# The Origins of Intergenerational Associations in Crime: Lessons from Swedish Adoption Data*

March 25, 2011

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*Abstract*

We use Swedish adoption data combined with police register data to study parent-son associations in crime. For adopted sons born in Sweden, we have access to the criminal records of both the adopting and biological parents. This allows us to assess the relative importance of pre-birth factors (genes, prenatal environment and perinatal conditions) and post-birth factors for generating parent-son associations in crime. We find that pre-birth and post-birth factors are both important determinants of sons' convictions and that mothers and fathers contribute equally through these two channels. We find little evidence of interaction effects between biological and adoptive parents' criminal convictions. Having a more highly educated adoptive mother, however, does appear to mitigate the impact of biological parents' criminality.

Keywords: adoption, crime, illegal behavior, intergenerational crime, intergenerational mobility, risky behavior.

JEL codes: J62, K42.

* We would like to thank Anders Björklund, David Cesarini, Mikael Lindahl, Erik Plug and seminar participants at the 2nd Bonn and Paris Workshop on Law and Economics, City University London, The Max Planck Institute (Bonn), The Stockholm School of Economics, Stockholm University, University College London and Uppsala University for their comments and suggestions. We gratefully acknowledge financial support from the National Science Foundation (grant SES-0819032) and from the Swedish Council for Working Life and Social Research (FAS).
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## 1 Introduction

A large body of research provides evidence of substantial intergenerational associations in criminal behavior.[1] The key findings from this literature are that family background (in general) and parental criminality (in particular) are among the strongest predictors of criminal activity, stronger even than one's own income or employment status. These important findings imply that if we want to fully understand the etiology of crime, we need to have a clear understanding of the familial nature of crime.

Taken together, the numerous parent-offspring correlations reported in this literature produce a rich, descriptive picture that highlights the role of the family in perpetuating crime from one generation to the next. Only a handful of these studies, however, have produced convincing empirical evidence concerning the underlying mechanisms that generate these associations. This shortage of credible empirical evidence has hampered the literature from reaching a consensus concerning the relative importance of the many hypothesized mechanisms. We aim to fill at least some of the gap in the literature. A better understanding of why intergenerational criminal correlations exist is necessary for the development of relevant theory and for designing effective social policy.

In this paper, we use Swedish adoption data combined with police register data to study parent-son associations in crime. For adopted sons born in Sweden, we have access to the criminal records of both the adopting and biological parents. This allows us to assess the relative

[1] The modern branch of this literature dates back to the seminal work of Glueck and Glueck (1950). They find that 66 percent of delinquent boys in Boston, Massachusetts had a criminal father compared to 32 percent of non-delinquents. Additional evidence of an intergenerational criminal relationship has been found across multiple data sets, cities, and countries (see, e.g., Ferguson 1952, Janson 1982, Wilson 1987, Farrington and West 1990, Rowe and Farrington 1997, Gregory 2004, Murray et al. 2007, Thornberry 2009, Farrington et al. 2009, and van de Rakt et al. 2009). Economists studying intergenerational criminal correlations include Case and Katz (1991), Williams and Sickles (2002), Duncan et al. (2005) and Hjalmarsson and Lindquist (2010, 2011). For instance, using data from the Stockholm Birth Cohort Study, Hjalmarsson and Lindquist (2011) find that sons whose fathers have at least one sentence have 2.06 times higher odds of having at least one criminal conviction than sons whose fathers do not have any sentence.

importance of pre-birth factors (genes, prenatal environment and perinatal conditions) and post-birth factors for generating parent-son associations in crime.[2] Our data also allow us to investigate potential interactions between pre-birth and post-birth factors. Evidence of interaction effects may be of particular interest to policy makers, since they directly address questions concerning the malleability of poor pre-birth factors to post-birth interventions.

In their review of the existing adoption-crime literature, Ishikawa and Raine (2002, p.90) conclude that, "In total, 15 well-executed adoption studies on antisocial behavior have been conducted in Denmark, Sweden, and the United States."[3] Nine of these studies are based on two data sets that include official criminal conviction records for all four parents of an adopted child. The most extensive data set includes register data on 14,427 non-familial adoptions in Denmark between 1924 and 1947 (Hutchings and Mednick 1974).[4] The second data set, which is now known as the Stockholm Adoption Study, was initially comprised of 2,324 individuals born in Stockholm between 1930 and 1949 and adopted at an early age by non-relatives (Bohman 1978).

Using the Danish adoption data, Mednick, Gabrielli and Hutchings (1984) report a statistically significant correlation between adoptees and their biological parents for property crimes, but not for violent crimes. They found no correlation between adoptees and their adoptive parents and no interaction effects between biological and adoptive parents' criminal convictions. In related work, they find no interaction effect between biological parent criminality and urban environment (Gabrielli and Mednick 1984). However, adopting parents' social class does seem to

[2] Our work is inspired by Björklund, Lindahl and Plug (2006) and their approach to identifying the effects of pre-birth and post-birth factors on intergenerational associations in education, earnings, and income.

[3] Rhee and Waldman's (2002) meta-analysis reports a somewhat larger number of studies (26), but they use a broader definition of antisocial behavior and report multiple publications of the same group of authors using the same data set. The major adoption studies, research teams, and data sets directly concerned with criminal behavior discussed in these two review articles are, for all intents and purposes, identical.

[4] These data were originally collected in order to study the heritability of schizophrenia (Kety et al. 1971).

dampen any inherited propensity towards criminal behavior, which speaks in favor of the existence of gene-environment interaction effects (Teilmann van Dusen et al. 1983).

Using the Stockholm data, Bohman (1978) found evidence of a genetic predisposition for alcohol abuse, but not for criminality. He argues that the parent-offspring associations in criminality observed in many studies (including earlier and concurrent adoption studies) may, in fact, be a byproduct of the familial nature of alcohol abuse. Bohman et al. (1982) reanalyzed a subset of this data (862 men) taking into account the type of crime committed and associations with alcohol abuse. They found that criminals who abused alcohol had higher rates of recidivism, longer jail sentences and had committed more violent crimes than criminals without alcohol problems. Non-alcoholic petty criminals had an excess of biological parents with records of petty crimes and no record of alcohol abuse. In contrast, the criminal behavior of violent, alcoholic criminals was uncorrelated with that of their biological and adoptive parents.[5]

Data sets used in adoption studies carried out in the United States are typically much smaller, more selective and frequently lack data on parent-offspring criminality (e.g., Crowe, 1974). Yet, these smaller samples often include valuable information concerning the adoption process, the characteristics of the rearing parents and environment, as well as parent-offspring diagnoses of personality disorders and manifestations of anti-social behavior other than criminal convictions.[6]

There are also a number of well known adoption studies published in the economics literature (e.g., Sacerdote 2002, Plug and Vijverberg 2003, Björklund et al. 2004, Plug 2004,

[5] Other studies that were generated by this project include (but are not limited to) Cloninger et al.'s (1982) study of gene-environment interaction effects and Sigvardsson et al.'s (1982) analysis of sex differences in offending and heritability.

[6] Using two independent samples of Iowa adoptees, Cadoret et al (1985) and Cadoret, Troughton and O'Gorman (1987), present evidence that both environmental and genetic factors influence alcohol abuse and antisocial personality in adult men. Cadoret, Cain and Crowe (1983) argue that gene-environment interaction effects are important for explaining the development of antisocial behavior among adolescents. Other related studies include Cadoret (1978), Cadoret and Cain (1980), Cadoret et al. (1990) and Cadoret and Stewart (1991).

Björklund et al. 2006, and Sacerdote 2007). These studies explore the importance of pre- and post-birth factors for explaining intergenerational associations in education and earnings.[7] Our own study is, in fact, closely related to this strand of literature, since there exists a clear connection between crime and the accumulation of human capital (Lochner 2004) that links outcomes of parents and children (Hjalmarsson and Lindquist 2011; Meghir, Palme and Schnabel 2011). As part of our sensitivity analysis, we use our data to replicate the findings from this literature concerning the intergenerational transmission of education. This enables us to make a direct comparison of the magnitudes of intergenerational associations in crime and education and allows us to assess the relative importance of pre- and post-birth factors across these two distinct outcomes.

The analysis presented in this paper is based on a newly constructed data set comprised of a large, nationally representative sample of individuals together with information on *all* adoptees. We have matched on all parents (biological and adoptive), brothers and sisters (biological and adopted), and children (biological and adopted). Official crime records for 1973 – 2007 have been matched on for each individual still alive and living in Sweden during this period. We also matched on register data concerning family structure, neighborhood, education, and income. Using this new data set, we can replicate the influential study of Mednick, Gabrielli and Hutchings (1984) on the whole population of adopted sons born in Sweden between 1943 and 1967; the reasons for this sample restriction are described in Section 4.

In addition, we make several original contributions to the literature. First, the data include all adopted sons born in Sweden between 1943 and 1967, so we can study later cohorts of adoptees (i.e., born after the 1940s) who have grown up in more recent, higher crime

[7] See Björklund and Jäntti (2009), Black and Devereux (2010), Sacerdote (2010) and Holmlund et al. (forthcoming) for reviews of this and related literature.

environments. Second, we have 35 years of crime data, while the Danish adoptee data includes only three years of crime data, which, as discussed in the text, can potentially yield biases due to measurement error. Third, we have detailed information about where individuals reside over time, which can be important if, for example, a parent lives in the countryside and her offspring lives in a big city with significantly higher opportunities for crime or higher detection and conviction rates.

Fourth, and most importantly, we did *not* construct this data set as an adoption cohort. That is, contrary to previous adoption studies, it is not a sample of adoptees only. Thus, we will be able to speak more directly to the question of the generalizability of our results to the population at large. We use adoptees and the classic adoption design, while at the same time running parallel experiments using a representative sample of biological parents and their own-birth children. Under certain assumptions – spelled out in Section 3 – we can generalize our findings concerning the relative importance of pre-birth and post-birth factors to the population at large.[8] This is important since the relevance of the findings from adoption studies for the development of theory and informing social policy largely depends on their generalizability.

