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Switching Schools: Revisiting the Relationship Between School Mobility and High School Dropout

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Youth who switch schools are more likely to demonstrate a wide array of negative behavioral and educational outcomes, including dropping out of high school. However, whether switching schools actually puts youth at risk for dropout is uncertain, since youth who switch schools are similar to dropouts in their levels of prior school achievement and engagement, which suggests that switching schools may be part of the same long-term developmental process of disengagement that leads to dropping out. Using data from the National Longitudinal Survey of Youth 1997, this study uses propensity score matching to pair youth who switched high schools with similar youth who stayed in the same school. We find that while over half the association between switching schools and dropout is explained by observed characteristics prior to ninth grade, switching schools is still associated with dropout. Moreover, the relationship between switching schools and dropout varies depending on a youth's propensity for switching schools.

KEYWORDS: dropout, school transfer, adolescence, propensity score matching

Graduating from high school is an important developmental task that marks the transition out of adolescence and into adulthood. However, recent statistics suggest that as few as two thirds of youth graduate within 4 years of entering high school, and that the odds of graduating from high school for black and Hispanic youth barely break 50/50 (Greene & Winters, 2006; Miao & Haney, 2004; Swanson & Chaplin, 2003).[1] High school dropouts are likely to face a number of problems, both immediately after dropping out and later in life. Nearly one half of all high school dropouts ages 16 to 24 are jobless (Sum et al., 2003), and high school dropouts earn about $9,245 less per year than high school graduates (Doland, 2001). Additionally, nearly half of all heads of households on welfare

(Schwartz, 1995) and nearly two thirds of prison inmates have not received a high school diploma (Harlow, 2003). Moreover, the costs of dropping out of high school and its associated ills fall not only on the individual high school dropout, but on the rest of society. It is estimated that the lifetime cost to the nation is $260,000 per dropout (Rouse, 2005).

One factor that is believed to put youth at risk for dropping out of high school is switching schools for reasons other than promotion from one grade to the next, e.g., from elementary school to middle school or from middle school to high school (Astone & McLanahan, 1994; Haveman, Wolfe, & Spaulding, 1991; Rumberger, 1995; Rumberger & Larson, 1998; South, Haynie, & Bose, 2007; Swanson & Schneider, 1999; Teachman, Paasch, & Carver, 1996). Indeed, switching schools is so strongly associated with dropping out that one study found that the majority of high school dropouts switched schools at least once, while the majority of high school graduates did not (Rumberger & Larson, 1998). Moreover, the relationship between switching schools and high school dropout appears to be robust to controls for prior academic achievement and student background characteristics (Rumberger & Larson, 1998; South, Haynie, & Bose, 2007).

However, whether switching schools actually causes students to dropout is uncertain. A few studies have documented that youth who switch schools resemble high school dropouts on several academic, family, and personal

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factors. Most notably, youth who switch schools are more likely to come from single-parent families, are more disengaged, and perform worse academically than youth who do not switch schools, as evidenced by their higher rate of absenteeism, lower grades, and more frequent school suspension and delinquency (Lee & Burkam, 1992; Rumberger & Larson, 1998). In addition, several studies that have examined the effects of switching schools on youth outcomes have found that much of the difference in achievement or problem behavior between youth who switch schools and those who do not disappears once socioeconomic background and prior achievement are taken into account (Gasper, DeLuca, & Estacion, 2010; Pribesh & Downey, 1999; Temple & Reynolds, 1999). Taken together, these findings suggest that the apparent effects of school mobility on dropout may have little to do with school mobility and more to do with earlier school performance, family instability and other social or emotional factors. Since dropping out is thought to be the result of a long-term process of disengagement from school, one that begins as early as first grade (Alexander, Entwisle, & Kabbani, 2001; Ensminger & Slusarcick, 1992; Finn, 1989), switching schools may simply be one point along a continuum of gradual withdrawal from school that ultimately ends with dropping out. It is therefore difficult to know whether mobility is a cause of dropout, or merely a symptom of the underlying process of disengagement that causes dropout.

The possibility that switching schools may be caused by the same cycle of disengagement that leads to dropout makes estimating the effect of switching schools on dropout a difficult task, due to selection bias. Since the factors that lead to dropout begin operating as early as first grade, youth who switch high schools are likely to be very different from youth who stay in the same high school in terms of their socio economic background, school performance, and behavior long before entering ninth grade. The main challenge therefore lies in knowing the unobserved counterfactual outcome—would the same youth have dropped out if they had not switched schools? Without experimental data, treated youth (who switched schools) must be compared to untreated youth (who stayed in the same school) who are similar on all background factors predictive of dropping out (both observed and unobserved). Such comparisons would provide better estimates than prior research of the effect of switching schools on dropout.

It is also possible that the effect of a transition such as school mobility-works differently across youth, depending on their initial risk (propensity) for changing schools. In other words, it is plausible that the youth most at risk for a nonpromotional school change would be most affected by that change, as it becomes one more jolt to an already unstable set of family circumstances, a history of poor school performance, and a tendency toward problem behaviors. The literature on repeat residential mobility suggests that all of the disruptions in the lives of very poor youth have cumulative negative effects (Shafft, 2006). At the other extreme, it is possible that youth

who are the least likely to switch schools come from more stable and higher functioning families and have enough personal resources to weather the storm of a school change. For students in the middle of the risk continuum, a school change might be the event that pushes a student over the edge if he or she is "making it" but coming from a fragile family or struggling socially. Therefore, we also consider the possibility that the effect of a school change varies by student's risk for experiencing the event.

In this study, we seek to determine whether switching high schools leads to dropping out, or whether high school mobility is simply a precursor to dropping out. To do this, we use data from the National Longitudinal Survey of Youth 1997 (NLSY97), sponsored by the U.S. Bureau of Labor Statistics. Designed to examine the educational and labor market experiences of youth, the NLSY97 contains richly descriptive information on youth's school enrollment, including the grade level of each school that a youth attended. In order to assess whether switching schools increases the likelihood of dropout, we use propensity score matching techniques to compare youth who switched high schools (switchers) with youth who stayed in the same high school (stayers) but who are similar on 177 characteristics measured before ninth grade. We consider a wide variety of background factors that may predispose youth to switching high schools or dropping out, including: demographics, socioeconomic background, family processes and dynamics, school performance and engagement, substance use and precocious transitions, and delinquency. By ensuring that youth who switched high schools are similar to youth who stayed in the same high school on all of these observed background characteristics, we can provide a better estimate than prior research of the relationship between switching schools and dropout. We then assess whether switching high schools has the same effect on youth who had a high propensity for switching compared to those with a low propensity. This allows us to determine whether switching schools leads to dropping out, and for which kinds of students.

Prior Research and Theory

Extent of School Mobility

While most youth do not experience much disruption in their school environments, a nontrivial number do end up changing schools outside of a normal promotion transition point (e.g. the transition from elementary to middle school at sixth grade) (National Research Council and Institute of Medicine, 2010). Over 30% of elementary school students make more than one school change between first and eighth grade (T. M. Smith, 1995), and more than 25% of students make a nonpromotional school change between Grades 8 and 12 (Rumberger & Larson, 1998). However, the extent to which students experience mobility varies closely with socioeconomic

characteristics (Hanushek, Kain, & Rivkin, 2004). For example, studies focusing on very poor minority families suggest that between 60% and 70% of these children change schools at least once in elementary grades and 20% change schools two or more times (Temple & Reynolds, 1999).

Most studies focus on the effects of residential mobility on youth developmental outcomes rather than school mobility per se (Astone & McLanahan, 1994; Hagan, Macmillan, & Wheaton, 1996; Haveman et al., 1991). This makes sense, as residential mobility is often accompanied by school change and is the most common cause for school mobility. However, residential and school moves are not always linked, since only 50%−60% of school changes are residential (Kerbow, 1996). Therefore, we study the impacts of school mobility on educational outcomes, independent of residential mobility, to understand the direct links between switching educational environments and the chances that a student will drop out of school.

