

Does student performance reduce imprisonment?*

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Crime has high social costs. The criminal justice system is costly, imprisonments have negative effects on labor force participation, and the pain for victims is significant for most types of crime. Criminal behavior is related to marginal costs and marginal utility that go beyond deterrence and punishment. Economic theory suggests that some policies, for example improved labor market opportunities, can reduce crime by increasing the individual's net costs. Because better educational performance improves human capital and thus labor market outcomes, theory suggests a negative effect of education on crime.

The United States has the highest documented incarceration rate in the world (www.prisonstudies.org), way above the other OECD countries. In terms of population, the incarceration rate is, e.g., five times larger than in England and ten times larger than in Norway. Nevertheless, the incarceration rates are of major concern also in the latter countries.

A growing literature, initiated by the seminal work of Lance Lochner and Enrico Moretti in American Economic Review 2004, including studies from the US, England, and other

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countries, estimates a negative causal impact of education on crime. This literature exploits variation in years of compulsory education and thus identifies the effect of increasing years of education from a low level. The skills inherent in human capital, however, are multifaceted and related to a range of other factors such as years of non-compulsory schooling, school quality, home environment, and innate ability.

This study uses detailed register data for the population of Norwegian students to analyze the impact of non-compulsory high school education and student achievement at age 16. We find a strong negative effect on imprisonment of students' grade point average (GPA), an achievement measure that is comparable across schools. This effect might be mediated through high school education. Indeed, we find a strong effect of high school attainment. However, the estimated effect of GPA is hardly affected when high school education is accounted for. It also seems like avoidance of educational failure in one dimension, either measured by student achievement or by high school attainment, is sufficient to escape crime.

The School System

Norwegian compulsory education consists of 10 years. From age six, children first attend seven years at elementary school and then three years at junior high school. It is not possible to fail a class; grade repetition is non-existent. Everybody graduates from compulsory education at the end of 10th grade, and receives a diploma containing 13 different grades set by the teachers. The grading system is a scale from one to six, where one is the lowest and six is the highest grade. All grades except the lowest grade are commonly used. In addition, all students complete a central exit exam at the end of compulsory education. The exam is graded anonymously by two external examiners assigned to each student, and this system helps anchoring the teacher set grades.

After compulsory education, about 95 percent of the cohorts enroll in high school immediately. High school education consists of several study tracks, where the main distinction is between three-year long academic study tracks and vocational study tracks which typically consist of two years of schooling and two years as an apprentice. It is the 19 counties that are responsible for high school education. In some counties there is school choice, with admission based on GPA, while other counties have decided to use school catchment areas. Several students transfer study tracks and schools during high school

education since there is a five-year legal right to high school education. Only about two-thirds graduate high school within this time frame, which is a major political concern.

Data and Methods

The data include all students finishing compulsory education in Norway during the years 2002-2004. The student information is matched with information about their parents, school identifiers, and a neighborhood identifier for the year the individual finished compulsory education.

Information on incarceration is provided by the Norwegian Correctional Services. The data include the date of imprisonment, the date of release, and an indicator variable for custody incarceration. The outcome variable we focus on is an indicator for incarceration at least once during a year starting in mid-June; the point in time that the school year ends. Figure 1 presents imprisonment rates at different ages separately for the three cohorts in the analysis. Incarceration below age 18 is rare, while the incarceration rate peaks at age 20-22. Recognizing that it is often a time lag from crime committed to incarceration, and that there is a legal right to five years of high school education, the main analyses below is based on imprisonment during the one-year period starting six years after the completion of compulsory education. The average age in this period is 22 years. On average, 0.76 percent has been in prison at least once in this one-year period, and the incarceration lasted 75 days. Analyses using the number of days in prison instead of the imprisonment indicator give the same qualitative results as reported below.

GPA reflects to a large extent socioeconomic status (SES), such as parental income and education, whether the parents are married or not, and whether they are working or not. We are able to control for these characteristics in the analysis below in contrast to most papers in the literature. In addition, school quality and neighborhoods might be important. We control for such unobserved factors by including detailed fixed effects in the empirical model.

A negative relationship between GPA and crime might simply reflect an association between GPA and post-compulsory schooling. It could be the case that only years of schooling matters for crime behavior, and not student achievement. To address this issue, we investigate whether the estimated effect of GPA is robust to the inclusion of measures of high school education. One complication of the analysis is that high school attainment and crime behavior

might be driven by the same unobserved factors. In spirit of the literature that identifies the effects of years of education by variation in compulsory schooling years, we identify the effect of high school education by the supply of high school education within an instrumental variable framework.