We first estimate a simple linear additive model. When defining crime at the extensive margin (i.e., whether an individual has *any* criminal convictions), we find that both pre-birth and post-birth factors are important determinants of sons' convictions. Mothers and fathers contribute equally through pre-birth and post-birth factors.

[8] The same cannot be said for previous adoption studies. For example, Crowe (1974) starts with a sample of 52 children, who were adopted away at birth, of incarcerated women in Iowa. Given that in all societies, few women go so far in their behavior that they end up in jail, Baker, Mack, Moffitt and Mednick (1989) conclude that convicted women have a stronger genetic predisposition than convicted men. This may imply that adopted away children also have a particularly high predisposition. This is not problematic if one simply wants to use these children as a test of the potential importance of inherited traits (as Crowe 1974 does), but it is problematic if one wants to make statements about the relative importance of pre- and post-birth factors for the whole population.

This finding stands in stark contrast to the current state of the adoption-crime literature as characterized, for example, by Bohman et al. (1982) and Mednick et al. (1984). As far as we know, ours is the first study to report positive correlations between adopted sons' and adoptive parents' criminal behaviors. Our explanation for this important difference in findings is quite simple. We believe that it is primarily due to measurement error, which has biased previous estimates of the correlation between adopted children's crime and their adopting parents' crime towards zero. To demonstrate the plausibility of this explanation, we re-estimate our model using only 3 years of crime data (similar to Mednick et al. 1984) as opposed to our full 35 years of data. When we do this, our estimates of the influence of adopting parents' convictions on their adopted children's convictions become zeros, which is similar to what we see in the rest of the adoption-crime literature.

The importance of both the biological and adoptive parents also persists when we define crime at the intensive margin (i.e., whether an individual is convicted of two or more offenses). However, at the intensive margin, post-birth channels appear to be more important than pre-birth channels. The role played by adoptive mothers appears to be particularly important.

We then go on to study interaction effects. We find little evidence of interaction effects between biological and adoptive parents' criminal convictions. But we do find evidence of a pre-birth/post-birth interaction effect between biological parents' criminality and adoptive parents' education. In particular, having a more highly educated adoptive mother appears to mitigate the impact of biological parents' criminality.

The remainder of this paper is organized as follows. Section 2 defines pre-birth and post-birth effects and briefly discusses some of the related literature. In Section 3, we present our statistical models of intergenerational transmission and discuss issues of identification. Section 4 describes the adoption process in Sweden, our data set, and the creation of the adoption and non-

adoption samples. It also provides descriptive statistics. Basic results from the linear model are presented in Section 5. In Section 6, we run an extensive set of sensitivity analyses. Section 7 investigates pre-birth/post-birth interaction effects. Section 8 concludes.

## 2 Theory and Related Literature

### 2.1 Pre-birth Factors

What are pre-birth factors and why do we believe that they may be important for the reproduction of crime from one generation to the next? Pre-birth factors are the sum of genetic influences, prenatal conditions and perinatal factors, plus all potential interaction effects. Prenatal conditions include intrauterine environmental factors. Perinatal factors include obstetric complications and health problems arising shortly after birth.

Smoking, drinking, taking drugs and poor nutrition during pregnancy are well known examples of maternal behaviors (or circumstances) that worsen the intrauterine environment of an unborn child and are believed to cause fetal neural mal-development in early pregnancy. Fetal alcohol syndrome, for example, is a known cause of mental retardation (Abel and Sokel 1987). It is also believed to play a role in serious psychiatric and development disorders (Famy et al. 1998). Maternal smoking is considered to be the single most important preventable cause of low birth weight (Almond and Currie 2010). Fetal exposure to environmental toxins such as lead (Hu et al. 2006), mercury (Murata et al. 2004) and low levels of radiation (Almond, Edlund and Palme 2009) have all been shown to have measurable effects on children's health and cognitive abilities.[9]

[9] For brief reviews of the economics literature concerning the "fetal origins" hypothesis, see Almond (2006) and Almond and Currie (2010).

Infectious diseases contracted by the mother while pregnant may also affect mental and physical health later in life. For example, Brown (2006) lists several infectious diseases that are known correlates of schizophrenia in children who were exposed to them *in utero*. Almond and Mazumder (2005) demonstrate the negative, long-term health effects of *in utero* exposure to the 1918 influenza pandemic. Cohorts that were *in utero* during the pandemic tended to have less education, lower income and higher incarceration rates as adults (Almond 2006).

In sum, there are a number of intrauterine environmental factors that are directly related to a child's birth weight, mental and physical health, and cognitive abilities. All of these factors are known correlates of antisocial behavior, including crime. This is why many researchers believe that poor intrauterine environments may play a role in the etiology of criminal behavior (see, e.g., Mednick and Kandel 1988 and Raine 1993).[10]

Several researchers have also reported positive correlations between obstetric complications and behavioral disorders among children and criminal and violent behavior among adults.[11] However, this connection appears to be driven by individuals with behavioral diagnoses (such as hyperactivity) and cases where parents were suffering from mental illness. It is not yet clear whether hyperactivity (for example) is caused by obstetric complications or if it is a separate condition that is merely correlated with difficult births. Thus, it may be premature to conclude that difficult births (per se) are linked to antisocial behavior. The poor behavioral outcomes of the children and adults in these studies could (instead) be due to poor intrauterine environments or to genetics. Having said this, we do know for a fact that some obstetric

[10] Although the adverse effects of a poor intrauterine environment are normally labeled as "biological" factors, some factors that affect the intrauterine environment, such as twining, may be due to a mother's genetic predisposition. Also, medical researchers believe that intrauterine environmental factors may affect the expression of genetic predispositions for certain health outcomes (see, e.g., Gluckman et al. 2008).

[11] See Mednick and Kandel (1988) and Raine (1993) for brief reviews of this literature.

complications (such as oxygen deficiency during birth) can have permanent, detrimental effects on children's mental and physical health.[12]

Since we are trying to explain the observed associations in crime between parents and their offspring, we must be careful when thinking about pre-birth factors such as prenatal environment and obstetric complications. Purely random effects (such as the 1918 influenza pandemic or radioactive fallout from Chernobyl) that affect unborn children, but are unrelated to a mother's own health status or behavior, will weaken, not strengthen, parent-offspring associations in antisocial behavior. In contrast, a drug using mother's behavior may hurt her child in a way that makes it more likely that her child also uses drugs or exhibits antisocial behavior.

Pre-birth factors also include genetically inherited traits, conditions and disorders. It is typically assumed that the only contribution made by the biological father to the development of criminal behavior in his adopted-away child is a genetic one.[13] The biological mother, on the other hand, may affect her child's future behavior through genes, prenatal environment and perinatal conditions.

A large number of conditions and mental disorders are known correlates of criminal behavior and are believed to be (at least partially) genetically inherited. These include (but are not limited to) autism (Lauritsen and Ewald 2001), schizophrenia (Kendler and Diehl 1993), alcoholism (Bohman 1978), attention deficit hyperactivity disorder (Cadoret and Stewart 1991), aggression (Cairns 1996), reading disorders (Castles et al. 1999) and low cognitive abilities

[12] Oxygen deficiency just before or during delivery can lead to permanent brain damage, which has been shown by several studies to be associated with greater attention deficits and hyperactivity (e.g., O'Dougherty, Nuechterlein, & Drew 1984). Obstetric complications have also been linked to autism (Deykin and MacMahon 1980).

[13] Of course, if the biological father is living with the biological mother, then he could exert influence over the intrauterine environment by facilitating the biological mother's alcohol or drug abuse, through abusive behavior or by exposing the mother to second-hand cigarette smoke.

(McClearn et al. 1997, Plomin 2003).[14] Thus, genes may affect the chance of developing one (or more) of these conditions. In turn, these types of conditions/disorders tend to raise one's propensity to engage in antisocial behavior and crime (see, e.g., Moffitt and Mednick 1988, Bock and Goode 1996 and Raine 1993).[15]

Family resemblances in personality traits and personality disorders may also be partly due to genetics (Cadoret et al. 1985, Cadoret et al. 1987, Loehlin 2005). For instance, genetics may partially determine preferences for giving, risk taking and overconfidence (Cesarini et al. 2009a, Cesarini et al. 2009b) or the propensity to trust others (Reuter et al. 2009). While we know that some personality disorders are related to (and, in some cases, even defined as) antisocial behavior, one could also hypothesize that even more ordinary personality traits such as generosity, trust and self-confidence may also play a role in determining an individual's propensity to commit crimes.

### 2.2 Post-birth Factors

Most social scientists and psychologists tend to think of the etiology of crime in terms of post-birth factors. These include social mechanisms (e.g., poverty), behavioral mechanisms (e.g., role modeling), psychological mechanisms (e.g., childhood traumas and abuse) and biological mechanisms occurring well after birth (e.g., a head injury or exposure to environmental toxins, such as lead). The mechanisms that are most relevant in this context are those that can help explain criminal behavior and, at the same time, generate parent-offspring correlations.

[14] Sacredote (2010) gives a concise review of the main findings within the voluminous behavioral genetics literature that measures the contributions of genes and family environment to IQ.
[15] In a simple human capital model of crime, learning ability that is partially inherited from one's parents gives rise to intergenerational correlations in education, earnings and crime (Hjalmarsson and Lindquist 2011).

One such mechanism is that having criminal parents decreases the relative costs of committing a crime, either because there is less stigma associated with having a criminal record or because parental criminality weakens the family's bonds (ties) with legitimate society. Sanctions imposed on a parent as a result of their criminal activity can also affect children's participation in criminal activities. Incarcerating a parent, for instance, can lower the needs-adjusted family income if the parent is a net contributor, yield stigma and decreased supervision for a child, and be a generally disruptive, traumatizing event for a child, which according to strain theory (Agnew, 1992) could increase a child's criminal activity. On the other hand, incarcerating a parent may decrease a child's criminal activity by removing a bad role model, or if this results in the child updating his beliefs about the expected relative cost of crime, and/or by increasing the needs-adjusted family income (if the incarcerated parent was not a net contributor).

