

SECONDARY SCHOOL TRACKING AND EDUCATIONAL INEQUALITY:  
COMPENSATION, REINFORCEMENT, OR NEUTRALITY?

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ABSTRACT

This paper investigates the effects of academic tracking within secondary schools on educational stratification. The paper considers systematically the ways that tracking can affect levels and dispersions of academic achievement and high school graduation rates among social groups. It reports the effects of track placement on students' outcomes while taking account of both measured and unmeasured causes of assignment of students to tracks; formulates and assesses structural models of the implicit organizational goals embodied in academic tracking; and examines effects of tracking on racial, sexual, and socioeconomic inequality for high school students in the United States. Data from the High School and Beyond Survey of students who were sophomores in 1980 show that placement in the college track substantially benefits growth in mathematics achievement and the probability of high school graduation, even when measured and unmeasured sources of nonrandom assignment to tracks are taken into account. Track assignment reinforces preexisting inequalities in achievement among students from different socioeconomic backgrounds. However, track assignment and differential achievement in tracks partially compensate blacks and girls for their initial disadvantages and makes racial and sexual inequalities smaller than they may have otherwise been. The paper provides qualified support for the view that students are assigned to the tracks that provide the greatest reward to their measured background characteristics.

## SECONDARY SCHOOL TRACKING AND EDUCATIONAL INEQUALITY: REINFORCEMENT, COMPENSATION, OR NEUTRALITY?<sup>1</sup>

Schools are important agents of social stratification in contemporary societies, and their sorting and socializing functions have long been of interest to sociologists. Of particular concern is the school's response to inequalities among entering students. Educational policies, practices, and organizational forms that are intended to raise levels of school performance are often accused of promoting educational stratification. Such is the case with academic tracking, the system of assigning high school students to different curricula according to their purported interests and abilities. While some claim that tracking is needed to provide appropriate opportunities for learning in a diverse population (e.g., Whipple 1936; Conant 1967), others see it as a system for maintaining social inequality in a stratified society (e.g., Oakes 1985).

Although tracking has been examined in many previous studies, its role in promoting excellence and/or maintaining inequality has not been fully clarified. This has resulted in part from a lack of criteria for evaluating within-school stratification. To judge tracking, one must distinguish between two aspects of its consequences: effects on educational productivity and effects on educational inequality. Productivity refers to raising or lowering average outcomes, such as achievement or graduation rates. Inequality refers to the increase or reduction in the dispersion of outcomes, both overall and between subgroups, such as whites and blacks or high and low socioeconomic groups. Contrasting judgments of tracking differ in the attention they pay to track effects on productivity and inequality. To adjudicate between opposing viewpoints, it is necessary to examine both kinds of outcomes.

Previous studies of track effects have also suffered from inadequate

treatment of the process of selection into track positions. In part this problem is a methodological one, because if selection is inadequately controlled, then apparent track effects may actually be the result of unmeasured variables that are correlated with both track assignment and track outcomes. Modeling the selection process also has substantive implications, for analyses of track assignment embody assumptions about the selection process that typically go unexamined.

In response to these concerns, the present paper has four objectives: (1) to consider more systematically the ways that tracking may enhance or reduce means and inequalities among social groups; (2) to illustrate how to assess the effects of track placement on academic outcomes while taking account of possible nonrandom selection of students to academic tracks; (3) to formulate and test alternative structural models about the implicit rules and strategies that govern track selection; and (4) to assess empirically the aggregate implications of tracking for racial, sexual, and socioeconomic inequality for a recent cohort of high school students in the United States.

### THREE VIEWS OF ACADEMIC TRACKING

Discussions of the effects of academic tracking on students typically emphasize one of three views. One view is that tracking raises overall academic achievement and compensates for student differences in aptitude and prior achievement. A second is that tracking fails to raise achievement and tends to reinforce preexisting inequalities. A third position is that the effects of tracking on student outcomes are largely neutral.

#### Positive Views of Tracking

The major pedagogic rationale for academic tracking is that students

differ in their academic goals and in the environments in which they learn best. Ideally, a system of academic tracking matches students' aptitudes with the objectives and learning environments to which they are best suited (Cook 1924; Whipple 1936; Conant 1967). In principle, both in the aggregate and for individuals, student achievement is higher in a tracked high school system than in one where tracking is nonexistent or in one where tracks exist but student aptitudes are not matched to track programs (Coxe 1936; Hopkins 1936; Conant 1967). Some advocates of tracking argue further that the system may compensate students of low academic promise by raising their achievement above what it would be in an untracked system (Moyer 1924; Keliher 1931).

This position argues that tracking enhances productivity (that is, raises mean outcomes), and leaves two possibilities for inequality: if the achievement of high-track students rises more than that of others, inequality increases. If low-track achievement scores benefit most, inequality declines. Both of these positions have received some empirical support (Whipple 1936; Findley and Bryan 1971; Good and Marshall 1984). Proponents of tracking are typically noncommittal as to whether one's assessment of tracking regimes should take into account whether they increase or decrease inequality.

#### **Negative Views of Tracking**

Critics of academic tracking stress the potential of tracking systems to widen differences between students. According to this argument, tracks stratify students and produce larger academic and post-schooling inequalities than would exist in the absence of tracking (Findley and Bryan 1971; Schafer and Olexa 1971; Rosenbaum 1976; Ball 1981; Hallinan 1984; Oakes 1985). Moreover, since track assignment is often associated with social factors that are bases of inequality (e.g., race, sex, socioeconomic status, class),

tracking may widen social inequalities that already exist to an undesirable degree (Schafer and Olexa 1971; Persell 1977; Oakes 1985). Finally, because of the potential stigma and uneven quality of instruction attached to non-college tracks, some students may in fact learn less or be less likely to realize their academic or vocational goals when assigned to a non-college track than they could in a different track or in an untracked high-school system (Hargreaves 1967; Lacey 1970; Keddie 1971; Rosenbaum 1976; Ball 1981; Oakes 1985).

In emphasizing track effects on inequality, some critics disregard overall educational productivity. Others suggest that tracking does not consistently affect outcomes (Persell 1977; Oakes 1985). But, if tracking has no effects at all on outcomes, it is difficult to conclude that it affects inequality. These critics imply that tracking fails to improve outcomes for high-track students and depresses results for others. Tracking, according to this view, reduces productivity and increases inequality.

#### Neutral Views of Tracking

A third view is that tracking's effects on levels and inequalities of outcomes are largely neutral. That is, tracking systems neither reduce nor widen preexisting inequalities among groups of students, nor do students' track assignments have harmful or beneficial effects on their level of achievement, competency, or post-high school success (Jencks et al. 1972; Jencks and Brown 1975; Alexander and Cook 1982). The differentiation of students within secondary schools may perform organizational functions and affect how students, teachers, and parents view student life. But the importance of tracking systems and track placement for social stratification is minimal and overstressed by both advocates and critics of tracking. Those

who view tracking as having little to do with educational outcomes base their case on an absence of effects on productivity. If tracking regimes fail to influence productivity within tracks, they cannot affect inequality, because inequality can only change as a result of tracking if persons in different tracks experience different changes in outcomes.

#### Implications

These divergent views indicate, first, that productivity and inequality are conceptually and empirically distinct. When productivity effects are absent, no effects on between-track inequality are possible. But otherwise, productivity and inequality may vary independently. Second, the contrasts show that one's evaluation of tracking depends not only on empirical findings about its influence on means and variances, but on one's values concerning the relative importance of productivity and equality. Stratification in schools may produce higher achievement overall, but increased productivity may be mainly due to higher outcomes among high-track students, so that inequality rises as well. In short, empirical analyses of tracking should take account of the several dimensions along which tracking systems can succeed or fail.

#### MODELS OF TRACKING AND ITS EFFECTS

##### Limitations of Traditional Approaches

The usual approach to analyzing track effects is to incorporate them into linear models of academic achievement and social stratification (e.g., Heyns 1974; Alexander and McDill 1976; Alexander, Cook, and McDill 1978; Alexander and Cook 1982; Waitrowski et al. 1982; Gamoran 1987). Such studies typically classify students by track (e.g., college vs. vocational vs. general, or academic vs. nonacademic) and treat track as a variable that intervenes



between family, school, and early achievement on the one hand and later achievement on the other. These studies attempt to ascertain which tracks lead to highest levels of later achievement, whether tracks independently affect later achievement once other characteristics of students and schools are controlled, and the degree to which track placement statistically explains the gross associations of background variables and later achievement.

While informative, such analyses are unable to address many of the issues with which we are concerned. First, by assuming the absence of unmeasured variables that jointly affect assignment to tracks and subsequent achievement, standard models may fail to disentangle track effects from preexisting differences among students. Common, unmeasured determinants of track placement and track outcomes can be viewed in two ways. On the one hand, they are "omitted variables," such as demographic, school, motivational, or aptitude factors that analysts fail to control. On the other hand, the joint determination of track placement and track outcomes may arise because students are assigned to tracks in part on the basis of their expected outcomes. For example, students may choose (or be assigned to) the track where they are expected to have their highest level of academic performance or to have their lowest probability of dropping out. In this event, tracking and its outcomes are simultaneously related, leading to an upward bias in estimated tracking effects.