Finally, we investigate whether there are interaction effects between GPA and years of high school education. The hypothesis is that high school education and GPA from compulsory education are substitutes in crime behavior.

Skills and Imprisonment

We find that student achievement measured by GPA at age 16 is negatively related to imprisonment at age 22. A rise in GPA by one standard deviation (about 0.8 grade points) is associated with a decrease in the probability of imprisonment by about 0.8 percentage points. The effect is above 100 percent of the mean probability of imprisonment. This is clearly a very strong association, and the result is not sensitive to the model specification. In a model controlling only for gender and immigration status, the effect is 118 percent. Controlling for our detailed SES-information reduces the effect to 107 percent, while controlling for unobserved school and neighborhood factors do not affect the estimate.

The size of the effect in percentage terms does not depend on age. Figure 2 presents relationships at different ages and corresponding confidence intervals. The estimate at age 17 is slightly larger than at older ages, but overall the relationship is remarkably stable during adolescence and young adulthood.

It is often a waiting period from the time of conviction to the time that the convicted person actually serves the sentence, in particular for the least severe crimes. Custody normally occurs right after the act of crime, and analyzing effects on custody might therefore better control for the age at the time the crime is convicted. We do find, however, an effect on custody that is exactly the same in percentage terms as the effect on the imprisonment indicator above. In addition, the effect on imprisonment is similar for males and females in percentage terms, even though imprisonment is ten times more common for males. Similarly, the effects are about the same for individuals with college and non-college educated parents. However, the relationship is clearly stronger for individuals with low GPA than for individuals with high GPA.

High School Education and Imprisonment

Why does GPA reduce crime? The underlying mechanism might be years of schooling. More schooling reduces crime, and GPA stimulates schooling. Our data show that the relevant dimension for the crime-education relationship is high school attainment. Imprisonment is 20 times more common for individuals with less than three years in high school than for high school graduates. This ratio reflects that imprisonment is rare for high school graduates. In addition, the average sentence is longer for dropouts, indicating that they commit more severe crimes. The descriptive evidence also indicates that there is a positive effect of just staying in school. It is not simply the high school degree that matters, but also the timing of dropout.

We extend the empirical model by including the number of semesters in high school up to age 21. Our measure of high school education simply count the number of semesters, regardless of whether the student changes study track, drop out and return, or have weak progression for other reasons. The number of semesters in high school education is estimated to be negatively related to imprisonment, given skills measured by GPA, and SES. However, this extension of the model does not affect the importance of GPA. Only a very small part of the effect of GPA on imprisonment seems to be mediated through high school education.

One obvious weakness with this analysis is that, even though we are able to control for a wide variety of potential confounding factors, unobserved factors might drive both dropout decisions and crime behavior. To account for this possibility, we use two measures of the counties' supply of high school education as instruments for the number of semesters in high school, in order to identify the effect on arguably exogenous variation. We exploit the fact that school structure and the supply of study slots at different study tracks are county decisions, and that vocational study tracks typically involve one more year of schooling than academic study tracks. Hence, the first instrument is the share of study slots in vocational study tracks, measured at the county level and lagged one year. In addition, high school education is arguably more cumbersome when there are few high schools nearby. The second instrument is thus an indicator for whether there are no more than five high schools within 30 minutes road travel from the student's residence.

Figure 3 shows that the effect of GPA on imprisonment at age 22 is almost independent of the model formulation. The effect of the number of semesters in high school education, however, depends on the identifying variation used. When the identification is based on the school

structure and the supply of study slots, the effect is much larger than when the identification is simply based on observed outcomes. The effect of GPA and high school education in the figure are comparable in the sense that the effect size is measured in terms of one standard deviation (which is equal to about 0.8 grade points for GPA and 3/4 years for high school education), and all effects are statistically significant at five percent level.

Finally, we investigate whether the effect of GPA depends on observed high school education. To simplify the exposition, Figure 4 presents the estimated probability of imprisonment at age 22 for different GPA-intervals for two groups of students; graduates and non-graduates. For the group of students that graduate high school within five years after finishing compulsory education, the probability of imprisonment is low, and our model suggest that this probability is almost independent of GPA from compulsory education. Likewise, for students with GPA above the average value (about 4.0 grade points), the model suggests that the probability of imprisonment is similar for individuals that graduate high school and not. The vulnerable group, for which better educational outcomes really matter, is students doing poorly both in compulsory education and in high school education. The educational outcomes are substitutes in crime behavior.