Social learning theory posits that individuals learn to engage in crimes through their associations with others, such as peers, classmates, neighbors, and families. Parents, in particular, can serve as role models for their children. They can teach their children (either explicitly or by example) beliefs that are favorable to crime, instead of teaching them that crime is wrong.[16] Social learning is the predominant theory used to explain, for example, the intergenerational transmission of intimate partner violence (Hines and Saudino, 2002). Alternatively, there may be a direct transference of specific criminal capital where, for instance, children are introduced into the parent's networks for obtaining/selling drugs or learn from their parents how to steal a car.[17]

[16] Duncan et. al. (2005) stress the importance of parents as role models for their children. Hjalmarsson and Lindquist (2011) conduct two exercises aimed at testing for potential role model effects. The first exercise focuses on the timing of the father's crime. The second exercise examines whether the intergenerational criminal relationship varies with the quality of the father – child relationship. The results from these two exercises provide indirect evidence that role modeling may play a role in the reproduction of crime from one generation to the next.

[17] See Bayer et. al (2009) for evidence of the transference of crime specific capital amongst peers. See also Butterfield's (2002) *New York Times* article entitled, "Father Steals Best: Crime in an American Family".

Parental investments in their children's human capital may also generate correlations in criminal activity (Hjalmarsson and Lindquist 2011). Individuals who are endowed with higher schooling from their parents will be most likely to continue investing more in schooling, earn higher wages, and commit fewer crimes. They (and their parents) commit fewer crimes since both generations have higher opportunity costs associated with criminal activity and incarceration. Thus, intergenerational criminal correlations may arise because socioeconomic status is correlated across generations.[18] Neighborhood environments can also generate intergenerational correlations in crime (Hjalmarsson and Lindquist 2011).[19]

## 3 Intergenerational Transmission Models

### 3.1 Linear Model: Identifying Pre- and Post-birth Effects

Equation (1) depicts the typical model used by researchers studying intergenerational criminality.

$$C_j^{bc} = \beta_0 + \beta_1 C_j^{bp} + \nu_j^{bc} \quad (1)$$

Measures of criminal convictions for biological children (superscript *bc*) and their biological parents (superscript *bp*) in family *j* are given by $C_j^{bc}$ and $C_j^{bp}$, respectively. $\beta_1$ indicates the strength of the intergenerational correlation and represents the total effect of the many pre- and post-birth mechanisms described above. We take advantage of the fact that we have crime data for both biological and adoptive parents of adopted children to decompose this correlation into

[18] We know of two studies within economics that measure the causal impact of parents' socio-economic status on children's crime. Akee et al. (2010) demonstrate that parental income has a causal impact that lowers the probability of minor offences among children and lowers the likelihood that a child self-reports that he/she has sold drugs. Meghir, Palme and Schnabel (2011) show that parental education has a negative causal impact on children's crime.

[19] Evidence concerning the importance of neighborhoods is provided by Ludwig, Duncan and Hirschfield's (2001) and Kling, Ludwig and Katz's (2005) analyses of the Moving to Opportunity experiment. For instance, the latter finds that, relative to control groups, the offer to relocate to lower-poverty areas reduces arrests among female youths for violent and property crimes and arrests among male youths for violent crimes, though an increase in property crime and other problem behaviors was also observed for males. Even biological determinants of anti-social behavior, such as lead poisoning, may be shared by parents and offspring living in the same toxic environment (Reyes 2007, Currie 2010).

the share due to pre-birth factors and that due to post-birth factors. Specifically, for a sample of adopted individuals, we estimate the following linear, additive model, where criminal convictions for adopted children (superscript *ac*) and their adoptive parents (superscript *ap*) in family *i* are given by $C_i^{ac}$ and $C_i^{ap}$, respectively. The terms $\nu_j^{bc}$ and $\nu_i^{ac}$ are regression error terms.

$$C_i^{ac} = \alpha_0 + \alpha_1 C_j^{bp} + \alpha_2 C_i^{ap} + \nu_i^{ac} \quad (2)$$

Due to large gender differences in criminal convictions and the fact that crime is a predominantly male behavior, equations (1) and (2) are only estimated for sons. Year of birth dummies for sons and each parent are included in the regression to account for the effect of different crime and conviction rates over time and at different stages of the life-cycle. Similarly, we control for county of residence dummies at 5-year intervals for sons and each parent to account for variations in crime and conviction rates across geographic areas and over time.

Under certain assumptions (discussed directly below), $\alpha_1$ and $\alpha_2$ are direct measures of the pre-birth and post-birth effects, respectively. Furthermore, if our simple, linear additive model is approximately correct, then the sum of $\alpha_1$ and $\alpha_2$ should equal $\beta_1$.

### 3.2 Identification Issues

To interpret $\alpha_1$ and $\alpha_2$ in Equation (2) as pre- and post-birth factors, we have to make two assumptions. First, we assume that adoptees are randomly assigned to families or that they are assigned to families according to rules/characteristics that we as researchers can observe and control for. If adoption agencies use information about the biological parents to match children to adoptive parents, then the pre- and post-birth characteristics will be correlated, yielding biased coefficients. Second, we assume that children move immediately to their adopting family. If this

assumption is violated, i.e. children do not move until after they are one year old, for instance, then it is possible that the estimated pre-birth effects are too high since they capture some of the post-birth environment; in contrast, the estimated post-birth effects will be too low.

To compare $\beta_1$ with $(\alpha_1 + \alpha_2)$, we must make three additional assumptions. First, biological and adopted children are drawn from the same distribution of children. That is, adopted away children have the same pre-birth characteristics as own-birth children. Second, biological and adopting parents are drawn from the same distribution of parents. That is, adoptive parents provide the same post-birth environment as own-birth parents. Third, parents treat adopted and own-birth children similarly.

Many of these assumptions are easily violated. Thus, Section 6 discusses the extent to which the first four assumptions are satisfied and the potential sensitivity of the baseline results to violations of these assumptions.[20]

### 3.3 Nonlinear Models: Interaction Effects

We then extend equation (2) to allow for possible interactions of pre- and post-birth factors.

$$C_i^{ac} = \alpha_0 + \alpha_1 C_j^{bp} + \alpha_2 C_i^{ap} + \alpha_3 C_j^{bp} C_i^{ap} + u_i^{ac} \quad (3)$$

If the interaction coefficient, $\alpha_3$, in equation (3) is positive, then this indicates that pre- and post-birth factors are complements in the production of child criminality. That is, children with

[20] Unfortunately, due to data limitations, we cannot directly test the last assumption. As done by Björklund, Lindahl and Plug (2006), one can potentially test the assumption that parents treat adopted and biological children the same by restricting the analysis to families with both adopted and biological children and comparing the intergenerational correlations. However, we do not pursue this analysis since the sample of such families is relatively small, particularly if one takes into account the fact that we are only studying males and that the guidelines followed by the Swedish authorities indicated that children up for adoption should be placed with families without biological children (and who do not expect to have such children in the future). Thus, families with both biological and adopted children may not be representative of adoptive families in general.

criminal birth parents who are adopted by criminal adoptive parents are even more likely to become criminal than a similar child who is adopted by non-criminal parents.

However, an adoptive parent's criminality may not be the only relevant variable through which a non-linear effect can occur. Thus, we explore interaction effects between pre-birth factors and other post-birth, environmental factors, such as education. The question that we want to address is whether or not such post-birth characteristics can offset the effects of pre-birth characteristics? How malleable are the effects of inherited traits with respect to environmental interventions? Equation (4) extends equation (2) to allow for an interaction between the criminal record of the birth parent and characteristics of the adoptive parent, $X^{ap}$.

$$C_i^{ac} = \alpha_0 + \alpha_1 C_j^{bp} + \alpha_2 C_i^{ap} + \alpha_3 C_j^{bp} X_i^{ap} + \alpha_4 X_i^{ap} + \eta_i^{ac} \quad (4)$$

For comparison purposes, we will also estimate equation (5) for own-birth children, where $X_j^{bp}$ represents post-birth, environmental characteristics of their parents.

$$C_j^{bc} = \beta_0 + \beta_1 C_j^{bp} + \beta_2 C_j^{bp} X_j^{bp} + \beta_3 X_j^{bp} + \eta_j^{bc} \quad (5)$$

## 4 Institutions and Data

### 4.1 Adoptions in Sweden

In this subsection, we present a brief overview of the Swedish adoption process. Since the adoptees used in this study are all born in Sweden between 1943 and 1967, we concentrate on the adoption rules and regulations for native born children during this time period.[21] We are particularly interested in three aspects of this process: (i) the timing of the child's placement in the adoptive home, (ii) the selection process used to match children with prospective parents, and

[21] Our description is based primarily on information taken from three sources: Almänna Barnhuset (1955), Bohman (1970) and Nordlöf (2001).

(iii) the populations from which these two groups are drawn. These aspects of the process speak directly to the identification strategy used in this and other adoption studies.

In Sweden, private adoptions are not allowed. All adoptions are decided by the court, which is required to take into account the advice of the local social authorities concerning the suitability of the prospective adopting parents. The placement should be in the child's best interest and no payments were required or allowed from the adopting parents. The biological mother and father must both give their consent if they are married; if the mother is unwed (which was typical), then only her consent was needed.

Adoption of small children was done anonymously.[22] However, the identities of the biological parents (when known) and adopting parents are all recorded in the court decision and kept in the census records as well. In fact, one of the first jobs of the adoption agency's social worker assigned to the case was to attempt to identify the biological father. This is how we can link adopted children to their biological and adopting parents.