Standard models also usually assume a unidimensional hierarchy of student aptitude, rather than allowing for multiple dimensions of aptitude (e.g., mechanical vs. verbal ability) to be best matched with tracks. As a result, the underlying rationale for tracking--that students differ in where they will most likely succeed--is denied by assumption, rather than represented as a

falsifiable hypothesis. For example, several studies find positive effects of membership in the academic track on achievement (e.g., Alexander, Cook, and McDill 1978; Kerckhoff 1986). The additive models that they use assume that tracking affects all students similarly. But low-achieving students may gain less than their high-achieving peers from advanced coursework (Alexander and Pallas 1984; Gamoran 1987). Accordingly, the effects of track assignment may vary across types of students.

Third, even though track selection and track outcomes are frequently examined together, past studies have neglected to consider their joint implications for inequalities between population subgroups. For example, male-female inequalities may be lower in the non-college than in the college track. Combining this with a college-track assignment bias favoring males (e.g., Alexander and McDill 1976) would mean that sex differences are larger than they would be if students were assigned without regard to sex, but smaller than they would be if all students were assigned to the college track.

Finally, analysts of tracking have been disinclined to develop formal models of how students are assigned to tracks and how tracks affect outcomes. It is thus hard to assess whether empirical evidence supports or rejects more general assessments of the successes and failure of tracking systems.

#### New Models of Tracking

This paper uses models that relax the assumptions of traditional approaches by allowing for the joint determination of tracking and its outcomes. These models (1) represent both the allocation of persons to tracks and the effects of tracks on outcomes; (2) quantify the degree to which common, unmeasured variables affect both tracking and its outcomes; (3) provide estimates of the effects of sociodemographic factors and prior

achievement within tracks that are relatively free from potential selection biases; and (4) show the impact of tracking by simulating how students would fare had they entered different tracks from those that they in fact occupy.

In our models, students are systematically selected into tracks on the basis of their known characteristics and the unobservable beliefs of teachers, administrators, parents, and students themselves about their "suitability" to a particular track. Measured and unmeasured factors jointly affect both achievement and track placement. Effectively, therefore, these models control unmeasured factors that may bias estimates of track effects in simpler models of tracking. They also reveal the differences in levels and differentials of track outcomes under hypothetical tracking systems and assignment rules. For example, they permit us to consider whether non-college track students would fare equally well in the college track. They also permit us to estimate whether the difference between college and non-college students would be greater or smaller if all students enrolled in a single track. Additionally, we are able to explore the effects of tracking on gaps between subgroups such as blacks and whites or boys and girls.

#### Track Assignment Models

In examining the criteria of track assignment, many analyses focus on the contrast between the relative importance of students' ascribed and achieved characteristics (Heyns 1974; Alexander and others 1976, 1978, 1982; Rehberg and Rosenthal 1978). Students' prior achievement appears to be the main predictor of track position, but family background also plays a role in the assignment process. Other studies point out the importance of school organizational conditions as well (DeLany 1986; Jones, Vanfossen, and Spade 1986; Gamoran 1987; Sørensen 1987). Students' chances of college-track

membership depend not only on their own attributes, but on their standing relative to others in the school, and on the school's programmatic organization. Features of a school's composition--its racial and ethnic makeup and the achievement level of its student body--and aspects of school organization--such as the proportion of students in the academic track and the availability of advanced courses--can affect a student's opportunity to enroll in a college-preparatory curriculum. By influencing track assignment, these school-level variables indirectly affect student outcomes such as achievement.

We are also concerned with the contributions of both school-level and individual predictors of track assignment. But in contrast to standard models, we explore the possibility that placement results from students' expected outcomes as well as from preexisting conditions. Decision-makers--whether school personnel or the students themselves--may evaluate students' chances for academic success in one or the other program. These expectations may derive from unmeasured characteristics of students as well as from their observed attributes. Of course, decisions about track enrollment are still subject to the constraints fostered by the organizational characteristics of particular schools.

Our approach further permits us to consider not only the criteria of assignment, but various rules or patterns that may govern the assignment process. By comparing the relative fits of alternative models of track placement, we can empirically examine the plausibility of some specific assignment rules. Two sorts of rules seem worth considering. First, the traditional rationale for tracking (that it allows schools to assign students to programs that are best suited to their interests and abilities) suggests that assignment is intended to maximize student performance. According to

this hypothesis, then, students are assigned to the track in which they obtain the greatest benefit from their prior achievements, aptitudes, and other learning-related background characteristics. We term this view the "Maximization Model."

A second possibility, which we call the "Quota Model," suggests that assignment is based on students expected performance in the college track, but without consideration for their possible success or failure elsewhere. This view acknowledges that schools have limited resources, and may not have space available for all students to enroll in a college-preparatory program (Hallinan and Sørensen 1986; Sørensen 1987). Consequently, they rank students in order of their expected outcomes in the high-status curricular program, and allow entry to the most promising candidates. This model is more sensitive than the first to the organizational aspects of the track assignment process. It recognizes, first, that schools may be limited in their resources. Second, it places a premium on a likely organizational goal of secondary schools: producing high performance in the college track.

These models imply that the parameters in models for track assignment will follow predictable patterns. The empirical validity of the models can be investigated by comparing them to one another and to a more standard model in which assignment is based solely on observed characteristics (the "Ascription Model"). In addition, all three of these models will be tested against a general, unrestricted model of track assignment based on observed and unobserved characteristics of students and schools. The models are discussed more formally below.

#### **Models of the Outcomes of Tracking**

Although the models discussed in this paper may apply to many educational

outcomes, this paper focuses on only two: mathematics achievement, and the propensity to graduate from high school. Comparing influences on these outcomes presents the opportunity to consider two types of track effects. Arguments for or against tracking are frequently based on its purported impact on achievement. Tracking is regarded as helpful or harmful because of its contribution to the school's technical function, producing cognitive skills. But schools have other functions as well, including the certification of graduates and their allocation to post-high-school roles (Parsons 1959; Clark 1962; Meyer 1977). The role of tracking in this process may be as important as its impact on achievement.

Among cognitive skill areas, mathematics achievement is probably the most likely to be influenced by curriculum because of its sensitivity to school influences. By contrast, verbal skills are more likely to be affected by experiences in the home or elsewhere outside school. Studies of track effects consistently find larger influences on mathematical than on verbal achievement (Jencks and Brown 1975; Alexander and Cook 1982; Gamoran 1987). This may seem a foregone conclusion inasmuch as mathematics is a key part of a college-preparatory curriculum (Vanfossen, Jones, and Spade 1987). It is an open question, however, whether development in basic mathematical skills is greater in academic tracks for all students. Students learn mathematical skills in applied courses as well and some may make greater gains in these contexts, particularly in basic skills. Tracking, therefore, is potentially beneficial to the mathematics achievement of all students if those who benefit most from exposure to the practical use of mathematics have such experience in the non-college track.

We examine high-school graduation rather than college attendance or

graduation, because college attendance is enhanced by enrollment in the college track almost by definition, whereas no similar definitional link exists between graduation and track placement. Thus each track may produce better chances of graduation for its incumbents than the other track. Some advocates of tracking stress the advantages of non-college-preparatory programs for keeping students in high school longer (see Mirel and Angus 1986). To our knowledge, however, no evidence is available that tracking raises graduation rates for students who are not bound for college attendance (Shavit 1984).

Mathematics achievement and the likelihood of graduation are influenced by other factors, including student characteristics, such as ability or prior achievement, sex, race, ethnicity, and socioeconomic status (e.g., Coleman et al 1966; Rumberger 1983). Because they also serve as predictors of track position, these variables make both direct and indirect contributions to outcomes. By contrast, we suggest that school composition and curricular characteristics make only indirect contributions to outcomes, through their effects on track assignment. Previous work suggests that the direct contribution of such school conditions is minimal (Gamoran 1987; see also Alwin 1976).

#### DATA

To estimate these models we use data from the High School and Beyond (HSB) survey, a national sample of high school sophomores in 1980 (Jones et al. 1984). These students were re-surveyed in 1982 and, for a random subsample, again in 1984. About 14,000 students participated in all three survey waves. Our sample includes all students, in both public and private

schools, who had complete data on track position, mathematics achievement, and whether or not they graduated from high school. This yields a total of 10,980 students.

#### Variables

Table 1 presents the means and standard deviations of the variables included in our analyses for both the total sample and the college and non-college track subsamples.

Track Position. In HSB, track position is indicated by students' responses to the question of whether their high school programs are best described as general, academic, or vocational. This approach uses students' beliefs about their programs, which may affect their later educational outcomes (Gamoran 1987). High school students often select their own courses (Powell, Farrar, and Cohen 1985) and make their own decisions about whether to drop out. Thus, their beliefs about their programs are important measures of track positions (Gamoran 1987).<sup>2</sup> We measure track position at a single time, that is, sophomore-year. Thus we limit ourselves to asking, what are the effects of perceiving oneself to be in a particular program in the sophomore-year?<sup>3</sup> Following previous studies, we focus on only a single track division, that is, college versus non-college tracks (e.g., Heyns 1974; Alexander and McDill 1976). Achievement differences between the college-preparatory and other tracks are much larger than between general and vocational programs (Gamoran 1987).

Track Outcomes. We examine the effects of track placement on senior-year mathematics achievement and on whether or not students obtain a high school degree. Mathematics achievement is measured with a test administered in 1982 to all respondents regardless of whether they were still in school. High



school graduation is measured as whether or not students obtained a regular high school diploma by 1984. Because of our interest in the success of schools in producing graduates, we code students who obtain a GED as non-graduates.<sup>4</sup> As Table 1 indicates, students in the college track enjoy much higher senior-year mathematics achievement and higher rates of high school graduation than their counterparts in the non-college track.

