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Labour Economics

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The heterogeneous effects of education on crime: Evidence from Danish administrative twin data[☆]

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ARTICLE INFO

JEL Classification:

I2
K42

Keywords:

Crime
Education
Twins

ABSTRACT

Using administrative Danish Register Data to identify all twins born 1965–1982, this paper estimates heterogeneous effects of education on crime. Controlling for genetic and environmental factors, the completion of upper secondary education significantly lowers the probability of conviction for total, property, and violent crimes for males. Family factors matter—education lowers crime earlier in the life cycle for children of low educated parents and later in life for children of high educated parents. Exposure to crime during childhood similarly impacts the dynamics of the crime reducing effects of education across the life cycle. Examining different educational programs reveals completing high school is important for crime reduction, while vocational education has a smaller impact on crime. Results are robust to controlling for differences in early health, directly estimating reverse causality between education and crime, and using data on prison sentences instead of convictions.

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1. Introduction

Education reduces crime—this fact has been established in a number of studies. This is true for both years of education as well as the completion of high school, or an equivalent level. This is also true for multiple crime types—total, property, and, in some studies, violent crimes. But is education equally effective in reducing crime for everyone? Given the vast differences in not only types of crime but also the motivating factors behind these crimes, there is good reason to believe education impacts the criminal behavior of specific types of individuals very differently. To this point, [Bell et al. \(2016\)](#) emphasize the need for a deeper understanding of heterogeneous effects within the crime reducing effects of education. Additionally, recent work in the U.S. by the [Council of Economic Advisers \(2016\)](#) concludes that, among other factors, investing in education is more cost-effective in reducing crime than incarceration. From a policy perspective, there is clear value in identifying both the specific individuals for whom education reduces crime and exactly when in the life cycle education does reduce crime.

This paper analyzes heterogeneity in the crime reducing capabilities of education using Danish twin data and makes three important contributions to the literature. First, heterogeneous effects are examined across family factors such as parental education as well as environmental factors such as growing up in neighborhoods with high and low levels of crime. Second, it evaluates the importance of different margins of education such as specific educational qualifications and programs as well as years of education for the crime reducing effects of education. Third, it expands upon [Webbink et al., 2013](#) by providing more generalizable results which use administrative twin panel data rather than self reported survey data, examining detailed crime types, and analyzing not only males but also females, who are becoming increasingly represented in the criminal justice system ([Council of Economic Advisers, 2016](#)).

Previous studies ([Bell et al., 2016](#); [Cano-Urbina and Lochner, 2017](#); [Hjalmarsson et al., 2015](#); [Lochner and Moretti, 2004](#); [Machin et al., 2011](#); [Meghir et al., 2012](#)) exploit changes in compulsory schooling laws to provide causal interpretations of the effects of education on crime. These studies generally find sizable and significant reductions in crime

[☆] The author is grateful to two anonymous referees and the editor Randi Hjalmarsson for their comments in revising this article. The author also wishes to thank Birthe Larsen, Lisbeth la Cour, Paolo Buonanno, Fane Groes, Moira Daly, Matthew Lindquist, Kevin Schnepel, Anna Pii Damm, Dario Pozzoli as well as seminar participants at the Copenhagen Business School, the Swedish Institute for Social Research (SOFI), the Norwegian School of Economics (NHH), and participants of the Economics of Crime workshop at the University of Copenhagen, the 2014 SMYE, the 2014 CEN Workshop, the 2015 RES Conference and Symposium of Junior Researchers, and the 2017 SOLE Conference. This work was partially supported by the [Research Council of Norway](#) through its Centres of Excellence Scheme, FAIR project No 262675. The author acknowledges financial and computing support from the Copenhagen Business School, the Norwegian School of Economics, and the Research Council of Norway.

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<https://doi.org/10.1016/j.labeco.2018.02.002>

Received 28 November 2016; Received in revised form 6 February 2018; Accepted 7 February 2018

Available online xxx

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due to additional years of education as well as the completion of high school for total and property crimes, with less defined results for violent crimes and for women across studies. In addition, there is some evidence that education has a larger impact on crime committed during younger ages (Hjalmarsson et al., 2015) and that accounting for juvenile crime may also be important. Webbink et al. (2013) investigate the reverse causality between education and crime and conclude that while education can reduce crime, limiting involvement in juvenile crime is a more dominant mechanism than education in terms of crime reduction. This paper takes a different approach than those exploiting compulsory schooling law changes—controlling for characteristics which are common between twins. As twins are genetically similar and are usually raised in the same environment during childhood, many unobservable factors which affect both education and crime are controlled for by comparing the outcomes of one twin to the other.

Using within twin fixed effects estimation, this paper confirms, in line with the existing literature, that the completion of upper secondary education significantly decreases the probability of conviction for males twins of total crimes, property crimes, and violent crimes by 9.5 percentage points (57%), 8 percentage points (76%), and 2.5 percentage points (59%) respectively. For males, involvement in juvenile crime significantly increases the probability of conviction as an adult, but to less of an extent than has been found previously (Webbink et al., 2013). Some crime reducing effects are also seen for females, but only for total crimes, and juvenile crime is important in explaining adult crime for females. In addition to the completion of upper secondary education, years of education have a similar crime reducing impact for males, but no corresponding effects are seen for females. Completing upper secondary education significantly lowers the probability of conviction for crimes committed at younger ages as well as those later in life for males.

