(0.438)                          |
| Parent is black                    | 7,890 | -0.00616<br>(0.0361)                        | -0.0116<br>(0.0272)                        | -0.000805<br>(0.0315)                      |
| Share of census tract black        | 8,799 | -0.0457<br>(0.114)                          | 0.0414<br>(0.0914)                         | -0.0845<br>(0.0687)                        |
| Share of census block black        | 8,792 | -0.0578<br>(0.0990)                         | 0.0460<br>(0.0802)                         | -0.0974<br>(0.0879)                        |
| Grade size                         | 8,879 | 151.5*<br>(76.61)                           | 72.65*<br>(38.25)                          | 76.41*<br>(40.52)                          |
| Gender ratio in grade              | 8,879 | -0.210<br>(0.155)                           | -0.293<br>(0.258)                          | 0.0361<br>(0.207)                          |
| Born in USA                        | 8,879 | -0.0207<br>(0.137)                          | 0.0364<br>(0.0774)                         | -0.0208<br>(0.105)                         |
| Lives with both biological parents | 7,875 | 0.363<br>(0.380)                            | 0.188<br>(0.208)                           | 0.139<br>(0.286)                           |
| Number of older siblings           | 8,866 | 0.0918<br>(0.706)                           | 0.00252<br>(0.465)                         | 0.0848<br>(0.475)                          |
| Years of parental schooling        | 8,492 | 0.507<br>(1.532)                            | 0.445<br>(0.849)                           | -0.133<br>(1.095)                          |
| Log of family income               | 6,998 | 0.207<br>(0.743)                            | 0.0818<br>(0.519)                          | 0.112<br>(0.526)                           |
| Home language is not English       | 8,879 | 0.00457<br>(0.102)                          | 0.0397<br>(0.0657)                         | -0.0126<br>(0.0785)                        |

*Notes:* Each coefficient is from a separate regression where the variable in the first column is regressed on one of the three specified independent variables, with controls including race, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level.

\*\*\* Significant at the 1 percent level.

\*\* Significant at the 5 percent level.

\* Significant at the 10 percent level.

Finally, the variation in the share of black students across cohorts may be partly affected by the end of court-ordered desegregation orders which occurred during this time. Lutz (2011) show that the expiration of court oversight led to significant changes in racial composition, but these changes are not correlated with other trends, and hence this is not a threat to our identification. Moreover, Table 2 shows that there is no significant correlation between our variation and neighborhood black shares, suggesting that our variation is not being driven by changes in the areas students are taken from or changes in the racial composition of those areas.

### 3. EXPOSURE AND FRIENDSHIP

Our empirical strategy relies on the implicit assumption that a higher share of blacks in a school cohort implies that white students are exposed more to black students. Since students may be somewhat segregated within schools, it is instructive to test this assumption before undertaking our main analysis. In this section, we therefore assess the impact of the share of blacks within cohorts on several measures of exposure. In particular, we examine several smaller peer groups with which students are likely to have a substantial amount of contact.

For students in high schools, the Add Health data provides information on how much class-time each student overlaps with each other student in Waves 1 and 2. From this, we can construct for each high school student a set of classmates with whom they took at least one course. These classes are much smaller than grades, with the median student having 44 classmates. Columns 1 to 4 of Table 3 show the results when we estimate equation (1) using the share of blacks within each student's classmates as the dependent variable. The results confirm that a higher share of blacks in the grade leads to more black classmates. Note that our measure of grade black share, which is constructed using Wave 1 data, has a significant impact on classmates in Wave 2, undertaken a year later, confirming that there is persistence in exposure over time.

The Add Health in-school survey also collects information on each student's school-sponsored extra-curricular activities, such as sports teams and language clubs. For each student, we construct the share of blacks among students of the same grade who undertake each activity, and then average this across the activities the student is involved in. Columns 5 and 6 of Table 3 report the results of estimating equation (1) with this as the dependent variable. The positive and significant coefficients indicate that a higher share of black students in an individual's cohort increases the share of blacks amongst peers with whom they undertake extra-curricular activities.

It's natural then to ask whether this exposure results in intensified interracial social interactions. Since Add Health collects information on friendships, we can directly test for an impact of cohort black share on the share of school friendships

TABLE 3: IMPACT OF COHORT BLACK SHARE ON EXPOSURE

|                                    | Share of classmates black |                     |                    |                      | Average black share of same grade students in same club |                       |
|------------------------------------|---------------------------|---------------------|--------------------|----------------------|---|-----------------------|
|                                    | in Wave 1                 |                     | in Wave 2          |                      | (5)   | (6)                   |
|                                    | (1)                       | (2)                 | (3)                | (4)                  |   |                       |
| Grade black share, both genders    | 0.347**<br>(0.133)        |                     | 0.347**<br>(0.158) |                      | 0.210***<br>(0.0305)                                    |                       |
| Grade black share, same gender     |                           | 0.153**<br>(0.0721) |                    | 0.221***<br>(0.0834) |   | 0.115***<br>(0.0233)  |
| Grade black share, opposite gender |                           | 0.180**<br>(0.0842) |                    | 0.131<br>(0.0855)    |   | 0.0856***<br>(0.0146) |
| Observations                       | 3788                      | 3788                | 2922               | 2922                 | 7032  | 7032                  |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

in Wave 1 that are with black students. In particular, we regress various measures of interracial friendship on the grade black share using the specification given in equation (1).

TABLE 4: IMPACT OF COHORT BLACK SHARE ON FRIENDSHIPS

| Dependent variable:                | Any black friends  |                     |                    |                     | Share of friends black |                     |                    |                     |
|------------------------------------|--------------------|---------------------|--------------------|---------------------|------------------------|---------------------|--------------------|---------------------|
|                                    | All                |                     | Closest            |                     | All                    |                     | Closest            |                     |
| Friends:                           | (1)                | (2)                 | (3)                | (4)                 | (5)                    | (6)                 | (7)                | (8)                 |
| Grade black share, both genders    | 0.0679<br>(0.0929) |                     | 0.0782<br>(0.0585) |                     | 0.0746<br>(0.0797)     |                     | 0.0961<br>(0.0685) |                     |
| Grade black share, same gender     |                    | 0.144**<br>(0.0583) |                    | 0.116**<br>(0.0446) |                        | 0.119**<br>(0.0597) |                    | 0.125**<br>(0.0554) |
| Grade black share, opposite gender |                    | -0.0667<br>(0.0571) |                    | -0.0268<br>(0.0390) |                        | -0.0336<br>(0.0458) |                    | -0.0123<br>(0.0431) |
| Observations                       | 11700              | 11700               | 11700              | 11700               | 9961                   | 9961                | 9961               | 9961                |
| Adjusted $R^2$                     | 0.016              | 0.017               | 0.013              | 0.014               | 0.038                  | 0.039               | 0.027              | 0.028               |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

The results are displayed in Table 4. In columns 1 to 4 our dependent variable is a binary variable indicating whether an individual has any black friends, while in columns 5 to 8 it is the share of a student’s friends who are black. In each case, we consider two sets of friends—in columns 1, 2, 5, and 6 we include all reported friends, while in columns 3, 4, 7, and 8 we focus on closest friends, that is, those friends with whom the student reports having the most contact during the week.

Overall, the estimates suggest that students have more black friends when there

is a greater share of blacks amongst students of their own gender.<sup>9</sup> This also holds true when we restrict just to close friendships. The difference in own and opposite gender we find in the impact of the share of black students on friendship is consistent with the psychological and sociological research: social interaction in non-romantic relationships rarely crosses gender lines, especially at an early age.<sup>10</sup> This provides extra motivation to divide students' peers by gender in the following analysis.

#### 4. MAIN RESULTS

Our main results are provided in Table 5. We first report the result of estimating equation (1) when the dependent variable is whether an individual reports having had any black partners in Wave 4. While there is no significant effect when not distinguishing by gender (column 1), we find that a higher share of blacks of the same gender increases the likelihood to have at least one black partner (column 2). Blacks of the opposite gender do not have any significant influence. In terms of magnitude, the point estimate implies that going from the average of 8 percent blacks in the cohort to 10 percent (an increase of around one within-school standard deviation) would increase the probability of dating a black by approximately 0.6 percentage points, which is about a quarter of the standard deviation in our sample.<sup>11</sup>

The estimates of our second specification, where the dependent variable is the share of reported partners that are black, are presented in columns 3 and 4 of Table 5. While the coefficient on grade black share in column 3 is significant, column 4 shows that the coefficient on the black share of the same sex cohort is positive and highly significant whereas the coefficient on the black share of the opposite sex peer group is insignificantly different from zero, as in column 2. Again, the magnitude of the effect is not trivial: an increase of around one within-school standard deviation of black students in the cohort would increase the average black share of

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<sup>9</sup>Our results are compatible with the existence of homophily in friendship found by Currarini et al. (2009) and Fletcher et al. (2013). Fletcher et al. (2013) find that a greater share of blacks in a cohort increases homophily once they control for the direct compositional effect that, if there are more blacks in a class, there are more potential matches with blacks. Here instead we are interested in whether more diversity in the classroom implies more contact with blacks in an absolute sense. Our findings in Table 4 suggest that the overall effect of both changes in friendship formation and the compositional effect are positive, which is consistent with Fletcher et al. (2013).

<sup>10</sup>See McPherson et al. (2001) and Kalmijn (2002), as well as the references discussed therein.

<sup>11</sup>Ideally we would like to compare the magnitude of the effect to the impact of some other variable, but we are not aware of other well-identified factors influencing interracial relationships. In column 3 of Appendix Table C7, however, we include the black share of an individual's census block in Wave 1 as a control variable. We find this coefficient to be significant but about half the size of the coefficient on the cohort black share.