Independent Variables. The predetermined variables in our analyses include sophomore-year scores on tests of mathematics, science, reading, vocabulary, writing, and civics; sociodemographic characteristics of students, including dichotomous variables that equal one for blacks, Hispanics, and males (and zero otherwise), and an index of socioeconomic status (SES) which is an unweighted linear composite of father's occupational prestige score, father's and mother's grades of school completed, family income, and a home artifacts scale; indicators of the demographic composition of a student's school, including its percent black, percent Hispanic, and mean SES; and indicators of the academic character of the student's school, including percent of students in the academic track, number of advanced mathematics courses available, and average sophomore-year mathematics achievement score. The school variables were taken from the 1980 school questionnaires, except for mean SES and mathematics achievement, which were computed from student scores.

## STATISTICAL MODELS

### General Model

To examine the effects of tracking on mathematics achievement and the probability of high school graduation we use endogenous switching regression

models, which are appropriate for the analysis of the effects of a categorical variable, such as track placement, when assignment to the categories may be affected by both measured and unmeasured variables that also affect the outcomes (Amemiya 1985; Maddala 1983; Mare and Winship 1988). Let  $d_i$  equal 1 for students in the college track and 0 for students in the non-college track. For the  $i$ th student ( $i = 1, \dots, I$ ), let  $Y_1$  and  $Y_2$  denote outcomes such as senior-year mathematics achievement in the college and non-college tracks respectively, and  $X_{ki}$  denote the effect of the  $k$ th independent variable ( $k = 1, \dots, K$ ) that may affect track assignment or outcome within tracks, including a constant. Under these assumptions, a model for track effects on the outcome is

$$(1) \quad Y_{1i} = \sum_k \beta_{1k} X_{ki} + \epsilon_{1i},$$

$$(2) \quad Y_{2i} = \sum_k \beta_{2k} X_{ki} + \epsilon_{2i},$$

where  $\epsilon_1$  and  $\epsilon_2$  are disturbances, and the  $\beta_{1k}$  and  $\beta_{2k}$  are parameters. The outcome is then two variables for each student. We observe only the outcome associated with the track that each student in fact enters. Nonetheless both the observed outcomes and the hypothetical outcomes that students would experience had they entered different tracks may affect their assignments to tracks. Some of the  $X_k$  may be excluded from one or both of (1) and (2) or have the same effects in both equations. If the effects of the independent variables are identical in the two tracks for all variables except the constant, then the net effect of track on outcome is  $\beta_{11} - \beta_{21}$ . Otherwise, the track effect is conditional upon the  $X_k$ .

If  $Y_1$  and  $Y_2$ , are intervally scaled, (1) and (2) are linear models. The model is then directly applicable to the analysis of mathematics achievement, which is measured on an approximately interval scale. To apply the model to

high school graduation, a dichotomous variable, we regard  $Y_1$  and  $Y_2$  as latent, interally scaled variables that are related to the probabilities of graduation and are indicated by a dichotomous variable denoting whether or not a student graduates (e.g., Winship and Mare 1983). Because the models for graduation and for mathematics achievement are formally identical, our discussion applies to both outcomes.

Now we consider the process by which students are assigned to tracks. Let students have latent scores  $Z_i$ , which index their likelihood of assignment to the college track. The probability of assignment to the college track is  $P(Z_i > 0)$ . Let the relative chances that a student is assigned to the college or non-college track be a function of both the predetermined factors  $X_k$  that affect outcomes in tracks, and also the expected outcomes of the tracks themselves. Thus,

$$(3) \quad Z_i = \sum_k \gamma_k X_{ki} + \eta_1 Y_{1i} + \eta_2 Y_{2i} + \zeta_i,$$

where  $\eta_1$ ,  $\eta_2$ , and the  $\gamma_k$  are parameters and  $\zeta$  is a stochastic disturbance. Throughout, we assume that  $\zeta$  is uncorrelated with  $\epsilon_1$  and  $\epsilon_2$  in (1) and (2). Substituting (1) and (2) into (3) yields:

$$(4) \quad Z_i = \sum_k \pi_k X_{ki} + \epsilon_{3i},$$

where  $\pi_k = \eta_1 \beta_{1k} + \eta_2 \beta_{2k} + \gamma_k$  and  $\epsilon_{3i} = \eta_1 \epsilon_{1i} + \eta_2 \epsilon_{2i} + \zeta_i$ . Thus (1), (2), and (3) are the structural form of a model for the assignment of students to tracks and the effects of tracks on outcomes; and (1), (2), and (4) are the corresponding reduced form.

To complete the model, we assume that  $\epsilon_1$ ,  $\epsilon_2$ , and  $\epsilon_3$  follow a trivariate normal distribution with  $\text{Var}(\epsilon_1) = \sigma_1^2$ ,  $\text{Var}(\epsilon_2) = \sigma_2^2$ ,  $\text{Var}(\epsilon_3) = \sigma_3^2$ ,  $\text{Cov}(\epsilon_1, \epsilon_2) = \sigma_{12}$ ,  $\text{Cov}(\epsilon_1, \epsilon_3) = \sigma_{13}$ , and  $\text{Cov}(\epsilon_2, \epsilon_3) = \sigma_{23}$ . Whereas the disturbance in the structural equation for allocating students to tracks,  $\zeta$ , is uncorrelated with

the disturbances in the outcome equations,  $\epsilon_1$  and  $\epsilon_2$ , the reduced form disturbance,  $\epsilon_3$ , is correlated with  $\epsilon_1$  and  $\epsilon_2$ . The parameter  $\sigma_{12}$ , the covariance of unmeasured determinants of outcomes across tracks, is not identified but this does not affect the other parameters in the model. Equations (1) and (2) are regression models for mathematics achievement and probit models for high school graduation. Equation (4) is also a probit model. These equations must be estimated in a way that takes account of the correlated disturbances. The distributions of not only  $Z$  but also  $Y_1$  and  $Y_2$  are defined for the entire population, not only for students who in fact enter the college or the non-college track. For example, if  $\bar{X}_k$  is the population mean of  $X_k$ , then  $\sum \beta_{1k} \bar{X}_k$  is the expected outcome for a random sample of the entire population when placed in the college track.

Our models include the effects of nonrandom selection into tracks. Single-equation least squares or probit estimates of (1) and (2) are consistent only if unmeasured determinants of track placement,  $\epsilon_3$ , are uncorrelated with unmeasured determinants of outcome within tracks,  $\epsilon_1$  and  $\epsilon_2$ ; that is, if students are assigned randomly to tracks (conditional on their observed  $X_k$ ). The covariances between the disturbances in the equations predicting assignment of students to tracks,  $\epsilon_3$ , and the outcome,  $\epsilon_1$  and  $\epsilon_2$ , adjust for potential inconsistency. The covariances  $\sigma_{13}$  and  $\sigma_{23}$ , moreover, show the degree and direction of nonrandom selection of students to tracks. This model thus represents the population-level effects of track on outcome, rather than observed differences in outcomes between college and non-college track samples. That is, it represents the effects of tracking and other variables on mathematics achievement or high school graduation, taking account of the biasing influences of unobserved factors on which students are

selected into tracks.

### Structural Models

The general model of tracking can incorporate assumptions about the rules that govern the assignment of students to tracks. We have suggested some alternative principles that may govern track assignment. Here we show how the Ascription, Maximization, and Quota Models are formally specified.

Ascription Model. Students may be assigned to tracks solely on the basis of their observed (predetermined) characteristics. That is, their expected outcomes  $Y_1$  and  $Y_2$  do not affect their assignment to tracks, once their measured characteristics  $X_k$  are taken into account. This model amounts to assuming that  $\eta_1 = \eta_2 = 0$  in (3). Thus  $\epsilon_3 = \zeta$ , which is uncorrelated with  $\epsilon_1$  and  $\epsilon_2$  and  $\sigma_{13} = \sigma_{23} = 0$ .

Maximization Model. In the Maximization Model, students are assigned to the tracks where they experience the greatest reward to their learning-related background characteristics. This model assumes that a random selection of students would fare less well in each track than the actual students assigned there. It is also a restricted case of the general model. In particular, in (3),  $\eta_1 = -\eta_2 = \eta$  and  $\gamma_k = 0$  for  $k > 1$ , yielding

$$\begin{aligned} (5) \quad Z_i &= \gamma_1 + \eta(Y_{1i} - Y_{2i}) + \zeta_i \\ &= \gamma_1 + \eta[(\sum_k \beta_{1k} X_{ki} + \epsilon_{1i}) - (\sum_k \beta_{2k} X_{ki} + \epsilon_{2i})] + \zeta_i \\ &= \sum_k \pi_k X_{ki} + \epsilon_{3i} \end{aligned}$$

where  $\pi_k = \eta(\beta_{1k} - \beta_{2k})$  for  $k > 1$ ,  $\pi_1 = \gamma_1 + \eta(\beta_{11} - \beta_{21})$ , and  $\epsilon_{3i} = \eta(\epsilon_{1i} - \epsilon_{2i}) + \zeta_i$ . The parameter  $\eta$  is the effect of the difference in expected outcomes between the college and non-college tracks on the chances that a student will be assigned to the college track. The model also implies restrictions on the covariance matrix of disturbances in (1), (2), and (4). The restrictions

require that  $\sigma_{13} - \sigma_{23} > 0$ , which, provided  $\eta > 0$ , accords with the assumption that students enter the track where their prior characteristics are most highly rewarded.

