

EDUCATIONAL ATTAINMENT, TEACHER/STUDENT RATIOS AND ADULT
INCARCERATION RISK AMONG U.S. BIRTH COHORTS SINCE 1910*

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ABSTRACT

Despite the institutional importance of schools and their centrality to explanations of crime, we know little about the relationship between school characteristics such as teacher/student ratios and adult incarceration risk. Educational skeptics argue that investment in schools has little effect on outcomes such as criminality or incarceration risk because criminal propensities are fixed at an early age and in any event, the organizational inefficiencies in public schools make them incapable of utilizing resources effectively to alter student outcomes. By contrast, some education proponents argue that schools increasingly provide critical defining moments in the life course and predict that by improving economic opportunities and facilitating social control in schools, greater resources can directly reduce criminality and incarceration risk. In this paper we use previously unreleased U.S. census data to identify the increasing association between educational attainment and teacher/student ratios on individual incarceration risk for five-year birth cohorts, beginning in 1910. Based on an elaborate fixed effect control methodology, we find conditional support for the conclusion that educational resources – measured as teacher/student ratios – are associated with reduced adult incarceration risk. We assess the robustness of this conclusion by replicating our analysis using school-level measures of teacher/student ratios and longitudinal indicators of individual-level incarceration from the National Longitudinal Study of Youth (NLSY).

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As jail and prison populations in the United States have reached levels that are both historically and comparatively unprecedented, there has been increasing interest in better understanding the determinants of incarceration. Accordingly, recent research has explored the effects of a wide range of macro-level variables on incarceration rates, including unemployment (Western and Beckett 1999; Grant and Martinez 1997; Chiricos and Delone 1992), economic inequality (Garland 1990; Greenberg 1999), electoral cycles (Beckett 1997; Jacobs and Carmichael 2001), welfare spending (Greenberg and West 2001) and race relations (Jacobs and Carmichael 2001; Greenberg and West 2001; Petit and Western 2004). However, with very few exceptions (Arum and Beattie 1999; LaFree and Arum 2006) researchers have not examined the possibility that school characteristics are associated with adult incarceration risk.

This is surprising because educational attainment has become an increasingly important determinant of life course outcomes – including employment, marriage and incarceration (Fischer and Hout 2006, Pettit and Western 2004, Goldin and Katz 2000, Mare 1991) – and in modern societies, sociologists have long recognized that schooling functions as the primary non-familial social institution responsible for socializing children and young adults to behave in a conventional law abiding fashion (Durkheim 1973). Indeed prior research has consistently shown that delinquent and criminal behavior are strongly associated with a variety of education related variables, including grades (Hirschi 1969; Kercher 1988), dislike for school (Gottfredson 1981; Sampson and Laub 1993), school misbehavior (Wilson and Herrnstein 1985) and educational attainment (LaFree and

Drass 1996; Freeman 1996; Lochner and Moretti 2001). But despite the institutional importance of schools and their centrality to explanations of crime, we know little about their association with incarceration risk.

In this paper we examine the association between teacher/student ratios and adult incarceration risk. The resource commitment that states make to faculty instruction in the classroom has long been an issue of considerable importance to both researchers and policy makers. But a lack of appropriate data has hampered attempts to examine connections between teacher/student ratios and incarceration risk. Very few datasets allow researchers to explore the relationship between childhood educational experiences and incarceration rates over the adult life course. Moreover, the validity of any school-level data is seriously compromised by the fact that students are not randomly assigned to institutions; indeed parents go to great lengths to get their children into what they perceive to be the very best neighborhood schools.

In this paper we address these data challenges in multiple ways. We begin by using previously unreleased U.S. census data to examine the association between teacher/student ratios and individual incarceration risk of five-year cohorts of students born since 1910. Census data have the considerable advantage of providing extremely large samples of individual-level data over long time periods. By attaching a measure of teacher/student ratios to individuals based on their cohort and birth state, we are able to examine the relationship between a major childhood educational characteristic on incarceration risk over the adult life course – an issue that can be explored in very few existing datasets. To reduce the possibility that our measures of school resources and adult incarceration risk are spuriously related, we use an innovative procedure inspired by labor economists Card and

Krueger (1992, 1996) that focus analytical attention on individuals *who have left their birth state*. Thus, we examine whether students currently living in say, California, face similar incarceration risks whether they were educated in Oregon in 1965 (where teacher/student ratios were relatively high) or Washington in the same year (where teacher/student ratios were relatively low).

We assess the robustness of our findings by replicating our analysis using school-level measures of teacher/student ratios and longitudinal indicators of individual-level incarceration from the National Longitudinal Study of Youth (NLSY). In both the census and NLSY analyses, our models include state-level fixed effects for both birth and current state of residence to control for unmeasured heterogeneity across states.¹ These methods allow us to analyze contextual variables while controlling for many of the most prominent sources of spurious effects. Thus, our analysis controls for the overall high incarceration likelihood that California residents have historically faced as well as the general risk that someone born in Oregon or Washington will end up in jail or prison regardless of variation over time in teacher/student ratios. Our analysis focuses on an empirical question with important policy implications: *Do students who were educated in contexts where there were more students per teacher face elevated risk of incarceration as adults?* Our results lead us to answer this question largely in the affirmative.

EDUCATIONAL RESOURCES AND INCARCERATION RISK

Researchers strongly disagree about the extent to which positive and negative student outcomes are directly affected by levels of educational resources available in schools. Thus, while some education researchers (Card and Krueger 1992, 1996; Hedges, Laine and

Greenwald 1999; Finn and Achilles 1990; Arum 1998) argue that school resources can play a positive role in improving student outcomes, others (Hanushek 1996, 1998; Jencks et al. 1972; Coleman et al. 1966) claim that resources play little or no role in student outcomes due to organizational inefficiencies in public schools or the role of peer climates and social background. Similarly, some criminologists (Wilson and Herrnstein 1985; Gottfredson and Hirschi 1990) maintain that criminal behavior patterns are firmly set at an early age and are subsequently little affected by schooling. While others (Jessor et al. 1991; Sampson and Laub 1993) argue that schools provide opportunities or “turning points” that can dramatically change the likelihood of juvenile delinquency and crime.

The main difference between skeptics and proponents of schooling as a predictor of subsequent criminality or incarceration is that the former (Wilson and Herrnstein 1985; Gottfredson and Hirschi 1990) assume that criminal behavior patterns are set early in life and are afterwards difficult or impossible to change, while the latter (Hagan and Wheaton 1993; Jessor et al. 1991; Laub and Sampson 1993) emphasize the malleability of youth and argue that schools may allow individuals to change their behavior permanently. Skeptics maintain that selection bias accounts for post-childhood measures associated with adult criminality and contact with the criminal justice system. For example, Gottfredson and Hirschi (1990) argue that delinquent patterns are firmly established in childhood and delinquent youth simply choose deviant associates and unconventional lifestyles as adults. Similarly, Wilson and Herrnstein acknowledge (1985:267) that juveniles who have difficulty in school are also more likely to commit crime, but conclude that both behaviors are produced by the same preexisting personality traits. In addition, skeptics within the

educational research community (Hanushek 1986, 1996; for a review, see Burtless 1996) claim that organizational inefficiencies in public schools make them incapable of systematically altering student outcomes through variation in educational resource investment.

By contrast, those who support the potential for schools to change the criminal trajectories of students most often suggest that educational resources can reduce adult criminality and incarceration risk either by improving non-criminal opportunities or by strengthening the effectiveness of school-based social control. Cloward and Ohlin (1960:98) provide the best known opportunity model of education, arguing that lower-class juveniles who fail to secure an adequate education have little chance of improving their circumstances and that the resulting frustration leads them to “acute discontent” and “aberrant behavior.” By contrast, Sampson and Laub (1993:101) support a social control model, arguing that schools are often better suited than families for effectively controlling juvenile delinquency, pointing out that teachers are trained to monitor the behavior of students, that teachers often have less difficulty than parents in recognizing delinquent behavior, and that schools have the authority, the means and the motivation to punish lapses in self control. Western and his associates (Pettit and Western 2004; Western, Kleykamp and Rosenfeld 2006) have documented an increasing association between education and incarceration in recent decades.

There is also much disagreement among researchers with regard to the extent to which incarcerated individuals represent a group selected for their actual criminal behavior as opposed to the processing decisions made by police, prosecutors and courts (O’Brien 1985; President’s Commission 1967). Thus, Hindelang (1981) distinguishes between

“behavioral” and “labeling” interpretations of official crime data and O’Brien (1996, 2003) contrasts “offender-generated” and “recorded” crimes. We note that finding a connection between state level spending on education and incarceration rates has important implications for theory and policy regardless of the combination of actual behavior and official bias represented by those who actually end up being incarcerated. But it is also important to emphasize that our analysis cannot distinguish the extent to which individuals in our analysis are incarcerated for behavioral or labeling reasons. We return to this issue in the conclusion.

Direct tests of the link between educational resources and incarceration risk are sparse. An early study in Tennessee by Reiss and Rhodes (1961) found that students who attended schools with others who had lower socio-economic backgrounds faced higher rates of subsequent incarceration, net of their family background. However, the authors included no direct measure of school resources. More recently, Arum and Beattie (1999) used data from the National Longitudinal Survey of Youth to examine the effects of differing types of high school experiences on the individual risk of incarceration among young men (ages 19 to 36) in their sample. The researchers found consistent evidence that students attending schools with more students per teacher faced an elevated risk of incarceration after graduation. As educational resources varied from 15 to 25 students per teacher, the risk of subsequent adult incarceration increased nearly one and one-half times (from 3.7 to 5.7 per thousand). However, this study was limited to observational data that measured resource investment at the local school level, even though individual selection into neighborhood schools is itself heavily influenced by school resources. Moreover, the

study also failed to take into account state-level variation associated with incarceration likelihood in both state of birth and state of residence.