TABLE 5: BENCHMARK RESULTS

|                                       | Any partners black |                    | Share of partners black |                      |
|---------------------------------------|--------------------|--------------------|-------------------------|----------------------|
|                                       | (1)                | (2)                | (3)                     | (4)                  |
| Grade black share,<br>both genders    | 0.246<br>(0.191)   |                    | 0.325**<br>(0.126)      |                      |
| Grade black share,<br>same gender     |                    | 0.283**<br>(0.119) |                         | 0.261***<br>(0.0858) |
| Grade black share,<br>opposite gender |                    | -0.0548<br>(0.123) |                         | 0.0586<br>(0.0808)   |
| Observations                          | 8879               | 8879               | 8696                    | 8696                 |
| Adjusted $R^2$                        | 0.061              | 0.062              | 0.055                   | 0.056                |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. The dependent variable in columns 1 and 2 is a dummy variable coded as one if a respondent reports having had at least one black partner. In columns 3 and 4 the dependent variable is the share of romantic partners who are black. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

adult relationships by half a percentage point, which is about a third of a standard deviation.

The results of Table 5 provide evidence that individuals who had a greater share of blacks in their school cohort have a higher chance to have one or more black partners later in life. The effect is not driven by students meeting romantic partners in their own grade. Rather, the results are consistent with the increase in close social interactions with black students of the same gender presented in the previous section. Hence, the importance of same sex peers could be driven by the fact that students typically form closer friendships with students of their own gender, and hence this peer group has the largest impact on post high-school relationships.<sup>12</sup>

Since it is the composition of same sex students which is driving our results, from now on we focus on these cohorts. To ease readability and clarity of our argumentation we focus on the binary interracial relationship measure as our outcome variable of interest. Results pertaining to the share of black partners can be found in Appendix C.1. Before we explore potential mechanisms behind our results, we explore the robustness to several alternative specifications.

We first analyze the extent to which our results may be affected by omitted variable bias by introducing a series of additional control variables. These results

<sup>12</sup>In line with this interpretation, Soetevent and Kooreman (2007) find that interactions with peers of the same gender are generally much stronger than those with peers of the opposite gender for several academic and non-academic outcomes.

TABLE 6: ROBUSTNESS TO ADDITIONAL CONTROLS

|                                       | (1)                | (2)                | (3)                | (4)                | (5)               |
|---------------------------------------|--------------------|--------------------|--------------------|--------------------|-------------------|
| Grade black share,<br>same gender     | 0.283**<br>(0.119) | 0.306**<br>(0.119) | 0.283*<br>(0.166)  | 0.315**<br>(0.158) | 0.317*<br>(0.180) |
| Grade black share,<br>opposite gender | -0.0548<br>(0.123) | -0.0584<br>(0.119) | -0.0386<br>(0.155) |                    |                   |
| Benchmark controls                    | Y                  | Y                  | Y                  | Y                  | Y                 |
| Extended controls                     |                    | Y                  | Y                  | Y                  | Y                 |
| School trends                         |                    |                    | Y                  |                    |                   |
| School-grade FE                       |                    |                    |                    | Y                  | Y                 |
| Tract FE                              |                    |                    |                    |                    | Y                 |
| Observations                          | 8879               | 8879               | 8879               | 8879               | 8879              |
| Adjusted $R^2$                        | 0.062              | 0.070              | 0.078              | 0.083              | 0.171             |

*Notes:* The table reports OLS estimates. The dependent variable is a dummy variable coded as one if a respondent reports having had at least one black partner. Benchmark controls are grade size, grade-gender fixed effects, and school-gender fixed effects. Extended controls include an individual's religion, birth year, the share of census block black, whether an individual lived with a single parent at Wave 1, whether an individual had repeated or skipped a grade prior to Wave 1, family income, mother's education, whether an individual was born in the US and the individual's age at Wave 4. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

are presented in Table 6. Column 1 presents our same sex cohort benchmark result, with column 2 introducing a number of control variables, including the share of blacks within an individual's census block, their family's income and their religion. Our coefficient of interest remains almost unchanged, suggesting that our result is not being driven by unobservables correlated with the controls we add (Altonji et al., 2005; Oster, 2017).

We can additionally control for a number of unobservables by introducing school trends and other fixed effects. Column 3 adds a trend variable for each school, which controls for factors such as differential dropout rates among blacks across schools. Column 4 adds school-grade fixed effects, such that our coefficient of interest is identified entirely from the difference between the black share among students of the same gender and the black share among students of the opposite gender. Finally, Column 5 introduces census tract fixed effects. On average there are 25 census tracts within a school, so including census tract fixed effects further ensures our results are not being driven by variation in the residential area from which students are drawn. In all these regressions, standard errors are larger than our benchmark due to a reduction in statistical power, but our coefficient moves relatively little and remains significant. Therefore, estimates in Table 6 strongly

suggest that unobserved omitted variables are unlikely to drive our result.

One potential concern with the methodology of exploiting cohort variation is that results can be driven by selection bias or measurement error, as described by Angrist (2014).<sup>13</sup> Since we have strong evidence that our variation in cohort black shares is random, this is unlikely to be a problem in our case, but we also check for bias from measurement error in three ways. First, if the cohort black share was proxying for an individual's true race, we would expect it to be significant when we replace our dependent variable with predetermined variables correlated with race. Yet in Table 2, we can see that the coefficient is insignificant when regressing parental race and two alternative measures of neighborhood black shares. Second, if our result is driven by measurement error in race, the coefficient should fall when we introduce other variables correlated with race, yet we observe little change when we do so. Third, following Carrell et al. (2016) and Feld and Zölitz (2017), we redo our estimation introducing varying amounts of measurement error. As expected, a greater amount of measurement error leads to results being attenuated to zero, and does not bias the coefficient upward. Results from these tests and more details can be found in Appendix C.3.

A different concern is that, since our identification is driven by small random variation across cohorts, our standard errors may be inappropriate or our results may be driven by some other aspect of the cohort which is correlated with the black share. We test for this in two ways. First, we construct over two hundred other cohort shares including, for instance, the share of Hispanics and the share who have college educated mothers. We enter them into regressions individually in place of our main explanatory variable and record the t-statistic. The t-statistics of our coefficients of interest in the benchmark results lie at the extremes of the right tails of the relevant distributions of the t-statistic resulting from this exercise (see Figure C3 in Appendix C.3). Second, we undertake one thousand placebo regressions whereby we assign students to cohorts within their school at random. Plotting the distribution of coefficients, we note that the true coefficient is clearly an outlier as it is larger than any of the placebo coefficients (see Figure C4 in Appendix C.3). We can therefore conclude that it is very unlikely that our result is driven by chance or correlation with other characteristics of school cohorts.

Since a number of individuals surveyed in Wave 1 are not included in our final sample, we may be concerned that this attrition impacts our results. In Appendix C.2 we provide several tests that show no evidence of such an impact. These include showing that, in our sample, the black share of one's cohort is not related to attrition

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<sup>13</sup> Angrist (2014) also discusses a range of other potential problems with the peer effects literature, but these are mainly not relevant to our context. For instance, non-linearity is not an issue since our peer characteristic of interest—being black or not—is binary in nature.

and controlling for being a respondent in Wave 3 do not affect our results. We also show that our results are relatively insensitive to the way individual Wave 4 weights are assigned. Results are also similar when we focus on relationships recorded in Waves 1 & 2, where attrition is much less of a concern. Finally, we use the procedure introduced by Lee (2009) to provide bounds of our results accounting for attrition, and find that the lower bound is significantly above zero.

We may also be concerned that our results are sensitive to the way the race of partners is measured, since this is self-reported by the interviewee. To address this issue, we use observations from Waves 1, 2, and 3 where the partners were interviewed and we use the interviewer's report of the partner's race. Using this alternative sample of partners, we show that cohort black share still has a significant impact both on the probability and the share of interracial relationships (see columns 1 and 5 of Table C8 in Appendix C.4). Impacts on interviewees reporting of partners' race is therefore unlikely to be affecting our results.

In Appendix C.5, we investigate several subsamples splits to investigate the nature and variation of our results. The results show that the coefficient of interest does not significantly differ by gender, region of the US or whether the cohort is measured in a middle or high school. Furthermore, we interact the cohort black share with the share of black students in school, the school segregation index of Echenique and Fryer (2007), the share of students residing in urban areas, the share of the Republican vote in 1992 US presidential elections in the school county, and the grade size. In none of the cases are the interaction terms significant, suggesting that our measured effect doesn't vary systematically across our sample.<sup>14</sup>

We also do the same analysis as in our benchmark specification for Hispanics and Asians, but we do not find any statistical effect of the share of students of those groups on subsequent romantic relationships (see Appendix C.4). This suggests there may be something special with respect to attitudes and social interactions with Blacks compared to other minorities, which is consistent with similar findings in the labor market (Hellerstein and Neumark, 2008).

We have so far established that students who have more blacks of the same gender in their school cohort go on to have, on average, more relationships with blacks as adults. To our knowledge, the only other paper that has looked at the impact of school peers on adult interracial relationships is that of Gordon and Reber (2016), who study the effect of school racial desegregation between 1961 and 1985 on subsequent black-white births. Their results are sensitive to the specification of cohort trends, and hence they cannot rule out no effect or a modest positive effect.

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<sup>14</sup>We do not find evidence for a non-linear effect of cohort black share on romantic relationships. Our ability to detect any non-linearity is however restricted by having a limited number of schools with a high black share and a potential correlation with other variables at the school level.



Our work is complementary to theirs in providing evidence on relationships beyond those that lead to children, and by studying a different era and source of variation. Additional data available in Add Health also allows us to provide insight on the potential mechanisms behind the increase in interracial relationships. This is what we explore in the next section.

## 5. INVESTIGATING MECHANISMS

There are three mechanisms that could lie behind the result identified in the previous section. First, the effect may be the result of a change in individuals' attitudes. Greater exposure to blacks may change beliefs in line with the "contact hypothesis" (Williams, 1947; Allport, 1954). Second, the effect may be the result of increased meeting opportunities. A greater number of blacks in an individual's cohort may increase the number of blacks in their social network, and through this network they may meet a greater number of potential black partners. Third, the effect may be the result of poorer educational achievement. Various studies suggest that an increased share of black students may worsen educational achievement for their peers (Hoxby, 2000; Hanushek et al., 2009; Billings et al., 2014). This may have knock-on effects on college attendance or employment which in turn impact individuals' propensity to form romantic relationships with blacks.

Identifying the mechanism at work is important for policy and for understanding the nature of peer effects. In particular, if adult relationships change as a result of a change in attitudes, this suggests cohort composition may impact a broader range of behaviors including discrimination. In this section, we aim to investigate whether evidence from our data is consistent with one or more of these mechanisms.