School Mobility Causes Dropout

Recent studies investigating mobility and school outcomes have drawn most heavily from Coleman's (1988) work on social capital theory (Hagan et al., 1996; Pribesh & Downey, 1999; Ream, 2005a). Coleman's seminal work suggests that students who change schools as a result of moving are more likely to experience high school dropout in part because of the loss of important social ties (1988, 1990). In particular, he argues that mobility is significant because it affects three forms of closure: parents are less likely to know the teachers in a new school; parents are less likely to know the parents of the child's new classmates; and the child is less likely to know the parents of other youth in the school (1990, p. 596). These relationships are significant for understanding educational attainment, mental health and whether youth engage in delinquent behaviors (Briggs, 1997, 1998; Coleman, 1988; Hagan et al., 1996; Pribesh & Downey, 1999). Additional work has confirmed that the effects of mobility on schooling outcomes is in part due to the loss of relationships with school personnel, parents, and peers (McLanahan & Booth, 1989; Pribesh & Downey, 1999; South et al., 2007).

Social capital within families is important for educational attainment because under stable conditions, parents can monitor children's school progress and provide educational guidance. However, moving can disrupt routines, affect parental relationships and also limit the extent to which parents can rely on social networks to gain knowledge about local school quality and the availability of educational programs and services. It is theorized that breaking social ties and disrupting the home environment creates psychological stress for adolescents and deprives both families and young

people of the resources that established social connections bring (Hagan et al., 1996; Kroger, 1980).

Changing schools can affect educational achievement in many other ways. In addition to severing relationships between children and local neighborhood adults (and breaking ties between parents and the parents of their children's friends), changing schools alters important connections to teachers, peers, and extracurricular opportunities and can disrupt instructional practices. For example, when children switch schools, it takes time for the schools to acquire student records and teachers have to get to know students, which can be difficult after the school year has already begun. There may also be a discontinuity in learning environments, goals, and assessments between the old and new school. This can make it difficult to catch up on coursework both because students have to learn about the new expectations for academic performance and behavior at the school, but also because students may miss learning about key concepts in the time lost between transitions (Kerbow, Azcoitia, & Buell, 2003).

The social transitions between schools can also be difficult for young people, as they enter new landscapes with well-developed friend networks and cliques. This can be difficult for transfer students as, by virtue of being "unknown," they have no entrée into the social hierarchy of the school (Eckert, 1989; Eder, 1985). Previous research has found that more mobile adolescents tend to be more socially isolated and less involved in extracurricular activities than nonmobile adolescents (Pribesh & Downey, 1999), which may lead to weak academic performance, lowered educational aspirations, and less commitment to and satisfaction with school.

Switching Schools as a Symptom of Disengagement

The argument that switching schools and dropout are instead based on similar underlying factors (rather than the former simply causing the latter) has received much less attention. However, when situated in a broader perspective on dropout, switching schools can be viewed more as a sign of impending school attrition than as a cause of dropout. Finn (1989) developed two models that view dropout as a long-term developmental process of disengagement from school. Finn's first model, the frustration–self-esteem model, argues that poor school performance leads to frustration and low self-esteem, which causes a youth to reject school, which they view as the source of their negative feelings. This school rejection may take the form of problem behavior, if a student seeks an increase in self-esteem through success in another arena—specifically, rebellious behavior. Problem behavior escalates and negatively affects school performance until the student eventually drops out, is expelled, or the student's parents transfer him or her to a different school in an attempt to remedy the problem.

Whereas the frustration–self-esteem model focuses on internal psychological processes, Finn's (1989) second model of dropout—the participation-identification model—emphasizes a youth's behavioral and emotional involvement with school. According to this model, students who fail to develop a sense of identification with school will drop out. The development of a sense of identification stems from participation in classroom and school activities, which fosters academic success, promotes a sense of belonging and the value of school-related goals, and increases future involvement in school. The failure to participate in these activities leads to poor academic performance, a lack of support and encouragement to continue participating in school, and emotional withdrawal from school. As the student gets older, attempts at withdrawal manifest themselves as problem behavior, including truancy and disruptive behavior. As the attention of teachers and school officials becomes focused on the problem behavior, and as suspensions and other disciplinary practices prevent the student from further participating in school activities, dropping out is likely.

There is some empirical evidence for the claim that switching schools is caused by the same cycle of disengagement that causes dropout. Lee and Burkam (1992) examined the causes of dropping out, transferring, and graduating. They found that the predictors of dropping out were similar to those of transferring, including frequent unexcused absences, low grades, dissatisfaction with and disinterest in school, cutting classes, suspension/probation, and trouble with the law. They concluded that the motivations for school transfer—or "dropping down"—were similar to those for dropping out and that transferring schools is one point along a continuum of school attrition which ends in dropout. Whereas transferring schools represents dissatisfaction and problems in a single school, dropping out represents dissatisfaction more globally. Similarly, Rumberger and Larson (1998) found that academic and behavioral disengagement in 8th grade (including absenteeism, misbehavior, and low expectations) predicted both whether students dropped out or transferred schools between the 8th and 12th grades.

A second source of evidence comes from studies that find that the association between school transfer and achievement and dropout is reduced when controls for preexisting background characteristics are introduced. Using data from a panel of low-income black children in Chicago, Temple and Reynolds (1999) found that while children who moved frequently between kindergarten and seventh grade performed nearly one grade level behind their peers in reading and mathematics in seventh grade, one half of this difference was due to the fact that they had lower achievement before they started to change schools.Pribesh and Downey (1999) found that preexisting differences accounted for 90% of the difference in test scores between movers and nonmovers. From this, they conclude that "Movers perform less well in school than non-movers in large part because the *kinds of families* that tend to move are also likely to have other disadvantages" (p. 531).

Differences in the Effect of Switching Schools

Because of the variation in family background, social networks and previous academic performance that characterizes the differences between youth who change schools and those who do not, it is also likely that school switching has different effects on youth who vary along these dimensions. Most experimental work estimates an "average treatment effect"(ATE) that shows how an intervention changed the average outcomes for those in the treatment group as compared to average outcomes for controls. However, this ignores the fact that individuals respond differently to treatments, depending on their own characteristics, whether they complied with treatment and treatment fidelity (Morgan & Winship, 2007). Thus, not all young people will respond to school mobility the same way, even if on average it seems to matter for the population.

School mobility might affect youth differently, depending on how their observable and unobservable characteristics and life circumstances put them at risk for the event. A school transfer might trigger a process of withdrawal and distress for a student, depending whether the school change occurs alongside other important events, such as family structure changes or significant events occurring in other domains of a youth's life, such as previous poor school performance, friendship dynamics, and puberty (Agnew, 1992; Pearlin, Meneghan, Lieberman, & Mullen, 1981; Raviv, Keinan, Abazon, & Raviv, 1990; Simons & Blyth, 1987). The extent to which the student is experiencing instability at home might also condition whether or not a school change leads to dropout, even for a student who performs well academically. For example, research generally finds that higher mobility rates among children of divorced families or stepfamilies can help explain their lower educational attainment (McLanahan & Sandefur, 1994; South, Crowder, & Trent, 1998; Speare & Goldscheider, 1987). Good relationships with parents or other adults might act as buffers to offset the effects of moving and school changes (Hagan, Macmillan, & Wheaton, 1996). Research on risk and resilience implies that some protective factors (like parents and schools) can help individuals respond to stressful situations and enhance their coping abilities (Jarrett, 1997; Rutter, 1987).

Youth's own personal characteristics and behavioral past might interact with the school change in a way that determines whether that transition leads to dropout. If youth have a tendency to be more popular with peers and make friends easily, a school change might not make much of a difference. However, if a student has had problem behaviors in the past, encountering new teachers and peers could trigger underlying tendencies to act out and lead to more withdrawal or disciplinary action. For example, a recent study of poor youth shows that the effects of changing neighborhoods differs by gender, prior engagement in risky behavior and neighborhood type (Bolland et al., 2009).

It is also possible that school mobility comes about as a "strategic" versus "reactive" process, set in motion by parents and youth to find a better fit between the student and the school (Ream, 2005b; Rumberger, Larson, Ream, & Palardy, 1999). Reactive school changes are those brought about because of behavior problems the student might be having at school, changes in the family structure, the loss of a parent's job and other push factors at the school level. In the literature, most school mobility is perceived as reactive, and thus associated with negative developmental outcomes. However, some parents actively seek out a school change to pursue higher quality schooling environments for their children (e.g. enrolling children in private, magnet or charter schools). It is possible that such proactive school mobility could be more beneficial for youth than the reactive school moves and help explain how different students weather the storm of school switching better than others (Ream, 2005b; Rumberger et al., 1999).