Indirect support for a connection between instructional resources and incarceration risk is found in research that (1) examines the effects of educational experiences on the commission of crime (Gottfredson and Gottfredson 1985; Farrington et al. 1986), or (2) examines the effects of instructional investment on socioeconomic outcomes that are thought to influence criminality or criminal justice outcomes indirectly (Arum 1998; Finn and Achilles 1990, 1999; Finn et al. 2001; Card and Krueger 1992, 1996). An English study by Rutter et al. (1979) reports no effect on crime of teacher/student ratio, although they did find significant effects of school climate defined as student composition and school ethos. Gottfredson and Gottfredson (1985) conclude that rates of student and teacher crime victimization in schools are a product of a range of school characteristics, including educational resources considered broadly, but they find no significant effect of teacher/student ratio on victimization rates.

Hirschi and Hindelang (1977) argue that the more education individuals have and the stronger their cognitive skills, demonstrated on standardized tests, the lower their crime risk. In support, Lochner and Moretti (2001) have shown that those who drop out of high school face significantly higher risks of incarceration and that these risks are linked to increases in criminal behavior and not educational differences in the probability of arrest or incarceration conditional on crime. Similarly, prior research (Gottfredson 1985; Farrington et al. 1986; Viscusi 1986) shows that both time spent at school and time spent working are associated with significantly lower levels of crime and Witte and Tauchen (1994) conclude that time spent in educational activities has a larger crime reduction effect

than does time spent at work. High grade point averages and positive student attitudes toward school have also been shown to reduce the likelihood of adolescent delinquency and adult criminality (Sampson and Laub 1993; Wiatrowski, Griswold and Roberts 1981). Finally, prior research confirms that negative attitudes toward school and low grades increase the probability of delinquency and negatively affect adult life course trajectories (Hagan, MacMillan and Wheaton 1996; Sampson and Laub 1993).

Researchers have also identified the effects of teacher/student ratio on a range of outcomes that may in turn be expected to affect crime and criminal justice processing, including improvement in test scores (Arum 1996; Finn and Achilles 1990), increased years of educational attainment (Bound and Turner 2006) and higher lifetime earnings (Card and Krueger 1992, 1996), as well as positive classroom environments (Sorenson and Hallinan 1977). For example, Mosteller (1995) reports on a randomized experimental study in Tennessee called the Student-Teacher Ratio (STAR) study and concludes that after four years, smaller classes did produce significant improvements in early learning and cognitive development for classes from kindergarten to third grade. Results from classrooms of 13 to 17 students were compared with classrooms of 22 to 25 students (see also Finn et al. 2001). Similarly, Sorenson and Hallinan (1977) show that reduced class size allows increased student opportunities for learning from, and relating to, their teachers.

It is possible that fewer students per teacher facilitate teachers' ability to maintain orderly classrooms, intervene to address student misbehavior and thus contribute to positive youth socialization – particularly for disadvantaged youth most at risk for subsequent incarceration. Experimental (Finn and Achilles 1990, Krueger 1999, Krueger

and Whitmore 2001) and quasi-experimental (Angrist and Lavy 1999) research, for example, has consistently demonstrated positive effects of smaller class size on improvement in standardized test performance, particularly for disadvantaged youth. In addition, researchers have also noted that reduced class sizes have indirect effects on improving instruction through increasing the willingness of high quality teachers to remain in public school classrooms (Gustafsson 2003: 105). As a group of prominent labor economists recently noted: “class size is important for the working conditions of teachers” and “the supply of teachers is sensitive to variations in working conditions” (Bjorklund et al. 2005: 64). While there are good reasons thus to expect a positive relationship between teacher/student ratios and improved adult outcomes (including reducing incarceration likelihood), other researchers have remained profoundly skeptical of the ability of educational resources to improve public school student outcomes significantly (for a review of this debate, see Burtless 1996).

To summarize, few studies have examined the connections between teacher/student ratio and adult incarceration risk. If educational skeptics are right, teacher/student ratio will not be clearly related to individual-level incarceration risk as human behavior is mostly fixed early in life and regardless, organizational inefficiencies in public schools will prevent improved teacher/student ratio from being effectively used to alter student outcomes. By contrast, if those who support a more malleable view of juveniles and public school outcomes are right, instructional investment in schools should be associated with reduced incarceration risk, through improving the quality of educational opportunity and enhancing the schools’ effectiveness at promoting self-control for students. The post-World War II United States provides a natural laboratory for the

study of relationships between educational resources and incarceration risk because of the great variability in these measures over time and across schools.

DATA AND METHODS

To generate reliable and robust estimates of the association between educational resource investment and adult incarceration, we conduct analysis with both census and National Longitudinal Study of Youth (NLSY) data.

Census Analysis

Card and Krueger (1992) used U.S. census data to test the effects of educational resources on labor market outcomes by assigning state-level, cohort-specific educational characteristics to individuals based on the state in which they were born. To control for the large differences in the return to education in different states and the possibility that these returns might be spuriously correlated with state investment in public schooling, they estimated rates of return to schooling only on men who were educated in one state and then moved to another. Using these methods, Card and Krueger (1992) demonstrated that educational resources in a state where an individual was born were systematically related to their adult earnings.

While Card and Krueger's empirical results were widely cited, their methods were also carefully critiqued (Heckman, Layne-Farrar and Todd 1996; Hanushek, Rivkin and Taylor 1996). In particular, critics questioned the absence of adequate controls for selective migration as well as the assumption of linearity in economic returns associated with years of schooling. In response to these criticisms, we modified the original Card

and Krueger methodology in several ways. First, in our multivariate analysis of U.S. census data, we use a sample based on the overall population as well as relying on an *interstate migrant sample* such as the one originally defined by Card and Krueger. If estimates are similar across samples, we can have greater confidence in the validity of our conclusions. Second, because migration selectivity may be related to migration distance, we add controls for migration that occurs solely between adjacent neighboring states as well as for migration that occurs solely within a region (i.e., Northeast, South, West and Midwest). We also further control for selective migratory pressures in our interstate migrant analysis by including a time-period specific measure of the out-migration rate of individuals aged 20 to 60 from each respondent's birth state. Third, we add an additional time-varying state of birth measure, *per capita state welfare spending*, to assess the extent to which the association between teacher/student ratio and subsequent incarceration might be spuriously related to this variable. It is likely that state policies towards investing in youth in schools (i.e., in educational resources measured as teacher/student ratios) and state policies towards investing in general public welfare programs (as measured by per capita state welfare spending) co-vary at the state-level over time. Given the possibility that state-level commitment to these education and welfare policies co-vary and an expectation that these investments potentially could have a similar pattern of associations with adult incarceration risk, controlling for this additional state-level factor in our modeling is warranted. In addition, we test in our modeling for non-linearities in the relationship between educational attainment and incarceration.

We use logistic regression with state-level fixed effects for both birth state and time-varying state of residence to calculate incarceration risk for adults who no longer reside in their birth state. Our research makes use of three waves of micro-level data on state prisoners and local jail inmates from the 1970, 1980, and 1990 U.S. censuses.² Because they were not necessarily located in the same state where they were convicted and resided, we exclude federal prisoners from our analysis.³ We merge 16% micro-level census data on state and local prisoners with 5% samples of publicly released micro-level data on non-institutionalized individuals from the 1980 and 1990 U.S. censuses and two 1% samples from the 1970 census.⁴ We re-weighted data from the various samples to represent the population accurately and used Huber-White estimation techniques to calculate robust standard errors that appropriately adjust for clustering at the cohort by state of birth level.⁵

For several reasons, we follow Card and Krueger's (1992) practice of using state-level teacher/student ratios as a measure of educational resources in the analysis. First, prior research (U.S. Advisory Commission 1990) shows that 85% of state-level variation in per student expenditures is explained by either teacher/student ratios or teacher salaries. Second, unlike teacher salaries, teacher/student ratios across states and over time self adjust for variation in labor costs. Third, state-level measures of teacher/student ratios are strategic because important decisions about school-level spending are made at the state level. Thus, Murray, Evans and Schwab (1998) found that two-thirds of recent variation in spending between schools was accounted for by differences *across* states rather than differences *within* states. Fourth, while variation in school-level spending within states is closely associated with self-selection into schools by social background, variation across states and over time is far less subject to this type of measurement bias (Loeb and Bound

1996). Witness the fact that despite their record as low spenders on education, both Arizona and Nevada have attracted disproportionate numbers of new residents in recent years.⁶ And finally, teacher/student ratios are theoretically related to opportunities for learning and the ability of teachers to monitor and enforce more effectively proper behavioral norms in the classroom.

For our census analysis, we obtain our measure of teacher/student ratios from the Digest of Education Statistics and the Biennial Survey of Education Series.⁷ We assign individuals to birth cohorts based on five-year intervals and attach teacher/student ratios to them at an average age of twelve.⁸ For example, we assign persons born between 1970 and 1974 state level student/teacher ratios for 1985; and persons born between 1965 and 1969 receive state-level student/teacher ratios for 1980.