There were very few explicit legal requirements concerning who was eligible to adopt a child. Adopting parents had to be at least 25 years old and free of tuberculosis or sexually transmitted diseases. Adoption by relatives was allowed, but very rare (Nordlöf 2001). Informally, the local social authorities used the following rules and recommendations. The adopting family must have adequate housing and the adopting father should have a steady income. The couple should be legally married and the adopting mother should be able to stay at home, at least while the child was small. The adopting couple should not have any biological

[22] Until 1959, adoptions in Sweden were so-called "weak" adoptions. That is, not all ties between the biological parents and their adopted away child were permanently cut. Biological parents still had a legal responsibility to support the child economically if the new, adopting family could not. Furthermore, the adopted child would still inherit from his/her biological parents. The legalities concerning weak adoptions, however, did not lead to any direct contact between the adopted away child and his/her biological parents. Starting in 1959, all legal ties between biological parents and their adopted away children were permanently cut. From then on, only "strong" adoptions were allowed. In 1971, all weak (pre-1959) adoptions were turned into strong adoptions.

children and it should be highly unlikely that they could in the future. The adopting parents should not be too old; it should be feasible that the mother is the child's biological mother.

The social authorities recommended not placing children with parents with alcohol problems, mental illness or who were engaged in criminal activities. However, prior criminal convictions or drunken incidents did not always preclude parents from adopting. The guidelines stated that a single drunken incident or petty shoplifting when younger, for example, should not necessarily be grounds for denying a prospective parent the opportunity to adopt. The guidelines recommended looking at the number and types of offenses together with how much time had elapsed since the last offense. Convicted sex offenders, however, were not allowed to adopt.

In their guidelines to social workers, the central social authority (*Socialstyrelsen*) argues that children should never be placed into a particular home at random – not even after conditioning on household income and marital stability. Whenever possible, the social authorities wanted to match children based on their biological parents' intellectual capabilities (i.e., the social worker's subjective opinion concerning intellectual abilities, talents, etc.) and physical appearance (e.g., hair color, eye color, height, etc.). Their hope was that parents would "recognize" themselves in their adopted child and that the child would feel a sense of belonging.

However, after conditioning on a set of readily observables characteristics (age, marital status, income and education), the evaluation literature (reviewed in Bohman 1970) finds no evidence that the social authorities were able to predict which parents would provide the needed emotional environment. It was hard to say *ex ante* who would grow into their role as a parent and who would not. The evaluation literature also argues that it is actually these types of less well defined variables (emotional environment, parenting skills, marital harmony, etc.) that are correlated with adopted children's maladjustment, school performance and anti-social behavior;

adoptive parents income, education, etc. are not (Bohman 1970). In this sense, many important "environmental" factors are conditionally randomly assigned to children.[23]

There were four alternative initial placement strategies for newborn children. Babies were either placed in a special nursery, in a home for unwed mothers, in temporary foster care, or directly in the home of the adopting family. The relative importance of these four types of placement changed over time. In Stockholm County, for example, the share of babies placed in a nursery before reaching their adopting family rose from 15 percent in 1940 to 86 percent in 1973, while the share placed directly in the adopting family fell from 62 to 7 percent (Nordlöf 2001). The share placed in homes for unwed mothers fell from 12 to 4 percent and the share placed in temporary foster care fell from 11 to 3 percent (Nordlöf 2001).

The share of children in Stockholm County that were permanently placed in their adoptive homes before age one rose between 1940 and 1973 from 63 to 83 percent (Nordlöf 2001). The share of children arriving at their permanent adopting home between ages one and two fell from 16 to 11 percent and ages two and three from 10 to 3 percent (Nordlöf 2001). Thus, 90 – 97 percent of all children were permanently placed before age three during this time period.[24]

In general, children born to single, unwed mothers had lower birth weights and poorer health outcomes (Bohman 1970). But prior to 1970, children with visible handicaps, severe health problems or whose parents suffered from severe cases of mental illness, alcoholism or

[23] One example of this is that prospective parents were interviewed on health issues and marital harmony. The explicit goal of these interviews was to place children in stable homes with lower chances of dissolution due to death or divorce. Despite these efforts, the sample studied by Bohman (1970) experienced the same rate of parental death and divorce as the population at large and the same rate as the sample of parents who were approved as adoptive parents, but for some reason or another did not end up with an adopted child.

[24] The actual placement guidelines in 1945 suggested that a child should be adopted at age one after a six month trial period in the home. In 1968, the guidelines suggested that the baby should be placed with its new family at age 3 – 6 months and be adopted 3 – 4 months later. When these guidelines were not followed, the tendency was to place the baby earlier (rather than later) with the adopting family (Nordlöf 2001). Note also that some adoptees may be misclassified as "late" adoptees, because they were first placed in a foster home and later adopted by their foster parents (Bohman 1970).

criminality were not always put up for adoption. In many instances, these children were either put into foster care or institutional care. This means that those children who were put up for adoption were a positively selected group from a somewhat negatively selected pool of children (in terms of birth weight, health outcomes and parental histories). The sample of adoptees studied by Bohman (1970), for example, had the same average birth weight and health outcomes (at ages 10 – 11) as their non-adopted peers in school.

### 4.2 The Data Set and Descriptive Statistics

The data used in this paper were assembled as follows. Statistics Sweden began by drawing a 25 percent random sample from Sweden's Multigenerational Register, which includes all persons born from 1932 onwards who have lived in Sweden at any time since 1961. Statistics Sweden also identified *all* individuals adopted by at least one parent in Sweden. Mothers and fathers, brothers and sisters, and children of each adopted individual as well as each index person in the 25 percent random sample were matched onto the sample. This resulted in a total sample size of 7,551,519 individuals.

Since adoption in Sweden is a centralized legal procedure, the registry data identifies whether a person has been adopted and identifies all adoptive mothers and fathers. For adoptees born in Sweden, we can also identify approximately 64% of their biological mothers and 41% of biological fathers. Longitudinal data concerning, for example, income, education, and geographical location for each individual were then matched on to this sample.

The data set created by Statistics Sweden was then matched with Sweden's official crime register by Sweden's National Council for Crime Prevention. Thus, for all 7.5 million people in our data set, we also have a full record of their criminal convictions for the years 1973 to 2007. We use this data to construct a number of crime variables. The first variable, *crime*, is a measure

of crime at the extensive margin. That is, it is equal to one if a person has ever been convicted of a crime between 1973 and 2007 and zero if he has not. The next three variables consider the types of crimes committed: violent, property, and other. We create variables indicating whether a person has been convicted of each of these three types of crimes between 1973 and 2007.[25] We also create variables that indicate whether each individual has been convicted of two or more crimes, i.e. an intensive margin measure of crime.

One conviction may include several crimes. Our crime type variables are created by looking over all of the crimes within a single conviction.[26] Speeding tickets, parking tickets and other forms of minor disturbances (ticketable offenses) are not included in our crime measure. It must be an offense that is serious enough to be taken up in court and that results in an admission of guilt or a guilty verdict.

We create two samples – an adoptive sample and a non-adoptive sample – that are used in our baseline analyses. Table 1 lists the sample restrictions that we impose and the corresponding impacts on sample sizes. Our raw data set contains 7,408,029 non-adopted individuals (including index and non-index persons) and 143,490 individuals adopted by at least one parent. Restricting our adoption sample to those adopted by both parents reduces it to 91,447 individuals. Further restricting the sample to those for whom *both* the biological mother and father are identified decreases the adoption sample to 12,296 individuals.[27] We create our non-adoption sample by

[25] Violent crimes, or crimes against persons, are crimes covered by chapters 3-7 in the Swedish criminal code (*brottsbalken*). Property crimes are those included in chapters 8-12 in the criminal code. These are standard definitions used by Sweden's National Council for Crime Prevention. All remaining crimes are labeled as "other". The 5 most common violent crimes are (in order of frequency) assault, molestation, unlawful threat, aggravated assault and aggravated unlawful threat. The 5 most common property crimes are petty theft (mainly shoplifting), theft, vandalism, larceny and fraud. The 5 most common "other" crimes are dangerous driving, driving without a license, unlawful driving, smuggling and minor narcotic offenses.

[26] Thus, if you steal a car, then commit an armed robbery and then get caught after a high-speed chase, you will have one trial and one sentence that include convictions for at least three crime types. In this case, the individual would receive violent = 1 (armed robbery), property = 1 (car theft), and other = 1 (serious traffic offense + resisting arrest).

[27] Section 6.3 addresses the concern that excluding the relatively large proportion of adoptions with unknown biological fathers affects the representativeness of our sample.

first restricting the sample to the 2,448,397 index persons. Further restricting the non-adoption sample to those with both biological parents identified reduces the sample size to 1,995,876.

For both the adoption and non-adoption samples, we impose the following additional restrictions. Because many of the adoptees with non-identified biological parents are born outside Sweden, we eliminate all immigrants. This decreases the adoption sample to 12,226 and the non-adoption sample to 1,896,197. We then eliminate individuals born in 1968 or later, which decreases the non-adoption sample to 849,378 and the adoption sample to 9,553. We choose this year as our cutoff because (i) the birth control pill was approved in 1965 and (ii) legal abortions were gradually introduced in Sweden from 1965 to 1975. As a result of these medical and legal changes, biological parents of adopted away children became more negatively selected over time.[28] As seen in Appendix Table 1, however, our results are quite robust to the birth year chosen to define our sample.

We also omit individuals born before 1943, as parents of these individuals are quite possibly too old to have a criminal record from 1973 to 2007. Children who died or emigrated from Sweden before 1974 are dropped from the sample, as they cannot show up in the crime data. Likewise, we omit any child who had at least one parent (biological or adoptive) die or emigrate from Sweden before 1974. Finally, restricting our data to males yields a non-adoption sample of 312,747 males and an adoption sample of 4,061 males.

Descriptive statistics are shown in Table 2. The first panel presents statistics for the samples of own-birth (non-adopted) and adopted children. Consistent with the literature that finds that adopted children generally have worse outcomes, we see that adopted sons are more

[28] Around 1967 in our data, we see a marked decrease in the average education levels of the biological parents of adopted children relative to the average education level among parents with own-birth children, while the relative education level of adoptive parents is quite stable over time. Similarly, we see an increase in the criminal records of biological parents of adopted away children, but not for other parents. These results are available from the authors upon request.

criminal than own-birth sons. A staggering 51% of adopted sons have been convicted, while "only" 36% of own-birth sons have been convicted.[29, 30] Adopted children also have higher conviction rates than own-birth children in each of the three crime categories. Likewise, 34% of adopted sons compared to 21% of own-birth sons are convicted of two or more crimes. Finally, adopted children in our sample are approximately two years younger than own-birth children.

