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## THE IMPACT OF EDUCATION ON CRIME: INTERNATIONAL EVIDENCE

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### Introduction

Policymakers interested in fighting crime often focus on enforcement and punishment; yet, recent research suggests that other policy mechanisms can also be effective. This review focuses on growing international evidence that suggests that policies designed to increase educational attainment and improve school quality can significantly reduce crime rates.

A few recent statistics from Europe and the United States highlight the strong connection between education and crime. In 1997, 75 percent of state and 59 percent of federal prison inmates in the US did not have a high school diploma (Harlow 2003).<sup>1</sup> In 2001, more than 75 percent of convicted persons in Italy had not completed high school (Buonanno and Leonida 2006), while incarceration rates among men ages 21-25 in the United Kingdom were more than eight times higher for those without an education qualification (i.e. dropouts) relative to those with a qualification (Machin, Marie and Vujic 2011). Finally, among Swedes born between 1943 and 1955, men with at least one criminal conviction had completed 0.7 years less schooling, on average, than men without a conviction; the difference for women was roughly half this size (Hjalmarsson, Holmlund and Lindquist 2011).

In this report, we begin with a brief discussion of the relationship between education and crime from an

economic perspective. We then survey recent evidence on the impacts of educational attainment and school quality/choice on adult crime. This is a rapidly growing area of research with a consensus emerging that education leads to important reductions in criminal activity. Finally, we conclude with a number of policy lessons related to education and its potential role as a crime-fighting strategy.

### The economics of education and crime

Why does education reduce crime and which types of crime are likely to be most sensitive to education policies? We offer a brief economic perspective on these questions.

Lochner (2004) emphasizes the role of education as a human capital investment that increases future legitimate work opportunities, which discourages participation in crime.<sup>2</sup> If human capital raises the marginal returns from work more than crime, then human capital investment and schooling should reduce crime. Thus, policies that increase schooling (or the efficiency of schooling) should reduce most types of street crime among adults; however, certain types of white collar crime (e.g. embezzlement, fraud) may increase with education if they sufficiently reward skills learned in school.

Education may also teach individuals to be more patient (Becker and Mulligan 1997). This would discourage crime, since forward-looking individuals place greater weight on any expected future punishment associated with their criminal activities. To the extent that time preferences are affected by schooling, crimes associated with long prison sentences (or other long-term consequences) should be most affected. Education may also affect preferences toward risk. If schooling makes individuals more risk averse, it should discourage crime with its greatest effects on offenses that entail considerable uncertainty in returns or punishment. Finally, schooling



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<sup>1</sup> Lochner and Moretti (2004) show that substantial differences in incarceration rates by education exist even after accounting for differences in age, state of birth, state of residence, and year of birth. Differences by education are also apparent in self-reported survey measures of crime in the US (Lochner 2004).

<sup>2</sup> This is consistent with numerous recent studies that show that higher wages reduce crime (e.g. Grogger 1998; Machin and Meghir 2004; Gould, Mustard and Weinberg 2002) and decades of research in labor economics showing that education increases wage rates (see e.g. David 1999).

may affect the set of people individuals interact with on a daily basis in school, work, or their neighborhoods. Assuming more educated people interact more with other educated people who are less inclined to engage in crime, this is likely to compound any reductions in crime associated with schooling. In most cases, mechanisms related to changes in preferences or social interactions suggest that educational attainment is likely to reduce most types of crime among adults.

### Evidence on education and crime

We now discuss evidence on the effects of educational attainment and school quality and choice on subsequent criminal outcomes. We also review empirical studies that analyze the relationship between school attendance and contemporaneous crime.<sup>3</sup>