### 5.A. *Attitudes*

To test whether our result is compatible with the contact hypothesis, we would like to look directly for changes in attitudes regarding race. The Add Health surveys do not ask questions specifically about such attitudes, but in Wave 3 respondents are asked to rate how important they think several elements are for a serious committed relationship. One of these elements is "being of the same race or ethnic group". We construct a binary measure of the relative importance of race in a relationship by comparing the rating given to race to the other factors. The coefficient is significant and negative (column 1 of Table 7), indicating that white students who had a greater share of blacks in their school cohort attach less importance to racial homogeneity within romantic relationships.

We would also like to get a sense as to whether attitudes towards race are impacted beyond the context of romantic relationships. We exploit here the fact that in

TABLE 7: IMPACT OF COHORT BLACK SHARE ON ATTITUDES

|                                       | Importance of race<br>in relationships<br>(1) | Are students in school<br>prejudiced?<br>(sample of blacks)<br>(2) | Liberalness<br>in Obama election year<br>(3) |
|---------------------------------------|---|--|--|
| Grade black share,<br>same gender     | -0.458**<br>(0.229)                           | -0.534*<br>(0.320)   | 0.907**<br>(0.399)                           |
| Grade black share,<br>opposite gender | 0.0403<br>(0.263)                             | 0.200<br>(0.209)   | -0.0760<br>(0.409)                           |
| Observations                          | 7386  | 9332   | 8336   |
| Adjusted $R^2$                        | 0.070   | 0.067  | 0.080  |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used in all regressions. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

the Wave 1 in-school survey students are asked how much they agree with the general statement “the students at this school are prejudiced”. Answers to this question could incorporate any form of prejudice, but for black respondents we can imagine answers should partly reflect the extent to which they feel non-black students are prejudiced towards black students. We therefore use the sample of black students in the in-school survey and regress this variable on the cohort black share. The corresponding estimate in Column 2 of Table 7 implies that a greater share of blacks within a grade indeed leads black respondents to report less prejudice.

A third strategy involves examining how liberal respondents report themselves to be in Wave 4. In general, changes in racial attitudes may not shift individuals’ overall political identification, but Wave 4 of the survey was collected in 2008, the year when Barack Obama was first campaigning to become president. In both the democratic primary and the general election, Obama positioned himself as the more liberal of the candidates with large-scale support. Hence it is reasonable to hypothesize that individuals’ political identification in 2008 may be particularly correlated with their attitudes towards blacks. We therefore regress declared liberalness in Wave 4 on the cohort black share (column 3 of Table 7). The coefficient is positive and significant, suggesting that a greater share of blacks among white students’ peers makes them declare themselves as more liberal in 2008.

### 5.B. Impact by distance, age and social network

Our results so far are consistent with a change in racial attitudes, but it is also possible that the effect we have found is driven by an increase in meeting opportunities that result from more diverse social networks formed in school. Indeed, we have

seen that students with more black peers make more black friends and hence it might be that, through these friends, they then meet more other black people who become romantic partners. In order to test whether such meeting opportunities can explain most of the impact on adult romantic relationships, in this section we investigate heterogeneity in our result by distance, age and social network. The basic idea is that, if the result is driven by social networks formed in school, then the effect should be strongest for those relationships formed right after and closest to school. If instead greater romantic interaction with blacks is driven by a change in attitudes, then our results should be similar in all relationships.

To analyze the differential impact by geographical distance, we exploit information provided by respondents on where they live and when, if ever, they moved between US states. We combine this with information on when the relationship began to construct three proxies for how physically distant relationships are from school. First, we use the distance of the physical location of the respondent in Wave 4 from their location in Wave 1. Second, we use whether the individual resides in Wave 4 in the same county of the school he attended. Third, we use the information of whether the respondent lived outside the state they went to school in when they met their partners reported in Wave 4. Table 8 then shows the results from interacting each of these measures of distance with the share of black students of the same gender in school. We control for the interaction of the relevant distance variable with grade-gender and school-gender fixed effects. None of the interaction terms are significant, and the coefficient on the cohort black share doesn't change substantially. This suggests that the effect of having a higher share of black students in school on the probability of interracial dating does not fade with distance from school. Since we expect social networks to be mostly local (especially concerning indirect meeting via friends of friends), this evidence suggests that the meeting opportunities mechanism is unlikely to drive our results.

Social networks are also very likely to deplete over time, especially at a young age. Hence, in columns 1 and 2 of Table 9 we compare the effect of the composition of a student's cohort on relationships formed before and after age 23. If the effect is being driven by meeting opportunities stemming from school social networks, it would likely be most important in relationships formed before or just after students left school. This is not what we find, however, with the point estimate being if anything larger for those relationships formed longer after leaving.

As a final test, we use information in Waves 1 & 2 on romantic relationships students had during high school. This information is useful because for these relationships we know whether the partners are in the same school or not, as well as whether they share mutual friends with their partners. Using this data, we run regressions similar to the benchmark model. We see that there is no evidence that the effect of cohort black share is strongest for partners within school or those with

TABLE 8: IMPACT BY DISTANCE FROM SCHOOL

|   | (1)                | (2)                | (3)                |
|---|--------------------|--------------------|--------------------|
| Grade black share,<br>same gender                       | 0.277*<br>(0.147)  | 0.319*<br>(0.180)  | 0.304**<br>(0.147) |
| Grade black share,<br>opposite gender                   | -0.0919<br>(0.161) | -0.134<br>(0.242)  | -0.0286<br>(0.160) |
| Same sex black share<br>x distance (1000 km)            | -0.0444<br>(0.166) |                    |                    |
| Opp sex black share<br>x distance (1000 km)             | 0.105<br>(0.248)   |                    |                    |
| Same sex black share<br>x not in school county          |                    | -0.0419<br>(0.247) |                    |
| Opp sex black share<br>x not in school county           |                    | 0.127<br>(0.370)   |                    |
| Same sex black share<br>x all partners met out of state |                    |                    | 0.0984<br>(0.387)  |
| Opp sex black share<br>x all partners met out of state  |                    |                    | -0.426<br>(0.439)  |
| Observations  | 8831               | 8875               | 8696               |
| Adjusted $R^2$  | 0.077              | 0.078              | 0.074              |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. The dependent variable is a dummy variable coded as one if a respondent reports having had at least one black partner. We also control for the interaction of the relevant distance variable with grade-gender and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

mutual friends (columns 3 to 6 of Table 9). Indeed the effect is significantly larger for relationships with partners not in the same school compared to those in the same school, which may be because black peers directly compete in the dating markets within schools. Overall, these results are inconsistent with the hypothesis that the main mechanism driving our result is an increase in indirect meeting opportunities.

### 5.C. Educational performance

It is reasonable to hypothesize that a student's performance in school may have an impact on the race of their future adult partners. For instance, if worse grades mean students are less likely to go to college, they may then meet proportionally more black people, and as a result be more likely to have a relationship with blacks. Similarly, if students go on to engage in criminal behavior, they may come into contact with more blacks and this may impact the race of their partners.

To test for this mechanism, we first analyze whether we observe any impact of

TABLE 9: IMPACT BY AGE AND SOCIAL NETWORK

|                                       | Any black partners in Wave 4 |                            | Any black partners in Waves 1 or 2 |                              |                              |                                 |
|---------------------------------------|------------------------------|----------------------------|------------------------------------|------------------------------|------------------------------|---------------------------------|
|                                       | met before<br>age 23<br>(1)  | met after<br>age 23<br>(2) | in same<br>school<br>(3)           | not in same<br>school<br>(4) | with<br>mutual friend<br>(5) | without<br>mutual friend<br>(6) |
| Grade black share,<br>same gender     | 0.139<br>(0.113)             | 0.259**<br>(0.105)         | -0.00691<br>(0.121)                | 0.273***<br>(0.0992)         | 0.0686<br>(0.145)            | 0.221*<br>(0.128)               |
| Grade black share,<br>opposite gender | -0.00216<br>(0.0878)         | -0.00935<br>(0.0924)       | 0.126<br>(0.184)                   | -0.0172<br>(0.106)           | 0.0970<br>(0.130)            | 0.193<br>(0.191)                |
| P-val, coefs equal                    | .4                           |                            | .02                                |                              | .37                          |                                 |
| Observations                          | 8879                         | 8879                       | 8879                               | 8879                         | 8879                         | 8879                            |
| Adjusted $R^2$                        | 0.060                        | 0.028                      | 0.050                              | 0.049                        | 0.048                        | 0.058                           |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

cohort black shares on average test scores, college attendance, employment, earnings or recorded crime. The results of these regressions are presented in Table 10, and we can see that the coefficient on the black share is always insignificant. This is consistent with Bifulco et al. (2011) who do not find any impact of minority shares on these outcomes.

The insignificance of the results in Table 10 may however result from a lack of power rather than the absence of any real effects. Indeed, an impact on test scores of the size estimated in Billings et al. (2014), for instance, is within our 95 percent confidence interval. We therefore regress our main outcome variable on these measures to come up with an approximate upper bound for the size of this mechanism.<sup>15</sup> Even if we assume that all of the true coefficients are at the upper bounds of the various 95 percent confidence intervals, we estimate that impacts on educational performance, employment and earnings can account for no more than 22 percent of the effect identified in our benchmark. This is consistent with the observation of Sacerdote (2014) that the impact of peers on social outcomes is larger than that on test scores. We therefore conclude that educational performance is unlikely to be an important mechanism in explaining our result.

<sup>15</sup>Results are available on request. One reason this upper bound is approximate is because the coefficients in this regression are likely to be biased due to omitted variables. We nonetheless use these coefficients because no well-identified impacts of these variables exist, and the direction of this bias is in any case likely to inflate the result.

