



# Post-compulsory education and imprisonment<sup>☆</sup>

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## HIGHLIGHTS

- We estimate the causal effect of post-secondary education on crime.
- The analysis uses Norwegian register data on education and imprisonment.
- The identification is based on constraints in the supply of school slots.
- We find a strong negative effect of high school education on imprisonment.
- This effect seems to be diminishing in the prior skills of the students.

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## ABSTRACT

This paper studies the causal relationship between education and crime. Using Norwegian register data, we estimate the effect of a post-compulsory high school education on imprisonment for young adults. The identification in the instrumental variables model is based on variation in the supply of school slots across school districts and neighborhoods. We find that the number of semesters in high school education has a strong diminishing effect on imprisonment. The effect is robust to model specification, but seems to be related to prior skills.

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## 1. Introduction

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 some types of crime. Becker (1968) and Ehrlich (1975) analyze crime in a utility maximization framework. The number of crimes committed by an individual is related to marginal costs (probability of conviction, punishment if convicted, etc.) and marginal utility (income from legal activity relative to illegal activity). Economic theory thus suggests that some policies can reduce crime by increasing the individual's net costs. An example is improved labor market performance, which increases

the opportunity cost of committing a crime. Indeed, the recent empirical literature finds that the probability of criminal activity is related to labor market outcomes.<sup>1</sup> Because better educational performance improves human capital and thus labor market outcomes, theory suggests a causal negative effect of education on crime.<sup>2</sup>

A large literature has investigated the relationship between years of education and crime. Recent papers have exploited variation in years of compulsory schooling to identify a causal relationship (Lochner and Moretti, 2004; Anderson, 2010; Machin et al., 2011; Meghir et al., 2011; Hjalmarsson et al., 2011). These studies typically find a causal effect that is similar to or larger than descriptive differences, which indicates that unobserved heterogeneity does not bias simple relationships downwards. The external validity of these studies must, however, be interpreted with care. The contents of the

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<sup>1</sup> See for example Grogger (1998), Machin and Meghir (2004), Lin (2008), and Fougère et al. (2009).

<sup>2</sup> As discussed by Lochner and Moretti (2004) and Machin et al. (2012), education might decrease criminal activity also by other mechanisms. Education can possibly increase risk aversion, influence preferences, and raise the stigma related to criminal activity. In addition, time spent in education might have a "self-incapacitation" effect.

reforms are to various extents unclear, in particular with regard to school quality, and they were implemented more than 40 years ago.<sup>3</sup>

We estimate a causal effect of post-compulsory schooling on imprisonment using recent Norwegian data. Post-compulsory education is a choice variable and less studied in causal frameworks. Machin et al. (2012) study a large expansion of post-compulsory education in the UK around 1990, and identify the effect of education by cohort indicators. Related evidence is based on a UK policy intervention introducing bonuses to 16–18 year olds from poor families on completion of coursework. The intervention seems to have improved the rate of students staying in school (Dearden et al., 2009) and reduced crime (Sabates and Feinstein, 2008).

Our IV analysis uses two measures of supply of school slots as instruments for post-compulsory high school education. Compulsory education in Norway is without grade repetition and tracking. Post-compulsory high school education consists of either three-year long academic study tracks or four-year long vocational study tracks. Most of the individuals stay several semesters in high school education, but only about 2/3 of the cohort graduates within five years. School structure and the supply of study places at different study tracks are county decisions. Since vocational study tracks require more semesters than academic study tracks, we expect the number of semesters in high school, at the individual level, to be positively related to the share of vocational study places in the county. This instrument has predictive power in spite of the fact that weaker students enroll in vocational study tracks. The second instrument is geographical proximity to high schools.

The skills inherent in human capital are multifaceted and related to factors such as school quality,<sup>4</sup> home environment, and innate ability, in addition to years of education. Compared to the previous literature, our data include an extensive set of socioeconomic characteristics and indicators for schools and neighborhoods. Heckman et al. (2006) and Carneiro et al. (2007) find that both cognitive and non-cognitive skills reduce self-reported crime. The estimated effect of years of schooling might therefore be related to skills. Consequently, we include GPA from compulsory education in the empirical model and investigate whether the effect of education on crime depends on GPA.

The paper is organized as follows. The next section presents relevant institutional information and data descriptions. Section 3 discusses the empirical approach, while the results are presented in Section 4. We show that the local average treatment effect of years of post-compulsory high school education on imprisonment is larger than the OLS estimate, but there appears to be important heterogeneities. Section 5 concludes.