### Educational attainment and crime

Early studies of the relationship between education and crime focused on their correlation conditional on measured individual and family characteristics using standard regression methods.<sup>4</sup> These studies must be interpreted with caution, since a negative cross-sectional correlation between education and crime, even after controlling for measured family background and neighborhood characteristics, does not necessarily imply that education reduces crime. Firstly, unobserved individual characteristics like patience or risk aversion are likely to directly affect both schooling and criminal decisions. Individuals who choose more schooling (even after conditioning on observable characteristics) might also choose less crime regardless of their education level, in which case regression-based estimates do not identify a causal effect. Secondly, using variation in crime and education across states or local communities may also produce biased estimates. Governments may face a choice between funding police or good public schools, which would tend to produce a spurious positive correlation between education and crime. Alternatively, unobserved characteristics of communities may directly affect the costs or benefits of both education and crime. Thirdly, reverse causality is another important

concern. Individuals who plan to heavily engage in crime (e.g. because they are particularly good at it, enjoy it, or live in areas with plenty of illicit opportunities) are likely to choose to leave school at a young age (Lochner 2004). Arrests or incarceration associated with juvenile crime may also cause some youths to drop out of school early (Hjalmarsson 2008).

Recent empirical studies generally estimate the effects of average educational attainment on arrest, conviction, or incarceration rates. To address concerns with endogeneity and unobserved heterogeneity, researchers have typically exploited exogenous changes in state or national rules that affect schooling decisions, examining the effects of these policies on subsequent crime. This ensures that estimates reflect causal effects of education on crime and not simply spurious correlations.

Lochner and Moretti (2004) examine state-level male arrest rates by criminal offense and age (five-year age categories beginning at ages 20-24 through 55-59) from the FBI's Uniform Crime Reports (UCR) for the US in 1960, 1970, 1980, and 1990. This data is linked to 1960-90 decennial US Census data on educational attainment and race. The main methodological contribution of Lochner and Moretti (2004) is the use of changes in state-specific compulsory schooling laws over time as instrumental variables for schooling. Intuitively, this strategy measures the extent to which an increase in a state's compulsory schooling age leads to an immediate increase in educational attainment and reductions in subsequent crime rates for affected cohorts. Because the laws only affect schooling at low levels (mainly grades 8-12), their instrumental variable (IV) estimates reflect the impact of an additional year of high school on crime.

Lochner and Moretti (2004) find that a one-year increase in average education levels in a state reduces state-level arrest rates by 11 percent or more. These estimated effects are very similar to the predicted effects derived from multiplying the estimated increase in wages associated with an additional year of school by the estimated effects of higher wage rates on crime (Gould, Mustard and Weinberg 2002). This suggests that much of the effect of schooling on crime may come through increased wage rates and opportunity costs. Given the strong relationship between high school completion and incarceration, Lochner and Moretti (2004) also estimate specifications using the high school completion rate as a

<sup>3</sup> See Lochner (2011a; b) for more detailed surveys of the effects of education and human capital policies on crime.

<sup>4</sup> Ehrlich (1975) provides an early empirical exploration of predicted effects of education on crime from a human capital perspective. See Witte (1997) for a survey of the early empirical literature on education and crime.

measure of schooling. These estimates suggest that a ten percentage point increase in high school graduation rates would reduce arrest rates by seven to nine percent.

Lochner and Moretti (2004) also use ordinary least squares (OLS) to estimate separate effects of education for different types of crime. These results suggest similar effects across the broad categories of violent (murder, rape, robbery, and assault) and property (burglary, larceny, motor vehicle theft, and arson) crime – a one year increase in average years of schooling reduces both property and violent crime by about 11-12 percent. However, the effects vary considerably within these categories. A one-year increase in average years of schooling reduces murder and assault by almost 30 percent, motor vehicle theft by 20 percent, arson by 13 percent, and burglary and larceny by about six percent. Estimated effects on robbery are negligible, while those for rape are significantly positive. Additional specifications suggest quantitatively similar effects for a 10-20 percentage point increase in high school graduation rates.<sup>5</sup> Following a similar approach, Lochner (2004) estimates *positive*, though statistically insignificant, effects of schooling on arrest rates for white collar crimes (forgery and counterfeiting, fraud, and embezzlement).