Analytic Approach

Prior studies that have examined the effects of school transfer on dropout have relied on standard regression adjustment to address the problem of selection bias (Rumberger & Larson, 1998; South et al., 2005; Swanson & Schneider, 1999). These studies all claim to find evidence of a detrimental effect of school transfer on high school graduation. However, standard regression adjustment may be inadequate for addressing selection bias for several reasons. First, regression relies heavily on model assumptions about functional form and extrapolates treatment effects even when treatment and control cases do not sufficiently overlap on observed characteristics. However, youth who transfer schools are likely to be different in important ways from youth who do not transfer schools. Regression adjustment ignores this lack of overlap of treatment and controls in its estimation of treatment effects. Such lack of overlap raises suspicions about what *would* have happened to youth who transferred schools if they had not transferred schools. Regression therefore reports an ATE of school transfer:

$$E(y_1 - y_0) \tag{1}$$

where y_1 denotes the probability of youth dropping out after transferring schools, and y_0 denotes the probability of a youth dropping out without transferring schools.

A better approach is to match youth who switched schools with youth who did not switch schools but who are similar on observed characteristics. When matching youth on many observed characteristics, one method that is particularly useful is propensity score matching, pioneered by Rosenbaum and Rubin (1983). Propensity score matching combines information on a large number of observed characteristics into a single scale that summarizes a youth's probability of receiving treatment, which in this case is

switching schools. Each treated case is matched to a control case with a similar probability or "propensity" for treatment based on observed characteristics.

Propensity score matching offers a substantial improvement over standard regression adjustment in two ways. First, propensity score matching does not rely on regression assumptions about additivity and linearity to estimate treatment effects. While an individual's propensity score is calculated using a logit or probit model, individuals are matched nonparametrically. Second, propensity score matching highlights the issue of common support. Matching forces researchers to examine the extent to which the treated and untreated groups overlap. It addresses the issue of selection bias by helping researchers get closer to the counterfactual question: *If youth who switched schools had stayed in the same school, would they have graduated?* Obviously, it is impossible to go back in time and redirect youth who transferred schools to stay in the same school. Propensity score matching helps to overcome this problem by comparing youth who transferred schools to youth with similar backgrounds who stayed in the same schools. Propensity score matching therefore reports an estimate of the "average treatment effect on the treated," where Z is whether a youth switched high schools:

$$E(y_1 - y_0|Z = 1) \tag{2}$$

The first step in propensity score matching is to use a logit model to estimate the probability of treatment (nonpromotional school change) given a set of observed characteristics

$$P_r(Z = 1|x) = \frac{e^{x\beta}}{1 + e^{x\beta}} \tag{3}$$

where $e^{x\beta}$ is the exponentiatedlogit or log odds of treatment and Z represents school mobility. The probability is restricted to be between 0 and 1. A key assumption of the propensity score method is the conditional independence assumption (CIA). The CIA states that selection into treatment is random conditional on a set of observed covariates. In other words, propensity score matching addresses "selection on observables" and cannot address selection bias on characteristics that are not measured or observed. If unobserved characteristics determine treatment status, then treatment assignment is not random and treated and control individuals still differ in important ways. While the CIA is a strong assumption that is unlikely to be satisfied in any observational study, we attempt to increase the plausibility of the CIA in two ways. First, we calculate propensity scores using 177 observed characteristics that are likely to affect both selection into treatment as well as the outcome (high school dropout). Many of these covariates may serve as proxies for unobserved characteristics with which they are correlated. The full list of matching covariates can be found in supplementary

Appendix S1 (see the online version of the journal). Second, we compare the distribution of pre- high school characteristics before and after matching using *t*-tests and measures of standardized bias to ensure that the groups are balanced on observed characteristics. However, it is important to note that propensity score matching by itself does not solve problems of selection bias. Any covariate that is unmeasured but highly correlated with switching schools could bias the estimated treatment effects.

After computing propensity scores, we matched treated youth (those who switched schools) to counterfactuals who were similar on observed characteristics but who did not switch schools. While there are many strategies for selecting counterfactuals, we accomplished matching using two common methods: nearest neighbor caliper matching with replacement and kernel matching. In nearest neighbor matching, treatment cases are randomly sorted and each treated individual t is matched with the control case c with the closest propensity score (J. A. Smith & Todd, 2005) as follows:

$$|p_t - p_c| = \min_{k \in \{D=0\}} \{|p_t - p_c|\} \quad (4)$$

where p_t and p_c are the propensity scores for the treated and control cases, respectively. The matching algorithm attempts to minimize the absolute difference between the treatment and control propensity scores. However, one shortcoming of nearest neighbor matching is that matches may not have the same propensity as treated cases. This is because nearest neighbor matching does not usually address the issue of common support, thereby leading to potentially bad matches when treated and control groups are substantially different. To address this issue, we imposed a restriction on the maximum distance between treated cases and counterfactuals. Specifically, we used a caliper of .01, meaning that the probability of treatment for each counterfactual had to be within 1% (high or low) of the probability for the treated case to which it was matched. Caliper matching ensures that treated and control cases are very similar.[2] To ensure that a match was found for every treated case, we matched with replacement, meaning that once an untreated control had been chosen for a match, they were able to serve as a counterfactual for multiple treated cases. While this strategy increases the variance of the treatment effect estimates, it maximizes the number of treated cases that are matched to counterfactuals.

We employ a second matching method—kernel matching—to assess the robustness of our findings. Whereas nearest neighbor matching pairs each treated case to only one counterfactual, kernel matching pairs treated cases with multiple counterfactuals weighted based on the distance of their propensity score. The distance is measured by the difference in propensity scores between the treated and control cases. In kernel matching, the contribution of each control case to the treatment effect of switching schools is dependent on its distance in propensity score. Youth who are similar in their estimated propensity count more in the estimation of the treatment

effect than youth who are different. In other words, better matches contribute more to the parameter estimates.In this way, kernel matching improves upon the estimates provided by nearest neighbor matching. We impose a bandwidth of .01 to produce results that are comparable with those derived from nearest neighbor matching.

After matching, we estimated treatment effects by calculating the percentage of youth who dropped out in both the unmatched and matched samples. To examine whether the effects of school transfer on dropout vary by preexisting differences, we stratified our sample by quartile of propensity score. We then estimate treatment effects separately for youth with different propensities for switching high schools.

Data and Methods

The NLSY97

This study uses data from the National Longitudinal Survey of Youth 1997 (NLSY97), sponsored by the U.S. Bureau of Labor Statistics. The NLSY97 is a nationally representative longitudinal survey of youth who were 12 to 16 years old on the sampling date of December 31, 1996 (or who were born between 1980 and 1984).[3] The NLSY97 is designed to document the transition from school to work and into adulthood. The NLSY97 sample is composed of two independent probability samples: (1) a cross-sectional sample of 6,748 youths who are representative of the noninstitutionalized population of youths in the USA who were born between 1980 and 1984, and (2) an oversample of 2,236 black and Hispanic youths. The cohort was selected this way to meet the survey design requirement of providing enough black and Hispanic respondents for statistical analyses.