Conclusion

By using Norwegian register data we provide a richer analysis of the relationship between education and crime than previous studies have been able to do. We find that both increased GPA from compulsory education and high school attainment have a strong diminishing effect on imprisonment. The effect of GPA is highly robust to different model specifications, while the effect of high school attainment is larger in models that rely on variation that are arguably exogenous for the students than when relying on observed outcomes. It seems like avoidance of educational failure in one dimension, either measured as achievement or as high school attainment, is sufficient to escape crime.

These results are in accordance with economic theory. Educational performance improves labor market outcomes and thus decreases the expected gain of crime. The present empirical literature cannot, however, say much about the mechanisms driving the results. The study of Lance Lochner and Enrico Moretti discusses some mechanisms other than those that follow from traditional economic models. If the stigma of a criminal conviction is larger for white collar workers than for blue collar workers, the expected loss for highly educated individuals

from criminal activity extends beyond the time spent in prison. Higher educational attainment may also alter an individual's patience, risk aversion, and the psychological costs of breaking the law, which might increase the cost of possible future punishment and deter individuals from committing crime. The relative importance of different mechanisms cannot, however, be revealed from the existing literature.

Figure 1. Average imprisonment rate at different ages

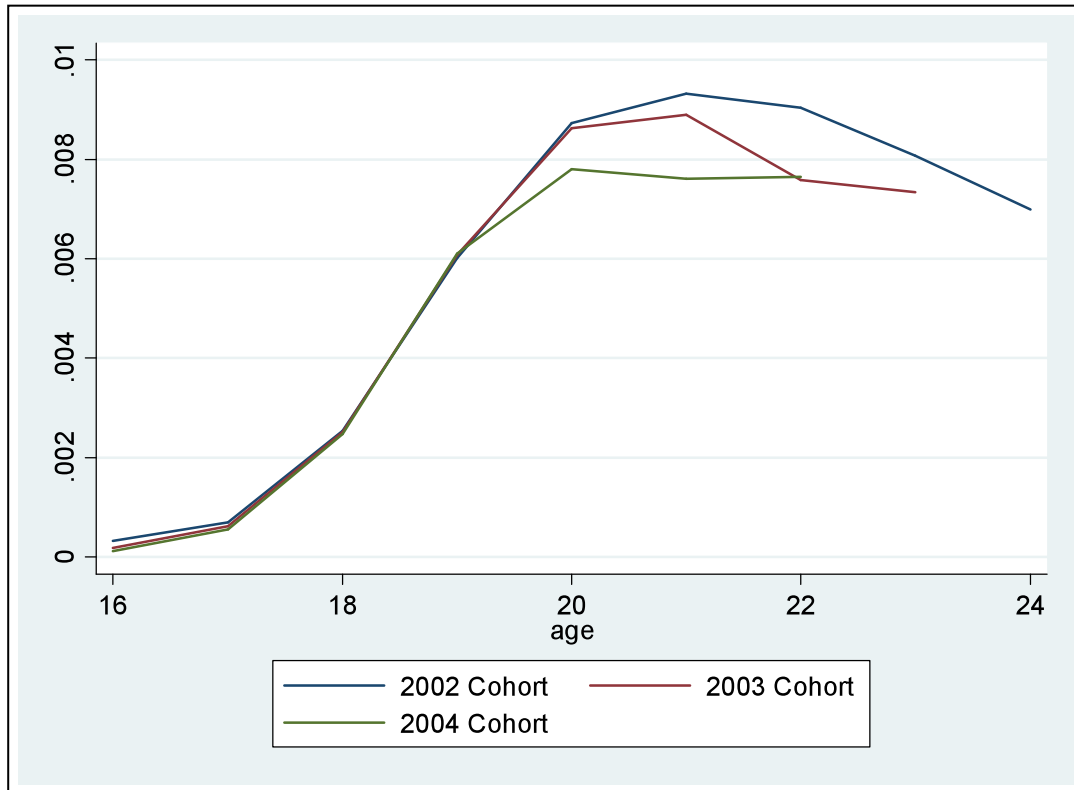


Figure 2. The effect of GPA on imprisonment in percent with 95 percent confidence interval, different ages