Lochner and Moretti (2004) also use individual-level data on incarceration and schooling from the 1960, 1970, and 1980 US Censuses to estimate the effects of educational attainment on the probability of imprisonment separately for black and white men (ages 20-60). Their estimates control for the age of the respondent, state of birth, state of residence, cohort of birth, and state-specific year effects. Analogous to their analysis of state-level arrest rates, they use state-level changes in compulsory schooling ages as an instrument for educational attainment. That is, identification comes from the fact that in any given state and year, different age cohorts faced different compulsory schooling laws during their high school years, causing them to acquire different levels of schooling and to commit crime at different rates. Both OLS and IV estimates are very similar and suggest that, on average, an extra year of education reduces the probability of imprisonment by slightly more than 0.1 percentage

point for whites and by about 0.4 percentage points for blacks. Given average incarceration rates for dropouts, this translates into a 10–15 percent reduction in incarceration rates for both white and black males associated with an extra year of completed schooling.<sup>6</sup> These estimated effects are comparable to those for arrest rates described earlier. OLS results suggest that completion of the twelfth grade causes the greatest drop in incarceration, while there is little effect of schooling beyond high school.

Machin et al. (2011) exploit a 1972–73 increase in the minimum schooling age (from age 15 to 16) in England and Wales to estimate the effects of schooling on criminal convictions for property and violent crimes over the period 1972–96. Using both IV and regression discontinuity methods, identification effectively comes from cohort-level changes in schooling attainment and crime for cohorts turning 15 immediately before and after the law change. Among men, they estimate that a one-year increase in average schooling levels reduces conviction rates for property crime by 20-30 percent and violent crime by roughly one-third to one-half as much, though the latter estimates are statistically insignificant. Compared to estimates for the US by Lochner and Moretti (2004), the impacts of education on property crime appear to be greater in the United Kingdom, while the effects on violent crime are weaker.

Meghir, Palme and Schnabel (2011) and Hjalmarsson, Holmlund and Lindquist (2011) use micro-data and Swedish compulsory schooling reforms to identify the causal effect of education on crime. The Swedish compulsory school reform, which primarily extended compulsory schooling from seven to nine years, differs from the US and U.K. reforms studied by Lochner and Moretti (2004) and Machin et al. (2011). The Swedish reform was implemented at different times across municipalities during the 1950s and 1960s. As such, these studies compare individuals who were exposed to two different school systems, but who are from the same birth cohort and are working in the same labor market. This isolates the partial equilibrium effects of the schooling reform on crime abstracting from any general equilibrium effects that the reform may have had on the Swedish labor market.

<sup>5</sup> Results for rape are surprising and not easily explained by standard economic models of crime. However, the results are consistent with some specifications in Gould et al. (2002), which suggests that local wage rates are positively correlated with local crime rates for rape.

<sup>6</sup> Oreopolous and Salvanes (2009) reproduce the Lochner and Moretti (2004) IV results for black males using the same estimation strategy with a slightly different specification and an expanded sample. Their estimate suggests that an additional year of completed schooling reduces incarceration rates among black men by about 20 percent.

Meghir et al. (2011) study the intergenerational effects of this reform on the crime of males directly affected by the reform and on the sons of men and women affected by the reform. They use census data for everyone born in Sweden between 1945 and 1955 and their children merged with individual register data on all convictions in Sweden between 1981 and 2008. Their estimates reveal a negative effect of the reform on both the likelihood of conviction (a five percent reduction) and the number of convictions (a reduction of 0.25 crimes for those coming from low SES backgrounds) among males directly affected by the reform. They find no effects on the probability of imprisonment. Perhaps more striking, sons whose fathers were assigned to the school reform have a 2.5 percent lower probability of being convicted. In contrast, they find that the reform has no effects on conviction rates among the sons of women assigned to the reform. They argue that these intergenerational effects probably operate through improved parenting and investments in children.