In our census analysis, we estimate the following equation: $P = 1/(1+e^{-XB})$; where XB is a function taking the general form of vectors: $\delta_j + \mu_{kt} + X_{ijckt} + E_{ijckt} + \gamma_{jc} + \Gamma_{ijckt}$. The probability of being incarcerated is calculated for the individual i , born in state j , in cohort c , and currently living in state k at time period t . δ_j represents a fixed effect for each birth state; μ_{kt} represents a fixed effect for each residence state at the time period of the census survey; X_{ijckt} represents a set of control variables affecting incarceration risk (e.g., age and gender); and r_{ijckt} represents an individual level error term. E_{ijckt} represents measurement of educational attainment; specifically, we allow for the possibility of non-linearities in the effects of educational attainment by including a spline for high school graduation along with the inclusion of a traditional year of schooling measure. In addition, in our full models we allow for the possibility of an increasing or decreasing association of educational attainment with incarceration by including an interaction between cohort and our

educational attainment measures. We examine the association between incarceration and variation in teacher/student ratios that are measured at the level of an individual's cohort and state of birth (i.e., cohort-state specific educational resource *intercepts*, γ_{jc}).⁹

Our estimates of individual incarceration risk control for gender, non-white race (measured as African-American or Hispanic), age and age-square (to control for the expected curvilinear association between age and incarceration). In addition, we add measures of birth cohort and state-level fixed effects for both origin and time varying state of residence to the models to adjust for the possibility that incarceration rates are sensitive to historical and geographic conditions affecting schooling and criminal justice sentencing. To address the possibility that time-varying state level characteristics explain the results, we also incorporate a measure of per-capita state welfare spending reported in the U.S. Statistical Abstracts.¹⁰ Unfortunately, these data are only available for post-1930 birth cohorts when the passage of the Social Security Act of 1935 dramatically increased government assistance for families. Not surprisingly, this state-level measure of welfare spending is highly correlated with state level of support for education, the major focus of our analysis. At the individual-level, the correlation between these two measures is relatively high (0.443 at the $p < .01$ level), as both these measures are a reflection of the extent to which states where individuals reside have made decisions to invest resources on improving social outcomes either in schools or in social conditions more generally. Finally, because young men are at particular risk of incarceration, we conduct a supplementary set of analyses on men aged twenty to forty. We have excluded individuals less than 20 years of age in the study as these individuals

are potentially still enrolled in high school and thus concurrently exposed to educational resource investment at the time of our measure of incarceration status.

Because these methods have not been widely used outside of labor economics, it is worth emphasizing how they reduce spuriousness. Take the case of police expenditures—often included in state-level studies of incarceration risk. We know that states vary greatly in terms of police expenditures and that such expenditures could reasonably be expected to affect incarceration risk. But in our analysis we are focusing particularly on individuals who have moved from their birth state. Thus, our analysis compares movers who have come from states and cohorts that devote high levels of resources to education, to movers from states and cohorts that devote fewer resources to education. The most likely way for our education resource results (measured as teacher/student ratios) to be a spurious product of police expenditure is if states that spent more on policing treated interstate movers differently, depending on whether these movers came from states that devoted higher or lower amounts of resources to education. In other words, it is much less likely that levels of police expenditures differentially affect movers from different states than it is that state levels of police expenditures differentially affect overall state levels of incarceration risk. In any event, our modeling strategy controls for this latter possibility through the inclusion of state-level time varying fixed effects for state of residence. The same reasoning applies to our other control variables, which have often been included in previous state-level studies of incarceration risk.

While analysis based on observational data is inherently subject to a critique that proposes an infinite set of measures potentially capable of leading to spurious results, we take seriously the possibility that state policies towards in-school educational investment

and out-of-school public welfare expenditures co-vary across states over time. To avoid the risk of spurious identification of an association between teacher/student ratio and incarceration that fails to account for this covariation, and to attempt to disentangle the effects of in-school educational investment and out-of-school public welfare expenditures on incarceration, we conduct supplementary analysis that also includes a measure of per capita state welfare spending assigned to individuals at age 12 based on cohort and state of birth measures. Because state welfare spending measures are only available for post-1930 birth cohorts, this supplementary analysis is based on a slightly smaller sample.

Descriptive statistics of the census data are reported in Appendix A1. We present data on all individuals in the census and, following Card and Krueger (1992), a sample of *interstate movers* (i.e., individuals who report differing birth and residence states). The use of census data provides extremely large samples of individuals between the ages of twenty and sixty. We exclude cases with census imputation of birth state, education or race.¹¹

NLSY Analysis

Given questions about the appropriateness of measuring educational resources at the state-level and the possibility of omitted variable bias in census analysis that presents only a limited set of measures to control for individual social background and school context (Betts 1995), we conduct a second set of analyses that measures educational resources at the school-level. Specifically, we examine the association between school-level resources (based on teacher/student ratios) and the likelihood that an individual is incarcerated between ages 22 and 45, controlling for a range of individual level characteristics, social

background and school characteristics. We also test for the possibility that state-level estimates are subject to problems of aggregation bias and find no evidence supporting this contention.¹²

Descriptive statistics on the NLSY data are reported in Appendix A2. We examine the association between teacher/student ratios and incarceration in a series of logistic models that sequentially add to individual-level characteristics controls for social background and school context. All models include fixed effects for both state of birth and state of residence at the end of the observation window. We analyze the full sample and given their elevated incarceration risk, do a separate analysis of men only. Our measure of incarceration is whether a survey was administered in either a prison or jail during the 1979 to 2002 observational window. The educational resources measure is based on high school administrator reports of the number of students enrolled and the number of teachers employed in the school. We control for high school graduation, years of education (measured at age 22), gender, race, ethnicity, age, mother's and father's education, parental income, number of siblings and whether from a two parent family. In addition, we control for school context including percentage of students eligible for free-lunch, percentage of non-white students, school size and whether a private school. Given that our census and NLSY measurement strategies vary as a product of differences in the structure and availability of data, the coefficients for teacher/student ratios and other variables are not directly comparable across analyses.

EDUCATIONAL CHARACTERISTICS AND ADULT INCARCERATION RISK

Table 1 identifies mean teacher/student ratios and incarceration rates per 1,000 adults in 1970, 1980 and 1990 for cohorts born between 1910 and 1969 for the census sample as a whole as well as for the sample of interstate movers. For example, members of the 1965 to 1969 birth cohort were assigned educational resource scores (with student/teacher ratios which averaged 18.9) in 1980; in 1990, cohort members faced an incarceration risk of 8.3 per thousand. Because we limit our analysis to adults, we include no one born after 1949 in the analysis of the 1970 census, after 1959 in the analysis of the 1980 census, and after 1969 in the analysis of the 1990 census. The mean teacher/student ratios series show that over time students have been increasingly exposed to greater instructional resources. Two characteristics of the incarceration rates shown in Table 1 are worth emphasizing. First, incarceration rates are consistently higher for younger cohorts with a single exception: the 1990 incarceration rate for the 1965 to 1969 birth cohort. And second, for same-age individuals, incarceration rates have substantially increased between the 1970 and 1990 census years. This last result reflects the huge nationwide increases in incarceration that began in the early 1970s (Western and Beckett 1999; Zimring, Hawkins and Kamin 2001).

Table 1 about here

In Figure 1, we use the census interstate migrant sample to show the relationship between instructional resource investment in the individual's birth state for cohorts born from 1910 to 1972 and the likelihood of adult incarceration based on whether individuals were incarcerated at the time of the 1970 to 1990 censuses. The size of the bubbles in Figure 1 indicates the population magnitude of the birth state. Probabilities for this figure are based on the actual percentage incarcerated.

Figure 1 about here

Figure 1 provides quite dramatic evidence of the degree of association between state-level teacher/student ratios and the probability that interstate movers will be incarcerated as adults. The Pearson correlation coefficient between these state-level measures is 0.67 weighted and 0.57 unweighted ($p < .01$ for both). Figure 1 shows clearly that individuals who were born in states that invest little in their schools (in terms of teacher/student ratios) face a much higher likelihood of ending up in other states' prisons and jails as adults. For example, interstate movers who were born in New York and New Jersey with student/teacher ratios of 21.5 have a 3.0 per thousand likelihood of being incarcerated. While interstate movers born in California with student/teacher ratios of 25.1, have a 5.4 per thousand probability of being incarcerated. It is worth pointing out that there are only two states, both with relatively small populations that are outliers in Figure 1 (see small circles in far bottom right). Hawaii and Utah have relatively high student/teacher ratios and yet relatively low out-migrant incarceration rates (Hawaii's student/teacher ratio is 25.1 and its out-migrant incarceration rate is 1.5 per thousand; Utah's student/teacher ratio is 27.5 and its out-migrant incarceration rate is 1.9 per thousand). Interestingly, both states also have unique demographic and cultural characteristics that may compensate for the effects of educational context on incarceration risk.

Figure 2 maps the degree to which host states of interstate movers exhibit different incarceration rates in the 1970 to 1990 censuses. These results are again descriptive and do not adjust for individual-level differences that are controlled for in the multivariate analysis presented below. Nevertheless, Figure 2 shows that interstate movers who

switch their residence to certain states are particularly likely to end up incarcerated. Nevada – a state that recently embraced the advertising campaign “What happens in Las Vegas stays in Las Vegas”– led the nation in locking up interstate movers (6.6 per thousand were incarcerated). Incarceration rates for interstate movers were also high in Texas, Arizona and the states of the Southeast. By contrast, New England as a region contained five of the eight states with the lowest rates of incarceration of interstate movers: New Hampshire, 1.3 per thousand; Vermont, 1.4 per thousand; Massachusetts, 1.7 per thousand; Rhode Island, 1.7 per thousand; and Maine, 1.8 per thousand (the other three non-New England states in this category are Hawaii, Montana and North Dakota with 1.6, 1.7 and 1.8 per thousand interstate movers incarcerated).

Figure 2 about here

To further examine the extent of association between teacher/student ratios and incarceration, we next present in Table 2 multivariate logistic regression results for individual incarceration risk with state-level fixed effects for both birth and time period by current residence state. Models 1-2 and 5-6 are based on a full census sample and models 3-4 and 7-8 are based only on individuals who reside in a state differing from their birth state. Models 1-4 are based on men and women, ages 20 through 55; models 5-8 are based on men aged twenty to forty. Models are run for each sample both with and without an interaction for cohort and educational attainment to test for the possibility that the association between educational attainment and incarceration is changing over time.