This formulation of the Maximization Model is very strong.<sup>5</sup> It assumes that persons make tracking decisions with complete foresight of the outcomes associated with alternative tracks (Mare and Winship 1988). That is, both measured and unmeasured determinants of expected outcomes affect the chances of assignment to the college track through a single parameter  $\eta$ . A weaker version of the model allows for distinct effects of measured ( $\sum \beta_{1k} X_{ki}$  and  $\sum \beta_{2k} X_{ki}$ ) and unmeasured ( $\epsilon_1$  and  $\epsilon_2$ ) parts of expected outcomes on track assignment. This is tantamount to relaxing the restrictions on  $\sigma_{13}$  and  $\sigma_{23}$  that are implied by the strong form of the Maximization Model. We discuss this possibility further below.

Quota Model. In the Quota Model, decision makers fill the college track with the top of the population as defined by its expected outcome in the college track. Conversely, they assign to the non-college track students who are expected to fall in the bottom of the outcome distribution if they enter the college track. Unlike in the Maximization Model, students' expected outcomes in the non-college track are irrelevant to their track assignment. Thus, the college track "dominates" the assignment process. The Quota Model implies restrictions on equation (3), namely  $\eta_2 = \gamma_k = 0$  for  $k > 1$ , that is

$$Z_i = \gamma_1 + \eta_1 Y_{1i} + \zeta_i.$$

This implies a reduced form of

$$\begin{aligned} Z_i &= \gamma_1 + \sum_k \eta_1 \beta_{1k} X_{ki} + \eta_1 \epsilon_{1i} + \zeta_i \\ &= \sum_k \pi_k X_{ki} + \epsilon_3, \end{aligned}$$

where  $\pi_1 = \eta_1 \beta_{11} + \gamma_1$ ,  $\pi_k = \eta_1 \beta_{1k}$  for  $k > 1$ , and  $\epsilon_{3i} = \eta_1 \epsilon_{1i} + \zeta_i$ . The

validity of this model can be tested by comparing the fit of the model when its restrictions are imposed to that of the general model.

#### Model Specification

Our models of track selection and track effects assume that track assignment may be influenced by prior individual and school-level conditions, including sophomore achievement levels, social demographic factors, school demographic composition, and school program emphasis. Thus our model of track assignment includes all of the independent variables discussed above. For the equations predicting senior-year mathematics achievement and the probability of high school graduation, we use a more restrictive specification. The outcome equations include the effects of sophomore-year achievement levels and of individual-level demographic characteristics of students (race, sex, ethnicity, and SES), but not the effects of school-level compositional and curricular factors. As noted earlier, these school-level factors have little impact on outcomes once individual-level measures of prior achievement and demographic factors are taken into account. In our models, however, school-level variables affect outcomes indirectly through track placement and may also have effects through sophomore achievement levels, although the latter effects are not modelled explicitly here.

For respondents with missing values on one or more of the independent variables, we impute their characteristics. Imputation was carried out using regression equations to predict each independent variable from all other independent variables. The imputation regressions are estimated over all observations with complete data on all independent variables. We estimated all models by maximum likelihood, using HOTZTRAN (Avery and Hotz 1983). Each model is estimated as three simultaneous nonlinear equations for track

placement, outcome in the college track, and outcome in the non-college track. For nested models, we compare their relative fits using likelihood ratio  $\chi^2$  statistics.<sup>6</sup>

## EMPIRICAL RESULTS

We first compare the fit of alternative structural models of tracking and track outcomes; then report parameter estimates for selected models of mathematics achievement and the probability of high school graduation; and finally examine the effects of tracking on levels and inequalities of outcomes.

### Relative Fit of Structural Models of Tracking Processes

Model 1a includes the independent variables discussed above and restricts neither the reduced-form slope parameters nor the error covariances in the tracking and outcome equations. This model is the baseline to which we compare restricted models. Model 1b restricts 1a by requiring that the effects of sophomore achievement levels, race, sex, SES, and ethnicity be the same in both the college and non-college tracks. The lower panel of Table 2 shows that this restriction fits the data well for graduation ( $\chi^2 = 8$  with 10 df), but not for mathematics achievement ( $\chi^2 = 52$  with 7 df). This suggests that the assumption of additive track effects is adequate in models of high school graduation, though not in models of mathematics achievement. In view of the very large sample size, the relatively large  $\chi^2$  statistic for the mathematics achievement model may still be consistent with the assumption of no large interactions. As shown below, however, whereas the effects of most independent variables are similar in the two tracks, a few differ significantly between tracks.



Models 2a and 2b are variants of the Ascription Model. They assume that no common unmeasured variables affect tracking and track outcomes once measured variables are taken into account [the covariances between the disturbances of the outcome and tracking equations ( $\sigma_{13}$  and  $\sigma_{23}$ ) are zero]. Relative to the general model, the restrictions of the Ascription Model fit the data poorly for mathematics achievement ( $\chi^2 = 12$  with 2 df), but very well for high school graduation ( $\chi^2 = 2$  with 2 df). For the probability of graduation, therefore, estimates of the effects of tracking and of achievement and demographic factors within tracks are not biased when selection on unmeasured factors is ignored. If students are tracked according to their expected relative chances of graduation in each track, the measured variables included in our model take account of their different expected probabilities of high school graduation.

Model 3a is the Maximization Model, which proposes that students' probabilities of assignment to the college track vary directly with the degree to which their characteristics predict an advantage in outcomes in the college track compared to the non-college track. As the large  $\chi^2$  statistics for the comparison of models 3a and 1a indicate, the relative fit of this model is very poor for both mathematics achievement and graduation. In this strong form, therefore, the view that students are optimally assigned to tracks for maximizing mathematics achievement or the probability of graduating from high school is not supported.

A less restrictive version of the Maximization Model assumes that track assignments vary with track outcomes expected on the basis of only the observed traits of students (rather than both observed and unobserved traits). Model 3b embodies this hypothesis. Relative to 1a, the restrictions contained

in 3b do not fit the data very well for mathematics achievement ( $\chi^2 = 52$  with 9 df), but they nonetheless fit a good deal better than Model 3a ( $\chi^2 = 1336$  with 2 df). For graduation, the modified Maximization model fits very well relative to the unrestricted model ( $\chi^2 = 6$  with 9 df). The data, therefore, provide some support for a weak form of the hypothesis that students are tracked to maximize their expected mathematics achievement and high school graduation probabilities.

Finally, the Quota Model, represented in Model 4, assumes that tracking decisions are determined by expected outcomes in the college track alone. The  $\chi^2$  statistics for both outcomes indicate that the restrictions implied by the Quota model fail to fit the data relative to the general model. The data provide no support for the "dominance" of the college track in the allocation of students.

These analyses of relative fit suggest that several structural models may govern the tracking and track outcome data in the HSB Survey. For both mathematics achievement and high school graduation, both the additive version of the general model (1b) and the weak form of the Maximization Model (3b) fit the data reasonably well relative to the unrestricted model (1a) given the large size of our sample. For high school graduation, the restrictions of the Ascription Model (2a) are also satisfied. These results suggest that the effects of prior achievement and sociodemographic factors on attainment that are typically reported in studies of tracking and track outcomes are roughly consistent with an attempt by families and schools to track students in accordance with their expected attainment in alternative tracks. The exact predictions of a model of "optimal" assignment of students to tracks, however, are not borne out. In particular, students' unmeasured characteristics that

affect their mathematics achievement are not incorporated into tracking decisions in an optimal way (Model 3a). Nor is the fit of the modified maximization model (3b) relative to the general model so good that other interpretations of the effects of past achievement and sociodemographic factors can be ruled out.

Models 1b, 2a, and 3a are not nested relative to each other, and thus we cannot choose between them on the basis of statistical tests. For the purposes of description, we present the results of the general model (1a) in our discussion of parameters below. Relative to the models 1b, 2a, and 3a, Model 1a suffers from lack of parsimony, but it does not have a much different pattern of effects from the more restrictive models. An inspection of the parameters of all three of these models (not shown here) indicates that our descriptive results are similar whether Model 1a, 1b, 2a, or 3b is used.

#### Track Placement

Table 3 reports the reduced-form parameter estimates for the general model for the determinants of sophomore-year track placement. Prior levels of academic achievement, sociodemographic factors, and school factors affect assignment to the college track. Consistent with earlier work, academic performance is an important predictor of track assignment (e.g., Heyns 1974; Alexander and McDill 1976; Alexander, Cook, and McDill 1978; Alexander and Cook 1982; Rehberg and Rosenthal 1978). We observe significant effects of achievement in mathematics, vocabulary, writing, and civics, but not reading or science. College track placement also varies directly with SES: the probit coefficient of .209 implies that, for students at the sample means on the other independent variables, those who are at least one standard deviation above the mean on SES enjoy a probability of placement in the college track

about 17 percent higher than those at least one standard deviation below the mean on SES.

The probit coefficient for females of 0.105 implies that, for students at the sample means on the other variables, girls have a probability of placement in the college track that is about 4 percent higher than boys. This finding differs from results of past studies using data for periods prior to the mid 1970's, in which sex differences were either insignificant or favored males (Alexander and Eckland 1975; Alexander and McDill 1976; Alexander, Cook, and McDill 1978; Alexander and Cook 1982; Rosenbaum 1980). Changing cultural expectations for girls' schooling may have removed the bias in track assignment that existed previously.