TABLE 10: IMPACT OF COHORT BLACK SHARE ON EDUCATIONAL PERFORMANCE

|                                       | Average<br>test score<br>(1) | Attended<br>college<br>(2) | Employed<br>(3)    | Log<br>earnings<br>(4) | Ever<br>arrested<br>(5) | Ever<br>incarcerated<br>(6) |
|---------------------------------------|------------------------------|----------------------------|--------------------|------------------------|-------------------------|-----------------------------|
| Grade black share,<br>same gender     | 0.269<br>(0.397)             | 0.328<br>(0.226)           | 0.0823<br>(0.232)  | -0.769<br>(0.498)      | -0.155<br>(0.239)       | -0.0491<br>(0.152)          |
| Grade black share,<br>opposite gender | 0.292<br>(0.384)             | 0.161<br>(0.183)           | -0.0141<br>(0.220) | -0.0961<br>(0.372)     | 0.336<br>(0.218)        | 0.0743<br>(0.185)           |
| Observations                          | 8808                         | 8878                       | 8875               | 8125                   | 8838                    | 8873                        |
| Adjusted $R^2$                        | 0.110                        | 0.119                      | 0.037              | 0.113                  | 0.093                   | 0.079                       |

*Notes:* The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

## 6. CONCLUSIONS

This paper finds that greater racial diversity in schools significantly impacts the prevalence of interracial adult relationships. The higher the share of black students of the same gender in a grade, the more likely a white student has a black partner during adulthood. Moreover, we provide evidence that this effect is associated with changes in stated attitudes and cannot be explained by increasing meeting opportunities since it is persistent across time, space and social networks.

Overall, our results enhance the understanding of how exposure to racial diversity can reduce the degree of assortativity by race in dating and marriage through a change in attitudes. This indicates that policies designed to increase racial diversity in schools may be effective in reducing racial prejudices and encouraging social integration more generally. Moreover, they might help to reduce household income inequality induced by assortative matching along race. Future research should nonetheless investigate whether policies that induce large changes in cohort composition induce similar effects.

Our paper has also highlighted the need to investigate further whether being exposed to racial diversity at school has implications for racial attitudes outside of the social sphere. One could imagine that attitudes that impact romantic relationships might also affect discrimination in the labor market or the workplace, but it is also possible that the latter may be more affected by work-related experiences. This is an important question to investigate if we are to understand fully the effects of policies designed to decrease racial discrimination.

## A. VARIABLE DEFINITIONS

TABLE A1: DESCRIPTION OF VARIABLES

| Variable                            | Wave | Description  | Values           |
|-------------------------------------|------|--|------------------|
| <i>Main variables</i>               |      |  |                  |
| Any partners black                  | 4    | Reports any black partners   | No = 0, Yes = 1  |
| Share of partners black             | 4    | Share of reported partners that are black  | [0,1]            |
| Grade black share, both genders     | 1    | Share of students in an individual's grade who define themselves to be black   | [0,1]            |
| Grade black share, same gender      | 1    | Share of students of the same gender as the individual in one's grade who are black (self-defined)   | [0,1]            |
| <i>Other variables</i>              |      |  |                  |
| Are students prejudiced?            | 1    | Extent to which students agree with statement "The students at this school are prejudiced"   | 0,...,4          |
| Average test score                  | 1    | Average of most recent grade in Maths, English, History and Science  | [1,4]            |
| Being liberal                       | 4    | Dummy coded as one if respondent considers himself/herself as liberal or very liberal.   |                  |
| Earnings                            | 4    | Income received from personal earnings before tax  | in U.S.\$        |
| Family income                       | 1    | Annual family income of individual   | in thous. U.S.\$ |
| Grade size                          | 1    | Number of students in individual's grade   | 9,...,695        |
| Grades in school                    | 1    | Number of grades in individual's school  | 1,...,6          |
| Importance of race in relationships | 3    | Takes value 0 if 'being of the same race or ethnic group' is ranked as a less important element of a serious relationship than love, fidelity, commitment and money; takes value 1 otherwise | 0,1              |
| In middle school                    | 1    | Individual's school has no grades beyond grade 9   | No = 0, Yes = 1  |
| In high school                      | 1    | Individual's school contains no grades before grade 9  | No = 0, Yes = 1  |
| Living in urban area                | 1    | Respondent lives in an urban area  | No = 0, Yes = 1  |
| Number of cohabiting partners       | 4    | Number of partners individual cohabited with for at least a month  | 0,...,21         |
| Parent is black                     | 1    | Parent interviewed in Wave 1 (normally resident mother) defines themselves as black  | No = 0, Yes = 1  |
| Respondent is white                 | 1    | Interviewer defines respondent as white  | No=0, Yes =1     |
| School segregation                  | 1    | Segregation of blacks in individual's school, as defined by Echenique and Fryer (2007)   | [0,1]            |
| Share of census block black         | 1    | Proportion of census block population black  | [0,1]            |
| Years of parental schooling         | 1    | Years of schooling of individual's most educated parent  | 8,...,17         |

## B. TESTS FOR NON-RANDOM CLUSTERING

We undertake a number of tests that look for evidence of non-random clustering of black students within schools in the in-school survey data. For these tests we use the sample of around 80,000 students who were surveyed in the in-school survey and who are in cohorts containing at least one student present in our main analysis sample. This is the relevant sample on which to conduct tests of non-random clustering since it is from this sample that we construct our independent variables measuring cohort black share. The intuitive idea behind these tests is that, if cohorts are more or less black in some systematic way, then an individual's race will be significantly

correlated with that of their peers. Traditionally, this hypothesis would be tested by regressing a dummy variable of whether an individual is black on the black share of the rest of their cohort. However, such a test would typically produce a negatively biased coefficient since individuals' peer groups necessarily exclude the individuals themselves. We thus undertake several tests designed to avoid this exclusion bias.

Caeyers and Fafchamps (2016) derive analytically a formula for the exclusion bias and then show that one can test for non-random clustering by transforming the standard test appropriately. In particular, in column 1 of Table B2 we use as a dependent variable the 'transformed black dummy'  $\widehat{Black}_i$ , where

$$\widehat{Black}_i = Black_i - bias_{cs} \times ShareBlack_{cs}.$$

Here  $Black_i$  is a dummy taking the value 1 if individual  $i$  is black, and  $bias_{cs} = (N_s - 1)(K_c - 1) / [(N_s - 1)(N_s - K_c) + (K_c - 1)]$ , where  $N_s$  is the number of students in the school and  $K_c$  the number of students in the cohort. The regression produces an insignificant coefficient, and hence does not reject random clustering. In Column 2, we carry out a similar test with the grade divided by gender. Coefficients on both peer groups are small and insignificant, consistent with our assumption of quasi-random allocation across grades.

TABLE B2: TESTS FOR NON-RANDOM CLUSTERING

|  | Transformed<br>black<br>dummy<br>(1) | Transformed<br>black<br>dummy<br>(2) | Black<br>dummy<br>(3) | Black<br>dummy<br>(4) | Black share<br>of males<br>in grade<br>(5) |
|--|--------------------------------------|--------------------------------------|-----------------------|-----------------------|--|
| Black share of others in<br>grade                | 0.219<br>(0.190)                     |                                      | 0.121<br>(0.500)      |                       |  |
| Black share of others of<br>same gender in grade |                                      | 0.00553<br>(0.0981)                  |                       | -0.115<br>(0.257)     |  |
| Black share of opposite<br>gender in grade       |                                      | 0.0291<br>(0.0920)                   |                       | 0.0541<br>(0.261)     |  |
| Black share of others in<br>school               |                                      |                                      | -109.2***<br>(25.83)  | -109.1***<br>(25.63)  |  |
| Black share of females<br>in grade               |                                      |                                      |                       |                       | 0.0636<br>(0.0799)                         |
| Observations                                     | 81638                                | 81638                                | 81638                 | 81638                 | 80696                                      |
| Adjusted $R^2$                                   | 0.999                                | 0.397                                | 0.410                 | 0.411                 | 0.980                                      |

*Notes:* The table reports OLS estimates. Controls in columns 1 to 4 include grade-gender fixed effects and school-gender fixed effects, and in column 5 include grade and school fixed effects. Regressions reported in this table are run on the Wave 1 in-school survey. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

An alternative method for correcting for exclusion bias is proposed by Guryan et al. (2009), who suggest controlling for the set of all potential peers. In our case,



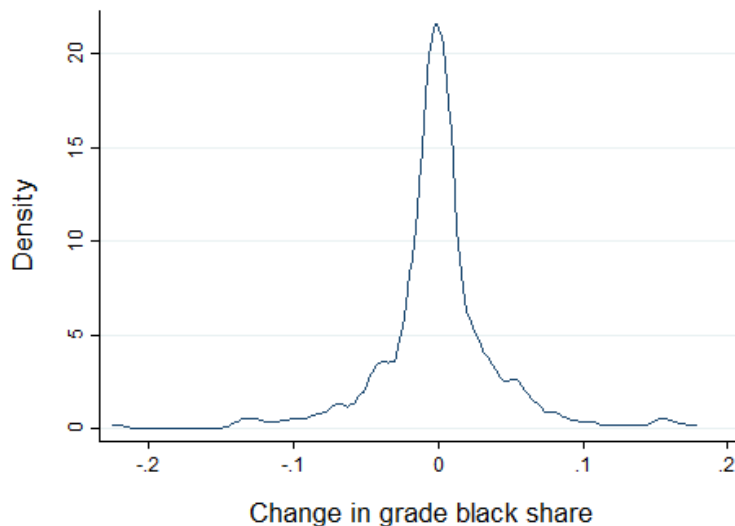
this involves adding the black share among all other students in the school as a control variable. Results of this test are displayed in Columns 3 and 4: again, the coefficients of interest on the cohort black shares are insignificant.

A simple less formal test is presented in column 5, whereby we regress the male black share on the female black share. The coefficient is insignificant, suggesting that there is unlikely to be important self-selection or omitted variables when it comes to race shares, since most factors which we could imagine influencing the female black share would also simultaneously influence the male black share.

Stevenson (2015) suggests an alternative test for non-random clustering: to pick randomly one observation within each cohort and to regress the share of blacks among the rest of the cohort on a dummy for whether the selected individuals are black, along with school-gender and grade-gender fixed effects. In this way, each observation is only present on either the RHS or LHS in each regression and there is no bias generated. We do this 10,000 times and, using the derived test statistics, obtain a p-value of .61 for the grade black share and a p-value of .50 for the same gender grade black share. Thus we are far from rejecting random clustering.