The middle panel of Table 2 presents comparable statistics for the birth parents of both own-birth and adopted sons. For adopted children, 16% of biological mothers and 41% of biological fathers have a conviction; this compares to 6 and 19% of biological mothers and fathers for own-birth children. These differences are also observed within each crime category and at the intensive margin. Note that because we are studying sons born between 1943 and 1967 and because our crime data begins in 1973, all parental crime variables in our study capture crimes committed *after* the birth of the child.

Finally, the average ages in 1973 of birth mothers and fathers of own-birth children are approximately 46 and 49, respectively. Birth parents of adoptive children are somewhat younger; the average age of biological mothers is 39 while that of fathers is 43. The bottom panel presents the corresponding statistics for adoptive parents. Just 5% of adoptive mothers have a criminal conviction while 14% of adoptive fathers have a record; very few adoptive parents have a violent crime conviction. Only 1% and 4% of adoptive mothers and fathers, respectively, have

[29] Though these conviction rates may sound high, they are in line with that found in previous research. Using the Stockholm Birth Cohort data, Hjalmarsson and Lindquist (2011) also report that 33% of males born in 1953 and living in Stockholm in 1963 have a criminal record.

[30] One potential concern is that our sample selection procedure yields adoption and own-birth samples that are not representative of the population in terms of crime rates. When considering males born between 1943 and 1967, we find that 51.2% of adopted males who are included in our sample have at least one conviction compared to a conviction rate of 47.9% for adopted males who are excluded from our sample. This difference, however, is completely accounted for by the year of birth. Similarly, own-birth index males who are included in our sample have a higher conviction rate than those that are excluded (36.4% versus 30.9%). This difference is partially explained by variation in the year of birth across the two samples. But, it is also important to point out that the excluded own-birth sample actually has a higher conviction rate for violent crime than the included sample (7.3% versus 6.8%).

convictions of two or more crimes. Finally, adoptive mothers and fathers are approximately 49 and 51 in 1973, respectively.

Taken together, these statistics indicate that adopted children come from a negatively selected group of biological parents (i.e., who are more criminal than the birth parents of own-birth children) and are adopted by a positively selected group of parents (i.e., who are less criminal than the birth parents of own-birth children). They also highlight the importance of controlling for year of birth in the empirical specifications, as adopted children tend to be younger than own-birth children and adoptive parents tend to be older than biological parents.[31]

## 5 Basic Results: The Linear Model

### 5.1 The Linear Model for Crime at the Extensive Margin

Table 3 presents the intergenerational transmission estimates for our aggregate measure of criminal convictions at the extensive margin separately for own-birth and adopted children. All regressions include year of birth dummies and county of residence dummies (at 5 year intervals) for all individuals included in the regressions, though for the ease of presentation, these coefficients are not reported.

The top panel of Table 3 presents the results of estimating equation (1) for own-birth children. Overall, these specifications indicate that more criminal parents (mothers and fathers) have more criminal sons. Having a father with at least one conviction increases the sons' chance of conviction by 12.1 percentage points (column 1) while a criminal mother increases his chance of conviction by 13.4 percentage points (column 2). When both the father and mother are simultaneously included (column 3), the mother's effect decreases just slightly to 11.5 percentage

[31] We also see some evidence that the birth parents of adopted children are slightly negatively selected in terms of their average education and income levels. In contrast, adoptive parents are slightly positively selected in terms of education and income.

points and that of the father to 11.3 percentage points. These decreases indicate that there is some assortative mating with respect to crime. But these decreases are relatively small, suggesting that such sorting may occur less with respect to crime than other dimensions, such as education. Thus, the criminal records of the mother and father appear to play equally important roles in determining the son's likelihood of having a criminal record.

The middle panel of Table 3 presents the results of estimating equation (2) for the sample of adopted sons. Column (1) shows that the criminal records of the biological and adoptive fathers have approximately equal effects (0.072 and 0.089, respectively). Column (2) finds that the criminal records of the biological and adoptive mothers also have approximately equal, and highly significant, effects on the son's criminal record (0.108 and 0.132). In addition, the mother coefficients are 50% larger than the corresponding father coefficients (i.e., biological mother versus biological father and adoptive mother versus adoptive father); however, these differences are not statistically significant. Including all parents simultaneously (column (3)) minimally affects the coefficients. Though the adoptive parent coefficients increase somewhat and those on the biological parents decrease somewhat, the standard errors are large enough such that these coefficients do not significantly differ from each other.

The result that both adoptive mothers and fathers matter sharply contrasts the findings of Mednick, Gabrielli, and Hutchings (1984), who find no relationship between the criminal records of adoptees and their adoptive parents. One possible explanation for this important difference is that the Danish adoption data set only contains three years of crime records. Given that adoptive parents tend to be positively selected in terms of criminality and that, for the adoptive parents, crime is not being measured at the peak of the crime lifecycle, it is likely that there is a substantial amount of measurement error introduced into the Danish measures of adoptive parent crime. We explored the feasibility of this explanation by "worsening" our data. In particular, we

create crime measures that are based on just 3-year time periods (1974-76, 1984-86, 1994-96, and 2004-06) and then re-run our baseline linear model. All of the estimates become substantially noisier; significant adoptive father effects are found only when crime is measured from 1984-86 and significant adoptive mother effects are never found.[32]

In the bottom panel of Table 3, we report the sums of the biological and adoptive parent coefficients and the corresponding standard errors and confidence intervals. The sums of the biological and adoptive father coefficients do not significantly differ from the own-birth biological father coefficient. However, the sums of the mother coefficients tend to be somewhat larger than the own-birth mother coefficients; the own-birth mother coefficient falls just outside the 95% confidence interval around the sums.

There are a number of lessons that can be taken away from these adoption results. First, biological mothers and fathers matter. Second, the criminal records of both adoptive mothers and fathers matter; the adoptive mother appears particularly important. The third lesson is based on a comparison of the strength of the adoptive and biological coefficients. Pre- and post-birth maternal factors are equally important. That is, a mother's influence on her son's criminality occurs equally through pre- and post-birth channels. Similarly, pre- and post-birth paternal channels are equally important. The fourth lesson indicates that the act of being adopted has minimal impact on the strength of the father-son intergenerational criminal relationship, as the total impact of the biological and adoptive fathers' criminality on the criminality of the adopted sons is very similar to the impact of the criminality of the biological fathers on that of their biological sons. However, the sums of the biological and adoptive mother coefficients are somewhat larger than the mother coefficients for own-birth children (we return to this result in Section 6).

[32] Results are available from the authors upon request.

### 5.2 The Linear Model for Crime at the Extensive Margin Across Crime Categories

Table 4 presents extensive margin results by crime type for our three sub-categories of crime: violent, property, and other. We begin with the results for own-birth children. First, we see that mothers and fathers have an approximately equal impact in all three crime categories. Having a violent mother increases the likelihood that the son has a conviction for a violent crime by approximately 13 percentage points while having a violent father increases the likelihood by about 12 percentage points. For property crimes, the corresponding intergenerational relationship for both mothers and fathers is an impact of about 15 percentage points while it is 10 percentage points for other crimes. Therefore, the same pattern is seen across crime categories as when looking at overall convictions – the criminal records of mothers and fathers are equally important.

The middle panel of Table 4 presents the results of estimating equation (2) for the sample of adopted sons for each crime category. Biological fathers play a significant role in each crime category. Having a biological father convicted of a violent crime increases the likelihood that the son has such a conviction by 6.9 percentage points.[33] Violent criminal convictions of the adoptive father, on the other hand, do not play a significant role. (It is important to recall, however, that the proportion of adoptive fathers with a violent criminal record is extremely low.)

The same pattern (important biological father, unimportant adoptive father) is also seen for property crimes, with a biological father coefficient of 0.098. For the 'other' crime category, we see that *both* biological and adoptive fathers are about equally important. Having a biological father convicted of an 'other' crime increases the likelihood that the son has such a conviction by

[33] Mednick et al. (1984) and Bohman et al. (1982) found no correlation in violent crime between adopted children and their biological parents. Once again, this can potentially be explained by there being a substantial amount of measurement error in the Danish measures of parents' violent crime, due to the 3-year time period during which the data spans. As we did for the extensive margin total crime results, we explored the feasibility of this explanation by creating measures of violent crime based on just 3-year time periods (1974-76, 1984-86, 1994-96, and 2004-06) and re-ran the set of experiments presented in this Section. Again, all of the estimates become substantially noisier and we no longer find a significant correlation between biological parents' violent crime and that of their adopted away son. Results are available from the authors upon request.

10.4 percentage points, while the corresponding effect of the adoptive father is 8.6 percentage points. Thus, it appears that it is adoptive fathers convicted of other crimes, as opposed to violent or property crimes, who are driving the estimate of the baseline adoptive father effect (Table 3).

Biological mothers also play a significant role in each crime category. Having a biological mother convicted of a violent crime increases the likelihood of a son's conviction by 13.9 percentage points. The corresponding estimates for the biological mother for property crimes and other crimes are 16.0 and 11.5 percentage points, respectively. Adoptive mothers have a large and significant impact on both the son's property crime record (0.104) and other crime record (0.141).

How do these crime specific results relate to the lessons learned from the baseline extensive margin specifications? The first lesson was that biological mothers and fathers matter. This pattern persists across all three crime categories. The second lesson was that the criminal records of both adoptive mothers and fathers matter. We see that the adoptive father result is being exclusively driven by the "other" crime category and that the adoptive mother result is being driven by both the property and other crime categories. The third lesson indicated that pre- and post-birth channels were equally important. This statement only holds true for both maternal and paternal factors with respect to other crimes and maternal factors for property crimes. Pre-birth factors may matter more than post-birth factors for violent crimes. This result, however, may be an artifact of small sample bias, since so few adoptive parents have been convicted of violent crimes. Finally, the fourth lesson indicated that the act of being adopted has minimal impact on the strength of the father-son intergenerational criminal relationship and increases the strength of the mother-son relationship (somewhat). Looking at the 95% confidence interval around the sums of the biological and adoptive coefficients, we see that the violent crime and property crime own-birth coefficients fall within the intervals. In contrast, three of the four

'other' crime own-birth coefficients fall just below the interval. It should also be noted that some of these intervals are quite large.