The positive coefficient for blacks contrasts with the gross difference between the tracks on race composition shown in Table 1. All of the gross race difference in track assignment is attributable to blacks' disadvantages on other factors. Indeed blacks fortunate enough to match nonblacks on levels of sophomore achievement and other social background and school factors enjoy a substantially higher likelihood of placement in the college tracks than their white counterparts. The probit coefficient of .259 for being black, when evaluated at the sample means of the other variables in the model, corresponds to a difference of approximately 10 percent in the probability of assignment to the college track. Thus race differences in college track placement provide some compensation for black disadvantages on past achievement, socioeconomic background, and school characteristics (Alexander, Cook, and McDill 1978; Alexander and Cook 1982; Rosenbaum 1980). Similarly, achievement, background, and school conditions fully account for the underrepresentation of Hispanics in the college-track reported in Table 1.

The equation for track assignment also suggests that insofar as tracking affects achievement and graduation, school-level factors may indirectly affect these outcomes through their effects on tracking (see also Gamoran 1987). All of the school demographic compositional variables, as well as track composition and mathematics course offerings, positively affect the chances of assignment to the college track.

#### Effects on Mathematics Achievement

Influence of Measured Variables. The first four columns of Table 4 show the effects of prior achievement and sociodemographic factors on mathematics achievement in senior-year for the college and non-college tracks. These parameters are adjusted for nonrandom selection into the college and non-college track on both measured and unmeasured variables. That is, the disturbances of the track outcome and the track assignment equations reported in Table 3 are correlated. Although the several sophomore achievement measures have different scales, the parameters in Table 3 and standard deviations in Table 1 show, not surprisingly, that sophomore mathematics achievement affects senior mathematics achievement much more strongly than the five other sophomore achievement scores. Still, higher achievement in science, reading, and writing in sophomore-year also benefit performance in mathematics in senior-year. Additionally, males, nonblacks, nonhispanics and persons with high SES enjoy more growth in mathematics achievement between sophomore and senior-years relative to females, blacks, hispanics, and persons with low SES respectively.

Most independent variables exert approximately equal effects on mathematics achievement in the two tracks. Exceptions are the effects of race, which suggest that the net disadvantage of blacks is lower in the

college than in the non-college track (-0.571 vs. -0.868) and of sex, which suggest that the net advantage of boys is almost twice as large in the college track as in the non-college track (1.250 vs. 0.664).

Influence of Unmeasured Factors. The disturbance covariances,  $\sigma_{13}$  and  $\sigma_{23}$ , provide information about unobserved influences on tracking and achievement, and the degree to which bias occurs in models that fail to analyze track selection and achievement jointly. Both  $\sigma_{13}$  and  $\sigma_{23}$  are statistically significant, although the Z-score of -3.2 for  $\sigma_{13}$  is modest in a sample of over 10,000. For the college track,  $\sigma_{13} = -0.117$ , which implies a correlation of  $-0.121/4.297 = -0.028$ . This indicates that students who actually enter the college track score slightly worse on senior mathematics than would a random sample from all sophomores who have equal values on the measured independent variables if they were placed in that track. That the correlation is so close to zero, however, suggests that nonrandom selection into the college track is trivially important for mathematics achievement once sophomore achievement levels and the sociodemographic factors included in our model are taken into account. In short, single-equation estimates of the achievement equation for the college track have negligible selection bias.

For the non-college track the selection bias is again small, but larger than for the college track. The estimate for  $\sigma_{23}$  implies a correlation of  $-0.392/4.751 = -.083$ . The negative value for  $\sigma_{23}$  indicates that students who enter the non-college track do somewhat better on senior mathematics than would a random sample of all sophomores who have equal sophomore achievement levels if they were placed in that track.<sup>7</sup> Selection into the non-college track, therefore, is biased in favor of students who perform well in that track compared to other students with the same attributes. Thus, single-

equation estimates of achievement in the non-college track potentially overstate achievement because they ignore positive selection into that track. Moreover, inasmuch as systematic selection on unmeasured, achievement-related factors is stronger for the non-college track than the college track, estimates of net achievement differences between tracks potentially understate the true effects of track on mathematics achievement.

#### Effects on High School Graduation

The last four columns of Table 4 show the effects of sociodemographic factors and prior achievement on the chances of high school graduation in the college and non-college tracks. As noted above, the restrictions of the Ascription model are satisfied for this outcome, implying the absence of nonrandom selection into tracks on unmeasured variables. This is corroborated by the estimates of  $\sigma_{13}$  and  $\sigma_{23}$ , which are statistically insignificant. Thus we discuss only the effects of measured variables on graduation.

Of the sophomore achievement measures included in the analysis, only mathematics and writing achievement significantly affect the probability of graduation in both tracks, and vocabulary affects graduation in the non-college track. The parameters imply that a one standard deviation change in sophomore mathematics achievement brings about a change of approximately 3 percent in the probability of high school graduation in the college track and a 5 percent change for the non-college track. SES also strongly affects graduation in both tracks. The estimates imply that a one standard deviation change in SES increases the probability of graduation by 3 percent in the college track and 5 percent in the non-college track.

In contrast to the results for the mathematics achievement equations, females, blacks, and Hispanics experience no disadvantage in their likelihood

of finishing high school once prior achievement and other background conditions have been taken into account. In fact, other things being equal, members of these groups are more likely to graduate. These results are consistent with prior analyses of HSB (Ekstrom et al. 1986) and other nationally representative data (Rumberger 1983). The probit coefficients imply a net difference of about 3.5 percent for the advantage of blacks over whites in both tracks. The implied gap is about 2 percent for girls over boys in the non-college track, but the difference is smaller and insignificant in the college track. For Hispanics, the results imply an advantage of about 4 percent for those in the non-college track but only about half that for members of the college track.<sup>8</sup>

#### The Effects of Tracking

What do the results indicate about the effects of tracking on mathematics achievement and on the probability of graduating from high school? Although Table 1 showed large between-track differences in these outcomes, at least part of these gaps can be attributed to between-track variation in other determinants of achievement and graduation. What proportion of the overall track differences actually results from tracking, and how much is due to variation in preexisting conditions? Table 5 presents a decomposition of the gross differences in mean outcomes.<sup>9</sup>

The Effects of Tracking on Mathematics Achievement. The bulk of the observed difference between tracks in mathematics achievement results not from tracking itself, but from preexisting differences between the members of the different tracks. The top half of column 1 presents the components of track differences in achievement that are attributable to differences in track incumbents on measured and unmeasured variables. Not surprisingly, most of



the gross difference results from varied levels of initial achievement: adjusting track differences in senior mathematics achievement for variation in sophomore achievement test scores reduces the gap between the tracks by 73 percent. SES accounts for 5 percent, while the other demographic variables contribute negligible amounts. Unmeasured variables that affect both achievement and tracking favor college-track students, but by a trivial amount.

All told, mean differences in preexisting conditions account for 79.3 percent of the 6.771-point spread between the tracks, leaving the net advantage of college-track students over others at 1.392, or 20.7 percent of the gross difference. This latter effect is similar to results from other analyses of HSB (e.g., Vanfossen, Jones, and Spade 1987). It represents less than two-tenths of a standard deviation on the test, but it is more than the total amount (1.10) gained by the average student between the sophomore and senior-years of high school (see Table 1). In addition, it is a larger gap than the advantage of students in non-college programs over high school dropouts (Gamoran 1987). Seen in these lights, the net track effect on mathematics achievement is substantial.

The lower half of Table 5 decomposes the net track difference further into portions associated with between-track differences in the effects of particular variables. The largest part of the variation here is simply associated with the constant, but some of the other coefficients differ enough between tracks to contribute to track differences in achievement. Between-track variation in the effects of unmeasured selection variables favor the non-college track, indicating that selection on unobserved variables actually suppresses part of the effects of tracking on achievement. In other words, if

students having equivalent levels on the measured independent variables were assigned to tracks at random, then track differences would be larger than those that are observed. This results from the positive selection bias for the non-college track discussed above.

The Effects of Tracking on the Probability of Graduating from High School. The decomposition of track differences in graduation probabilities mirrors the pattern of the achievement decomposition, but differs in relative quantities. The largest portion of the selection effects is again the mean difference in sophomore achievement scores, but it accounts for only 35 percent of the gross difference in graduation. The relative contribution of SES differences between tracks is nearly three times greater than in the achievement decomposition: between-track differences in mean SES account for 13.7 percent of the association between tracking and the likelihood of completing high school. Once again, mean differences in other selection factors, measured and unmeasured, matter relatively little.

Tracking itself accounts for a much larger portion of the overall gap between college- and non-college-track students. Differences in means explain 48 percent of the original difference, resulting in a net track effect of 52 percent or .501 in the probit (Z-score) scale. This implies that graduation rates for college-track students are about 10 percentage points higher than for non-college-track students, a substantial advantage considering the high average rates of graduation overall. Because the achievement and background variables exert similar effects across tracks, the net track difference of .501 appears primarily in the constant.

Tracking and the Level and Dispersion of Schooling Outcomes. On the whole, the results show that tracking reinforces initial differences in

mathematics achievement and in the propensity to complete high school. Academic and nonacademic students are 1.392 points farther apart on the mathematics test, and about 10 percentage points farther apart in their likelihood of graduating, than they would be if all were in a single curricular program. Thus, inequality in these outcomes is wider than it would be in the absence of tracking.