Feld and Zölitz (2017) show that if variation in cohort black shares is systematic, then measurement error should bias the coefficients of our regressions upwards; they should be biased downwards if the variation is instead random. In Section C.3, we test for the impact of measurement error on our results by introducing random error in our measure of race. Consistently with variation in cohort black shares being random, we find that doing so biases our results towards zero.

FIGURE B1: KERNEL DENSITY OF CHANGE IN GRADE BLACK SHARE



As a final test on the randomness of variation in grade black share, we check

whether differences in black share across grade are symmetric. If we found that black shares were on average significantly higher for later grades, or the opposite, we might worry that the variation stemmed from systematic trends. For instance, if changes in grade black share were driven by blacks dropping out disproportionately, we would observe that on average black shares would fall as we advanced through grades. To examine this, we collapse our data down to the school-grade level and calculate the change in black share between each grade and the previous grade. We plot the distribution of this variable in Figure B1 and we observe that there is no obvious asymmetry. Indeed, the mean change in grade black share is  $-0.0000266$ , while the mean absolute change in grade black share is  $0.0262$ .

Overall, therefore, all the tests we perform suggest that the variation in black share across grades can be considered as random.

## C. SUPPLEMENTARY RESULTS AND ROBUSTNESS CHECKS

### *C.1. Using share of partners black as dependent variable*

In the benchmark results presented in Table 5 we used two alternative dependent variables—a binary variable indicating whether an individual reported any black partners, and a continuous variable measuring the share of reported partners that were black. While the tables in the main text focus on the specification using the binary variable, we now present results using the share of black partners. Results in subsequent sections of the appendix are then reported for both dependent variables. Table C3 reports the results when we run the same regressions as reported in Tables 6 and 8 with the alternative dependent variable.

Table C4 then reports the results when we run the regressions shown in Table 9. In both tables, we see that results are very similar to those obtained using the binary dependent variable.

### *C.2. Robustness to attrition and weighting*

Since a number of individuals surveyed in Wave 1 of the survey are not included in our final sample, we may be concerned that this attrition impacts our results. In this section we therefore undertake a number of tests to examine whether there is any evidence of attrition bias.

We begin by taking the sample of students interviewed in Wave 1 and estimate equation (1) where the dependent is a dummy indicating whether the pupil is in our Wave 3 sample. The results of this regression are presented in column 1 of Table C5, and we note the coefficient is insignificant. Column 2 presents the results of a similar regression where the dependent variable is a dummy for the pupil being in

TABLE C3: ROBUSTNESS TO CONTROLS AND INTERACTION WITH DISTANCE VARIABLES WHEN DEPENDENT VARIABLE IS SHARE OF PARTNERS BLACK

|  | (1)                  | (2)                  | (3)                 | (4)              | (5)              | (6)                  | (7)                | (8)                 |
|--|----------------------|----------------------|---------------------|------------------|------------------|----------------------|--------------------|---------------------|
| Grade black share, same gender                       | 0.261***<br>(0.0858) | 0.275***<br>(0.0852) | 0.221**<br>(0.0992) | 0.177<br>(0.124) | 0.211<br>(0.149) | 0.280***<br>(0.0956) | 0.309**<br>(0.125) | 0.284***<br>(0.104) |
| Grade black share, opposite gender                   | 0.0586<br>(0.0808)   | 0.0569<br>(0.0809)   | 0.0494<br>(0.0829)  |                  |                  | 0.0465<br>(0.102)    | 0.107<br>(0.153)   | 0.0916<br>(0.0958)  |
| Same sex black share x distance (1000 km)            |                      |                      |                     |                  |                  | -0.0679<br>(0.139)   |                    |                     |
| Opp sex black share x distance (1000 km)             |                      |                      |                     |                  |                  | 0.0469<br>(0.191)    |                    |                     |
| Same sex black share x not in school county          |                      |                      |                     |                  |                  |                      | -0.143<br>(0.155)  |                     |
| Opp sex black share x not in school county           |                      |                      |                     |                  |                  |                      | -0.175<br>(0.205)  |                     |
| Same sex black share x all partners met out of state |                      |                      |                     |                  |                  |                      |                    | -0.0917<br>(0.257)  |
| Opp sex black share x all partners met out of state  |                      |                      |                     |                  |                  |                      |                    | -0.330<br>(0.295)   |
| Benchmark controls                                   | Y                    | Y                    | Y                   | Y                | Y                | Y                    | Y                  | Y                   |
| Extended controls                                    |                      | Y                    | Y                   | Y                | Y                |                      |                    |                     |
| School trends  |                      |                      | Y                   |                  |                  |                      |                    |                     |
| School-grade FE                                      |                      |                      |                     | Y                | Y                |                      |                    |                     |
| Tract FE   |                      |                      |                     |                  | Y                |                      |                    |                     |
| Observations   | 8696                 | 8696                 | 8696                | 8696             | 8696             | 8648                 | 8692               | 8696                |
| Adjusted R <sup>2</sup>                              | 0.056                | 0.062                | 0.073               | 0.074            | 0.158            | 0.080                | 0.068              | 0.065               |

*Notes:* The table reports OLS estimates. The dependent variable is share of partners who are black. Benchmark controls are grade size, grade-gender fixed effects, school-gender fixed effects. Extended controls include religion, birth year, the share of census block black, whether an individual lived with a single parent at Wave 1, whether an individual had repeated or skipped a grade prior to Wave 1, family income, mother's education, whether an individual was born in the US and age at Wave 4. In columns 6 to 8 we also control for the interaction of the relevant distance variable with grade-gender and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

our Wave 4 sample, and again we see the coefficient is insignificant. These results suggest there is no systematic relationship between an individual's cohort black share and their probability to be in Wave 4.

In order to provide further evidence that our results are not driven by attrition we carry out a number of further tests. In column 3 of Table C5, we simply take our benchmark regression and add a control variable indicating whether a respondent was interviewed in Wave 3. The variable is negative and significant, suggesting that

TABLE C4: IMPACT BY AGE AND NETWORK WHEN DEPENDENT VARIABLE IS SHARE OF PARTNERS BLACK

|                                    | Black share of Wave 4 partners |                         | Black share of Wave 1 & 2 partners |                           |                           |                              |
|------------------------------------|--------------------------------|-------------------------|------------------------------------|---------------------------|---------------------------|------------------------------|
|                                    | met before age 23<br>(1)       | met after age 23<br>(2) | in same school<br>(3)              | not in same school<br>(4) | with mutual friend<br>(5) | without mutual friend<br>(6) |
| Grade black share, same gender     | 0.313**<br>(0.136)             | 0.257**<br>(0.126)      | 0.133<br>(0.218)                   | 0.513***<br>(0.154)       | 0.170<br>(0.220)          | 0.316<br>(0.199)             |
| Grade black share, opposite gender | 0.0798<br>(0.130)              | -0.00476<br>(0.115)     | 0.420<br>(0.274)                   | -0.0133<br>(0.224)        | 0.0801<br>(0.180)         | 0.290*<br>(0.150)            |
| P-val, coefs equal                 | .4                             |                         | .02                                |                           | .37                       |                              |
| Observations                       | 5603                           | 5764                    | 4897                               | 3878                      | 4127                      | 5476                         |
| Adjusted $R^2$                     | 0.058                          | 0.055                   | 0.138                              | 0.125                     | 0.088                     | 0.152                        |

Notes: The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

TABLE C5: ROBUSTNESS TO ATTRITION AND WEIGHTING

|                                    | In Wave 3 sample<br>(1) | In Wave 4 sample<br>(2) | Any black partners in Wave 4 |                         |                   | Any black partners in Waves 1 or 2<br>(6) |
|------------------------------------|-------------------------|-------------------------|------------------------------|-------------------------|-------------------|---|
|                                    |                         |                         | (3)                          | (4)                     | (5)               |   |
| Grade black share, same gender     | 0.185<br>(0.127)        | -0.0397<br>(0.135)      | 0.290**<br>(0.119)           | 0.402**<br>(0.154)      | 0.214*<br>(0.115) | 0.191**<br>(0.0776)                       |
| Grade black share, opposite gender | -0.00706<br>(0.168)     | -0.0986<br>(0.168)      | -0.0496<br>(0.123)           | 0.0197<br>(0.101)       | 0.0820<br>(0.103) | 0.0771<br>(0.103)                         |
| In wave 3 sample                   |                         |                         | -0.0174**<br>(0.00801)       |                         |                   |   |
| Weights:                           | None                    | None                    | Wave 4                       | Wave 4<br>excl. top 10% | None              | Wave 1                                    |
| Observations                       | 11700                   | 11700                   | 8879                         | 8014                    | 9141              | 11026                                     |
| Adjusted $R^2$                     | 0.036                   | 0.033                   | 0.063                        | 0.055                   | 0.045             | 0.040                                     |

Notes: The table reports OLS estimates controlling for grade size, grade-gender fixed effects, and school-gender fixed effects. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

those interviewed in Wave 3 are less likely to have black partners than those not, but this relationship appears orthogonal to our results—the coefficient on the same gender black share barely changes compared to the benchmark.

In order to mitigate against attrition problems, our analysis has used probability weights constructed by Add Health. We may however be concerned that our results are being driven by individuals to which Add Health assigns high weights in Wave 4 of the survey. In order to test for this, column 4 removes those individuals with weights in the highest 10%. We observe that the coefficient on the cohort black share is significant and slightly larger than that in our benchmark regression. In column 5 we carry out the benchmark regression without using any probability

weights, and we observe that our result is still significant at the 10 % level. We therefore conclude that our results are not being driven by individuals to which Add Health assigns high probability weights.

An alternative way of testing whether our results are driven by attrition is to look at relationships recorded in other Waves of the survey. In column 6 of Table C5 we therefore use whether a respondent of the in-home survey has ever had a relationship with a black outside of school in Waves 1 or 2 as our dependent variable.<sup>16</sup> We find that the same gender cohort black share has a significant impact on the probability of dating a black, providing further evidence our result is not being driven by attrition in Wave 4 of the survey.

As a final test we calculate bounds on our result accounting for attrition using the method developed by Lee (2009). The bounds constructed by Lee (2009) aim to provide ‘worst case’ scenarios by taking extreme assumptions about attrition. Intuitively, the sample is trimmed to achieve balance between the treatment and control groups, removing alternately the highest and lowest values of the dependent variable. This provides bounds for the treatment effect on the assumption that the effect of treatment on attrition is monotonic—in our case, that students in grades with higher black shares are less likely to be in Wave 4 than those in grades with low black shares.