### 5.3 The Linear Model for Crime at the Intensive Margin

Table 5 presents the intergenerational transmission estimates for those who have been convicted of two or more crimes.[34] These specifications assess whether children of parents who have been convicted of multiple offenses are also more likely to be convicted of more than one offense. As in Table 3, the top panel presents the results for own-birth children, the middle panel presents the results for adoptive children, and the bottom panel presents the sums of the coefficients from the adoptive children regressions. Year of birth dummies and county of residence dummies (at 5 year intervals) are still included for all individuals.

The top panel of Table 5 indicates that sons whose fathers have been convicted of two or more crimes are 16.4 percentage points more likely to be convicted of multiple crimes themselves. Sons whose mothers have been convicted of two or more crimes are 21.2 percentage points more likely to be convicted of multiple crimes themselves. When biological mothers and fathers are included simultaneously (column 3), the coefficients decrease a little, but the mother coefficient (0.180) remains somewhat larger than the father coefficient (0.153). Overall, these specifications indicate that sons are not only more likely to become a criminal when they have a criminal parent, but the degree to which they partake in criminal activity is strongly related to the intensity of their parent's criminal careers.

[34] An individual is defined as having been convicted of two or more crimes if he has only one conviction that includes two or more crimes or if he has two or more convictions. The same qualitative pattern of results is seen when this intensive margin variable is defined as those who have been convicted of three or more crimes. These estimates, however, are not as precise due to a substantial decrease in the proportion of individuals who have committed three or more crimes.

In the adoptive son regressions, the coefficients for all four parents are significant. Column (1) indicates that sons are 7.9 percentage points more likely to have been convicted of multiple offenses if their biological fathers have been convicted of multiple offenses and 13.5 percentage points if their adoptive fathers have been convicted of multiple offenses. The corresponding effects of the biological and adoptive mothers in column (2) are 10.2 and 21.4 percentage points, respectively.[35] As in the own-birth sample, the point estimates for mothers are greater than those for fathers, though they are not as precisely estimated. Finally, none of the sums of the biological and adoptive parent coefficients in the bottom panel significantly differ from the corresponding own-birth regression coefficients.

How do the lessons that can be taken away from this intensive margin analysis compare with those from the extensive margin? As was the case in the extensive margin: (i) *both* biological mothers and fathers matter (lesson one) and (ii) *both* adoptive mothers and fathers matter (lesson two). There are, however, some differences between the intensive and extensive margin analyses. First, pre- and post-birth channels are not equal at the intensive margin (lesson three); rather, post-birth maternal and paternal channels appear more important than pre-birth channels.[36] Second, adoption has minimal impact on the overall strength of the intergenerational relationship at the intensive margin, whereas this statement only holds true at the extensive margin for fathers (lesson four).

[35] Specifications that consider the intensive margin by crime type indicate that the large adoptive mother effect is not driven by a single crime category. In contrast, the adoptive father effect at the intensive margin appears to be driven by the "other" crime category, just as it was at the extensive margin. Overall, the results from the intensive margin regressions by crime type do not lead us to amend the lessons learned.

[36] When we define the intensive margin as multiple convictions, instead of multiple crimes, then the adoptive father and biological father coefficients are of equal magnitude. The adoptive mother coefficients, however, still dominate the biological mother coefficients.

## 6 Robustness of Basic Results and Comparison to Educational Outcomes

### 6.1 Nonrandom Assignment

The above discussions interpret the coefficients on the biological parents as pre-birth factors and those on the adoptive parents as post-birth factors. Interpreting the results in this way implies that we are assuming that adoptees are randomly assigned to families, or that they are assigned to families according to rules/characteristics that we as researchers can observe and control for. This section considers the extent to which nonrandom assignment is an issue in our study.[37]

We first investigate the relationship between the criminal records of the adoptive and biological parents in Table 6. If there is random assignment of adopted children to adoptive parents, then the criminal records of the biological parents should be unrelated to those of the adoptive parents. The top panel presents the analysis using the extensive margin crime variable while the bottom panel uses the intensive margin (i.e., 2 or more crimes) variable. In columns (1) and (2), we regress the criminal record of the adoptive father on those of the biological father and mother. At the extensive margin, adopted sons with criminal biological fathers are 3.9 percentage points more likely to have a criminal adoptive father. At the intensive margin, adopted sons with criminal biological fathers are 1.7 percentage points more likely to have a criminal adoptive father. However, at both margins, there is no relationship between the criminal records of the biological mother and adoptive father. To allow for the possibility that any non-random assignment is driven by year of birth or geography, column (3) controls for year of birth and 5-year county of residence dummies. Column (4) adds controls for the biological mother and father's education and the log of average real income. These additional controls decrease the magnitude of the extensive margin biological father coefficient to 0.027 and that of the intensive

[37] It is important to note that random assignment is an assumption that is implicit in most adoption studies. One of the unique features of our data set is that we can actually test the extent to which this assumption is true. Many adoption studies cannot do this, as they often lack information about the biological parents.

margin coefficient to 0.004, which becomes insignificant. Columns (5) – (8) replicate this analysis for the adoptive mother. There is no relationship between the criminal records of either of the biological parents and adoptive mothers at both the extensive and intensive margins.

Thus, this analysis finds some evidence of non-random assignment and that Swedish authorities placed adopted children with adoptive parents similar to their biological parents. This is particularly true for the matching of biological and adoptive fathers. However, even in this case, the coefficients are fairly small and much of the relationship is accounted for by observables.

Another way to think about the issue of nonrandom assignment is as an omitted variables problem. That is, we would expect omitted pre-birth factors to be correlated with the adoptive parents' criminal record, biasing our estimate of $\alpha_2$, and omitted post-birth factors to be correlated with the biological parents' criminal record, biasing our estimate of $\alpha_1$. How concerned should we be about omitted variables? To answer this question, we define column (1) of Table 3 as the baseline result for fathers (biological and adoptive). Similarly, we define column (2) of Table 3 as the baseline results for mothers. These estimates are reported in row (1) of Table 7. Row (2) of Table 7 considers how sensitive the adoptive parent coefficients (i.e., the post-birth estimates) are to excluding the variables for the biological parents. The coefficients on the adoptive father and mother change minimally. Row (3) of Table 7 conducts the same exercise for biological parents: that is, how sensitive are the pre-birth estimates to excluding the criminal records, year of birth, and region of residence dummies for the adoptive parent? Again, there is very little impact on the baseline results for the biological parents.

Rows (4) and (5) conduct the opposite exercise. Rather than excluding biological and adoptive parents' characteristics, we assess how sensitive the baseline results are to adding

information about the parents. Row (4) controls for the biological parent's years of education and income and row (5) controls for comparable measures for the adoptive parent. Including these controls has virtually no impact on the estimated coefficients. Thus, despite the fact that we find some evidence of the existence of nonrandom assignment, Table 7 indicates that our baseline results are not particularly sensitive to this issue.

### 6.2 Adoption Age

Thus far, we have been working under the assumption that adopted children are placed in their new adoptive families at birth. If a significant number of adoptees are not placed in their new families as babies, then we risk overestimating pre-birth effects and underestimating post-birth effects. Unfortunately, we do not have any reliable information concerning the date of adoption. We do know, however, that very few children stayed with their birth parents after being born (Bohman 1970, Nordlöf 2001, Björklund et al. 2006). We can, therefore, safely assume that our estimates of birth parent coefficients include only pre-birth influences of these parents on their adopted away children.

Our post-birth effects, however, could still be biased (downwards) if children experience two post-birth environments (the post-delivery placement and the adoptive family environment) that have differential impacts on a child's later outcomes. Nordlöf (2001) reports that the share of children in Stockholm County that were permanently placed in their adoptive homes before age one rose between 1940 and 1973 from 63 to 83 percent (Nordlöf 2001). Using nationwide data drawn from the same sources as our own data, Björklund et al. (2006) report that 80 percent of adoptees born in the 1960s were living with their new families before age one.

Although a large majority of our children were most likely placed as babies, a non-trivial share may have experienced extended post-delivery placements longer than 12 months.[38] If such placements affected later outcomes in a manner different than what otherwise would have occurred if the child had been placed directly in the adopting family, then we may be underestimating the post-birth effects of these children's adopting parents.[39] This, in turn, would lower the average effect in the whole sample.

### 6.3 Unknown fathers

Another concern is that our estimates are biased as a result of the restriction that both biological parents are identified. Given that the biological father is only known for about 40% of Swedish born adoptees, it is certainly possible that this sample is not representative. To assess the extent to which this is a concern, row (6) of Table 7 presents results when extending the sample of adoptees to all adoptions where the biological mother is identified, i.e. regardless of whether the biological father is known. This increases the sample of adopted males to 8,403. Though the coefficients on the biological and adoptive mother decrease somewhat compared to our baseline, these changes are generally not significant and the same qualitative pattern is seen. Pre- and post-birth maternal factors are still equally important determinants of the son's criminal record.

### 6.4 Comparable Samples

Here, we address the potential problem that adopted children and their parents are different from other children and parents. Adoptive parents tend to be somewhat older and less likely to appear

[38] Some adoptees may be misclassified as "late" adoptees, because they were first placed in a foster home and later adopted by their foster parents (Bohman 1970).

[39] We say "may be" biased because this bias also assumes a particular form of the family production function. In particular, it assumes that parents cannot or do not compensate for their child's extended post-delivery placement with larger investments. It could also be that the particular lesson of "don't steal" only needs to be learned once or that it cannot be taught to children until they have reached a certain age.

in the police register while biological parents of adopted away children are younger and more likely to appear in the register.