Table 2 about here

Table 2 shows considerable support for the educational resource argument. We found the expected negative relationship between educational resources and incarceration risk in all eight models, for the total census samples, for the samples restricted to those who are now living in a state different than the one in which they were born, for models of men and women ages 20 to 55, and for models of only men ages 20 to 40. It is important to note that our significance tests in the multivariate analyses are based on the number of five-year cohort by state terms for which we assigned teacher/student ratios. For example, significance tests in Table 2 are based on 11 five-year birth cohorts multiplied by the 50 states (i.e., observations clustered into 550 cohort*birth states). This means that obtaining statistical significance is far more difficult than it would be if the statistical tests were based instead on the huge census samples and unadjusted for clustering. Moving from 15 students per teacher to 25 students per teacher on the teacher/student ratios measure is associated with a 1.6 times reduction in incarceration risk for interstate migrants in Model 4 and a 1.7 times reduction for men ages 20-40 in the interstate migrant census sample (Model 8). Moreover, when we excluded birth state fixed effects from our regression models in a supplementary analysis (available upon request), state-level differences in on the association between teacher/student ratio and incarceration were similar to the strong associations identified in the descriptive findings presented in Figure 1.

Incarceration risk declines significantly in all models for individuals with higher levels of educational attainment. In addition to linear effects of years of education, high school graduates (compared to drop outs), face a much lower incarceration risk in all four models that exclude the years of education*cohort and the high school

graduate*cohort interaction terms. In the four models that do consider these interactions, we found significant evidence of change in the relationship between educational attainment and incarceration over time. In our analysis of our interstate migrant sample (Model 4), we find that high school graduates with twelve years of education in the 1930-1934 birth cohort (cohort=0) have a 1.1 times greater likelihood of being incarcerated than a high school dropout with eight years of schooling from that cohort. This difference between a high school dropout who attained eight years of schooling and a high school graduate with twelve years of education increased to a 5.5 times greater likelihood of being incarcerated for the 1965-1969 birth cohort (cohort=7). The addition of cohort and educational attainment interaction terms also appreciably increases the fit of the models (e.g., the pseudo r-squared term increased from 0.231 to 0.237 between models 3 and 4, and from 0.180 to 0.185 between models 7 and 8). However, while the increasing association of educational attainment and incarceration over time are intriguing and consistent with other research, caution in interpretation is warranted as individuals incarcerated in our sample from earlier cohorts are at a significantly later life course stage in the 1970s, 1980s and 1990s survey than is the case with later cohorts.

Examining covariates measuring individual characteristics in the models reveals few surprises. Men are much more likely incarcerated than women (about 15.5 times). Both African-Americans and Hispanics are much more likely incarcerated than whites (in supplementary analysis, African-Americans were approximately 6.6 times more likely; Hispanics also have higher odds-ratios, although the interpretation of these effects is significantly complicated by inconsistencies in census operationalization of this category with under-identification of Hispanic ethnicity in the 1970 census relative to latter

years).¹³ In all eight models, incarceration risk increases significantly as age increases but then declines as individuals become more elderly. The inclusion of additional migration-selection controls in our models had few effects on our findings. Compared to others, interstate movers within the South and Midwest had higher rates of incarceration. Measures controlling for the overall rate of movement out of a respondent's birth state had only marginal or non-significant effects.

Table 3 about here

Table 3 presents results that examine the extent to which the association between teacher/student ratio and incarceration is robust to modeling specifications that include state-level time varying measures of per capita state welfare expenditures. Due to data availability, this analysis is limited to post-1930 birth cohorts. To allow comparisons, in Models 1, 3, 5 and 7 we show results for the previous analysis (i.e., Table 2, Models 2, 4, 6 and 8), but limited to post-1930 birth cohorts. We then add to each model the per capita state welfare spending measure (results shown in Models 2, 4, 6 and 8). Note that teacher/student ratios are still significant and negative for all four models when we limit the analysis to the post-1930 birth cohorts and do not include per capita state welfare spending. Note also that when we add state welfare spending to the models, the parameter estimates for our measure of teacher/student ratio decline considerably, between 27 to 38 percent. However, coefficients for teacher/student ratio in all four models are still negative and analysis of both interstate migrant samples remains statistically significant at the $p < .05$ level. These models also suggest that state expenditures on public welfare, similar to investment in teacher/student ratios, are associated with reduced incarceration risk for individuals born into these social contexts.

When we conducted this supplementary analysis separately for whites and non-whites, we found results largely comparable and consistent to those discussed above. In an analysis of whites, we found a significant relationship between greater teacher/student ratio and reduced adult incarceration risks in all four modeling specifications [coefficients, standard errors and significance level for post-1930 birth cohorts, whites only analysis with state welfare spending were: model 2, -13.285* (5.777); model 4, -13.349* (5.380); model 6, -10.206** (3.157); model 8, -11.578** (3.258)].¹⁴ These findings are consistent with the contention that investment in improved teacher/student ratios is associated with reduced incarceration rates in general, although a significant part of this relationship is associated with the fact that states with more generous spending on public welfare are also those with more generous spending on education, and that these state-level factors co-vary over time. As a whole these findings suggest that state investment in education and public welfare both are associated with reduced likelihood of youth subsequently being incarcerated as adults, with the effects of investment in teacher/student ratios robust across most model specifications.

NLSY Analysis

The NLSY data rely on school-level measurement of educational resources based on a very different modeling strategy. Most importantly, while the fixed effects for birth state in the census analysis rely on an identification strategy that highlights differences in resource investment across states over time, the fixed effects for birth state in the NLSY analysis focus attention on teacher/student ratio variation within states for a particular cohort. Despite these very different identification strategies underlying our modeling

assumptions, the relationship between our measures of teacher/student ratio and individual incarceration risk in the two analyses are remarkably consistent. In the NLSY analysis higher teacher/student ratios are significantly associated with reduced incarceration risk for all three of the full sample models and also for all three of the men-only models. Table 3 shows that the effects are robust and largely unaffected by the inclusion of additional controls for social background and school context.

Table 4 about here

Only a small number of other variables in the NLSY models demonstrated a significant association with incarceration. Years of education was strongly associated with incarceration likelihood, as too was being a high school graduate, male or African-American. Interestingly in Model 6 with controls for both social background and school context included, U.S. born Hispanic men were actually less likely to be incarcerated than whites with similar educational levels. Parental income was associated with reduced risk of adult incarceration. The finding that private schools were associated with higher rates of male incarceration was unexpected – 17 out of 398 men (4.3%) who attended private school were incarcerated after age 22, a likely consequence of the fact that some private schools are primarily used as a behavioral intervention to remediate adolescent delinquency (none of the 406 women who attended private school experienced incarceration).

CONCLUSIONS

Contrary to skeptics of educational resource investment and in support of educational resource proponents, we find significant evidence that states and schools with higher

teacher/student ratios produce adults who face lower incarceration risks. We also find that states that invest more in teacher/student ratios also typically spend more on social welfare programs generally and that these factors co-vary and are both associated with reduced adult incarceration rates. Hence, our findings are largely consistent with those theories of crime (Matza 1964; Hagan 1991; Sampson and Laub 1993) that emphasize the malleability of criminal propensity. In his influential work on delinquency and drift, Matza (1964:28) argues that delinquents are not locked into crime in an absolute way, but rather exist in a “limbo between convention and crime, responding in turn to the demands of each, flirting now with one, now the other....” In line with our results, such reasoning suggests that it may well be easier for juveniles to “drift” into crime when they are educated in schools that devote fewer resources to classroom instruction or live in states that invest less in public welfare more generally.

The main strengths of our analyses are that we have applied an elaborate fixed effects research design to reduce the chances of spurious findings and have replicated our results using both state and school level data. A limitation of our research is that we cannot specify the precise mechanisms linking teacher/student ratios and incarceration risk. In particular, our data do not allow us to determine the extent to which teacher/student ratios affect incarceration risk by improving youth socialization and decreasing criminality or through their impact on the decision-making of officials in the legal system. We must leave it to others to settle the long-standing debate (cf., Hindelang 1981; O’Brien 2003) about whether those found in the criminal justice system are there primarily because of their actual behavior or the labeling of criminal justice officials. Despite considerable data and methodological challenges, future studies should strive to assemble and analyze

individual-level longitudinal data that would allow researchers to examine directly these mechanisms.

In the face of evidence of the growing importance of education on a range of life-course outcomes including unprecedented levels of incarceration, and increasingly shrill arguments over the social and monetary costs of public education, it is critical to have more definitive information on possible links between teacher/student ratios and adult incarceration risk. While there is evidence that the connections between teacher/student ratios and incarceration risk are complex and causality can not definitively be established with observational data of this character, the associations between teacher/student ratios and adult incarceration rates are evident in both descriptive and multivariate analytical frameworks. These findings suggest the possibility that investing more on smaller classroom sizes or related programs might ultimately offer a less expensive and more socially desirable alternative to increasing rates of adult incarceration.

However, for several reasons additional empirical research on the topic is warranted before specific policy changes are warranted. First, as noted above, additional research is required to strengthen and more definitively establish the causal inferences argued for here. Second, given the covariance between state expenditures on public welfare and teacher/student ratios, as well as the association of both of these factors with adult incarceration, this study has not been able to establish the primacy of investment in schools as opposed to more general public welfare expenditures that some sociologists have argued would be a more effective mechanism of improving youth outcomes (see e.g., Jencks et al. 1972, Conley and Albright 2004). Finally, educational reform based on hiring additional teachers to raise teacher/student ratios is a costly policy intervention. While our research

suggests that such an investment might reduce adult incarceration, we have not attempted to adjudicate amongst a set of alternative educational investments that might be even more efficient and effective. In particular, if the mechanism whereby teacher/student ratios affects incarceration is through enhanced classroom order and the promotion of school authority relationships conducive to youth socialization, then arguably similar effects could be realized at much reduced costs through the development and consistent implementation of pro-active, responsive and fair school disciplinary systems (Arum 2003) that are capable of producing and sustaining positive school climates where both instruction and youth socialization can flourish.