Effects on mean outcomes are somewhat equivocal, because answering the question of whether tracking raises or lowers mean outcomes depends on what it is compared to. We speculate that overall achievement and graduation rates would be higher if all students enrolled in a college preparatory program, but lower if all were in a program like the non-college track. Furthermore, the positive selection for the non-college track indicates that mean outcomes are slightly higher under the current system of track selection than they would be if students were randomly assigned to tracks in the observed proportions.<sup>10</sup>

#### Tracking and Stratification:

##### Race, Sex, and Socioeconomic Inequalities

What are the sources of inequalities in mathematics achievement and high school graduation rates? By decomposing group differences, one can see the conditions that add to or subtract from unequal outcomes among race, sex, and socioeconomic groups. Table 6 summarizes the components of differences in achievement and graduation between races, sexes, and socioeconomic groups. These components include: the differences between groups in average values of factors affecting their track assignments and their outcomes within tracks (rows 1 and 3); group differences in unmeasured factors that affect both track assignment and outcomes (row 2); and the net effects of group membership on track assignment and on outcomes (rows 4 and 5). The formulas for these

components are presented in the Appendix.

Inequality in Mathematics Achievement. For all three group comparisons (male vs. female, nonblack vs. black, high SES vs. low SES), about half of the observed gaps can be attributed to differences in sophomore achievement scores (row 1a). Also for all three comparisons, selection effects are minute (row 2). Beyond these similarities, the decompositions vary across the group comparisons.

Other background characteristics (mainly SES and other test scores) account for more than one-fourth of the overall difference between blacks and whites. The effect of background on track assignment also plays a role in the race achievement gap, because blacks are lower in SES, which reduces the chances of college-track enrollment, thus lowering achievement. However, the black-white difference in track assignment favoring blacks (see Table 3) means that achievement differences would be 8.2 percent larger if assignment were unrelated to race: net of other conditions, blacks are more likely than whites to be placed in the college track, where achievement is higher. Blacks' greater chances of college track enrollment partly compensate for their initial deficit.

Black-white differences are smaller in the college track than in the non-college track (-.571 vs. -.868, Table 4). But the race difference is even smaller under the observed system than it would be if all students were placed in the college track, because of blacks' greater likelihood of assignment to the college track. However, the means for both groups would be highest if all students enrolled in a college-preparatory program (assuming that our models would still hold under such radically changed conditions).

Unlike the race differences, the sex difference is larger in the college

track (1.25) than the non-college track (.664) (Table 4), so male-female differences would apparently be largest if all students were assigned to the college track. If all students were enrolled in non-college programs, the sex difference would be smaller, but so would overall achievement (Table 5). As with race, sex differences are smallest under existing tracking systems, because the assignment process favors females. In addition, members of the higher-achieving group (boys) are overassigned to the program where their advantage is smaller (the non-college track). These conditions reduce the achievement gap between the sexes by 22.2 percent.

The results for the decomposition of SES effects are fundamentally different. Here, the assignment process is not compensatory; instead, tracking increases the gap between advantaged and disadvantaged students by almost 9 percent. Thus, the means for both groups would be highest, and the between-group difference would be smallest, if all students were assigned to a college-preparatory program. If all were placed in the non-college track, group differences would be reduced (because there would be no tracking to favor high-SES students), but overall mean achievement would be lower too (Table 5).

Inequality in Graduation Rates. The results in the bottom panel of Table 6 show how observed differences in graduation rates favor nonblacks, even though net effects favor blacks. The original gap is more than accounted for by background differences, including measured effects on graduation and on tracking, and unmeasured selection effects. However, two other conditions favor blacks. One is the assignment process: race differences in graduation rates would be more than 20 percent larger without it. Second, the direct effect of race on graduation is positive (see also Table 4). Our model does

not account for this effect, which comes to 58.8 percent of the observed difference. The components of the sex difference in graduation rates favor females throughout. About two-thirds of this gap is unexplained by the model. Nearly a fourth results from the assignment process that gives females an advantage over males. SES differences again contrast with the others. As with achievement, track assignment increases initial differences because it favors high-SES students who have a higher probability of graduating to begin with.

In summary, although tracking widens the gaps between high and low achievers and between those most and least likely to graduate, it does not always reinforce existing bases of social inequality. Tracking practices reduce sex and race inequalities through assignment practices that favor females and blacks. With regard to graduation, compensatory track assignment contributes to net differences that ultimately favor traditionally underachieving groups. At the same time, tracking adds to the difference between students from high- and low-SES backgrounds on both outcomes.

#### SUMMARY AND CONCLUSIONS

The effects of tracking on inequality are decidedly not neutral in the population represented by the HSB data. The net track effect of 1.4 points on the mathematics test is substantial, relative to the average sophomore-senior gain in mathematics achievement. And, given the high rates of graduation overall, the college-track advantage of 10 percent is also important. These track effects appear in models that control for selection bias. Because low achievers are less likely to be assigned to the college-preparatory program, tracking reinforces initial differences among students assigned to college and

non-college curricula. Moreover, tracking exacerbates the gap in achievement and in the probability of graduating between students of high- and low-SES backgrounds.

While none of tracking's effects are neutral, not all of them are reinforcing. Because the assignment process favors blacks and females over nonblacks and males who are equal on other characteristics, tracking appears to compensate for pre-existing differences between the races and sexes. The compensatory effects are particularly great for girls' mathematics achievement, because boys are overassigned to non-college programs where the sex difference is smaller. In short, current tracking regimes produce less inequality between otherwise similar blacks and nonblacks and males and females than would occur if students were randomly assigned to tracks, or than if all students enrolled in either one of the two existing tracks.

Assessment of track effects on productivity depends on what comparison is selected for simulation. If our models hold, average rates of both achievement and graduation would be higher if all students enrolled in the college track, but lower if all belonged to the non-college program. Despite some evidence of tracking according to students' expected outcomes, mean achievement for non-college students would still be higher in the college track. The significant positive selection effects in the mathematics achievement equation are too small to overcome the track effects themselves, which favor the college track. The positive selection indicates that achievement in the non-college track is higher with its actual incumbents than it would be with a random population, but an individual non-college student's performance would be higher in the college track.

Contrary to the expectations of some educators (see Mirel and Angus

1986), non-college programs do not do a better job of holding their students in school. Although our models are explicitly designed to reveal differences among students that would make some more suited to benefit from one track or the other, this hypothesis was not borne out. Instead, all students would be more likely to graduate if they enrolled in the college track. Even more than for achievement, the analyses of graduation indicated that students are tracked in accordance with their expected likelihood of finishing high school. Specifically, we cannot reject the hypothesis that tracking maximizes outcomes expected on the basis of measured characteristics. But as in the achievement equations, the effects of tracking overcome any existing positive selection biases, so that non-college students actually graduate less often as a result of their track assignment. This may indicate that high school attendance is less valuable, and opportunities outside of school are more attractive, for students not bound for college than for those who are (Stinchcombe 1964; Meyer 1980).

An important limitation of our analyses of tracking's role in educational productivity is that they rest on simulations of alternative tracking regimes, rather than deriving from comparisons to actual untracked or differently-tracked schools. In a recent study of ability grouping in Britain, Kerckhoff (1986) examines schools with and without formal internal stratification. In that study, compared to similar students in untracked schools, high-track students achieve more and low-track students less. Means thus are similar in tracked and untracked schools, making the effects of tracking on productivity appear neutral with respect to the entire population.

The small amount of selection bias in our results suggests that previous analyses of the effects of tracking that used stringent controls for prior



achievement were not seriously contaminated by selection bias (e.g., Rehberg and Rosenthal 1978; Alexander and Cook 1982; Gamoran 1987). Moreover, because of positive selection into the non-college track, selection bias that did occur in such studies may have resulted in underestimates of track effects on achievement in mathematics. That is, controlling for measured variables, students who enter the non-college track perform somewhat better than would a random selection of students. Exploratory work with the HSB data indicates that using fewer controls for prior achievement increases the selection bias for the college track, suggesting that multiple dimensions of achievement are associated with both track selection and outcomes, just as Jencks (1985) has argued for selection into the private school sector.

Our analyses also show that formal models of the structure of the tracking process require refinement to be able to fit data on national populations. In further work, it may be useful to combine analyses of several outcomes of tracking into a single model. For example, schools do not assign students to tracks by maximizing mathematics achievement alone. Instead they may compromise between putting students in demanding academic programs and minimizing rates of dropout. Whereas analyses of either outcome alone cannot detect such a complex strategy, combined analyses may be able to.

#### APPENDIX: DECOMPOSITION OF GROUP DIFFERENCES

Consider two groups, say  $m$  and  $f$ , for whom we wish to decompose differences in mathematics achievement or high school graduation. Let  $\bar{Y}_m$  and  $\bar{Y}_f$  be group-specific means on the outcome;  $\bar{\phi}_m$  and  $\bar{\phi}_f$  be group-specific proportions assigned to the college track; and  $\bar{Y}_{m1}$ ,  $\bar{Y}_{m2}$ ,  $\bar{Y}_{f1}$ , and  $\bar{Y}_{f2}$  be group-specific means on the outcome for the college and non-college tracks

respectively. Then a general decomposition is:

$$\bar{Y}_m - \bar{Y}_f = ((\bar{\Phi}_m - \bar{\Phi}_f)(\bar{Y}_{m1} + \bar{Y}_{f1}) + [(1-\bar{\Phi}_m) - (1-\bar{\Phi}_f)](\bar{Y}_{m2} + \bar{Y}_{f2}) + (\bar{\Phi}_m + \bar{\Phi}_f)(\bar{Y}_{m1} - \bar{Y}_{f1}) + [(1-\bar{\Phi}_m) + (1-\bar{\Phi}_f)](\bar{Y}_{m2} - \bar{Y}_{f2}))/2.$$

The first two terms sum to group differences that occur because the two groups are assigned to the college track at different rates. The third and fourth terms sum to group differences that occur because groups differ within tracks in their levels of the outcome.