Measures

School mobility. Our measure of school mobility is derived from retrospective self-reports of each school attended since the last interview. Beginning in round 2, the youth questionnaire collects information on each school that a youth attended since the last interview. Youth are queried on the dates of attendance as well as the grade level of the school (e.g., elementary school, middle school, high school). Information for each school is entered on a roster, and a unique ID number assigned to each school for each youth enables the identification of schools attended by a youth in previous rounds. This makes it possible to construct the complete history of each school attended for each youth, including the dates attended and the grade level. Using this information, we created a variable that counted the number of high schools that a youth ever reported attending. We then created a dummy variable equal to 1 if a youth ever attended more than one high school and 0 if a youth attended only one high school.[4] Mobile youth are therefore considered youth who attended

more than one high school.[5] Since changing high schools should not be the result of a promotion from one grade to the next, our measure of school mobility should tap nonpromotional school change.[6]

Dropout. The dependent variable in this study is dropout, which we derived from youth self-reports of school enrollment at each round of the NLSY97.NLSY97 staff created a variable that summarizes the youth's enrollment status at each round based on the information collected on school enrollment. Dropout is defined as any youth who is not enrolled in school and who does not have a high school diploma at the time of the round 7 interview, when the youth are between the ages of 19 and 22. Youth who obtained a GED are counted as high school dropouts in the analysis because their labor market outcomes are more similar to those of high school dropouts than to those of high school graduates (Cameron & Heckman, 1993).[7]

Matching covariates. Our selection of covariates used to predict the propensity for switching high schools was partially guided by the few studies that exist that examine the causes of switching schools, and the requirement that the covariates be measured before the event of interest. This literature suggests that youth who switch schools are more disadvantaged academically and socioeconomically. As noted by Rubin and Thomas (1996), the criteria for including variables in the propensity score model is not their statistical significance but rather their power in balancing the means and covariances of the treatment and control groups. For this reason, and because the literature on the causes of switching schools is quite thin, we were liberal in our variable selection and excluded a variable only if there was reason to believe that it was unrelated to treatment or outcome. If balance can be achieved on a large number of characteristics, it strengthens our confidence that the differences between treatment and matched counterfactuals are minimized.

The NLSY97 is particularly well suited to propensity score matching because it contains rich information on both time-invariant and time-varying characteristics from before youth entered high school. We matched youth on 177 covariates including: demographics, family processes, socioeconomic status, health, delinquency, victimization, peer influence, school experiences, adult-like behaviors, and time use (see Supplementary Appendix S1 in the online version of the journal). Prior studies show that demographic factors are associated with school mobility. Black and Hispanic youth are more likely to move than white youth (Ream, 2003; Rumberger & Larson, 1998). Changes in family structure may also lead to mobility (Astone & McLanahan, 1994). One important demographic factor in predicting school mobility is residential mobility. Therefore, we include demographic measures such as gender, race, family structure, residential location, region, and average number of residential moves per year since birth. We also consider family processes and dynamics. The dynamics of single- and stepparent families that are prone to moving may put youth at risk for school disengagement and dropout. For example, a single-parent family may provide youth with less

supervision and monitoring and fewer resources for academic success and the addition of new family members may destabilize family interactions in stepfamilies. Family processes are linked with school withdrawal, including dropout (Rumberger, Ghatak, Poulos, Ritter, & Dornbusch, 1995)

While prior research is ambivalent about the relationship between socioeconomic status and switching schools, socioeconomic factors are extremely predictive of dropout (Ekstrom, Goertz, Pollack, & Rock, 1986; Rumberger, 1983). We include a wide array of socioeconomic indicators, including mother's age at first birth, parental education, receipt of various types of public assistance, and information on family assets.

We also match youth on measures of delinquency and problem behavior. Youth who are deemed "troublesome" may be transferred to another school or alternative program, and delinquency and problem behavior plays a key role in the process of withdrawal from school, including dropout (Elliott & Voss, 1974; Mensch & Kandel, 1988). Our measures of problem behaviors include youth's participation in delinquency and substance use, and whether a youth has ever had sexual intercourse or been arrested. We include a related set of indicators for peer influence, which has also been linked to dropping out.

We include covariates to capture youth's victimization experiences. Moving or switching schools may be prompted by being bullied or living in an unsafe neighborhood. Our measures of victimization include whether a youth had been bullied by age 12, whether the youth's house had been broken into, and whether the youth had ever seen someone get shot.

Consistent with the idea that switching schools is one point along a continuum of disengagement, prior research shows that academic achievement and engagement are important predictors of switching schools (Lee & Burkam, 1992; Rumberger & Larson, 1998). Switching schools may be an alternative to dropping out for youth who feel alienated and are seeking a change of environment. Our measure of school performance and engagement include eighth grade GPA (Grade Point Average), grade retention, suspension, and standardized scores on the computer adaptive version of the Armed Forces Vocational Aptitude Battery (CAT-ASVAB). We also include a related set of indicators capturing how youth spend their time, including doing homework, watching TV, reading, etc. These behaviors may serve as proxies for engagement in school.

All of our observed covariates used to match treatment and control cases were measured in round 1 (1997), before youth in our analytic sample entered high school. Thus, they occur before the treatment of switching high schools, which is a requirement for propensity score matching.[8]

Sample Size and Missing Data

Not all of the 8,984 NLSY97 youth are included in this analysis. We have selected a sample that allows us to assess the effect of switching high schools

on dropout for youth who are similar on pre-high school characteristics. This involved making several restrictions to the sample. First, we limited our analyses to youth who were born in 1983 and 1984, since youth who were born between 1980 and 1982 had already started high school by round 1 of the NLSY97. If we had included youth who were already enrolled in high school by round 1, we could not use round 1 covariates to match because they would have occurred *after* treatment for many youth. Moreover, we do not have information on non-promotional school changes before round 1. This restriction resulted in the largest sample loss. However, because this sample selection was based on age, it should not bias our results. Second, since we required information on whether a youth changed high schools or dropped out, we limited our sample to youth who were interviewed at some point after they should have graduated from high school, even if they missed a wave, since they would have complete retrospective school enrollment histories. We chose to limit our analyses to youth who participated in the round 8 interview, when our sample members were between the ages of 19 and 21 and should have graduated from high school. Third, we excluded any youth for whom we could not determine whether they changed high schools or dropped out. The final sample consists of 2,751 respondents.[9]

With the exception of the measures of household income and cognitive ability, the response rate for most items in the NLSY97 is quite high. However, given the large number of observed covariates used to match changers and nonchangers, discarding cases with missing data on any covariate would result in substantial data loss. At the same time, missing data on a covariate may tell us something important about an individual that may be related to his or her propensity for treatment. We followed a method recommended by Rosenbaum and Rubin (1984) and imputed missing covariate data and included a dummy variable flag for the missing values. In this way, the propensity score reflects the pattern of missingness and groups should be balanced on the distribution of missing values as well as observed covariates. Since missing values are flagged, the choice of imputed value does not affect the parameter estimate for the covariate with missing data. In this case, we chose to impute missing values with zero. However, the choice of imputed value could affect the differences between treatment and control groups, so we assess balance only on valid observations for covariates.

Results

Descriptive Findings

Figure 1 shows the number of high schools attended by NLSY97 youth born in 1983 and 1984. Since the estimates are weighted, they may be

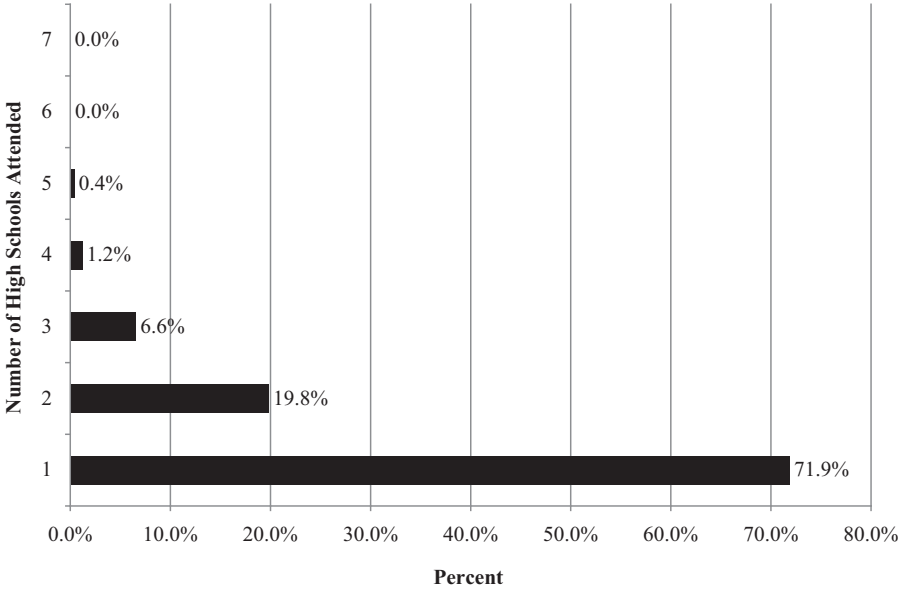


Figure 1. **Number of high schools attended by youth born in 1983 and 1984.**

thought of as nationally representative. More than 70% (71.9%) of NLSY97 youth attended one high school. About one in five youth (19.8%) attended two high schools, and 6.6% of youth attended three high schools. Few youth attended more than three high schools.