REFERENCES

- Angrist, Joshua and Victor Lavy. 1999. "Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement," *Quarterly Journal of Economics* 114(2):533-75.
- Arum, Richard with Irene Beattie, Jennifer Thompson, Richard Pitt, Sandra Way. 2003. *Judging School Discipline: The Crisis of Moral Authority*. Cambridge, MA: Harvard University Press.
- Arum, Richard. 1996. "Do Private Schools Force Public Schools to Compete?" *American Sociological Review* 61:29-46.
- . 1998. "The Effects of Resources on Vocational Student Educational Outcomes: Invested Dollars or Diverted Dreams." *Sociology of Education*. 71:130-151.
- Arum, Richard and Irene Beattie. 1999. "High School Experience and the Risk of Adult Incarceration." *Criminology* 37:515-538.
- Austin, James and Barry Krisberg. 1998. "The Unmet Promise of Alternatives to Incarceration." *Crime and Delinquency* 28:374-409.
- Betts, Julian R. 1995. "Does School Quality Matter? Evidence from the National Longitudinal Survey of Youth," *The Review of Economics and Statistics* 77/2: 231-250.
- Bjorklund, Anders, Melissa A. Clark, Per-Anders Edin, Peter Fredriksson and Alan Krueger. 2005. *The Market Comes to Education in Sweden: An Evaluation of Sweden's Surprising School Reforms* (New York: Russell Sage Foundation).
- Bound, John and Sarah Turner. 2007. "Cohort Crowding: How Resource Affect College Attainment," *Journal of Public Economics* 91:877-899.

- Burtless, Gary, editor. 1996. *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*. Washington, DC: Brookings Institution Press.
- Card, David and Alan Krueger. 1992. "The Economic Return to School Quality." *Journal of Political Economy* 100:1-40.
- . 1996. "School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina." *Journal of Economic Perspectives* 10:31-50.
- Chambliss, William J. 1994. "Policing the Ghetto Underclass – The Politics of Law and Law- Enforcement." *Social Problems* 41 (2) 177-194.
- Cloward, Richard and Lloyd Ohlin. 1960. *Delinquency and Opportunity*. New York: Free Press.
- Coleman, James, Ernest Campbell, Carol Hobson, James McPartland, Alexander Mood, Frederich D. Weinfeld, and Robert York. 1966. *Equality of Educational Opportunity*. Washington, D.C.: Department of Health, Education and Welfare.
- Conley, Dalton and Karen Albright, eds.. 2004. *After the Bell: Family Background, Public Policy, and Educational Success*. New York: Routledge.
- Durkheim, Emile. 1973 [1925]. *Moral Education: A Study in the Theory and Application of the Sociology of Education*. New York: Macmillan Publishers.
- Elder, Glen. 1985. *Life Course Dynamics: Trajectories and Transitions, 1968-1980*. Ithaca, NY: Cornell University Press.

Finch, Michael D., Michael J. Shanahan, Jeylan T. Mortimer, and Seongryeol Ryu. 1991.

“Work Experience and Control Orientation in Adolescence.” *American Sociological Review* 56:597-611.

Finn, Jeremy D. and Charles M. Achilles. 1990. "Answers and Questions About Class

Size: A Statewide Experiment," *American Educational Research Journal* 27:557-577.

----- 1999. “Tennessee’s Class Size Study: Findings, Implications and Misconceptions,”

Educational Evaluation and Policy Analysis 21:97-109.

Finn, Jeremy D., Susan B. Gerber, Charles M. Achilles, and Jayne Boyd-Zaharias. 2001.

“The Enduring Effects of Small Classes,” *Teachers College Record* 103:145-183.

Fischer, Claude and Michael Hout. 2006. *Century of Difference: How Americans*

Changed in the Last One Hundred Years. New York: Russell Sage.

Gamoran, Adam and Robert Mare. 1989. "Secondary School Tracking and Educational

Inequality: Compensation, Reinforcement or Neutrality?" *American Journal of Sociology* 54:1146-83.

Garland, David. 2001 *The Culture of Control: Crime and Social Order in*

Contemporary Society. Chicago: University of Chicago Press.

Goldin, Claudia and Lawrence Katz. 2000. “Education and Income in the Early Twentieth

Century,” *Journal of Economic History* 60:782-819.

Gottfredson, Gary and Denise Gottfredson. 1985. *Victimization in Schools*. New York:

Plenum Press.

Gottfredson, Michael and Travis Hirschi. 1990. *A General Theory of Crime*. Stanford:

Stanford University Press.

- Greenberg, David and Valerie West. 2001. "State prison populations and their growth, 1971-1991" *Criminology* 39 (3): 615-653.
- Gustafsson, Jan-Eric. 2003. "What Do We Know About the Effects of School Resources on Educational Results?" *Swedish Economic Policy Review* 10:77-110.
- Hagan, John and Blair Wheaton. 1993. "The Search for Adolescent Role Exits and the Transition to Adulthood." *Social Forces* 71:955-980.
- Hagan, John, Ross MacMillan and Blair Wheaton. 1996. "The Life Course Effects of Family Migration on Children." *American Sociological Review* 61:369-85.
- Hanushek, Eric. 1986. "The Economics of Schooling: Production and Inefficiency in Public Schools," *Journal of Economic Literature* 24 (September): 1141-77.
- , 1996. "School Resources and Student Performance." Pp. 43-73 in *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, edited by Gary Burtless. Washington, DC: Brookings Institution Press.
- , 1998. "Conclusions and Controversies about the Effectiveness of School Resources," *Economic Policy Review-Federal Reserve Bank of New York* 4:11-27.
- Hanushek, Eric, Steve Rivkin, and Lori Taylor. 1996. "Aggregation and the Estimated Effects of School Resources." *Review of Economics and Statistics* 87:611-627.
- Harrison, Paige and Allen J. Beck. 2006. *Prison and Jail Inmates at Midyear 2005*. U.S. Department of Justice: Bureau of Justice Statistics.
- Heckman, James, Anne Layne-Farrar, and Petra Todd. 1996. "Human Capital Pricing Equations with an Application to Estimating the Effect of Schooling Quality on Earnings." *The Review of Economics and Statistics* 78:562-610.

- Hindelang, Michael. J. 1981. "Variations in Sex-Race-Age-Specific Incident Rates of Offending." *American Sociological Review* 46: 461-74.
- Hirschi, Travis and Michael Hindelang. 1977. "Intelligence and Delinquency: A Revisionist Review." *American Sociological Review* 42:571-86.
- Jencks, Christopher, Marshall Smith, Henry Acland, Mary Jo Bane, David Cohen, Herbert Gintis, Barbara Heyns and Stephen Michelson. 1972. *Inequality: A Reassessment of the Effect of Family and Schooling in America*. New York: Basic Books.
- Jessor, Richard, John Donovan, and Frances Costa. 1991. *Beyond Adolescence: Problem Behavior and Young Adult Development*. New York: Cambridge University Press.
- Kercher, Kyle. 1988. "Criminology." Pp. 294-316 in *The Future of Sociology*, ed. by Edgar F. Borgatta and Karen S. Cook. Beverly Hills, CA: Sage.
- Klein, Stephen, Joan Petersilia and Susan Turner. 1990. "Race and Incarceration Decisions in California." *Science* 247:812-16.
- Krueger, Alan. 1999. "Experimental Estimates of Educational Production Functions," *Quarterly Journal of Economics* 115:1239-85.
- Krueger, Alan and Diane Whitmore. 2001. "The Effect of Attending a Small Class in the Early Grades on College Test Taking and Middle School Test Results: Evidence from Project STAR," *Economic Journal* 111(468):1-28.
- LaFree, Gary and Richard Arum. 2006. "The Impact of Racially Inclusive Schooling on Adult Incarceration Rates among U.S. Cohorts of African Americans and whites since 1930." *Criminology* 44:73-103.

- LaFree, Gary and Kriss A. Drass. 1996. "The Effect of Changes in Intra-racial Income Inequality and Educational Attainment on Changes in Arrest Rates for African Americans and Whites, 1957 to 1990." *American Sociological Review* 61:614-34.
- Laub, John and Robert Sampson. 1993. "Turning Points in the Life Course: Why Change Matters to the Study of Crime." *Criminology* 31:301-325.
- Lochner, Lance and Enrico Moretti. 2001. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports." National Bureau for Economic Resources: Working Paper.
- Loeb, Susanna and John Bound. 1996. "The Effect of Measured School Inputs on Academic Achievement: Evidence from the 1920s, 1930s, and 1940s Birth Cohorts." *Review of Economics and Statistics* 78:653-664.
- Mare, Robert. 1991. "Five Decades of Educational Assortative Mating," *American Sociological Review*, Vol. 56/1:15-32.
- Massey, Douglas and Nancy Denton. 1993. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, MA: Harvard University Press.
- Matza, David. 1964. *Delinquency and Drift*. New York: Wiley.
- Meyer, John and Brian Rowan. 1977. "Institutional Organizations: Formal Structure as Myth and Ceremony," in *Organizational Environments: Ritual and Rationality*. Beverly Hills: Sage.
- Mosteller, Frederick. 1995. "The Tennessee Study of Class Size in the Early School Grades," *The Future of Children* 5:113-127.
- Murray, Sheila E., William Evans, and Robert Schwab. 1998. "Education-Finance Reform and the Distribution of Education Resources." *American Economic Review*

88:789-812.