The within-track group differences in the outcome are made up of mean differences between groups on the measured and unmeasured independent variables and net group differences. That is:

$$\bar{Y}_{m1} - \bar{Y}_{f1} = \Sigma\beta_{1k}(\bar{X}_{mk} - \bar{X}_{fk}) + \beta_1^* + \sigma_{13}(\bar{\phi}_m/\bar{\Phi}_m - \bar{\phi}_f/\bar{\Phi}_f)$$

and

$$\bar{Y}_{m2} - \bar{Y}_{f2} = \Sigma\beta_{2k}(\bar{X}_{mk} - \bar{X}_{fk}) + \beta_2^* + \sigma_{23}[\bar{\phi}_m/(1 - \bar{\Phi}_m) - \bar{\phi}_f/(1 - \bar{\Phi}_f)]$$

where  $\bar{X}_{mk}$  and  $\bar{X}_{fk}$  are group-specific means for the k<sup>th</sup> independent variable;  $\beta_{1k}$  and  $\beta_{2k}$  are the effects of the k<sup>th</sup> independent variable on the outcome in the college and non-college tracks respectively;  $\beta_1^*$  and  $\beta_2^*$  are the effects on the outcome of being in group m relative to group f for the college and non-college tracks respectively;  $\bar{\phi}_m$ ,  $\bar{\Phi}_m$ ,  $\bar{\phi}_f$ , and  $\bar{\Phi}_f$ , are the group-specific normal probability density and cumulative density functions for the corresponding group-specific probabilities of assignment to the college track; and  $\sigma_{13}$  and  $\sigma_{23}$  are the covariances between the disturbances of the outcome and tracking equations for college and non-college tracks respectively. Within each track, the first component is for differences between groups on measured variables; the second is the net group effect on the outcome; and the third is for unmeasured differences between groups.

Group differences in the probability of assignment to the college track

can be decomposed as follows:

$$(\bar{\Phi}_m - \bar{\Phi}_f) = \{\Phi(\Sigma\pi_j\bar{X}_j + \pi^*) - \Phi(\Sigma\pi_j\bar{X}_j)\} + \\ \{(\bar{\Phi}_m - \bar{\Phi}_f) - [\Phi(\Sigma\pi_j\bar{X}_j + \pi^*) - \Phi(\Sigma\pi_j\bar{X}_j)]\}$$

where  $\pi_j$  is the effect of the  $j$ th independent variable on the (probit of the) probability of being in the college track and  $\pi^*$  is the effect on the (probit of the) probability of being in the college track for group  $m$  relative to group  $f$ , and all other notation is as defined above. The first component is for net group differences in proportions assigned to the college track. The second component is for differences attributable to group differences in the independent variables.

We combine these decompositions to get the quantities in Table 6.

Measured Background Effects on Outcome:

$$\{[\Sigma\beta_{1k}(\bar{X}_{mk} - \bar{X}_{fk})](\bar{\Phi}_m + \bar{\Phi}_f) + [\Sigma\beta_{2k}(\bar{X}_{mk} - \bar{X}_{fk})][(1-\bar{\Phi}_m) + (1-\bar{\Phi}_f)]\}/2.$$

Unmeasured Selection Effects on Outcome:

$$\{\sigma_{13}(\bar{\phi}_m/\bar{\Phi}_m - \bar{\phi}_f/\bar{\Phi}_f)(\bar{\Phi}_m + \bar{\Phi}_f) + \\ \sigma_{23}[\bar{\phi}_m/(1 - \bar{\Phi}_m) - \bar{\phi}_f/(1 - \bar{\Phi}_f)][(1-\bar{\Phi}_m) + (1-\bar{\Phi}_f)]\}/2.$$

Group Effects on Outcome:

$$\{\beta_1^*(\bar{\Phi}_m + \bar{\Phi}_f) + \beta_2^*[(1-\bar{\Phi}_m) + (1-\bar{\Phi}_f)]\}/2.$$

Background Effects on Track Assignment:

$$\{(\bar{\Phi}_m - \bar{\Phi}_f) - [\Phi(\Sigma\pi_j\bar{X}_j + \pi^*) - \Phi(\Sigma\pi_j\bar{X}_j)]\}(\bar{Y}_{m1} + \bar{Y}_{f1})/2 - \\ \{(\bar{\Phi}_m - \bar{\Phi}_f) - [\Phi(\Sigma\pi_j\bar{X}_j + \pi^*) - \Phi(\Sigma\pi_j\bar{X}_j)]\}(\bar{Y}_{m2} + \bar{Y}_{f2})/2$$

Group Effects on Track Assignment:

$$\{[\Phi(\Sigma\pi_j\bar{X}_j + \pi^*) - \Phi(\Sigma\pi_j\bar{X}_j)](\bar{Y}_{m1} + \bar{Y}_{f1})\}/2 - \\ \{[\Phi(\Sigma\pi_j\bar{X}_j + \pi^*) - \Phi(\Sigma\pi_j\bar{X}_j)](\bar{Y}_{m2} + \bar{Y}_{f2})\}/2.$$

## FOOTNOTES

2. On the basis of a correlation of .6 between student and school reports of track positions in data from the National Longitudinal Study of the High School Class of 1972, Rosenbaum (1980) argued that students may misperceive their track locations. Student and school reports, however, agreed on 80 percent of the cases (see Fennessey et al. 1981). Moreover, students may not have been in error in all 20 percent of cases that did not match; the respondent for the school may have been incorrect. [On the ambiguity of tracking information in high school guidance departments, see DeLany (1986)]. Finally, data from HSB reported by Vanfossen, Jones, and Spade (1987) indicate that 85% of students who reported the college track as sophomores took courses that were possibly or definitely college-oriented.

3. If students change tracks (Gamoran 1987), then our estimates of the effects of tracking may be smaller than in an approach that takes account of students' complete high school track "careers." Our analysis provides an unbiased assessment of the effects of track position at one time in students' careers.

4. Analyses based on a definition of graduates that includes GED recipients yield results very similar to those reported here.

5. An even stronger version of the model would maintain that students are literally assigned to tracks where their expected outcomes are highest. In such a case,

$$Z_i = \eta(Y_{1i} - Y_{2i}) + \zeta_i$$

and  $\pi_k = \eta(\beta_{1k} - \beta_{2k})$  for all  $k$  (not just  $k > 1$ ). Such a model would rule out an independent structural effect of track placement on outcomes. Analyses not presented here show that this model fits the data very poorly. By allowing for an unrestricted intercept  $\gamma_1$  in (5), the model discussed in the text

allows for a separate track effect, but also includes the restriction that track assignment is governed in part by a principle of comparative advantage.

6. The  $\chi^2$  statistics are equal to -2 times the differences between the log likelihood statistics for nested models.

7. A positive  $\sigma_{13}$  signifies positive selection into the college track because unmeasured determinants of achievement and college track placement are positively correlated. Conversely, a negative  $\sigma_{23}$  signifies positive selection into the non-college track because it denotes a negative correlation between unmeasured determinants of achievement and college track placement, that is, a positive correlation between unmeasured determinants of achievement and non-college track placement (Maddala 1983; Mare and Winship 1988).

8. The small changes in graduation probabilities reported here might suggest that the effects on graduation probabilities of socioeconomic status, sex, and race are relatively small. In fact, however, differences of 1 percent or 2 percent in the probability graduation of graduation are substantial when viewed in the context of the high rates of graduation in the HSB sample (see Table 1). In the college track, the proportion graduating is .95, which imposes a ceiling on group differences in graduation.

9. The values in Table 5 are based on the following decomposition:

$$\bar{Y}_1 - \bar{Y}_2 = (\Sigma(\beta_{1k} + \beta_{2i})(\bar{X}_{1k} - \bar{X}_{2k}) + \Sigma(\beta_{1k} - \beta_{2k})(\bar{X}_{1k} + \bar{X}_{2k}) + (\sigma_{23} + \sigma_{13})[\bar{\phi}/\bar{\Phi} - \bar{\phi}/(1 - \bar{\Phi})] + (\sigma_{13} - \sigma_{23})[\bar{\phi}/\bar{\Phi} + \bar{\phi}/(1 - \bar{\Phi})])/2$$

where  $\bar{Y}_1$  and  $\bar{Y}_2$  denote the sample average values of the outcome variable,  $\bar{X}_{1k}$  and  $\bar{X}_{2k}$  denote the sample averages for the kth independent variable,  $\beta_{1k}$  and  $\beta_{2k}$  denote the effects of the kth independent variable on the outcome, and  $\sigma_{13}$  and  $\sigma_{23}$  are the correlations between the disturbances in the outcome and the tracking equations for the college and non-college tracks respectively. The quantities  $\bar{\phi}$  and  $\bar{\Phi}$  denote the normal density and cumulative density functions

respectively for the probability of assignment to the college track evaluated at the sample means of the independent variables. The first and third terms in the decomposition are the components of difference attributable to differences in track means on measured and unmeasured factors respectively. The second and fourth terms are the components of difference attributable to track differences in effects of measured and unmeasured factors respectively.

10. These models can show the potential impact on marginal individuals were they to move from one position to another. In the aggregate, they suggest how average levels of the outcome variable would change in their levels and distribution for groups under alternative assignments to the ones observed in the sample. One must be cautious, however, in extrapolating from the models to hypothetical systems of assignments. Movements by a few students are unlikely to affect the structure of assignment and outcome for the population as a whole. If, however, substantial portions of students were reassigned, the overall system and the appropriate model could change, thereby invalidating inference from the original model. For example, if track effects result from social comparisons made between tracks, it is impossible to simulate outcomes in the absence of tracking because the comparisons may not exist. These models, therefore, can suggest the impact of a system of sorting persons to positions and outcomes, but they are not a substitute for historical or comparative data on alternative systems.