Table 1 shows the percentage of youth who were high school dropouts in round 8 by the number of high schools attended. Consistent with prior research, youth who attend more than one high school are more likely to be high school dropouts. The dropout rate for youth who stay in the same high school is 8.1%. The dropout rate for youth who attend two high schools (one change) is over twice that rate—19.1%. The dropout rate for youth who attend three to five high schools is three times the dropout rate for youth who stay in the same school—between 25.9% and 29.5%. The overall high school dropout rate in the NLSY97 sample is 11.9%.

Comparing Switchers and Stayers

One of the biggest problems with the comparisons in Table 1 is that youth who attend more than one high school are likely to be different on a wide array of characteristics before high school. A major benefit of the NLSY97 is a rich set of pre-high school characteristics which can be used to compare mobile and nonmobile youth. Youth who changed high schools

Table 1
School Mobility and High School Dropout

Number of High Schools	Number of Youth	Percent Dropout
1	1,933	8.1%*
2	559	19.1%*
3	204	25.9%*
4	40	28.3%*
5	12	29.5%*
6	2	100.0%*
7	1	100.0%*
Total	2,751	11.9%

*The difference in proportion between youth who attended more than one high school and youth who attended one high school is statistically significant at $p < .05$.

differ from youth who did not change high schools on 110 of these pre-high school characteristics according to a two tailed t test at $p<.05$—that is, they differ on nearly two thirds of the characteristics (62%).

A useful way of assessing the extent of covariate imbalance is the standardized bias, as recommended by Rosenbaum and Rubin (1985). This can be calculated as follows:

$$100 * \frac{x_t - x_c}{\sqrt{\frac{s_t^2 + s_c^2}{2}}} \tag{5}$$

In this equation x_t is the sample mean for the treatment group and x_c is the sample mean for the control group; s_t and s_c are the respective sample standard deviations, which are equally weighted. When the absolute value of this statistic is greater than 20, the covariate is said to be imbalanced.

Standardized biases are presented in Supplementary Appendix S1 (see online version of the journal) for all covariates used in matching. Using this criterion, 39 covariates, or 22% of the covariates, are unbalanced between the two groups. Clearly, a change of high schools is not the only difference between youth who switch high schools and those who stay in the same high school. The results shed some light on how switchers differ from stayers. Demographic and socioeconomic indicators are the most imbalanced. Youth who switch schools are more likely to live in a central city, to come from a household where the biological mother is the only parent and to have a mother who gave birth when she was a teenager. Youth who switch schools are also more socioeconomically disadvantaged. They are less likely to have a computer at home, more likely to have parents who received various types of government aid, and have fewer family assets. Not surprisingly, switchers also have a history of residential moves.

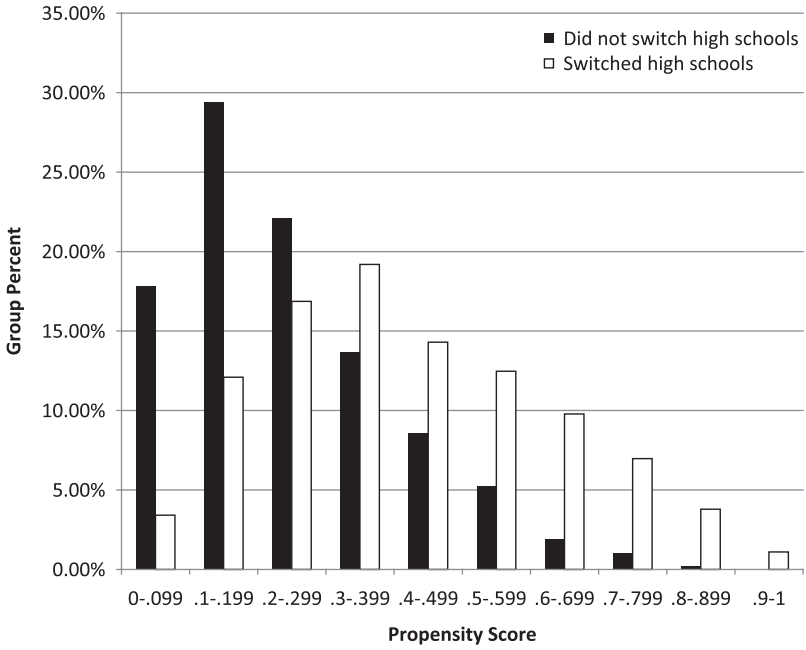


Figure 2. **Distribution of propensity scores by school mobility.**

However, socioeconomics are not the only differences between switchers and stayers. They also differ in terms of family processes and dynamics. Switchers are less attached to their father figures, subject to less monitoring by their mother and father figures, and their parents are less likely to volunteer at school. Consistent with prior studies on the causes of switching schools, switchers also have lower academic achievement and higher disengagement than stayers. For example, youth who switch high schools are more frequently absent from school, have lower eighth-grade GPAs, and are more likely to have been suspended from school than stayers. There are also large differences in terms of school aptitude. Youth who switch high schools perform more poorly on most subsets of the ASVAB.

To address this comparability problem, we matched school movers to nonmovers based on propensity scores derived from the 177 pre-high school characteristics. Of the 818 youth who switched high schools, we matched 797 to counterfactuals who did not switch high schools. We discarded 21 switchers for whom we could not find a suitable counterfactual from among the stayers. Even though we allowed a counterfactual to serve as a control for more than one youth (replacement), a full 87% of the controls were matched to just one treated case.

Table 2
Summary of Balance, by Matching Method

	Unmatched		Nearest Neighbor		Kernel	
	t	Bias	*t*	Bias	*t*	Bias
Number of covariates	177	177	177	177	177	177
Number of covariates imbalanced	110	39	5	0	0	0
Percent of covariates imbalanced	62%	22%	3%	0%	0%	0%

Note. Nearest neighbor matching was performed with a caliper of .01 and replacement. Kernel matching was performed using the Epanechnikov kernel.

Figure 2 shows the distribution of propensity scores by school mobility. The figure shows the percent of switcher and stayers that have estimated propensity scores that fall within each of the propensity score groups. The average propensity score is .30, showing that switching highs schools is not an uncommon experience for youth in the NLSY97. The highest propensity score was .98; the lowest propensity score was .00. For youth who switched high schools, the average propensity score was .42; for youth who stayed in the same high school, the average propensity score was .24. Figure 2 shows that youth who changed schools have higher propensity scores on average than youth who did not change schools. Many youth who do not change schools are not useful counterfactuals for youth who do change schools, and a few youth who did not change schools serve as useful comparisons. However, there is still a great deal of common support.