The method developed by Lee (2009) is designed for situations where individuals are subject to a binary treatment and exogeneity is not conditional on control variables. To provide relevant bounds, we therefore need to adapt our specification. To do so, we first construct an independent ‘treatment’ variable which takes the value 1 if an individual’s cohort had a higher black share than the average cohort within the school and 0 otherwise. In column 1 of Table C6 we undertake our benchmark regression with this alternative variable and we obtain similar results to our benchmark—students in cohorts with a higher black share than average are significantly more likely to have a black partner.

Columns 2 and 3 of Table C6 then provide bounds on our result when we trim the sample manually in the spirit of Lee (2009). In particular, in columns 2 and 3 we drop observations from our control group so that the proportion treated in our final sample is the same as the proportion treated in the original Wave 1 sample. To calculate a lower bound on our result in column 2, we drop those observations that contribute most to a positive correlation between the dependent and treatment variable, that is, those observations which have the smallest residual when we regress the dependent variable on the control variables. In column 3 we instead drop those observations in the control group with the highest such residual.

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<sup>16</sup>We focus on relationships outside of school because changes number of blacks of the same gender automatically affect the degree of competition for dating blacks within the school.

TABLE C6: LEE BOUNDS ANALYSIS

|   | Manual trimming       |                       |                        | Stata command           |                        |                        |
|---|-----------------------|-----------------------|------------------------|-------------------------|------------------------|------------------------|
|   | OLS                   | Lower bound           | Upper bound            | OLS                     | Lower bound            | Upper bound            |
| <i>Base dependent variable: Any partners black</i>      |                       |                       |                        |                         |                        |                        |
|   | (1)                   | (2)                   | (3)                    | (4)                     | (5)                    | (6)                    |
| main  |                       |                       |                        |                         |                        |                        |
| Above average black share                               | 0.0163**<br>(0.00686) | 0.0129*<br>(0.00743)  | 0.0538***<br>(0.00650) | 0.0129***<br>(0.00469)  | 0.0105**<br>(0.00502)  | 0.0541***<br>(0.00418) |
| Grade black share, opposite gender                      | -0.0561<br>(0.124)    | -0.0396<br>(0.128)    | 0.00274<br>(0.101)     |                         |                        |                        |
| Benchmark controls                                      | Y                     | Y                     | Y                      |                         |                        |                        |
| Observations  | 8879                  | 8596                  | 8596                   | 8879                    | .                      | .                      |
| <i>Base dependent variable: Share of partners black</i> |                       |                       |                        |                         |                        |                        |
|   | (7)                   | (8)                   | (9)                    | (10)                    | (11)                   | (12)                   |
| main  |                       |                       |                        |                         |                        |                        |
| Above average black share                               | 0.0114**<br>(0.00467) | 0.0108**<br>(0.00500) | 0.0339***<br>(0.00447) | 0.00935***<br>(0.00338) | 0.00772**<br>(0.00363) | 0.0355***<br>(0.00303) |
| Grade black share, opposite gender                      | 0.0584<br>(0.0826)    | 0.0596<br>(0.0837)    | 0.0321<br>(0.0640)     |                         |                        |                        |
| Benchmark controls                                      | Y                     | Y                     | Y                      |                         |                        |                        |
| Observations  | 8696                  | 8431                  | 8431                   | 8696                    | .                      | .                      |

*Notes:* The dependent variable in columns 1 to 3 is whether an individual reports any black partners, and in columns 4 to 6 is the residual when this variable is regressed on grade size, school-gender fixed effects, and grade-gender fixed effects. The dependent variable in columns 7 to 9 is the share of partners who are black, and in columns 10 to 12 it is the residual when this variable is regressed on grade size, school-gender fixed effects, and grade-gender fixed effects. Lower and upper bounds in columns 2, 3, 8, and 9 are obtained by trimming the sample of those who were in a grade with an above average black share based on the value of the residual and then undertaking OLS. Lower and upper bounds in columns 5, 6, 11 and 12 are calculated using the methodology of Lee (2009) via the Stata command `leebounds` produced by Tauchmann (2014). Standard errors (in brackets) are clustered at the school level in columns 1 to 3 and 6 to 8. Benchmark controls are grade size, school-gender fixed effects, and grade-gender fixed effects. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

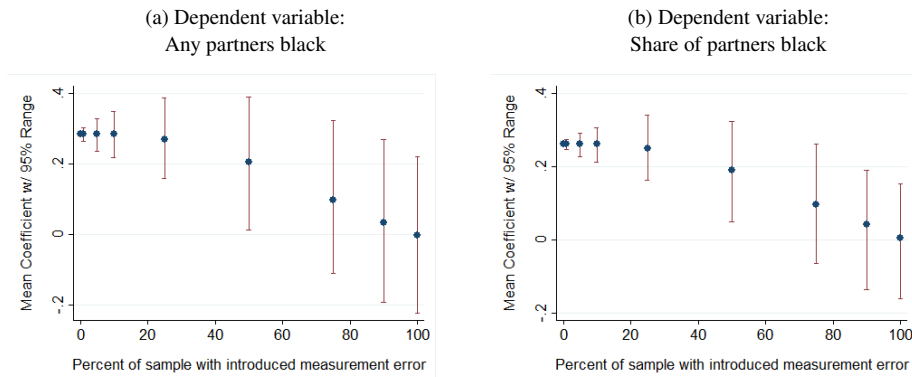
Trimming the sample manually in this way allows us to keep a specification close to our benchmark. As a robustness check, we now implement Lee's methodology precisely. To do so, we use as our dependent variable the residual when we regress our base dependent variable (i.e. 'any partner black' or 'share of partners black') on our set of controls (grade size, grade-gender fixed effects and school-gender fixed effects). Column 4 of Table C6 presents the results when we regress this variable using OLS on our treatment variable. Columns 5 and 6 then display upper and lower bounds as calculated using the Stata command `leebounds` produced by Tauchmann (2014). Columns 7-12 of Table C6 then carry out the same analysis using the share of partners black rather than the binary variable.

The results in Table C6 suggest that our results are not significantly upward biased due to attrition: in all cases, the lower bound is significantly above zero. Moreover the 95% confidence interval for the treatment effect as calculated by Imbens and Manski (2004) does not include zero. Overall, therefore, we conclude that attrition is unlikely to be able to explain the effect we find.

### C.3. Robustness to measurement error

As discussed in Section 4, if the variation in black shares within schools is not random, then the estimated coefficients might be biased due to measurement error. One way to test whether our results may be biased by measurement error, suggested by Carrell et al. (2016) and Feld and Zölitz (2017), is to gradually introduce measurement error into our data and observe how our coefficient of interest changes. In particular, we repeat the following process 1000 times. First, we generate a new variable which takes the value one with a probability equal to the predicted black share based on school, gender and grade. Second, we generate a new black dummy variable which takes the observed value with a 99 percent chance and the random value with a 1 percent chance. We construct new cohort black shares based on this dummy and then undertake our standard regression with race variables besides the black dummy removed. Third, we repeat this process for other error levels.

FIGURE C2: SENSITIVITY OF MAIN RESULT TO MEASUREMENT ERROR IN BLACK VARIABLE



Notes: The y-axis variable is the average coefficient on cohort black share from 1000 regressions where, before each regression, the black dummy variable is replaced with a random value for a share of the sample. This share is indicated on the x-axis.

Figure C2 shows the results of this process, where we plot the average coefficient generated as well as the 95 percent range. We can see that as more measurement error is introduced, the coefficient falls towards zero. This is consistent

with our variation being random, and shows that measurement error would bias our results downwards rather than upwards.

TABLE C7: ROBUSTNESS TO MEASUREMENT ERROR

| Dependent variable:                 | Any partners black |                      |                      |                          | Share of partners black |                      |                      |                         |
|-------------------------------------|--------------------|----------------------|----------------------|--------------------------|-------------------------|----------------------|----------------------|-------------------------|
|                                     | (1)                | (2)                  | (3)                  | (4)                      | (5)                     | (6)                  | (7)                  | (8)                     |
| Grade black share, same gender      | 0.283**<br>(0.119) | 0.282**<br>(0.121)   | 0.296**<br>(0.119)   |                          | 0.261***<br>(0.0858)    | 0.258***<br>(0.0854) | 0.271***<br>(0.0849) |                         |
| Grade black share, opposite gender  | -0.0548<br>(0.123) | -0.0612<br>(0.123)   | -0.0602<br>(0.125)   |                          | 0.0586<br>(0.0808)      | 0.0528<br>(0.0822)   | 0.0543<br>(0.0801)   |                         |
| Black dummy - Wave 4 interviewer    |                    | 0.257***<br>(0.0838) |                      |                          |                         | 0.246***<br>(0.0897) |                      |                         |
| Census block black share            |                    |                      | 0.134***<br>(0.0480) |                          |                         |                      | 0.105**<br>(0.0402)  |                         |
| Number of blacks of same gender     |                    |                      |                      | 0.00232***<br>(0.000682) |                         |                      |                      | 0.00125**<br>(0.000488) |
| Number of blacks of opposite gender |                    |                      |                      | 0.000204<br>(0.000707)   |                         |                      |                      | -0.000197<br>(0.000515) |
| Observations                        | 8879               | 8879                 | 8879                 | 8879                     | 8696                    | 8696                 | 8696                 | 8696                    |
| Adjusted $R^2$                      | 0.062              | 0.067                | 0.065                | 0.062                    | 0.056                   | 0.066                | 0.060                | 0.054                   |

*Notes:* The table reports OLS estimates. Controls include grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Another way to check for measurement error is to add variables that may be correlated with the measurement error and observe whether our result changes. We therefore add to our benchmark regression two variables that are likely to be correlated with an individual's true race: a dummy for whether the interviewer in Wave 4 declares the surveyed individual to be black, and the share of the population that are black in the census block where they live. The results are shown in columns 2 and 3 of Table C7, and we include our benchmark regression in column 1 for comparison. Both added variables are positive and highly significant, but the coefficient on the cohort black share changes little from the benchmark result in column 1. The same holds true when we use the share of black partners as the dependent variable. This further suggests that measurement error is unlikely to be driving our results.