## 2. Institutions

### 2.1. School system

Norwegian compulsory education consists of 10 years.<sup>5</sup> It is not possible to fail a class; grade repetition is non-existent.<sup>6</sup> Everybody

<sup>3</sup> While Machin et al. (2011) estimate a strong effect of education on crime when exploiting the British school leaving age reform in 1972, Clark and Royer (2010) find little evidence that additional education improves health outcomes or changes health behavior when they exploit the British school leaving age reforms in 1947 and 1972.

<sup>4</sup> Some other papers have investigated the effect of school quality. Cullen et al. (2006) and Deming (2011) exploit school admission policies based on lotteries. The winners of the lotteries are considered to have attended schools of higher quality than the losers. Both papers find that lottery winners commit less crime.

<sup>5</sup> The school system is relatively homogenous. Less than two percent of all students attend a private compulsory school. Private compulsory schools are mainly Christian schools or schools with an alternative pedagogical approach. Private high schools enroll about 5% of the students. Both private compulsory schools and private high schools receive grants per student from the central government. The grant typically amounts to 85% of average spending per student in public schools. The condition for the grant is that the school only charges tuition of up to 15% of average spending per student in public schools.

<sup>6</sup> This indicates that students are supposed to be of the same age at the end of compulsory education. However, there are some exceptions. It is possible to start one year ahead of the birth cohort, and the student may postpone starting school for one year if not considered mature enough. These decisions are made by the parents together with the school and psychologists. In addition, some older students return to school to improve their grades, and immigrants are often over-aged.

graduates from compulsory education at the end of 10th grade, and receive a diploma containing 13 different grades set by teachers and the result on a written external exit exam in either Norwegian, or English, or mathematics. The grade system consists of a scale from one to six, where one is the lowest and six is the highest grade.<sup>7</sup> The average grade from compulsory education (GPA) matters for the non-compulsory high school enrolment.

The municipalities are responsible for compulsory education, while the counties are responsible for post-compulsory high school education. For the 19 counties in Norway, the most important task is to provide high school education, which accounts for over 50% of total county spending. About 95% of each cohort enrolls in high school directly after the end of compulsory education. The counties are financed by grants from the central government.

When starting high school, the students could choose between 15 different study tracks in the empirical period of this paper. The main distinction is between academic study tracks and vocational study tracks. The latter includes industrial design, health and social work, mechanics, electrical trades, etc., and typically consists of two years of schooling followed by two years as an apprentice. An academic study track consists of three years of schooling and leads to a high school diploma, which is required for university enrollment.

All students have a legal right to complete high school, but it has to be within a time frame of five years. There is an option for the student to apply for a transfer to another study track or school. However, transfer to another study track most often implies grade repetition and a longer time period before graduating. In their application for high school enrollment, students have to rank three different study tracks. They have a legal right to be enrolled in one of these three tracks, but whether they are enrolled in the first, second, or third preferred track depends on their GPA. Enrollment in different study tracks and schools is thus decided by student demand and the supply of study places provided by the county. The counties decide the location of schools, the composition of different study tracks at each school, the degree of school choice, and the spending level at each school and study track.

### 2.2. Judicial system

The Norwegian constitution is founded on the principle of “separation of powers”, formulated by the French philosopher Montesquieu, and the principle of popular sovereignty. This ensures that the judicial functions are well separated from the legislative and the executive powers. The main courts of justice are divided into three levels. They consist of the District Courts in the first instance, the Courts of Appeal in the second instance, and the Supreme Court in the third instance. Norway is divided into 66 judicial districts, with one District Court per judicial district. The judicial districts include 1–19 municipalities.

The police districts are larger than the judicial districts. During an investigation, the police may hold a suspect in custody for three days without a court order. Beyond this time, the police needs approval from the District Court in order to keep the suspect in custody. Custody is only used when the freedom of the suspect is believed to interfere with the investigation. For most offenders, the investigation period does not include any days spent in custody. When the investigation is finished, the case is brought before the District Court by the prosecution authorities.

Thus, there is typically a time lag from when a crime is committed to imprisonment, except for custody. There is not much data available on the length of this period, but for crimes committed in 1997 and taken to court, the average number of days before the trial was 153. As far as we know, there is no major trend in this regard over the

<sup>7</sup> All individuals graduate from compulsory education by law, and it is in principle not possible to fail a subject. However, in some cases teachers do not have the necessary information to set a grade, and students might be exempted from specific subjects. In particular, about 10% of the students do not have a grade in the second official written Norwegian language.

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