- O'Brien, Robert M. 1985. *Crime and Victimization*. Beverly Hills, CA: Sage.
- , 1996. "Police Productivity and Crime Rates: 1973-1992." *Criminology* 34: 183-207.
- , 2003. "UCR Violent Crime Rates, 1958-2000: Recorded and Offender-Generated Trends." *Social Science Research* 32: 499-518.
- Petit, Becky and Bruce Western. 2004. "Mass Imprisonment and the Life Course: Race and Class Inequality in U.S. Incarceration." *American Sociological Review* 69:151-169.
- President's Commission on Law Enforcement and Administration of Justice. 1967. *Crime and its Impact: An Assessment*. Washington, DC: U.S. Government Printing Office.
- Sampson, Robert and John Laub. 1993. *Crime in the Making: Pathways and Turning Points Through Life*. Cambridge, MA: Harvard University Press
- Sorenson, Aage and Maureen Hallinan. 1977. "A Reconceptualization of School Effects." *Sociology of Education* 50:273-89.
- Sutherland, Edwin Hardin. (1947). *Principles of Criminology (Fourth Edition)*; Chicago: J.B. Lippincott.
- Tonry, Michael. 1995. "20 Years of Sentencing Reform – Steps Forward, Steps Backward." *Judicature* 78: 169-172.
- United States Advisory Commission on Intergovernmental Relations. 1990. *The Structure of State Aid to Elementary and Secondary Education*. Washington, DC: Government Printing Office.

- Useem, Bert, Raymond V. Liedka, and Anne M. Piehl. 2002. "Popular Support for the Prison Build-Up." *Punishment and Society* 5:5-32.
- Western, Bruce and Katheryn Beckett. 1999. "How Unregulated is the U.S. Labor Market? The Penal System as a Labor Market Institution." *American Journal of Sociology* 104:1030-1060.
- Western, Bruce, Meredith Kleykamp, and Jake Rosenfeld. 2006. "Did Falling Wages and Employment Increase U.S. Imprisonment?" *Social Forces* 84/4:2291-2311.
- Wiatrowski, Michael, David Griswold, and Mary Roberts. 1981. "Social Control Theory and Delinquency." *American Sociological Review* 46:525-541.
- Wilson, James Q. and Richard Herrnstein. 1985. *Crime and Human Nature*. New York: Simon and Schuster.
- Witte, Anne D. and H. Tauchen. 1994. "Work and Crime – An Exploration Using Panel-Data." *Public Finance – Finances Publiques* 49:155-167.
- Viscusi, W. K. 1986. "The Risks and Rewards of Criminal Activity – A Comprehensive Test of Criminal Deterrence." *Journal of Labor Economics* 4:317-340.
- Zimring, Franklin E., Gordon Hawkins, and Sam Kamin. 2001. *Punishment and Democracy: Three Strikes and You're Out in California*. New York: Oxford University Press.

ENDNOTES

¹ In our census analysis, fixed effects for state of residence are time period specific (i.e., state of residence * 1970/1980/1990 survey wave).

² The current position of the U.S. Census Bureau is to not make the 2000 census data on state and local prisoners available to researchers.

³ In 1995, federal prisoners accounted for less than 6 percent of all persons held in prisons and jails in the United States (Harrison and Berk 2006:2). Compared to those in state facilities, persons in federal prison are disproportionately made up of those with drug and white-collar (e.g., extortion, bribery, fraud) offenses.

⁴ Publicly released micro-level data were obtained from the IPUMS site located at the University of Minnesota (<http://www.ipums.umn.edu>). Specific samples extracted were: 1990 5% state, 1980 5% state (A Sample), 1970 (Form 1) State, 1970 (Form 2) State. Data on U.S. state and local prisoners were provided by the U.S. Department of the Census. For the 1980 and 1990 extracts we relied on a 5% state sample; for 1970, we used both 1% state sample Form A and Form B.

⁵ Because we use these weights for our analysis, our standard errors are conservatively estimated – although we have a 16% sample of prisoners, our analysis reduces the weight of these cases by one-third, thus inflating our standard errors.

⁶ Card and Krueger point out (1996:36) that student/teacher ratios are also strategic because changes in class size are one of the most common objects of educational reform proposals.

⁷ Like Card and Krueger (1992), we did not have measures of private schooling available for our census analysis. However, prior research (Arum 1996) suggests that when private

school sectors are large (and thus potentially most threatening to our results) educational spending for a state's public and private schools is nevertheless highly correlated.

⁸ We use an average age of 12 because it is half way through a typical K-12 educational career. Moreover, choosing older ages raises the problem that an increasing number of high school dropouts may no longer be enrolled in school—a particularly important issue for early cohorts.

⁹ In supplementary models, we examined the effects of educational attainment in relation to an interaction with educational resources [$E_{ijkt} \bullet (\gamma_{jc})$]. This interaction term represents both higher and lower order terms (i.e., educational attainment, instructional resources, and attainment interacted with resources) and thus identified associations between incarceration, education and variation in student-teacher ratios that are measured at the level of an individual's particular cohort and birth state (i.e., variation in education attainment *slopes* related to cohort-state specific resource investment). While we found significant interaction effects that magnified the consequences of educational attainment in states with higher levels of resource investment, these findings were not replicated in the NLSY analysis.

¹⁰ Specifically, we included measures of state expenditures on public welfare per capita with respect to state population. When Statistical Abstracts reports were provided solely for total state expenditures on public welfare, we adjusted these figures based on state reported population for the year. State public welfare expenditures include cash assistance (such as AFDC, emerging out of the Aid to Dependent Children enacted in 1935, and later TANF, created in 1997), health services other than hospital administration (including

Medicaid, enacted in 1965) and non-health social services (such as child care, child welfare, adoption assistance, foster care, etc.).

¹¹ In supplementary analysis, we also explored the possibility of analyzing a sample of *recent interstate migrants* (i.e., individuals who migrated out of their state birth in the five years immediately preceding the census). This more restrictive sample contained considerably fewer cases, yielded unreliable estimates, and differed from the other two samples on many factors (including higher incarceration rates, concentration in the later time-period and younger age).

¹² Specifically, we examined a set of models on interstate movers in the NLSY similar to the ones presented in terms of controls and fixed effects for state of birth and state of residence. In these supplementary models, we varied whether resources were measured at the school-level or state-level. State-level estimates were slightly lower, but not statistically different, than estimates based on school-level measures.

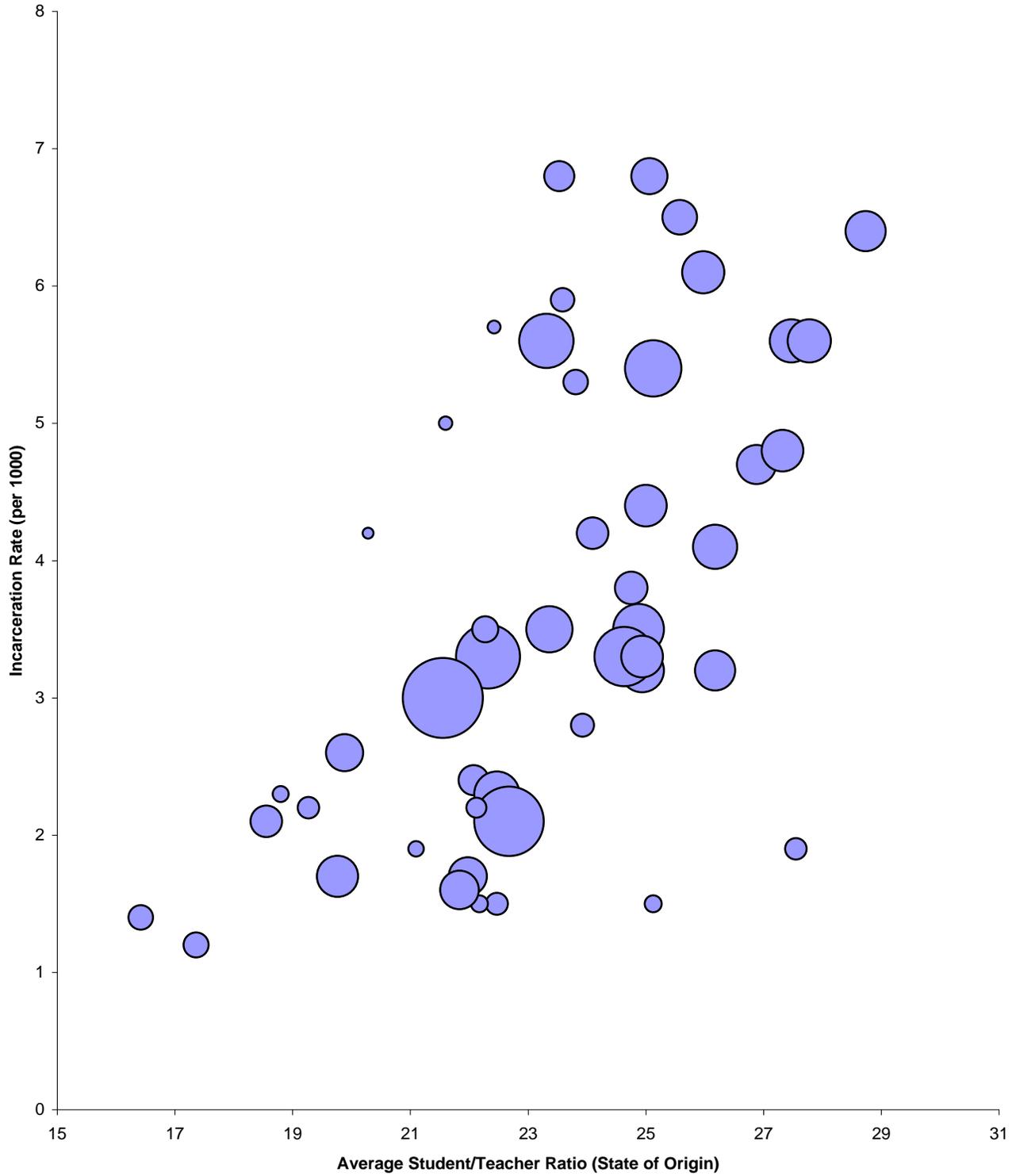
¹³ Note that the latter estimate is at least partially a result of historical inconsistencies in census identification of Hispanics with significant undercounting in 1970 relative to later censuses. Note also that results here are an average of findings across the models.