Table 2 provides a summary of covariate balance before and after matching. By matching via nearest neighbor with replacement and a caliper of .01, all but five of the 177 matching covariates are brought into balance between switchers and stayers using the *t*-test criteria.[10] For example, switchers spend fewer days reading and are more frequently absent from school after matching by nearest neighbor. Given the theoretical importance of school disengagement, imbalance on the number of absences raises concern. However, 97% of the covariates are balanced using the *t*-test criteria. Moreover, using the Rosenbaum and Rubin standardized bias criteria, evidence for balance is even stronger: none of the original 39 covariates classified as imbalanced remains so after matching. Even in a randomized experiment, we would expect some significant differences between changers and nonchangers simply due to looking at 177 covariates. Less than 1% is well under the 5% we might expect by chance alone. However, kernel matching successfully achieves balance on all 177 covariates. The five

Table 3

Percent Reduction in Bias for the 25 Most Imbalanced Covariates Before Matching

	Unadjusted Means				
	Attended >1 High School			Percent Reduction in Bias	
Variable	Yes	No	Standardized Bias	Nearest Neighbor	Kernel
Demographics					
Both biological parents	39.9%	57.2%	−34.9	90.1	96.7
Dwelling – house	7.3%	4.7%	−25.5	95.6	95.7
Residential moves/year since birth	.2	.2	23.9	92.2	95.7
Socioeconomic Status					
Had a computer past month	42.4%	55.5%	−26.4	68.3	91.5
Inside of house nice	53.5%	66.2%	−26.0	97.0	95.9
Outside of house nice	51.6%	63.5%	−24.3	98.9	96.5
Building on street well kept	46.3%	59.0%	−24.0	73.0	94.2
Number of family assets	2.2	2.8	−34.5	99.1	93.8
Parent received AFDC	41.3%	25.6%	31.8	95.6	90.3
Parent received food stamps/WIC	53.6%	40.0%	26.0	92.5	82.0
Years/last 5 AFDC	.9	.4	28.5	94.5	95.6
Years/last 5 food stamps/WIC	1.1	.6	28.1	89.6	97.3
Years/last 5 received Medicaid	.9	.5	34.7	62.0	95.3
School Performance and Engagement					
8th grade grades	5.1	5.9	23.9	38.9	57.4
Number of absences	4.9	3.5	−47.7	97.7	96.8
ASVAB – math knowledge	−.8	−.4	−28.8	91.2	95.8
ASVAB – arithmetic reasoning	−.9	−.6	−28.8	85.4	97.5

(continued)

Table 3 **(continued)**

Variable	Unadjusted Meansl: Attended >1 High School: Yes	Unadjusted Meansl: Attended >1 High School: No	Standardized Bias	Percent Reduction in Bias: Nearest Neighbor	Percent Reduction in Bias: Kernel
ASVAB – assembling objects	–.9	–.6	–26.7	93.5	96.7
ASVAB – paragraph comprehensive	–.7	–.5	–26.6	94.6	96.6
ASVAB – mechanical comprehension	–1.00	–.7	–27.2	79.8	98.6
ASVAB – general science	–.80	–.6	–26.2	71.6	98.8
ASVAB – work knowledge	–1.1	–.8	–24.8	71.8	99.5
ASVAB – numerical operations	1.3	1.5	–25.0	97.6	92.0
Ever suspended	32.0%	18.7%	32.0	95.3	99.1

Note. The unadjusted mean is the mean of the covariate for switchers and stayers before propensity score matching. The standardized bias is a standardized version of the difference in the covariate means between the two groups before matching. Standardized biases that have absolute values greater than 20 are said to be imbalanced. Positive values indicate that switchers have more of a characteristic than stayers; negative values indicate that switchers have less of a characteristic. The percent reduction in bias is the percent by which standardized bias of the covariate was reduce by matching. Larger values indicate that matching was more successful in balancing the covariate between the groups. AFDC = Aid to Families with Dependent Children; ASVAB = Armed Forces Vocational Aptitude Battery; WIC = women, infants, and children.

Table 4
Average Effect of Switching High Schools on Dropout

	Percent—Treated	Percent—Controls	Difference	Standard Error	*t*
Dropout					
Unmatched	24.3	9.7	14.6	0.01	10.26*
Nearest neighbor	24.0	15.4	8.5	0.02	3.61*
Kernel	24.0	18.3	5.7	0.02	3.05*

*The difference in proportion between switchers and stayers is statistically significant at $p < .05$.
Note. Standard errors for nearest neighbor and kernel matching estimates were calculated using 1,000 bootstrap iterations to account for the fact that the propensity score was estimated in an earlier step.

covariates that were imbalanced after nearest neighbor matching are balanced after kernel matching. For this reason we regard the treatment effect estimates derived from kernel matching to be more accurate than those derived from nearest neighbor matching.

A useful metric of balance is reduction in absolute standardized bias, which iscalculated by first determining unadjusted bias, then calculating adjusted bias and thepercent decrease in the absolute value of each. Standardized bias reductions from nearest neighbor and kernel matching are presented in Table 3 for the 25 covariates that were most biased in unadjusted comparisons. Most of these covariates had standardized biases greater than 25% before matching, and many had biases higher than 30 or even 40. As can be seen, most of these covariates were indicators of socioeconomic status and academic achievement, engagement, and aptitude. For many of the covariates, matching reduced bias by over 90%, and for most, bias was reduced by 80%. Kernel matching is more successful than nearest neighbor matching in reducing bias on socioeconomic and academic characteristics. The one exception is number of absences, for which bias was reduced by only 39% after nearest neighbor matching and 57% after kernel matching. However, the fact that kernel matching is able to balance absences between switchers and stayers by both the standardized bias and *t*-test criteria minimizes any concern that we may have about possible confounding on absences.[11] It appears that by matching, we were successfully able to eliminate differences between mobile and nonmobile youth on 177 covariates.

Treatment Effect Estimates of Switching High Schools

Table 4 gives the estimated treatment effects of switching high schools on dropping out. The first row provides treatment effects estimates before performing propensity score matching. These provide baseline estimates

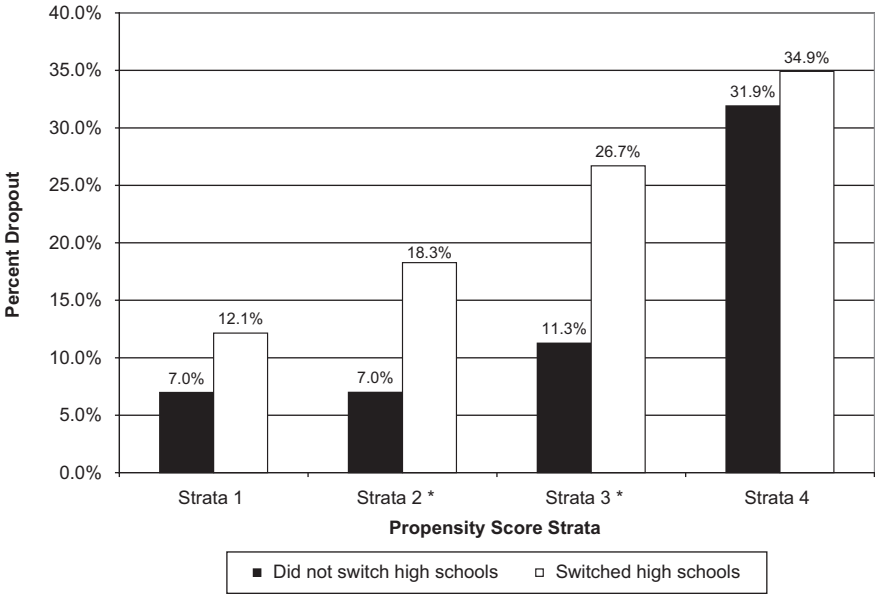
of the treatment effect of switching high schools on dropping out. The effect of switching high schools on dropping out is large in the unmatched sample. Switchers have a dropout rate that is 14.6 percentage points higher than stayers. However, the effect of switching high schools on dropping out is noticeably smaller after matching switchers and stayers on propensity scores. For example, after matching using nearest neighbor, school switchers have a dropout rate 8.5 percentage points higher than stayers. In kernel matching, the dropout rate is only 5.7 percentage points higher. The treatment effect of mobility on dropout using kernel matching is less than half the baseline treatment effect. Switching high schools has a significant effect on dropout once we account for selection into switching high schools.[12]

Heterogeneous Effects of School Mobility on High School Dropout

We examined whether the influence of switching high schools on dropout varied by a youth's propensity to switch high schools by stratifying our matched sample into quartiles of propensity score. Each youth receives a propensity score between 0 and 1 that indicates his or her propensity to switch high schools. Within our matched sample, we divide youth into four equal groups based on their propensity to switch high schools, ranging from low to high. The bottom quartile included youth whose propensity scores ranged from .02 and .24, youth in the second quartile had propensity scores between .24 to .36, youth in the third quartile had propensity scores between .36 and .52, and youth in the top quartile had propensity scores between .52 to .86.