Despite these apparent differences, we have, thus far, been comparing our intergenerational estimates for adoptees directly to the full population of own-birth children and parents. To investigate whether this is a reasonable comparison, we re-estimate our baseline results using two different, more comparable samples. The first sample addresses the issue that adoptive parents tend to be positively selected, so that adopted children may face advantageous post-birth environments. In particular, we create a sample consisting of own-birth children and their parents, but we require that the parents have similar observables to those of *adoptive parents*. In contrast, the second new sample consists of own-birth children and their parents, where the parents are required to have similar observables to the *biological parents of adopted away children*. This sample addresses the issue that adopted children may be endowed with less advantageous pre-birth characteristics, since biological parents tend to be negatively selected. Both samples are created using a propensity score matching method.[40]

Rows (8) and (9) of Table 7 present the results of re-estimating our baseline intergenerational association for these new samples of own-birth children and parents. We assess whether these new estimates are similar to the baseline presented in column (3) of Table 3 (see also row (7) of Table 7). Three out of four new point estimates are not significantly different from the baseline estimates and are very close to their baseline counterparts. The new estimate for slightly older and positively selected mothers (0.186) reported in row (8) of Table 7 is

[40] We employed a nearest neighbor matching method without replacement. In case of a tie, we included both neighbors. Adopted sons were matched to own-birth sons using an estimated propensity score. The propensity score was estimated using a probit model with adopted (yes=1, no=0) as the dependent variable. Regressors included the child's birth year, mother's age at child's birth, father's age at child's birth, mother's income, father's income, mother's education, father's education, mother's criminal record and father's criminal record. When estimating the propensity score for our first sample of "positively" selected parents, we included both biological parents with own-birth children and adoptive parents. When estimating the score for our second sample of "negatively" selected parents, we included biological parents with own-birth children and the biological parents of adopted away children.

significantly larger than our baseline mother estimate at the 10% level, but is quite close to the sum of biological and adoptive mother coefficients (0.205) reported earlier in Table 3. Taken together, these results imply that slightly older mothers in families with somewhat higher incomes and educations may have a larger influence over their sons' criminal activity than the average mother.

The main message from this exercise, however, is that our baseline estimates (and comparisons) are generally not sensitive to the fact that adopted children and their adoptive parents are different from other parents and children. These differences do not translate into meaningful differences in the estimated intergenerational association in crime.

### 6.5 Comparison to Educational Outcomes

Before continuing with our exploration of potential interaction effects, we would like to compare our results from Tables 3 and 5 with similar estimates for high school completion and years of schooling.[41] These estimates (reported in Table 8) are comparable to those reported in Björklund et al. (2004, 2006). There are two results in Table 8 that we would like to emphasize. First, the own-birth intergenerational association in high school completion is about twice that for our extensive margin measure of crime. It lies closer to our intensive margin measure of crime, especially for mothers. The second, perhaps more interesting result is that for our crime outcomes, the adoptive mother and father coefficients are larger than the corresponding biological parent coefficients for both the extensive and intensive margin crime specifications. In contrast, the reverse is true in three out of four cases for our educational outcomes. Thus, an intriguing hypothesis is that "nurture" matters relatively more for intergenerational associations

[41] Our dichotomous variable for high school completion (yes=1 or no=0) is defined as having completed a 3-year gymnasium degree or a higher degree. Education levels, 1 to 7, are translated into years of schooling as follows; level 1 = 7 years, level 2 = 9 years, level 3 = 11 years, level 4 = 12 years, level 5 = 14 years, level 6 = 15.5 years, and level 7 = 19 years.

in crime than it does for intergenerational associations in education. In particular, the role of adopting mothers is much larger for criminal outcomes than for educational outcomes.

## 7 Nonlinear Models

Table 9 presents the results of estimating equation (3) using our baseline measure of crime (at least one conviction in any crime category). Columns (1) and (2) present the results for fathers and mothers, respectively. None of the interaction coefficients are significant, though they are both positive (0.024 for fathers and 0.084 for mothers). Thus, when using the overall crime conviction measure, there is no indication of an interaction between pre- and post-birth factors.[42,43]

However, crime of the adopting parents may not be the most salient environmental factor. We, therefore, investigate the possibility that the adoptive parents' education may interact with pre-birth factors.[44] More generally, we are interested in knowing how malleable pre-birth factors are to post-birth interventions, such as the provision of public schooling.

The top panel of Table 10 presents the results of estimating equation (5) for own-birth children while the bottom panel presents the results of estimating equation (4) for the sample of adoptees. We have constructed a dichotomous measure of education that is equal to one if the parent has completed a 3-year gymnasium or college education and zero otherwise. For the adoptive parents in our sample (most of whom are born between 1900 – 1940), completing a

[42] The small (and insignificant) point estimate for the father interaction effect is consistent with our assumption of a linear, additive model and our findings that the sum of the biological and adoptive father coefficients was similar to the coefficient for fathers with own-birth children. The larger (but still insignificant) point estimate for the mother interaction effect echoes the earlier result that the sum of the biological and adoptive mother coefficients were somewhat larger than the coefficient for mothers with own-birth children.

[43] Given the apparent importance of adoptive mothers relative to adoptive fathers, we have also estimated specifications that include interactions between the biological fathers' crime and the adoptive mothers' crime (both overall and by crime type). We generally do not find any evidence of significant interaction effects.

[44] We have also looked at income as a mediating factor. The results are quite similar to those reported here for education. But income tends be a noisier measure of family environment factors, especially for mothers.

degree from a 3-year gymnasium places them well above the median education level. For these cohorts, a 3-year gymnasium program had much more of a college flavor to it than it does today;[45] 29 percent of adoptive fathers and 14 percent of adoptive mothers in our sample have completed a 3-year gymnasium or college degree. For parents with own-birth children, these numbers are 23 and 12 percent, respectively.

The own-birth children results shown in the top panel of Table 10 are consistent with what one would expect. First, sons with high educated parents are less likely to be convicted of a crime. Second, the interaction between the biological parent's crime and education is negative and significant in columns (1) and (2). Having a higher education partially offsets the effect of the parent's criminal record on the child's probability of being convicted.

The results for adopted children presented in the bottom of Table 10 are much less precisely estimated. Nevertheless, some interesting patterns are observed. First, we see in columns (1) and (2) that adopted sons with highly educated adoptive fathers are less likely to be convicted of a crime, while adoptive mothers' education has no direct impact. Second, we see that the interaction between the biological father's crime and the adopting father's education is significantly positive and large, 0.112 (0.044). Third, the interaction effect between the biological mother's crime and the adopting mother's education is significantly negative and large, -0.133 (0.077). Thus, having a more educated adoptive mother appears to offset the negative impact of biological mothers' criminality.

An important question, of course, is why we would find a significantly *positive* father interaction effect. A closer look at our data indicates that the positive father interaction effect is being driven solely by fathers with college degrees. They make up roughly 8 percent of our

[45] The 2-year gymnasium was run separately from the 3-year gymnasium and did not provide a theoretical education. It was a trade school.

sample of adopting fathers. Thus, we have speculated about two hypotheses. First, college educated fathers may spend more time working and less time with their sons, while adopted sons may actually need more time from their fathers. This lack of paternal parenting may lead to behavioral problems among these adopted sons. Second, the father-son relationship may be strained due a large father-son ability gap. By "ability gap" we mean that many highly educated (able) fathers may have been matched with less able sons. In turn, this ability gap may have led to a strained father-son relationship, for example, if the adopted son could not live up to his adoptive father's academic expectations. Social workers consciously tried to avoid this situation, hence our discussions of non-random placement in Sections 4 and 6. However, non-random placement did not appear to be that successful (i.e., placements appear to be more random than what social workers would have liked).

To examine this last hypothesis, we construct a new variable using information on parents' education level (1 to 7) in the following manner. First, we add together the adopting mother's and father's education level. This gives us a number between 2 and 14. We then create the same measure for biological parents. Lastly, we subtract the number for the biological parents' education levels from the adopting parents' education levels. The new variable, *Education Difference*, is positive if the adopting parents are (together) more educated than the biological parents.[46] The idea is that a son's innate learning ability will be correlated with his biological parents' education levels. Thus, our new variable measures the degree to which parents (and in particular fathers – since there is more variation in fathers' education) and sons are "mismatched". Does this mismatch produce the observed positive father interaction effect?

[46] We have also calculated the educational difference based only on fathers' education levels and on mothers' education levels. Using these variables produces similar results.

Columns (3) and (4) re-estimate the regressions run in columns (1) and (2) for the sample of sons with *Education Difference* greater than zero, i.e., for the "mismatched" sample. We see now that the father's positive interaction coefficient grows even larger, while the mother's interaction effect goes from significantly negative to insignificantly positive. Columns (5) and (6) restrict the sample to sons' whose innate ability is as good or better than his adoptive parents, i.e. *Education Difference* is less than or equal to zero. Here, we see that the father's positive interaction coefficient is now smaller (and insignificant) and the mother's interaction effect is significantly negative and quite large. Taken together, we find that an adopting mother's education can offset poor pre-birth characteristics, while the adopting father's education appears to have an ambiguous or at least more complex effect. Once again, these results remind us of the importance of social mothers in the perpetuation of crime from one generation to the next.

## 8 Conclusions

There are a number of lessons that can be learned from our paper about the origins of intergenerational criminal associations. The first lesson is that biological parents – fathers and mothers – matter. In addition, we see that biological parents matter for sons at both the extensive and intensive margins and in all crime categories: violent, property, and other. This contrasts previous studies that have only found correlations between biological parents' and their adopted away children's convictions for property crimes (see, e.g., Bohman et al. 1982 and Mednick et al. 1984).

The second lesson is that the criminal records of both adoptive mothers and fathers matter, regardless of whether crime is measured at the extensive or intensive margin; adoptive mothers, however, appear to be particularly important. These new results stand in sharp contrast to the existing adoption-crime literature, which reports no significant associations between the

criminal records of adopted children and their adopting parents (see, e.g., Bohman et al. 1982 and Mednick et al. 1984). In fact, this is the first study that we know of that documents a positive correlation between adopted sons' and adoptive parents' criminal behavior. As argued in the paper, we believe that earlier studies were plagued by measurement error that biased their results towards zero.