One further technique that has been used to address the concerns of Angrist (2014) is to split the sample between the individuals who may be producing the peer effects from those who are being influenced by them. In columns 4 and 8, therefore, we show that our result holds when we make the main independent variable the number of blacks in their cohort, rather than the share.

#### C.4. Other specifications of race

Table C8 presents the results when we look at race in different ways. First, in column 1, we use the sample of relationships where the partner was also interviewed:



in Waves 1 & 2 a number of in-school partners were interviewed as part of the normal in-home survey, and in Wave 3 a random subsample of current partners were interviewed. Using this subsample of partners allows us to use a different definition of partner race from that declared by the main interviewee, and thus examine the possibility that cohort black share influences interviewee’s reporting of partners’ race. The coefficients are significantly different from zero and insignificantly different from our benchmark results, suggesting that any impact on interviewees reporting of partners’ race is unlikely to be affecting our results.

TABLE C8: OTHER SPECIFICATIONS OF RACE

| Dependent variable:                         | Any partners                             |                    |                    |                    | Share of partners                        |                      |                    |                    |
|---|--|--------------------|--------------------|--------------------|--|----------------------|--------------------|--------------------|
|   | Black<br>(per the<br>interviewer)<br>(1) | Black<br>(2)       | Hispanic<br>(3)    | Asian<br>(4)       | Black<br>(per the<br>interviewer)<br>(5) | Black<br>(6)         | Hispanic<br>(7)    | Asian<br>(8)       |
| Grade black share,<br>same gender           | 0.603**<br>(0.264)                       |                    |                    |                    | 0.602**<br>(0.264)                       |                      |                    |                    |
| Grade black share,<br>opposite gender       | 0.0510<br>(0.220)                        |                    |                    |                    | 0.0388<br>(0.220)                        |                      |                    |                    |
| Grade black (alt def)<br>share, same gender |  | 0.252**<br>(0.122) |                    |                    |  | 0.221**<br>(0.0863)  |                    |                    |
| Grade black (alt def)<br>share, opp gender  |  | -0.129<br>(0.110)  |                    |                    |  | -0.00556<br>(0.0694) |                    |                    |
| Grade Hispanic share,<br>same gender        |  |                    | -0.0333<br>(0.200) |                    |  |                      | -0.0323<br>(0.136) |                    |
| Grade Hispanic share,<br>opposite gender    |  |                    | 0.217<br>(0.219)   |                    |  |                      | 0.133<br>(0.144)   |                    |
| Grade Asian share,<br>same gender           |  |                    |                    | -0.114<br>(0.105)  |  |                      |                    | -0.106<br>(0.0812) |
| Grade Asian share,<br>opposite gender       |  |                    |                    | -0.0577<br>(0.127) |  |                      |                    | -0.0229<br>(0.108) |
| Observations                                | 2105                                     | 8879               | 7614               | 8879               | 2105                                     | 8696                 | 7463               | 8696               |
| Adjusted $R^2$                              | 0.186                                    | 0.064              | 0.109              | 0.055              | 0.190                                    | 0.062                | 0.118              | 0.062              |

*Notes:* The table reports OLS estimates. Partners in columns 1 and 5 are all those interviewed in Waves 1,2 and 3; all other columns concern partners reported in Wave 4. Controls include grade size, grade-gender fixed effects and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

In column 2, our black share is calculated based on those who declare themselves to be black, rather than simply those who declare themselves to be black *and only black*. This distinction might be important since those of mixed race are likely to behave differently from blacks (Fryer et al., 2012). We obtain a very similar result, which is not surprising given the relatively small number of mixed race individuals. Columns 3 and 4 then look at two other minorities, Hispanics and Asians, and find no significant relationship between their cohort share and subsequent adult relationships with this groups. This suggests that prevailing attitudes towards interracial relationships with these groups are different.

Finally, columns 5 to 8 show that similar conclusions can be drawn when we focus on the effect on the share of partners of a given race.

### C.5. Subsample splits and interactions

In Table C9, we present subsample splits that are of interest to understand further any variation in the impact of black students on the probability and the share of adult romantic relationships (first and second panel respectively). For each split, we present results of a Wald test that the coefficients are identical in the final row.

TABLE C9: SUBSAMPLE SPLITS

|  | Gender  |          | School type   |             | Region     |          |          |         |
|--|---------|----------|---------------|-------------|------------|----------|----------|---------|
|  | Female  | Male     | Middle school | High school | North-east | Mid-west | South    | West    |
| <i>Dependent variable: Any partners black</i>      |         |          |               |             |            |          |          |         |
|  | (1)     | (2)      | (3)           | (4)         | (5)        | (6)      | (7)      | (8)     |
| Grade black share, same gender                     | 0.348*  | 0.199*   | 0.267         | 0.317       | 1.370**    | 0.205    | 0.137    | 0.479   |
|  | (0.198) | (0.117)  | (0.179)       | (0.191)     | (0.547)    | (0.255)  | (0.116)  | (0.278) |
| Grade black share, opposite gender                 | -0.0746 | -0.0345  | -0.0698       | -0.0405     | 0.226      | -0.0873  | -0.0658  | -0.212  |
|  | (0.240) | (0.107)  | (0.190)       | (0.203)     | (0.287)    | (0.347)  | (0.118)  | (0.235) |
| P-val, coefs equal                                 | .52     |          | .84           |             | .1         |          |          |         |
| Observations                                       | 4623    | 4256     | 1882          | 5154        | 1612       | 2690     | 3167     | 1410    |
| Adjusted $R^2$                                     | 0.052   | 0.043    | 0.039         | 0.073       | 0.057      | 0.115    | 0.023    | 0.053   |
| <i>Dependent variable: Share of partners black</i> |         |          |               |             |            |          |          |         |
|  | (9)     | (10)     | (11)          | (12)        | (13)       | (14)     | (15)     | (16)    |
| Grade black share, same gender                     | 0.319** | 0.186**  | 0.310**       | 0.234*      | 0.844***   | 0.312    | 0.141*   | 0.307   |
|  | (0.124) | (0.0929) | (0.135)       | (0.131)     | (0.295)    | (0.248)  | (0.0788) | (0.178) |
| Grade black share, opposite gender                 | 0.0609  | 0.0584   | 0.117         | 0.0813      | 0.416      | 0.145    | -0.0385  | 0.0612  |
|  | (0.144) | (0.0730) | (0.158)       | (0.118)     | (0.308)    | (0.188)  | (0.0943) | (0.172) |
| P-val, coefs equal                                 | .36     |          | .67           |             | .1         |          |          |         |
| Observations                                       | 4537    | 4159     | 1841          | 5048        | 1564       | 2638     | 3111     | 1383    |
| Adjusted $R^2$                                     | 0.047   | 0.028    | 0.048         | 0.062       | 0.054      | 0.090    | 0.037    | 0.038   |

*Notes:* The table reports OLS estimates. Controls include grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

First, we show that the effect is significant for both male and female students, and not significantly different. We also find no evidence of significant differences when we break down the sample between middle and high schools, providing further evidence that our results are not driven by differential dropout rates or students moving between schools. Indeed, when the dependent variable is the share of partners black, the coefficient is significant for both middle and high schools.

The final splits shown in Table C9 is by the region the school is located in. The test that all coefficients are equal cannot be rejected at the 10 % level, though

the effect does appear to be strongest in the North-East. This may be related to different patterns of segregation or racial attitudes across regions, so we next try to study whether there is a systematic impact across these lines.

To investigate further potential heterogeneity in the effect across schools, in Table C10 we interact our independent variables of interest with various school characteristics. This includes the share of students at the school who are from urban areas, the share of Republican votes in the 1992 presidential election in the county, the share of blacks within the school, the segregation index proposed by Echenique and Fryer (2007) based on friendship networks of blacks within the school, and the number of students in the grade. We normalize each variable such that the median school has a value of zero. Overall, none of the interaction terms are significant, suggesting no simple pattern of heterogeneity across schools.

### *C.6. Placebo tests*

To address concerns that our standard errors may be inappropriate or our results may be driven by some other cohort characteristic, we undertook two different sets of placebo tests. First, we constructed over two hundred other cohort share variables based on other questions in the in-school survey. The resulting variables include, for instance, the share of the cohort who are Hispanic, the share who live with both of their parents, and the share whose most recent history grade was an A. Figure C3 then plots the t-statistics from the regressions when we enter each of these variables individually into our regression instead of the cohort black share. The red lines represent the t-statistics we obtain in our benchmark, and for both dependent variables they clearly lie at the very right tail of the distribution. Hence, we can conclude that it is very unlikely that our result is driven by chance or correlation with another characteristic of school cohorts.

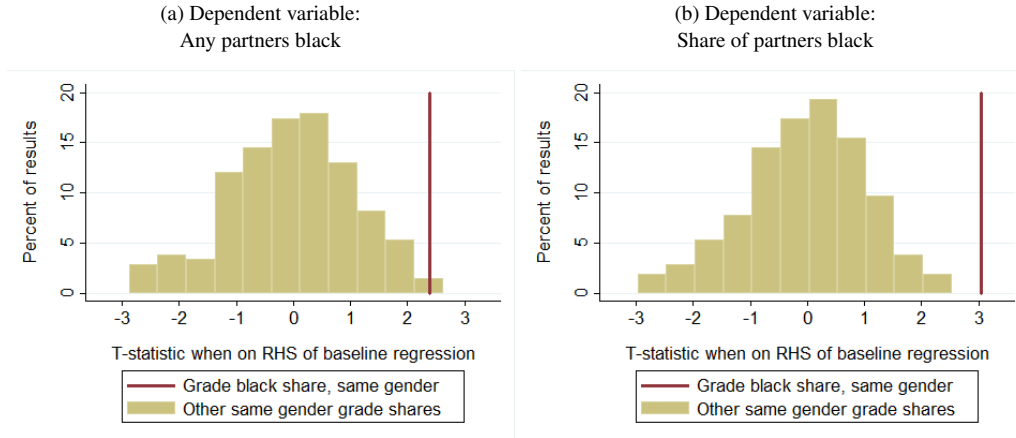
Our second placebo test involves reassigning students to cohorts randomly so that our measure of cohort black share is in general not that of their cohort, but another within the same school. We then carry out the same regression as in our benchmark one thousand times to produce a distribution of coefficients, which is displayed in Figure C4 alongside the coefficient from our benchmark. As expected, the distributions are centered on zero, and of the thousand placebo regressions very few produce coefficients as large as these from our benchmark. This further confirms that our result is not spurious.