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TABLE 1

MEANS AND STANDARD DEVIATIONS OF VARIABLES FOR TOTAL, AND TRACK-SPECIFIC SAMPLES\*

Variable	Sample					
	Total		College Track		Non-college Track	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
College Track (vs. Other)	0.33	0.47	1.00	0.00	0.00	0.00
Graduate (vs. Non-Grad.)	0.87	0.34	0.95	0.22	0.82	0.38
Senior Math Achievement	20.12	8.10	24.81	7.54	17.76	7.31
Sophomore Achievement						
Mathematics	19.02	7.09	22.76	6.80	17.14	6.46
Vocabulary	11.01	4.19	13.07	4.01	9.97	3.88
Reading	9.27	3.73	10.98	3.77	8.41	3.40
Science	11.12	3.54	12.53	3.38	10.41	3.40
Writing	10.48	3.76	12.22	3.36	9.60	3.65
Civics	5.91	1.93	6.65	1.86	5.54	1.86
Female (vs. Male)	0.51	0.50	0.53	0.50	0.49	0.50
Black (vs. Nonblack)	0.14	0.35	0.11	0.31	0.15	0.36
Hispanic (vs. non-Hisp.)	0.11	0.31	0.08	0.27	0.13	0.33
Socioeconomic Status	-0.06	0.72	0.23	0.71	-0.20	0.68
School % Black	13.70	22.24	12.23	20.51	14.43	23.02
School % Hispanic	5.27	12.87	4.78	12.08	5.52	13.24
School SES	-0.04	0.38	0.08	0.41	-0.10	0.35
School % College Track	43.55	27.83	52.39	27.97	39.12	26.68
School Math Average	18.85	3.42	19.86	3.46	18.34	3.29
School # of Math Courses	3.43	0.73	3.54	0.67	3.38	0.76

\*Observations are weighted. Unweighted number of observations is 10980. See text for discussion of variables and samples.

TABLE 2

LOG LIKELIHOOD STATISTICS AND LIKELIHOOD RATIO TESTS  
FOR MODELS\* OF TRACK ASSIGNMENT AND TRACKING OUTCOMES

Model	Outcome					
	Mathematics Achievement			Graduation		
	LogL	Parameters		LogL	Parameters	
1a. General	-76520	43		-19823	41	
1b. General Equal Slopes	-76546	33		-19827	31	
2a. Ascription	-76526	41		-19824	39	
2b. Ascription Equal Slopes	-76552	31		-19829	29	
3a. Maximization	-77214	32		-20036	30	
3b. Maximization Unrestricted $\sigma_{ij}$ 's	-76546	34		-19826	32	
4. Quota	-76905	32		-20056	30	
Contrast	$\chi^2$	d.f.	p	$\chi^2$	d.f.	p
1b vs. 1a	52	10	<.01	8	10	.63
2a vs. 1a	12	2	<.01	2	2	.37
2b vs. 1a	64	9	<.01	12	9	.21
2b vs. 2a	52	7	<.01	10	7	.19
3a vs. 1a	1388	11	<.01	426	11	<.01
3b vs. 1a	52	9	<.01	6	9	.74
3a vs. 3b	1336	2	<.01	420	2	<.01
4 vs. 1a	770	11	<.01	466	11	<.01

\* See text for description of models.

TABLE 3  
 \*  
 REDUCED FORM PARAMETERS FOR MODEL OF TRACK ASSIGNMENT  
 (Model 1a, Table 2)

Independent Variable	Probit of Probability of Entering College Track	
	$\pi$	$\pi/SE(\pi)$
Sophomore Achievement		
Math	0.036	16.7
Vocabulary	0.039	10.8
Reading	0.004	1.1
Science	-0.002	-0.4
Writing	0.028	6.9
Civics	0.040	6.3
Female	0.105	5.0
Black	0.259	7.3
Hispanic	0.057	1.9
SES	0.209	13.2
Math Average <sup>†</sup>	0.003	0.6
Prop. Hispanic <sup>†</sup>	0.499	8.8
Prop. Black <sup>†</sup>	0.501	8.2
School SES <sup>†</sup>	0.072	1.8
Prop. College Track <sup>†</sup>	0.830	21.7
Math Courses <sup>†</sup>	0.048	3.5
Constant	-2.779	-27.2

\* Parameters are probit coefficients. N = 10980.

† Characteristics of high school that respondent attended in 1980.

TABLE 4

\*  
PARAMETERS FOR MODELS OF SENIOR YEAR MATHEMATICS ACHIEVEMENT  
AND HIGH SCHOOL GRADUATION (Model 1a, Table 2)

Independent Variable	Dependent Variable							
	Mathematics Achievement				High School Graduation			
	College Track		Noncollege Track		College Track		Noncollege Track	
	$\beta$	$\beta/SE(\beta)$	$\beta$	$\beta/SE(\beta)$	$\beta$	$\beta/SE(\beta)$	$\beta$	$\beta/SE(\beta)$
Sophomore Achievement								
Math	0.658	70.0	0.655	71.4	0.035	7.0	0.035	12.3
Vocabulary	0.045	2.5	0.087	5.6	0.010	1.3	0.021	4.7
Reading	0.170	8.2	0.073	4.0	-0.000	-0.0	-0.012	-2.2
Science	0.163	7.7	0.125	6.9	-0.002	-0.2	0.003	0.5
Writing	0.132	6.2	0.143	8.3	0.045	4.8	0.033	6.5
Civics	0.032	1.0	0.046	1.7	0.012	0.8	0.004	0.5
Female	-1.250	-12.1	-0.664	-7.2	0.059	1.2	0.086	3.2
Black	-0.571	-4.0	-0.868	-7.3	0.170	2.8	0.162	5.0
Hispanic	-0.634	-4.8	-0.478	-4.6	0.108	2.0	0.209	7.1
SES	0.707	10.3	0.858	13.4	0.334	10.1	0.283	14.9
Constant	3.116	12.2	2.145	11.8	0.307	3.1	-0.187	-3.6
$\sigma$	4.297	130.0	4.751	164.8	1.000		1.000	
$\sigma_{13}, \sigma_{23}$	-0.121	-3.2	-0.392	-8.5	-0.049	-1.2	-0.070	-1.6
$R^2$	0.675		0.578					

\* Graduation equation parameters are probit coefficients. Achievement equation parameters are regression coefficients. N = 10980.



TABLE 5

DECOMPOSITION OF OBSERVED TRACK DIFFERENCES IN  
SENIOR MATHEMATICS ACHIEVEMENT AND HIGH SCHOOL GRADUATION

Component	Mathematics Achievement		High School Graduation	
	Component	%	Component	%
Track Differences in Means				
Sophomore Achievement	4.941	73.0	0.340	35.1
Female	-0.038	-0.6	0.003	0.3
Black	0.029	0.4	-0.007	-0.7
Hispanic	0.028	0.4	-0.008	-0.8
SES	0.338	5.0	0.133	13.7
Selection	0.075	1.1	0.006	0.6
Total Due to Means	5.373	79.3	0.467	48.2
Track Differences in Effects				
Sophomore Achievement	0.540	8.0	0.101	10.5
Female	0.281	4.2	0.013	1.4
Black	0.039	0.6	0.001	0.1
Hispanic	-0.016	-0.2	-0.011	-1.1
SES	-0.002	-0.0	0.001	0.1
Selection	-0.421	-6.2	-0.098	-10.1
Constant	0.971	14.3	0.494	51.0
Total Due to Effects	1.392	20.7	0.501	51.9
Total*	6.771	100.0	0.968	100.0

\*Components may not sum to totals because of rounding. Totals may not agree with differences between track-specific means in Table 1 because models are estimated on unweighted observations whereas descriptive statistics are based on weighted observations.

TABLE 6

DECOMPOSITION OF RACE, SEX, AND SES DIFFERENCES  
IN SENIOR MATHEMATICS ACHIEVEMENT AND HIGH SCHOOL GRADUATION

Mathematics Achievement						
Component	Nonblack vs. Black		Male vs. Female		Hi vs. Lo SES	
	Component	%	Component	%	Component	%
1a. 1980 Mathematics Difference	3.68	53.0	0.61	46.7	4.47	43.2
1b. Other Measured Background Effects	1.97	28.3	0.13	9.5	1.85	17.9
2. Unmeasured Selection Effects	0.04	.6	-0.02	-1.2	0.18	1.8
3. Background Effects on Track	1.06	15.2	0.04	3.3	1.16	11.2
4. Group Effect on Track	-0.57	-8.2	-0.29	-22.2	0.89	-8.6
5. Group Effect on Mathematics	0.78	11.2	0.84	64.0	1.79	17.3
6. Total	6.96	100.0	1.31	100.0	10.34	100.0

  

High School Graduation						
Component	Nonblack vs. Black		Male vs. Female		Hi vs. Lo SES	
	Component	%	Component	%	Component	%
1. Measured Background Effects	0.38	136.9	-0.01	10.3	0.17	15.6
2. Unmeasured Selection Effects	0.01	3.1	-0.00	3.0	0.04	3.7
3. Background Effects on Track	0.11	40.9	0.00	-3.6	0.13	11.4
4. Group Effect on Track	-0.06	-22.1	-0.03	24.6	0.10	8.7
5. Group Effect on Graduation	-0.16	-58.8	-0.08	65.8	0.67	60.7
6. Total	0.28	100.0	-0.12	100.0	1.11	100.0

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