¹⁴ While the teacher/student ratio coefficients were not significant in the supplementary non-white analyses that controlled for time varying state welfare spending, the magnitude of coefficients were also not significantly different and were roughly comparable to those found in the analyses done on whites [coefficients, standard errors and significance level for teacher/student ratios and non-white post-1930 birth cohorts with state welfare spending: model 2, -7.010 (8.594); model 4, -6.500 (7.770); model 6, -9.090 (9.722); model 8, -6.155 (8.468)]. The robust standard errors are much larger in the non-white

analyses as many of the birth-state by cohort cells have relatively limited numbers of cases given patterns of U.S. racial dispersion.

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Figure 1: Birth State Educational Resources and Imprisonment Risk of Interstate Migrants (1970-1990)



State-level correlation: 0.67 ($p < .01$) weighted; 0.57 ($p < .01$) unweighted.

Figure 2: Incarceration Rate for Non-Native State Residents (1970-1990)

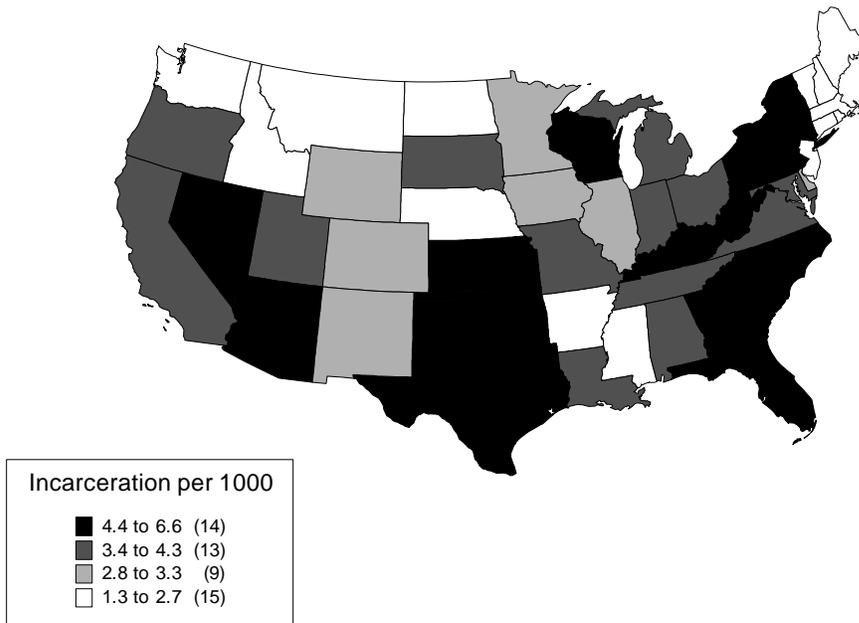


Table 1. Educational Resources and Incarceration Rates for Five-Year Birth Cohorts (1915-1969) of All Individuals and Interstate Migrants Who Reside in Non-Birth State

A. All Individuals

Birth Cohort	Assignment Year	Student/Teacher Ratio ^a	Incarceration 1970 ^b	Incarceration 1980	Incarceration 1990
1915-1919	1930	30.0	0.9		
1920-1924	1935	30.1	1.3	0.4	
1925-1929	1940	25.5	2.0	0.8	
1930-1934	1945	24.0	2.7	1.1	1.0
1935-1939	1950	24.5	3.4	1.5	1.7
1940-1944	1955	23.8	4.3	2.3	2.4
1945-1949	1960	23.1	4.7	3.5	3.8
1950-1954	1965	24.1		4.8	5.7
1955-1959	1970	22.4		5.3	7.8
1960-1964	1975	20.9			9.9
1965-1969	1980	18.9			8.3

B. Interstate Migrants, Individuals Who Reside in Non-Birth State

Birth Cohort	Assignment Year	Student/Teacher Ratio ^a	Incarceration 1970 ^b	Incarceration 1980	Incarceration 1990
1915-1919	1930	29.9	1.3		
1920-1924	1935	30.0	1.8	0.4	
1925-1929	1940	25.3	2.6	1.0	
1930-1934	1945	23.8	3.0	1.2	1.2
1935-1939	1950	24.4	3.6	1.9	2.1
1940-1944	1955	23.7	4.6	2.6	2.8
1945-1949	1960	23.1	4.9	3.8	4.3
1950-1954	1965	24.0		4.9	5.9
1955-1959	1970	22.2		5.5	7.5
1960-1964	1975	20.8			9.1
1965-1969	1980	18.8			7.5

^a Data are from Digest of Education Statistics and the Biennial Survey of Education Series.

^b Incarceration rates are per 1,000 adults.

Table 2: Logistic Regression of Effects of State of Origin Educational Characteristics, Individual Educational Attainment and Other Variables on Likelihood of Interstate Migrants' Incarceration (1970-1990), fixed effects for residence state*time period and birth state [U.S. Census analysis]

	Men and Women (Ages 20-55)				Men Only (Ages 20-40)			
	Census Sample		Interstate Migrant Sample		Census Sample		Interstate Migrant Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Educ. Characteristics and Cohort:</i>								
Teacher/student ratio	-9.912* (4.998)	-12.484* (5.261)	-16.172* (6.635)	-18.127** (6.433)	-11.984* (5.842)	-11.941* (5.916)	-22.668** (6.370)	-20.283** (5.621)
Years of education	-0.067** (0.016)	-0.075** (0.018)	-0.117** (0.009)	-0.103** (0.008)	-0.090** (0.019)	-0.110** (0.033)	-0.132** (0.009)	-0.101** (0.018)
High school graduate	-0.371** (0.103)	0.555** (0.152)	-0.417** (0.050)	0.356** (0.044)	-0.301** (0.116)	0.897** (0.234)	-0.431** (0.051)	0.445** (0.068)
Cohort (-3 to 7)	0.594** (0.069)	0.840** (0.081)	-0.047 (0.055)	0.206** (0.057)	0.304** (0.087)	0.514** (0.114)	0.298* (0.135)	0.646** (0.136)
Years of education*cohort		-0.007 (0.005)		-0.015** (0.002)		-0.002 (0.008)		-0.016** (0.004)
High school graduate*cohort		-0.204** (0.040)		-0.175** (0.012)		-0.259** (0.055)		-0.190** (0.017)
<i>Individual Characteristics:</i>								
Gender	2.887** (0.055)	2.890** (0.052)	2.718** (0.042)	2.724** (0.043)				
Non-white	4.280** (0.108)	4.294** (0.107)	2.563** (0.050)	2.581** (0.048)	4.554** (0.112)	4.577** (0.110)	2.679** (0.050)	2.695** (0.049)
Age	0.207** (0.023)	0.215** (0.022)	0.100** (0.014)	0.091** (0.011)	0.189** (0.044)	0.199** (0.041)	0.187** (0.034)	0.210** (0.034)
Age-squared	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.003** (0.001)	-0.003** (0.001)	-0.003** (0.000)	-0.003** (0.000)
<i>Migration-Selection Controls:</i>								
Northeast birth-residence states	0.333* (0.146)	0.361* (0.141)	-0.013 (0.069)	-0.026 (0.067)	0.363* (0.162)	0.404** (0.155)	-0.045 (0.067)	-0.060 (0.067)
South birth-residence states	0.190* (0.075)	0.146 [†] (0.076)	0.097* (0.044)	0.094* (0.044)	0.235** (0.088)	0.193* (0.089)	0.093 [†] (0.048)	0.087 [†] (0.047)
Midwest birth-residence states	0.318** (0.119)	0.294* (0.115)	0.135* (0.053)	0.136* (0.053)	0.401** (0.129)	0.376** (0.123)	0.128* (0.061)	0.129* (0.061)
West birth-residence states	-0.260* (0.110)	-0.271* (0.112)	0.035 (0.067)	0.039 (0.068)	-0.213 [†] (0.122)	-0.209 [†] (0.124)	0.042 (0.076)	0.044 (0.078)
Adjacent birth-residence states	0.110* (0.046)	0.131** (0.046)	-0.002 (0.026)	0.006 (0.025)	0.115* (0.055)	0.140* (0.055)	0.030 (0.031)	0.037 (0.030)
Percent interstate migration out of birth state			-0.005 [†] (0.003)	-0.005 [†] (0.003)			-0.004 (0.003)	-0.004 (0.003)
<i>Pseudo R-squared</i>	0.352	0.356	0.231	0.237	0.321	0.325	0.180	0.185

** p<.01; * p<.05; [†] p<.10; standard errors adjusted for clustering by cohort specific state of origin.

Census Sample, N=12,431,738; Interstate Migrant Sample, N=4,479,429.

Census Sample males<=40, N=4,475,342; Interstate Migrant Sample males<=40, N=1,569,684.