Having confirmed education reduces an individual's probability of conviction as an adult, the paper examines the presence of heterogeneous effects of education on crime for males. Family factors are important in the dynamics of the crime reducing capabilities of education across the life cycle from the ages of 18–30. From age 18 to the mid-twenties, education significantly reduces crime only for those from a low educated household, with no significant crime reducing impact of education at these younger ages for those with two highly educated parents. However, later in life, the crime reducing effects of education “catch up” for those of highly educated households and by the age of 30, the estimated effects of education on crime are similar irrespective of family education. Environmental factors are also important—education significantly reduces the probability of conviction for crimes both at younger and older ages for those exposed to high youth crime during childhood while education reduces only crimes committed later in life for those exposed to low levels of youth crime. As with parental education, the estimated effects are similar by age 30 for both groups.

For those from disadvantaged backgrounds, measured in terms of parental education and exposure to youth crime, education is effective in lowering crime committed both early and later in life. In contrast, education only decreases crimes committed later in life for those from more advantaged backgrounds. These patterns of heterogeneity imply education will be especially beneficial for those from disadvantaged backgrounds as it can decrease crimes committed during younger ages in formative years at the early stages in the life cycle where crime may have greater adverse effects on future outcomes. Examining detailed educational qualifications reveals that the overall impact of the completion of upper secondary education on crime is primarily driven by the completion of high school, and while the completion of vocational education also reduces crimes, this effect is smaller in magnitude. In addition to total, property, and violent crimes, education significantly decreases participation in narcotics crimes and marginally reduces tax crimes when analyzing all available crime types.

Isolating heterogeneous effects of education on crime which are causal in nature represents an empirical challenge. This relationship is complicated by the fact that education decisions are endogenous—more

crime prone individuals are both less likely to pursue education and more likely to commit crime—and that causality runs in both directions—participation in crime as a juvenile can directly affect the level of schooling an individual attains. This paper overcomes this endogeneity problem using within twin estimation which, in addition to identifying causal effects of education on crime, provides many other advantages to enable the examination of heterogeneity in the effects of education on crime. First, effects are identified over the entire population, not only from those who comply with compulsory schooling reforms at the lower end of the educational distribution. Second, the analysis is not constrained to one specific educational change, providing the freedom to analyze the impact of multiple educational qualifications and time periods. Third, estimation within twins enables the direct analysis of potential reverse causality between education and crime.

Despite the prominent use of twin studies,¹ there are also limitations to using twin data. Specifically, while monozygotic (MZ) twins are virtually genetically identical, differences in unobservable factors which affect both education and crime participation are determined by more than just genetic factors, and these differences in unobservables could be what drive differences in twin education levels (Bound and Solon, 1999; Griliches, 1979; Sandewall et al., 2014). While the results presented in this paper are subject to these criticisms, particularly as data on zygosity is unavailable, multiple steps are taken to account for unobservable differences between twins. Importantly, twins raised in different households during childhood are excluded from the sample, as these twins are not exposed to similar environmental factors. Results are robust to controlling for early health differences between twins, indicating such differences do not determine within twin variation in education levels, and to excluding twins with large differences in education. Additionally, for males, results are robust to using data on prison sentences instead of convictions and, again for males, directly estimating the reverse causality between education and crime.

The next section briefly outlines the reasons why education can affect crime. Section 3 describes Danish Register Data and the sample of twins and Section 4 provides summary statistics. Section 5 outlines within twin fixed effects estimation and discusses potential threats to this methodology. The baseline results of the effects of education on crime are reported in Section 6, while Section 7 examines the heterogeneous effects of education on crime. Section 8 details the robustness of the results and Section 9 concludes.

2. Why can education reduce crime?

2.1. Effects on employment

Education can reduce criminal activity by affecting an individual's labor market prospects, predominantly through increasing wages and increasing an individual's probability of employment.² First, education builds human capital which leads to higher wages. Increased wages increases the opportunity cost of crime (foregone wages while incarcerated), thus reducing an individual's propensity to engage in criminal behavior under the framework of Becker (1968). Second, if employers see educational qualifications as an indicator of potential productivity, education can increase the probability that an individual will be employed. Having a legal job reduces the financial need for illegal wages through crime, also lowering an individual's propensity to engage in

¹ Twins have long been used as an identification method, and particularly in the education literature, to estimate the returns to education (Ashenfelter and Krueger, 1994; Ashenfelter and Rouse, 1998; Isacson, 1999), the intergenerational transmission of education (Behrman and Rosenzweig, 2002; Holmlund et al., 2011; Lundborg et al., 2014; Pronzato, 2012), the impact of spousal education on earnings (Huang et al., 2009), and even in the portfolio choice literature (Calvet and Sodini, 2014).

² For a theoretical model, see Lochner (2011).

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