Youth in the four propensity groups differ along demographic, socioeconomic, behavioral, and academic dimensions. For example, nearly two thirds (64%) of youth in the low propensity group live with both biological parents, compared to 44% and 35% in the middle groups and 27% in the highest propensity group. Similarly, 20% of youth in the low propensity group had a teen mother, as compared to 46% in the highest propensity quartile. Interviewers for the NLSY97 report that 73% of the houses that the low propensity group live in are "nice", as compared to only 41% of the homes where the high propensity group reside. The neighborhoods of high propensity youth are also more dangerous (twice as many interviewers report concerns for their safety in the communities where the high risk youth live), are more likely to have gangs, and these youth report twice as many break-ins to their home as their lower propensity counterparts.

Youth with a high propensity for school changes differ on more than just family characteristics. They report engaging in theft crimes at rates that are more than 10 times higher than youth who are at a lower risk for school mobility. They are four times more likely to report being bullied at school, three times more likely to report being in a fight, and are suspended at four times the rate of their lower risk counterparts. The high propensity youth report fewer pro-school peers, more absences, less school attachment, and lower test scores.



* The difference in proportion between switchers and stayers is statistically significant at $p < .05$.

Figure 3. **Dropout rate in matched sample by propensity to switch high schools and switching high schools.**

Clearly, youth in the higher propensity groups have a greater constellation of risk factors for dropping out than youth in the lowest propensity group.

We examined whether switching high schools has a different effect on dropout for these propensity groups by comparing dropout rates within each group. Figure 3 presents dropout rates in the matched sample by propensity score level and whether a youth switched high schools. The figure shows that, for school changers, dropout rates increase with each propensity score level. Within each propensity score level, youth who switched high schools are at a higher risk of dropping out than youth who stayed in the same high school. We performed t-tests to determine whether the dropout rates were different within each stratum. These results suggest that dropout rates were significantly higher among switchers in *the two middle strata only*. This suggests that the effect of changing high schools works differently for youth with varying school mobility risk levels. For those students who were most and least at risk for a school change, the school change did not have an independent effect on whether they dropped out. Rather, school mobility made the difference between dropping out and not dropping out only among students who were at moderate risk of changing schools to begin with.[13]

Why might this be? Supplementary Appendix S2 (see the online version of the journal) shows how youth with varying propensities for switching schools compare on a number of important family, school, neighborhood, and behavior measures. It is clear that the middle two strata are at a much higher risk for school mobility and other negative educational outcomes, as compared to the youth in the lowest propensity strata. Therefore, they are less likely to be buffered by past academic success, a stable family, and economic resources. However, when compared to the highest propensity strata, the two middle strata are less mobile (experiencing 2.3. to 2.5 moves, compared to 3.4 moves), less likely to have been raised by a teen mom, more likely to be monitored by both parents, and considerably less likely to have been on welfare in the last 5 years. They are also much less likely to report having committed a major theft, having attacked another student, being bullied themselves, or having smoked pot. Their suspension rates are also much lower. It seems as though while the middle strata students are already struggling in some ways (when compared to the lowest risk students), as long as they stay in the same school with the same teachers and peers, they might be able to persist to graduation. However, if a disruptive school transfer occurs, it might trigger their pre-existing risk factors and problem behaviors and lead to a process of more delinquency and academic withdrawal.

As for the strata least at risk for a school transfer, previous research suggests that perhaps more stable families, higher academic engagement, and a low tendency toward delinquency buffer these youth when they do change schools. In other words, they have a safety net and a solid set of personal resources that could help them weather the storm of a school switch.For the strata most at risk for school mobility, it could be that they are already far along the path to withdrawal and academic disengagement and the school change would not change their dropout chances either way. These students are already operating with such a substantial set of challenges and instabilities that the additional transition does not alter their behaviors. We cannot definitively conclude why the middle risk students seem most affected by school mobility, or why the most at risk youth don't experience a further increase in their dropout rates after the change. However, it is important to recognize that the effects of school transitions (and likely family transitions) do not affect all youth the same way, possibly indicating a need for different kinds of assistance to students from different backgrounds.

Discussion and Conclusion

Although the focus has shifted to the importance of a college degree for increasing the chances of attaining success in America, the value of a high school diploma has never been greater. Over the past 25 years, earnings differences between high school graduates and high school dropouts have

grown (Day & Newburger, 2002). Youth who miss out on this important developmental milestone are likely not only to find themselves without the skills to succeed in a competitive U.S. labor market that increasingly rewards skills and education but are also likely to be beset by other problems—including imprisonment, poor heath, and having children who are also at risk of high school dropout, to name a few.In this study, we have shown that dropping out of high school is not an uncommon experience for youth in the NLSY97, a nationally representative sample of U.S. youth; about 12% of youth have not obtained a high school diploma by their early 20s.

Like previous research, we find that just under 30% of high school students attend more than one high school, and the students who change schools are more likely to drop out. Consistent with other studies that examine the backgrounds of mobile students, we find that the students who are most likely to switch schools are also those students who are operating with a number of existing risk factors, such as behavioral problems, lower test scores, more school absences, a non-intact family, previous substance use, lower incomes, and more residential mobility. However, unlike previous research, we use a more appropriate modeling strategy to help better disentangle the consequences of switching schools from the effects of preexisting differences in risk factors for dropout between mobile and nonmobile youth. Using propensity score matching, we compared outcomes for students who were similar in their observed risk for school mobility, but who differed by whether or not they *actually* switched schools.

We found that the differences in dropout rates between switchers and stayers could be largely accounted for by family structure and previous behavior and academic performance. However, even after accounting for factors that affect "selection" into mobility (the treatment), changing schools during high school increased dropout by between 6% and 9%. Therefore, it seems possible that switching high schools is part of the process of disengaging from school and it can contribute to dropout.

Another contribution of our work is the finding that school mobility does not work the same way for all youth. For those students who are operating with myriad risk factors, changing schools does not further increase their already high chances of dropout. At the other end of the spectrum, for the students least at risk of changing schools, a school switch does not seem to increase the chances of dropping out. These students are likely well protected from any of the destabilizing effects of mobility, coming from two parent families and reporting low levels of problem behavior and higher levels of school attachment and test scores. The more troubling groups are the two middle propensity strata—those students who are not the least at risk or the worst off. These students seem to dropout at higher rates if they change schools, suggesting that the difficulty of the school transfer might interact with some background risk factors and push them into a spiral of disengagement. These students are better off than their highest risk counterparts, having lower

delinquency rates, coming from slightly less mobile families, having lower rates of being born to a teenage mom, and living in less crime ridden neighborhoods. However, they are similar in that they are still lower income and prone to some school behavior problems.

Limitations and Directions for Future Research

While we have made improvements over previous work in this area, the findings of this study should be interpreted with several limitations in mind. First, while the use of propensity score matching represents a substantial improvement over prior studies on the effects of switching schools on dropout, it is by no means a panacea.Propensity score matching only addresses selection on covariates that were measured and used to predict the propensity scores. To the extent that any characteristic that causes both switching schools and dropping out was omitted, our treatment effect estimates will be biased. We believe that by assessing balance on 177 observed characteristics, we have reduced the threat of selection bias considerably more than prior studies. However, it is never possible to approximate randomization with observational data, and future researchers should continue to investigate whether the relationship between switching schools is robust when matching on additional covariates, such as measures of school characteristics, which may influence student departure but were not included in this study.

A second limitation is that this study was unable to assess the impact of switching schools *before* high school on dropping out. Even before they entered ninth grade, many youth who eventually switched high schools were already disengaged from school, not doing well academically, and frequently suspended from school. The academic and behavioral problems experienced by these youth may well be *effects* of switching schools multiple times in elementary and middle school. By the time they get to high school, many youth who switch schools may have already experienced a developmental process of school failure, disengagement from school, and switching schools that will ultimately culminate in dropping out. For such youth, switching high schools may well represent the continuation of a pattern that began years before. Switching elementary or middle schools may be more detrimental to graduation prospects.Future research should therefore consider the consequences of early school changes and how such disruptions explain the relationship between later transitions and dropping out.