Hjalmarsson et al. (2011) use the same reform to instrument for years of schooling and a 25 percent random sample of those born between 1942 and 1955 from Sweden's Multigenerational Register merged with Swedish crime register data for 1973 to 2007. The first stage of their analysis finds that exposure to the reform significantly increases average educational attainment by 0.28 years for males and 0.16 years for females. Baseline estimates indicate that more schooling significantly reduces criminal activity for both males and females at both the extensive and intensive margins. For males, one additional year of schooling reduces the likelihood of conviction by 7.5 percent, the likelihood of incarceration by 16 percent, the number of crimes by 0.4, and the number of days sentenced to prison by six percent. For females, one additional year of schooling significantly lowers the chance of conviction by 11 percent and the number of crimes by 0.09. Significant negative effects on male convictions are observed in each of the following age categories: 18-29, 30-39, and 40-49. Finally, schooling reduces crime across offense categories. For males, an additional year of schooling decreases the likelihood of a property crime conviction by 10 percent, a violent crime conviction by 13 percent, and a conviction of other types of crime by 5 percent. The magnitudes of these estimates are similar to those for the US (Lochner and Morretti 2004). For females, the impacts are even larger in percentage terms – an additional year of schooling significantly decreases the likelihood of

conviction for a property offense by 28 percent and a violent offense by 50 percent.

Buonanno and Leonida (2006) estimate the effects of educational attainment on crime rates using a panel of 20 Italian regions 1980 to 1995. Using OLS, they control for region and time fixed effects, along with region-specific quadratic time trends, and a rich set of time-varying region-specific covariates. Their estimates suggest that a ten percentage point increase in high school graduation rates would reduce property crime rates by four percent and total crime rates by about three percent (effects on property crime are statistically significant, while effects on total crime are not.) They find no evidence to suggest that university completion reduces crime.

Merlo and Wolpin (2009) take a very different approach to estimating the relationship between schooling and subsequent crime. Using individual-level panel data on American black males ages 13–22 from the NLSY, they estimate a discrete choice vector autoregression model in which individuals can choose to engage in crime, attend school, and/or work each year. These decisions are allowed to depend on unobserved individual-specific returns to each activity, as well as crime, schooling, and work choices during the previous year. Simulations that use estimates for their model suggest that, on average, attending school at age 16 reduces the probability of a black male ever committing a crime over ages 19–22 by 42 percent and the probability of an arrest over those ages by 23 percent.

A final study worth mentioning examines the effects of an explicit education subsidy on youth burglary rates in England. Between 1999 and 2002, England piloted Educational Maintenance Allowances (EMA), which provided subsidies of up to GBP 40 per week (plus bonuses for completion of coursework) for low-income 16–18 year old youths to attend school. The program was administered in 15 local areas with low schooling participation rates. During the same time period, the Reducing Burglary Initiative (RBI) funded 63 different local burglary reduction schemes as a separate pilot project. Roughly half of all EMA pilot areas were also selected for the RBI. Sabates and Feinstein (2008) use a differences-in-differences strategy to identify the effects of each pilot program, as well as the combination of the two, on burglary. Their findings suggest that the combination of both the EMA and RBI significantly reduced burglary rates by about

5.5 percent relative to ‘matched’ comparison areas. The effects of the EMA alone were slightly lower, but still significant.

### School quality and crime

It is likely that school quality and the type of schools students attend also affect criminal behavior. While there are no studies that directly estimate the effects of measured school quality on crime, three recent studies on school choice and desegregation provide some useful insights.<sup>7</sup>

Cullen, Jacob and Levitt (2006) find that ‘winning’ a randomized lottery for admission to Chicago high schools significantly raises peer graduation rates by six percent and the share of peers who test above national norms by about 14 percent; however, lottery winners appear to be placed in lower tracked classes within the better schools. Interestingly, they find no evidence that lottery winners perform better on a wide range of academic measures and some evidence that they are more likely to drop out of high school. The latter may be due to a mismatch between student ability and school demands. Despite the disappointing findings regarding academic outcomes, those who won lotteries to high achievement public schools reported nearly 60 percent fewer arrests on a ninth grade student survey. These winners also reported getting into less trouble at school, and school administrative data suggests that they had lower incarceration rates during school ages.