Table 3: Logistic Regression of Effects of State of Origin Educational Characteristics, Individual Educational Attainment, State Welfare Spending and Other Variables on Likelihood of Interstate Migrants' Incarceration (1970-1990), fixed effects for residence state*time period and birth state [U.S. Census analysis – restricted to post 1930 birth cohorts]

	Men and Women (Ages 20-55)				Men Only (Ages 20-40)			
	Census Sample		Interstate Migrant Sample		Census Sample		Interstate Migrant Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Educational, Characteristics, Welfare Spending and Cohort:</i>								
Teacher/student ratio	-13.817* (5.772)	-10.081 [†] (6.064)	-19.406** (7.020)	-12.275* (5.578)	-13.235* (6.375)	-9.650 (6.773)	-21.301** (5.905)	-13.240** (5.002)
Years of education	-0.053 [†] (0.031)	-0.058 [†] (0.031)	-0.073** (0.016)	-0.081** (0.016)	-0.098* (0.044)	-0.103* (0.044)	-0.084** (0.025)	-0.094** (0.026)
High school graduate	0.606** (0.203)	0.614** (0.206)	0.379** (0.061)	0.395** (0.061)	0.936** (0.266)	0.949** (0.271)	0.465** (0.082)	0.489** (0.082)
Cohort (0 to 7)	0.941** (0.097)	0.958** (0.100)	1.111** (0.144)	1.144** (0.145)	0.550** (0.135)	0.559** (0.136)	0.725** (0.150)	0.758** (0.152)
Years of education*cohort	-0.013 [†] (0.007)	-0.012 (0.007)	-0.023** (0.004)	-0.022** (0.004)	-0.005 (0.010)	-0.004 (0.010)	-0.020** (0.006)	-0.018** (0.006)
High school graduate*cohort	-0.210** (0.049)	-0.212** (0.050)	-0.175** (0.015)	-0.179** (0.015)	-0.265** (0.061)	-0.267** (0.062)	-0.192** (0.019)	-0.198** (0.019)
State welfare spending per capita		-0.001* (0.001)		-0.002** (0.000)		-0.001* (0.001)		-0.002** (0.000)
<i>Individual Characteristics:</i>								
Gender	2.853** (0.054)	2.853** (0.054)	2.666** (0.045)	2.668** (0.045)				
Non-white	4.360** (0.115)	4.359** (0.115)	2.591** (0.050)	2.603** (0.051)	4.603** (0.113)	4.602** (0.113)	2.693** (0.050)	2.706** (0.051)
Age	0.227** (0.027)	0.219** (0.025)	0.256** (0.031)	0.242** (0.030)	0.215** (0.043)	0.208** (0.041)	0.230** (0.037)	0.218** (0.035)
Age-squared	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.002** (0.000)	-0.003** (0.001)	-0.003** (0.001)	-0.003** (0.000)	-0.003** (0.000)
<i>Migration-Selection Controls:</i>								
Northeast birth-residence states	0.380** (0.144)	0.369* (0.142)	-0.021 (0.070)	-0.013 (0.070)	0.420** (0.156)	0.407** (0.153)	-0.048 (0.068)	-0.036 (0.067)
South birth-residence states	0.150 [†] (0.081)	0.136 [†] (0.080)	0.085 [†] (0.045)	0.075 (0.046)	0.185* (0.091)	0.172 [†] (0.091)	0.071 (0.047)	0.061 (0.049)
Midwest birth-residence states	0.359** (0.122)	0.363** (0.122)	0.141* (0.055)	0.147** (0.056)	0.417** (0.125)	0.421** (0.125)	0.140* (0.062)	0.148* (0.063)
West birth-residence states	-0.274* (0.118)	-0.275* (0.120)	0.021 (0.070)	0.032 (0.071)	-0.206 (0.128)	-0.208 (0.129)	0.027 (0.079)	0.037 (0.081)
Adjacent birth-residence states	0.143** (0.049)	0.146** (0.049)	0.026 (0.026)	0.028 (0.027)	0.142* (0.057)	0.145* (0.057)	0.047 (0.031)	0.050 (0.031)
Percent interstate migration out of birth state			-0.004 (0.003)	-0.004 (0.003)			-0.004 (0.003)	-0.004 (0.003)
Pseudo R-squared	0.357	0.357	0.234	0.234	0.327	0.327	0.186	0.187

** p<.01; * p<.05; [†] p<.10; standard errors adjusted for clustering by cohort specific state of origin.

N=10,344,943; Interstate Migrant Sample, N=3,687,098.

Census Sample males<=40, N=4,265,950; Interstate Migrant Sample males<=40, N=1,492,189.

Table 4: Logistic Regression of Effects of School Resources, Individual Educational Attainment and Other Variables on Likelihood of Adult Incarceration, fixed effects for residence and birth states (NLSY analysis)

	Men and Women			Men Only		
	(1)	(2)	(3)	(4)	(5)	(6)
<i><u>Educational Characteristics:</u></i>						
Educational resources ¹	-12.405* (6.198)	-13.263* (6.283)	-14.313* (7.040)	-20.768** (7.532)	-21.369** (7.572)	-21.899** (8.465)
Years of education	-0.437** (0.067)	-0.388** (0.070)	-0.387** (0.071)	-0.478** (0.077)	-0.428** (0.081)	-0.430** (0.082)
High school graduate	-0.513* (0.243)	-0.526* (0.245)	-0.524* (0.246)	-0.476 [†] (0.269)	-0.498 [†] (0.271)	-0.505 [†] (0.274)
<i><u>Individual Characteristics:</u></i>						
Male	2.236** (0.222)	2.266** (0.223)	2.281** (0.224)			
African-American	1.794** (0.182)	1.652** (0.197)	1.370** (0.234)	1.931** (0.199)	1.807** (0.216)	1.511** (0.257)
Hispanic	0.000 (0.337)	-0.221 (0.359)	-0.446 (0.376)	-0.008 (0.367)	-0.260 (0.393)	-0.506 (0.413)
Age	-0.908 (1.237)	-0.849 (1.244)	-0.851 (1.247)	-2.641* (1.329)	-2.650* (1.339)	-2.707* (1.341)
Age-squared	0.011 (0.015)	0.010 (0.015)	0.010 (0.015)	0.032 [†] (0.016)	0.032 [†] (0.016)	0.033* (0.017)
<i><u>Social Background:</u></i>						
Mother's education		-0.032 (0.036)	-0.034 (0.036)		-0.056 (0.040)	-0.060 (0.040)
Father's education		-0.028 (0.028)	-0.028 (0.028)		-0.024 (0.032)	-0.024 (0.032)
Two parent family		0.003 (0.195)	0.016 (0.195)		-0.061 (0.212)	-0.048 (0.213)
Parental income		-0.011* (0.004)	-0.011* (0.005)		-0.011* (0.005)	-0.011* (0.005)
Siblings		-0.019 (0.031)	-0.020 (0.032)		-0.038 (0.035)	-0.038 (0.035)
<i><u>School Context:</u></i>						
School percent poverty			0.006 (0.004)			0.004 (0.004)
School percent nonwhite			0.005 (0.004)			0.006 (0.004)
School size			-0.001 (0.136)			0.015 (0.153)
Private school			0.780 [†] (0.430)			1.030* (0.448)
<i>Pseudo R²</i>	0.315	0.321	0.326	0.295	0.302	0.308

** p<.01; * p<.05; [†] p<.10;

Models 1-3, N=7163; Models 4-6, N=3,537. Mean substitution for missing data (dummy variables for imputation not reported).

¹ Educational resources is teacher/student ratio

Appendix A1: Means and Standard Deviations for Census Sample and Interstate Migrants Who Reside in Non-Birth State Sample

	<u>All individuals Census Sample</u>	<u>Interstate Migrants Sample</u>
<i><u>Dependent Variable:</u></i>		
Incarceration in state or local institution (x 1000)	3.916	3.890
<i><u>Educational Characteristics, Welfare Spending and Cohort:</u></i>		
Educational resources	0.044 (0.008)	0.043 (0.007)
High school graduate	0.787	0.823
Years of education	12.471 (2.452)	12.882 (2.476)
Cohort (-3 to 7)	2.448 (2.689)	2.290 (2.652)
State welfare spending per capita ¹	53.878 (65.957)	50.442 (64.025)
<i><u>Migration-Selection Control Measures:</u></i>		
Northeast birth-residence states	0.186	0.083
South birth-residence states	0.273	0.170
Midwest birth-residence states	0.224	0.094
West birth-residence states	0.108	0.074
Adjacent birth-residence states	0.088	0.196
Percent interstate migration out of birth state		38.526 (10.859)
<i><u>Individual Characteristics:</u></i>		
Male	0.490	0.494
Non-white	0.113	0.109
Age	34.044 (11.356)	35.078 (11.293)
Age squared	1288.841 (821.560)	1357.705 (824.946)

Census Sample, N=12,431,738; Interstate Migrant Sample, N=4,479,429.

¹ Data present for post-1930 birth cohorts only: Census Sample, N=10,344,943; Interstate Migrant Sample, N=3,687,098. (standard deviation for continuous measures)

Appendix A2: Means and Standard Deviations for National Longitudinal Survey of Youth Data

<u>Dependent Variable:</u>	<u>All individuals</u>	<u>Males only</u>
Incarceration after age 22 (x 1000)	28.655	49.921
<u>Educational Characteristics:</u>		
Educational resources ¹	0.056 (0.025)	0.056 (0.031)
High school graduate (age 22)	0.875	0.857
Years of education (age 22)	12.796 (1.995)	12.701 (2.032)
<u>Individual Characteristics:</u>		
Male		
African-American	0.121	0.118
Hispanic	0.038	0.036
Age	40.788 (2.408)	40.807 (2.468)
Age-squared	1668.670 (196.587)	1670.320 (201.582)
<u>Social Background:</u>		
Mother's education	11.755 (2.699)	11.799 (2.700)
Father's education	11.934 (3.588)	11.982 (3.628)
Parental income	42.727 (26.725)	43.552 (28.026)
Siblings	3.267 (2.410)	3.209 (2.466)
Two parent family	0.875	0.876
<u>School Context:</u>		
School percent poverty	19.670 (20.456)	19.784 (20.905)
School percent non-white	19.255 (26.609)	18.683 (26.716)
School size (log)	6.978 (0.756)	6.975 (0.774)
Private school	0.057	0.057

All individual N=7,163; males, N=3,537.