There are also substantive limitations that follow from some of these methodological shortcomings. While we can examine students' propensity to switch schools based on observable covariates, we still do not know the unobservable reasons behind why the school change occurred. For example, we do not know whether the school change was initiated by the school (in the case of serious behavior problems) or the parents and student themselves (in the case of highly motivated families). We are also unable to examine whether

the school change was a long or short distance from the student's original school and whether the quality of the new school varied significantly from the previous school. It is clear that in order to understand better the process behind school mobility, we need more qualitative and ethnographic studies that more closely follow the trajectories of stable and mobile students and their families. One example is Ream (2005b), which uses mixed methods research to show that the reasons why students move are complex, involving both strategic and reactive responses on the part of families and schools. More research along these lines could shed light on the costs and benefits to mobility and how the conditions under which youth change schools have implications for their educational, social, and developmental outcomes.

Such research is necessary to understand better what kinds of programs and practices could help support students when they do change schools, and what parents need to know before initiating a school change. The results from this study indicate that school mobility may be a significant factor that leads some students to dropout of high school. While our study cannot pinpoint the most effective practices to prevent dropout for such students (see Rumberger et al, 1999 for discussion of recommendations), it does further support the concerns of researchers and policymakers that school mobility increases the risk of educational failure and is therefore an important area for future research (e.g. National Research Council and Institute of Medicine, 2010).

Notes

An earlier version of this paper was presented at the American Educational Research Association annual meeting in Denver, CO. The authors are grateful to the National Academy of Education, the Spencer Foundation and the William T. Grant Foundation for supporting the analysis and writing of this manuscript through generous fellowships to the second author. The authors gratefully acknowledge Steve McClaskie of the Center for Human Resources Research at Ohio State University, whose expertise was invaluable in helping us navigate the NLSY97 data set. All three authors are broadly interested in the way social context (e.g., family, school, and neighborhood) shapes the educational outcomes of young people as well as causal inference with experimental and nonexperimental data. The research was motivated by the first author's interest in understanding high school dropout as a developmental process, and the second author's focus on the role of housing and neighborhoods on family and youth outcomes. In an earlier article in *Social Science Research*, the authors found that the effects of residential and school mobility on adolescent delinquency and drug use were explained by unobserved differences between mobile and nonmobile youth, a finding at odds with the consensus that mobility is harmful. The authors hope that this research will spur a renewed interest in understanding the underlying motivations why youth change schools and school policies related to mobile students.

[1]Christopher Swanson and Duncan Chaplin used data from the Common Core of Data (CCD) to calculate the Cumulative Promotion Index (CPI). The value of the CPI approximates the probability that a student entering ninth grade will complete high school 4 years later with a regular diploma. They find a national graduation rate of 66.6%. They also observed dramatic racial disparities in high school completion, with white and Asian students graduating at much higher rates than students from historically disadvantaged minority groups. White and Asian students complete high school at 75% and 77%,

respectively. By contrast, graduation rates for black and Hispanic students are 50% and 53%, respectively.

[2]We used the commonly employed Epanechnikov kernel, which is the default for kernel matching in STATA's psmatch2. However, we also implemented kernel matching with other kernels, including the normal kernel. Choice of kernel did not affect our results. Results are available from the authors upon request.

[3]The NLSY97 cohort was selected in two phases. In the first phase, a list of housing units was derived from a stratified multistage area probability sample. The list of eligible housing units was composed of 96,512 households.In the second phase, subsamples of eligible persons identified in the first phase were selected. Screener interviews were completed in 75,291 households to identify individuals in the appropriate age range for the study. Of the 9,806 respondents who were identified as eligible for the survey, 8,984 participated in round 1 of the survey, which took place in 1997 (91.6% of eligible respondents). Follow-up interviews with the original respondents are conducted annually. NLS surveys are known for their relatively high sample retention rates. In the case of the NLSY97, 81.7% or 7,338 of the original round 1 respondents also participated in round 9 (2005).

[4]There are two additional sources of school information in the NLSY97. In 1997, the parent interview collected information on the number of schools a youth attended since seventh grade, including grade level. While the parent interview could provide retrospective information about the number of high schools attended for youth who attended high school before round 1, such youth are not included in the study because baseline covariates measured in round 1 would have occurred after changing high schools. A second source of information is the transcript survey. In round 2 and again in round 8, NLS staff collected high school transcripts from NLSY97 respondents who had graduated from high school or who were no longer enrolled but who were age 18 or older. Each high school transcript contains a school ID code identifying the high school from which coursework was completed. Using this information, we constructed a second measure of school mobility counting the number of high schools attended as indicated on a youth's transcript. However, we found that this measure lacked validity. It did not correspond to the self-report measure and youth who changed schools did not fit the profile of school changers. We suspect the reason has to do with variations in the way schools report transferred coursework taken over the summer.

[5]We believe we are justified in using two or more high schools as the cut point for our measure of school mobility. Most youth in the NLSY97 who attend more than one high school attend only two high schools.

[6]We were unable to also consider the effect of residential mobility. The NLSY97 collects the dates of all moves to a different city, county, or state but not of moves within the same city. Because the date of short-distance moves in unknown, we would have had to exclude them from the analysis and focus only on long-distance moves. Because poor and minority youth are more likely to make short-distance moves, the results would be biased toward the effect of long-distance residential moves among middle-class youth. For this reason, we chose not to examine the effect of residential mobility. We do not believe, however, that excluding residential mobility overstates the effect of school mobility. Residential mobility is thought to lead to dropout in part because it prompts a change of schools. Indeed, most of the mechanisms by which residential mobility would affect dropout (such as loss of friends or adult relationships) are also implicated in school mobility.

[7]We also conducted all of the analyses with GED holders counted as high school graduates and the overall results were unchanged.

[8]Because the covariates used to predict a youth's propensity to switch high schools were all measured at round 1, and because youth were in different grades at round 1, the length of time between the measurement of the covariates and entering ninth grade (or switching high schools) varies from youth to youth. For youth who entered high school shortly after round 1, the measures represent more distal information on disengagement and performance.

[9]We conducted analyses to examine whether our analytic samples differed from the full NLSY97 sample, given that the most mobile youth might have dropped out between Wave 1 and any later waves. When comparing the two samples on 21 of the covariates used in the models, we found that there were almost no significant differences on

mean values of the covariates. The samples had equivalent means on family income, parental education and the proportion of youth in two parent families, which reduces the concerns about attrition bias.

[10]One of these five, the chronic health conditions scale, was balanced before matching. Two of the covariates—whether there are any gangs in the youth's neighborhood and whether a youth had ever been arrested—were imbalanced in the opposite direction before matching. That is, before matching, switchers were more likely to report gangs in their neighborhoods and having been arrested, but after matching by nearest neighbor they are less likely to report these events.

[11]Given the theoretical importance of absences for dropout, we attempt to improve the percent bias reduction in number of absences by including a squared term for absences in the propensity score model, a strategy recommended by some researchers (Rubin & Thomas, 1996). The addition of this higher order term resulted in a 99% balance reduction on number of absences. However, further reducing the bias on number of absences did not change the estimated effect of switching schools on dropout. Results are available from the author upon request.

[12]As mentioned, propensity score matching addresses selection bias owing to observed but not unobserved characteristics. We believe that we have minimized concerns about unobserved heterogeneity by matching switchers and stayers on 177 covariates measured prior to high school. However, in order to assess the effect that such "hidden bias" might have on our results, we conducted a sensitivity analysis. Specifically, we calculated Rosenbaum's bounds, which show how strong the correlation between an unobserved covariate and switching schools would have to be in order for the effect of switching schools on dropout to be rendered spurious (see Rosenbaum & Rubin 1983 for a more technical discussion). Results indicated that an unobserved covariate would have to affect the odds of switching schools by a factor of 1.5 (or 50%) in order for the effect of switching schools to drop from significance at the .05 level. An unobserved covariate that affects the odds of treatment by 1.1 to 1.4 does not change the findings. The findings therefore appear to be sensitive to a moderate amount of bias, increasing our confidence in the results. Results are available from the authors upon request.

[13]We conducted this analysis further subdividing the sample into five rather than four propensity score strata. We found a similar pattern of results to those obtained with four strata. For youth in the lowest and highest strata, switching schools had no effect on dropout. However, for youth in the middle three strata, switching schools had a significant effect of dropout. Results of this analysis are available from the authors upon request.

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