TABLE C10: INTERACTION WITH REGIONAL AND SCHOOL CHARACTERISTICS

| Interaction term:                                  | School urban share  | Republican vote share in 1992 | School black share | School black segregation | Students in grade      |
|--|---------------------|-------------------------------|--------------------|--------------------------|------------------------|
| <i>Dependent variable: Any partners black</i>      |                     |                               |                    |                          |                        |
|  | (1)                 | (2)                           | (3)                | (4)                      | (5)                    |
| Grade black share, same gender                     | 0.222*<br>(0.118)   | 0.254**<br>(0.122)            | 0.513**<br>(0.249) | 0.591**<br>(0.266)       | 0.422**<br>(0.205)     |
| Grade black share, opposite gender                 | -0.107<br>(0.103)   | -0.0805<br>(0.130)            | 0.184<br>(0.202)   | -0.0123<br>(0.258)       | -0.0239<br>(0.146)     |
| Same gender x interaction term                     | 0.202<br>(0.251)    | -1.426<br>(1.123)             | -0.892<br>(0.740)  | -0.744<br>(0.491)        | 0.00169<br>(0.00151)   |
| Opp. gender x interaction term                     | 0.252<br>(0.242)    | -1.498<br>(1.299)             | -0.910<br>(0.726)  | -0.188<br>(0.495)        | -0.00112<br>(0.00111)  |
| Observations                                       | 8879                | 8828                          | 8879               | 8802                     | 8879                   |
| Adjusted R <sup>2</sup>                            | 0.062               | 0.064                         | 0.062              | 0.063                    | 0.073                  |
| <i>Dependent variable: Share of partners black</i> |                     |                               |                    |                          |                        |
|  | (6)                 | (7)                           | (8)                | (9)                      | (10)                   |
| Grade black share, same gender                     | 0.213**<br>(0.0839) | 0.248***<br>(0.0877)          | 0.255*<br>(0.143)  | 0.361***<br>(0.124)      | 0.283**<br>(0.138)     |
| Grade black share, opposite gender                 | 0.0122<br>(0.0707)  | 0.0711<br>(0.0779)            | 0.235<br>(0.153)   | 0.156<br>(0.179)         | 0.110<br>(0.117)       |
| Same gender x interaction term                     | 0.150<br>(0.186)    | -1.374<br>(0.922)             | 0.0264<br>(0.516)  | -0.264<br>(0.239)        | 0.000788<br>(0.00112)  |
| Opp. gender x interaction term                     | 0.315**<br>(0.152)  | -0.630<br>(0.963)             | -0.650<br>(0.455)  | -0.255<br>(0.347)        | -0.00102<br>(0.000819) |
| Observations                                       | 8696                | 8645                          | 8696               | 8622                     | 8696                   |
| Adjusted R <sup>2</sup>                            | 0.056               | 0.064                         | 0.058              | 0.057                    | 0.067                  |

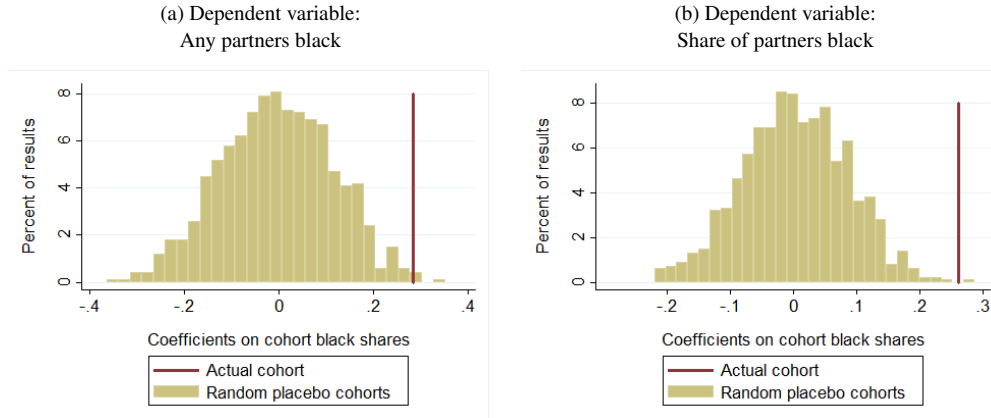
*Notes:* The table reports OLS estimates. Controls include grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. In columns 5 and 10, the interaction term varies within schools, so we interact it also with school fixed effects. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

FIGURE C3: DISTRIBUTION OF T-STATISTICS FROM REGRESSIONS ON OTHER COHORT SHARES



Notes: Each t-statistic is taken from a regression where the independent variable is one of over 200 cohort share variables. The red lines are the t-statistic in the benchmark specification, i.e. columns 2 and 4 of Table 5.

FIGURE C4: DISTRIBUTION OF COEFFICIENTS FROM REGRESSIONS ON RANDOMLY ASSIGNED COHORT SHARES



Notes: Each coefficient is taken from a regression where the independent variable is the share of blacks among a randomly chosen cohort within the school. The red lines are the coefficients in the benchmark specification (columns 2 and 4 of Table 5).

C.7. Other relationship measures

Table C11 presents the results of making a number of alternative relationship measures the dependent variable in our standard specification. Columns 1 to 3 focus

on binary variables that indicate whether an individual ever married or cohabited with someone, ever had a child or ever divorced respectively. All the coefficients are insignificant, implying that the shift in the racial composition of relationships does not go along with any change in their nature.

TABLE C11: OTHER RELATIONSHIP MEASURES

| Dependent variable:                | Ever married or cohabited<br>(1) | Ever had children<br>(2) | Ever divorced<br>(3) | Ever married or cohabited with a black<br>(4) | Share of married or cohabiting partners black<br>(5) | Ever had a child with a black<br>(6) |
|------------------------------------|----------------------------------|--------------------------|----------------------|---|--|--------------------------------------|
| Grade black share, same gender     | -0.0822<br>(0.227)               | 0.0510<br>(0.234)        | 0.183<br>(0.189)     | 0.188*<br>(0.0987)                            | 0.203**<br>(0.0956)                                  | 0.207**<br>(0.0897)                  |
| Grade black share, opposite gender | -0.207<br>(0.221)                | 0.00119<br>(0.188)       | 0.181<br>(0.168)     | -0.136<br>(0.110)                             | -0.0570<br>(0.0858)                                  | -0.0434<br>(0.0779)                  |
| Observations                       | 8879                             | 8696                     | 8879                 | 8879  | 7579   | 8879                                 |
| Adjusted $R^2$                     | 0.073                            | 0.132                    | 0.063                | 0.069   | 0.069  | 0.055                                |

*Notes:* Controls include grade size, grade-gender fixed effects, and school-gender fixed effects. Wave 4 cross-sectional weights are used. Standard errors (in brackets) are clustered at the school level. \*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Columns 4 and 5 examine the effect on the probability of ever cohabiting or getting married with a black and the black share of cohabiting and married partners. We find the coefficient to be of similar magnitude to our benchmark. Finally, in the spirit of Gordon and Reber (2016), we see that the share of black peers in school as a positive effect on the probability that white students have a child with a black partner in adulthood (column 6).

#### D. SCHOOLS WITH MOST VARIATION IN COHORT BLACK SHARE

Table D12 provides summary statistics for schools that have within-school variation in the black cohort share above median. Comparing with Table 1, we see that the main difference is the share of black students in the school. We also see that these schools are more likely to be located in the South and have a greater share of students living in urban areas, but there are still many schools in areas outside the South and with rural students that are in this half of the sample.

TABLE D12: SUMMARY STATISTICS FOR SCHOOLS WITH COHORT BLACK SHARE S.D. ABOVE MEDIAN

|                                 | Mean | Between school s.d. | Within school s.d. | N    |
|---------------------------------|------|---------------------|--------------------|------|
| <i>Main variables</i>           |      |                     |                    |      |
| Any partners black              | .058 | .051                | .21                | 4427 |
| Share of partners black         | .038 | .037                | .14                | 4335 |
| Grade black share, both genders | .15  | .14                 | .022               | 4427 |
| Grade black share, same gender  | .14  | .14                 | .033               | 4427 |
| <i>Other Wave 1 variables</i>   |      |                     |                    |      |
| Age                             | 16   | 1.2                 | 1.2                | 4427 |
| Female                          | .52  | .093                | .49                | 4427 |
| Hispanic                        | .24  | .35                 | .22                | 4427 |
| Family income                   | 52   | 34                  | 44                 | 3439 |
| Grade size                      | 252  | 193                 | 32                 | 4427 |
| Grades in school                | 4    | 1.3                 | 0                  | 4427 |
| In middle school                | .16  | .39                 | 0                  | 4427 |
| In high school                  | .63  | .51                 | 0                  | 4427 |
| Lives in urban area             | .63  | .43                 | .17                | 4382 |
| Region = Northeast              | .21  | .43                 | 0                  | 4427 |
| Region = Midwest                | .12  | .35                 | 0                  | 4427 |
| Region = South                  | .48  | .53                 | 0                  | 4427 |
| Region = West                   | .18  | .41                 | 0                  | 4427 |
| <i>Other Wave 4 variables</i>   |      |                     |                    |      |
| Age                             | 29   | 1.2                 | 1.2                | 4427 |
| Number of recorded partners     | 1.9  | .28                 | 1.3                | 4427 |
| Number of cohabiting partners   | 1.3  | .28                 | 1                  | 4427 |
| Number of marriages             | .62  | .21                 | .56                | 4335 |
| Attended college                | .66  | .18                 | .43                | 4427 |
| Employed                        | .66  | .074                | .47                | 4426 |

*Notes:* Summary statistics are calculated using the Wave 4 cross-sectional weights, which aim to produce a representative sample from individuals who are surveyed in both Waves 1 and 4.

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