To this end, Deming (forthcoming) examines the impacts of open enrollment lotteries (for middle and high schools) in the Charlotte-Mecklenburg, North Carolina school district on adult criminal outcomes seven years after random assignment. Given his interest in the effects of school choice on crime, he categorizes males based on their likelihood of arrest (a function of demographic characteristics, earlier math and reading test scores, and other school-related behaviors at young ages). For his entire sample of middle and high school lottery participants, ‘high-risk’ youth (i.e. the top quintile of predicted arrest probability) have seven times more felony arrests (seven years after random assignment) than the average student from the bottom four quintiles com-

bined. Like Cullen et al. (2006), Deming estimates significant effects of winning a school lottery on the quality of school attended, especially among ‘high-risk’ youth, but no effects on achievement tests. There appears to be some effect on student enrollment during high school years, but there is no evidence that ‘high-risk’ lottery winners are more likely to graduate from high school. Among high school lottery winners in the high-risk category, Deming estimates a roughly 45 percent reduction in the number of adult felony arrests (cumulative as of seven years after the lottery).

Court-ordered school desegregation policies enacted since *Brown vs. Board of Education of Topeka* in 1954 dramatically altered the types of schools blacks attended in many American districts. In most cases, the resources and average student achievement of schools attended by blacks would have improved markedly. Guryan (2004) estimates that these desegregation efforts significantly increased high school graduation rates among blacks by two to three percentage points, but had no effect on white graduation rates. Weiner, Lutz and Ludwig (2009) examine whether these changes affected county-level homicide rates. Their estimates suggest that homicide deaths among blacks ages 15–19 declined by 17 percent in the first five years after court-ordered desegregation, while homicide deaths among white 15–19 year olds declined by about 23 percent. Homicide deaths among slightly older whites and blacks also declined. In looking at offenders, they find that arrest rates for homicide declined by one-third for blacks between the ages of 15–19 years, while there was no decline for young whites. They argue that much of the effect may be coming from the increased schooling among blacks.

### Contemporaneous schooling and crime

There are three main ways in which altering youths’ schooling attendance is likely to affect their contemporaneous engagement in crime. Firstly, school may have an incapacitation effect – youth cannot be in two places at once, and many criminal opportunities are more limited in school than on the streets. This effect depends, in part, on the ease with which youth can engage in crime during non-school hours. Secondly, longer periods of school attendance should increase labor market skills and improve future employment prospects. This, in turn, may make juvenile arrests and long periods of detention

<sup>7</sup> See Lochner (2011a; 2011b) for additional evidence on the role of early childhood and school-age interventions on crime.

more costly, reducing incentives to engage in crime while enrolled in school. Thirdly, schools bring hundreds of adolescents together for the day. It is quite possible that the social interactions from this lead to altercations and more general group-based delinquency. The incapacitation and human capital effects are likely to imply negative effects of school attendance on crime, while the social interaction effect could be positive or negative.

Three relatively recent studies shed light on these effects by estimating the impacts of different ‘interventions’ that directly affect youth schooling attendance. Anderson (2009) examines the effect of increasing state compulsory schooling ages (i.e. forcing some youths to stay in school), while Jacob and Lefgren (2003) and Luallen (2006) study the effect of extra days off from school due to teacher in-service days or teacher strikes (i.e. keeping all youths out of school). These interventions differ in two important respects. Firstly, increases in compulsory schooling ages typically ‘require’ that students stay in school at least one additional year and sometimes more, whereas teacher in-service days and strikes are of very short duration. Secondly, while teacher strikes and in-service days release all students from school, changes in compulsory schooling laws typically affect a small set of marginal students. All three potential effects of school attendance on crime are likely to be relevant to changes in compulsory schooling, while the effects of in-service days and teacher strikes are likely to be limited to incapacitation and social interactions. Social interaction effects are likely to be magnified in the latter cases due to the universal nature of the ‘policies’.