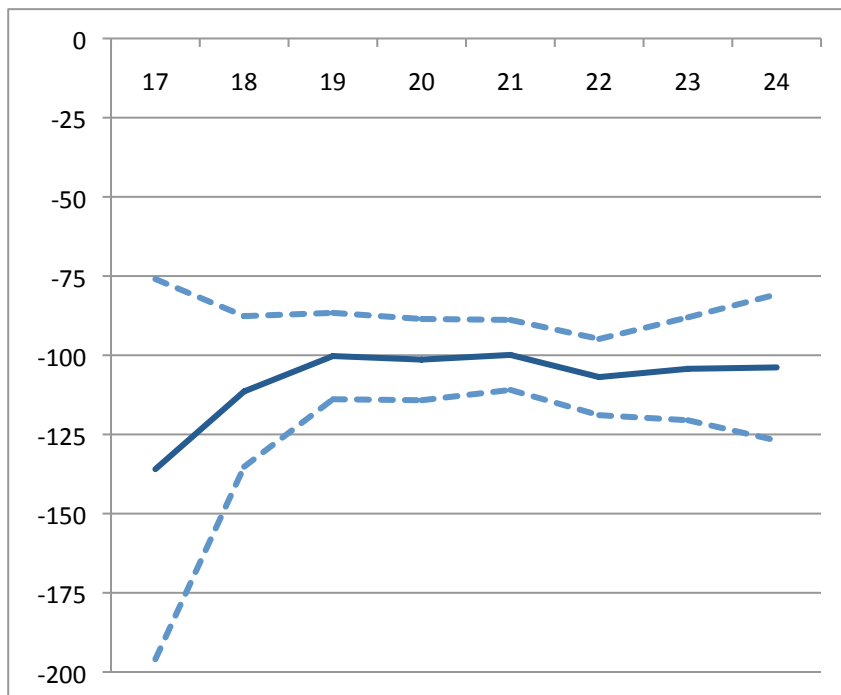


Figure 3. The effect on imprisonment of GPA and high school attainment, in percent

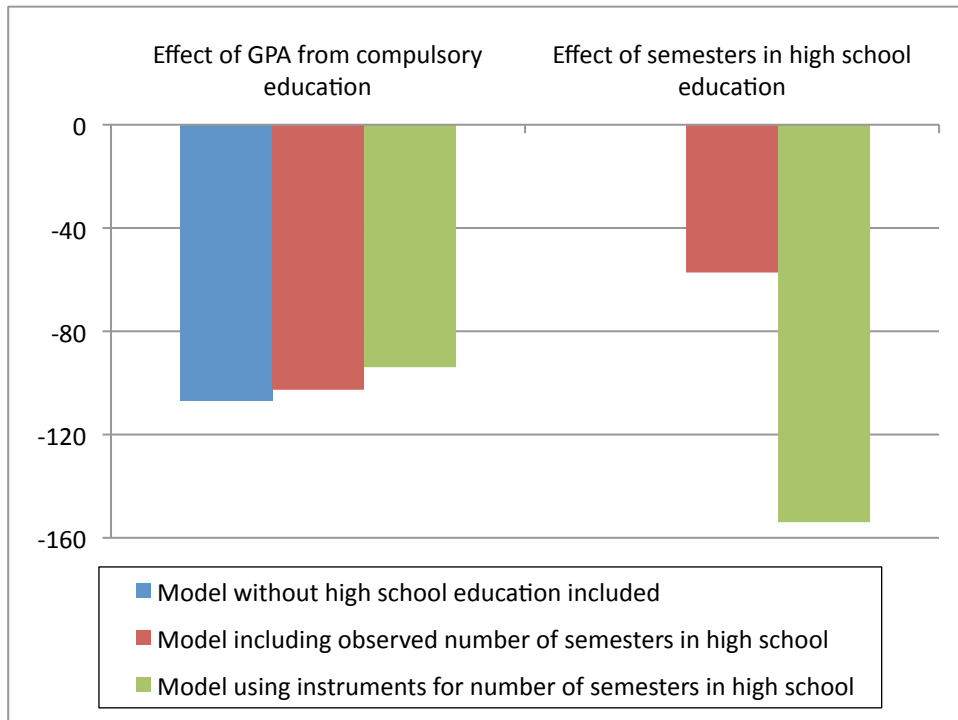


Figure 4. Estimated relationship between imprisonment and GPA interacted with high school graduation, percentage points