Anderson (2009) estimates that increasing the compulsory schooling age from 16 to 17 or 18 years of age reduces arrests at the affected ages by nearly 10 percent, with similar impacts on both violent and property crime. By contrast, Jacob and Lefgren (2003) and Luallen (2006) estimate mixed effects of extra days off from school on crime due to teacher in-service days or strikes. Their estimates suggest that in urban areas an additional day of school reduces juvenile property crime by 15-30 percent; however, it increases violent crime by roughly 30 percent. Interestingly, Luallen (2006) finds that the impacts of an extra school day are insignificant in rural and suburban areas, suggesting that the incapacitation and social interaction effects of school attendance are particularly strong in urban areas and negligible (or offsetting) elsewhere.

## Policy lessons and conclusions

We conclude with a discussion of important policy lessons regarding education and crime.

Firstly, increasing educational attainment and school quality can yield sizeable social benefits. Lochner and Moretti (2004) calculate that the social savings of a one percentage point increase in male US high school graduation rates (from reduced crime alone) in 1990 would have amounted to more than USD 2 billion. This represents more than USD 3,000 in annual savings per additional male graduate. In the UK, Machin et al. (2011) estimate a social savings of over 10,000 pounds per additional student qualification (similar to high school completion in the US) from reductions in property crime alone (estimated effects on violent crime in the UK are statistically insignificant.)

Deming (forthcoming) estimates that reductions in crimes leading to an arrest realized from offering better quality school options to a high-risk youth would conservatively produce USD 16,000 in social savings to victims over the next seven years. Because better schools are also likely to have reduced crimes that never lead to an arrest, total victimization savings are likely to be substantially higher. Total social savings should be still larger after factoring in savings on prisons and other crime prevention costs.

Secondly, given that the most sizeable reductions in crime appear to result from the final years of secondary school, policies that encourage high school completion would seem to be most promising in terms of their impacts on crime. Because crime rates are already quite low among high school graduates, policies that encourage post-secondary attendance or completion are likely to yield much smaller social benefits from crime reduction.

Thirdly, policies designed to encourage schooling among more crime-prone groups are likely to produce the greatest benefits from crime reduction. Deming (forthcoming) estimates that improved school choice for middle and high school students

<sup>8</sup> Fast Track provides group- and individual-based services to children from high-poverty and high-crime neighborhoods in the US who exhibit conduct problems in kindergarten. With the goal of preventing antisocial behavior and psychiatric disorders, the program provides services during grades one to ten focusing on three elements of development: social and cognitive skills, peer relationships, and parenting.

<sup>9</sup> Estimates from Machin et al. (2011) suggest that education reduces property crime more than violent crime in the UK.

<sup>10</sup> As Heckman, Stixrud and Urzua (2006) show, both ‘cognitive’ and ‘non-cognitive’ skills are acquired in school, are rewarded in the labor market, and affect crime.

leads to significant reductions in arrests for high-risk youth, but not for others. Consistent with this, the school-age Fast Track program appears to have reduced juvenile crime only among very high-risk children, showing little impact on even moderately high-risk children (CPPRG 2007; 2010).<sup>8</sup>

Fourthly, education policies can reduce property crime as well as violent crime. In both the US and Sweden, the estimated effects of educational attainment or school enrollment on property and violent offenses appear to be quite similar in percentage terms (Lochner and Moretti 2004; Anderson 2009; Hjalmarsson et al. 2011).<sup>9</sup> Even murder appears to be quite responsive to changes in educational attainment and school quality (Lochner and Moretti 2004, Weiner et al. 2009).

Fifthly, higher wages increase the opportunity costs of both property and violent crime. Lochner and Moretti (2004) show that the estimated effects of educational attainment on crime can be largely accounted for by the effects of schooling on wages and the effects of wages on crime. This is important since it suggests that policymakers can reduce crime simply by increasing labor market skills; they need not alter individual preferences or otherwise socialize youth.<sup>10</sup>

Lastly, education-based policies need not increase educational attainment to reduce crime. Studies on school choice lotteries (Cullen et al. 2006; Deming forthcoming) suggest that providing disadvantaged urban youth with better schools can substantially reduce juvenile and adult crime, even if it has little effect on traditional education outcomes.

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