The third lesson is that, at the extensive margin, a mother's influence on her child's criminality occurs approximately equally through pre-birth and post-birth channels. The same holds true for a father's influence. However, at the intensive margin, post-birth channels appear to be more important than pre-birth channels and adoptive mothers are particularly important. The fourth lesson indicates that the act of being adopted has minimal impact on the overall strength of the intergenerational criminal relationship.

Finally, consistent with Mednick, Gabrielli, and Hutchings (1984), we find little evidence of an interaction effect between biological and adoptive parents' convictions. We do, however, find significant interactions between adoptive parents' education and biological parents' criminality. Most importantly, we find that adoptive mother's education appears to mitigate the negative impact of poor pre-birth factors. This implies that maternal education may play a particularly important role in preventing crime and that poor pre-birth factors do not necessarily lead to poor life outcomes in a purely deterministic fashion.

**References**


Abel, Ernest L. and Robert J. Sokol (1987) “Incidence of Fetal Alcohol Syndrome and Economic Impact of FAS-Related Anomalies,” *Drug and Alcohol Dependence* 19(1), 51-70.

Agnew, Robert (1992) “Foundation for a General Strain Theory of Crime and Delinquency,” *Criminology.* 30(1), 47-87.

Akee et al. (2010) ”Parents' Incomes and Children's Outcomes: A Quasi-experiment Using Transfer Payments from Casino Profits,” *American Economic Journal: Applied Economics* 2(1), 86-115.

Allmänna Barnhuset (1955) *Adoption: En vägledning för myndigheter, tjänstemän och förtroendemän, vilka har att syssla med frågor angående adoption*, Direktionenen over Allmänna Barnhuset i samråd med Medicinstyrelsen och Socialstyrelsen.
Almond, Douglas (2006) “Is the 1918 Influenza Pandemic Over? Long-Term Effects of *In Utero* Influenza Exposure in the Post-1940 U.S. Population,” *Journal of Political Economy* 114(4), 672-712.

Almond, Douglas and Janet Currie (2010) “Human Capital Development before Age Five,” NBER Working Paper 15827.

Almond, Douglas, Lena Edlund and Mårten Palme (2009) “Chernobyl's Subclinical Legacy: Prenatal Exposure to Radioactive Fallout and School Outcomes in Sweden,” *Quarterly Journal of Economics* 124(4), 1729-1772.

Almond, Douglas and Bhashkar Mazumder (2005) “The 1918 Influenza Pandemic and Subsequent Health Outcomes: An Analysis of SIPP Data,” *American Economic Review* 95(2), 258-262.

Baker, Laura A., Wendy Mack, Terrie E. Moffitt and Sarnoff A. Mednick (1989) “Sex Differences in property Crime in a Danish Cohort,” *Behavior Genetics* 19(3), 355-370.

Bayer, Patrick, Randi Hjalmarsson, and David Pozen, “Building Criminal Capital Behind Bars: Peer Effects in Juvenile Corrections,” *Quarterly Journal of Economics* 124(1), 105-147.

Björklund, Anders and Markus Jäntti (2009) “Intergenerational Income Mobility and the Role of Family Background, Chapter 20 in Wiemer Salverda, Brian Nolan, and Timothy M Smeeding (editors) *Oxford Handbook of Economic Inequality*, Oxford University Press, Oxford.

Björklund, Anders, Mikael Lindahl and Erik Plug (2004) “Intergenerational Effects in Sweden: What Can We Learn from Adoption Data?” IZA Discussion Paper 1194.

Björklund, Anders, Mikael Lindahl and Erik Plug (2006) “The Origins of Intergenerational Associations: Lessons from Swedish Adoption Data,” *The Quarterly Journal of Economics* CXXI(3), 999-1028.

Black, Sandra E. and Paul J. Devereux (2010) ”Recent developments in Intergenerational Mobility” NBER Working Paper No. 15889.

Bock, Gregory R. and Jamie A. Goode (eds.) (1996) *Genetics of Criminal and Antisocial Behavior*, Chichester: John Wiley & Sons.

Bohman, Michael (1970) *Adopted Children and Their Families: A Follow-Up Study of Adopted Children, Their Background, Environment and Adjustment*, Proprius Förlag, Stockholm.
Bohman, Michael (1978) “Some genetic Aspects of Alcoholism and Criminality,” *Archives of general Psychiatry* 35, 269-276.

Bohman, Michael, C. Robert Cloninger, Sören Sigvardsson and Anne-Liis von Knorring (1982) “Predisposition to Petty Criminality in Swedish Adoptees: Genetic and Environmental Heterogeneity” *Archives of General Psychology* 39, 1233-1241.
Brown, Alan S. (2006), “Prenatal Infection as a Risk Factor for Schizophrenia,” *Schizophrenia Bulletin* 32(2), 200-202.

Butterfield, Fox (2002) “Father Steals Best: Crime in an American Family,” *The New York Times*, August 21, 2002.

Cadoret, Remi J. (1978) “Psycopathology in Adopted-Away Offspring of Biological Parents with Antisocial Behavior,” *Archives of general Psychiatry* 35, 176-184.

Cadoret, remi J. and Colleen Cain (1980) “Sex Differences in Predictors of Antisocial Behavior in Adoptees,” *Archives of General Psychiatry* 37, 1171-1175.

Cadoret, Remi J., Colleen A. Cain and Raymond R. Crowe (1983) “Evidence for Gene-Environment Interaction in the Development of Adolescent Antisocial Behavior,” *Behavior Genetics* 13(3), 301-310.

Cadoret, Remi J. and Mark A. Stewart (1991) “An Adoption Study of Attention Deficit/Hyperactivity/Aggression and Their Relationship to Adult Antisocial Personality,” *Comprehensive Psychiatry* 32(1), 73-82.

Cadoret, Remi J., Thomas W. O’Gorman, Ed Troughton and Ellen Heywood (1985), “Alcoholism and Antisocial Personality: Interrelationships, Genetic and Environmental Factors,” *Archives of General Psychiatry* 42, 161-167.

Cadoret, Remi J., Edward Troughton, Jeffrey Bagford and George Woodworth (1990) “Genetic and Environmental Factors in Adoptee Antisocial personality,” *European Archives of Psychiatry and Neurological Sciences* 239, 231-240.

Cadoret, Remi J., Ed Troughton and Thomas W. O’Gorman (1987) “Genetic and Environmental Factors in Alcohol Abuse and Antisocial Personality,” *Journal of Studies on Alcohol* 48(1), 1-8.

Cairns, Robert B. (1996) "Aggression from a Developmental Perspective: Genes, Environments and Interactions," in Gregory R. Bock and Jamie A. Goode (eds.), *Genetics of Criminal and Antisocial Behavior*, Chichester: John Wiley & Sons, 45-60.

Case, Anne and Katz, Lawrence F. (1991) "The Company You Keep: The Effects of Family and Neighborhood on Disadvantaged Youths," NBER Working Paper No. 3705.

Castles, Anne, Helena Datta, Javier Gayan and Richard K. Olson (1999) "Varieties of Developmental Reading Disorder: Genetic and Environmental Influences, *Journal of Experimental Child Psychology* 72, 73-94.
Cesarini D., C.T. Dawes , M. Johannesson, P. Lichtenstein and B. Wallace (2009a) "Genetic Variation in Preferences for Giving and Risk-Taking," *Quarterly Journal of Economics* 124, 809-842.

Cesarini D., M. Johannesson, P. Lichtenstein and B. Wallace (2009b) "Heritability of Overconfidence," *Journal of the European Economic Association* 7, 617-627.

Cloninger, C. Robert, Sören Sigvardsson, Michael Bohman and Anne-Liis von Knorring (1982) "Predisposition to Petty Criminality in Swedish Adoptees: Cross-Fostering Analaysis of Gene-Environment Interaction" *Archives of General Psychology* 39, 1242-1247.

Crowe, Raymond R. (1974) "An Adoption Study of Antisocial Personality," *Archives of General Psychiatry* 31, 785-791.

Currie, Janet (2010) "Inequality at Birth: Some Causes and Consequences," NBER Working Paper 16798.

Deykin, Eva Y. and Brian MacMahon (1980) "Pregnancy, Delivery, and Neonatal Complications Among Autistic Children," *American Journal of Diseases of Children* 134(9), 860-864.

Duncan, Greg, Ariel Kalil, Susan Mayer, Robin Tepper, and Monique Payne (2005) "The Apple Does Not Fall Far From the Tree," in Samuel Bowles, Herbert Gintis and Melissa Osborne Groves (eds.), *Unequal Chances: Family Background and Economic Success*, Princeton University Press.

Famy, Chris, Ann P. Streissguth and Alan S. Unis (1998) "Mental Illness in Adults with Fetal Alcohol Syndrome or Fetal Alcohol Effects," *The American Journal of Psychiatry* 155, 552-554.

Farrington, David P., Jeremy W. Coid and Joseph Murray (2009) "Family Factors in the Intergenerational Transmission of Offending," *Criminal Behaviour and Mental Health* 19(2), 109-124.

Farrington, David and Donald West (1990) "The Cambridge Study in Delinquent Development: a long-term follow up of 411 London males," in H. J. Kerner and G. Kaiser (Eds.), *Criminality, Personality, Behavior, and Life History*, Berlin: Springer-Verlag.

Gabrielli, William F., Jr. and Sarnoff A. Mednick (1984) "Urban Environment, genetics, and Crime," *Criminology* 22(4), 645-652.

Ferguson, Thomas (1952) *The Young Delinquent in His Social Setting*, London: Oxford University Press.

Gluckman, Peter D., Mark A. Hanson, Cyrus Cooper and Kent L. Thornburg (2008) "Effect of In Utero and Early-Life Conditions on Adult Health and Disease," *The New England Journal of Medicine* 359(1), 61-73.

Glueck, Eleanor and Sheldon Glueck (1950) *Unravelling Juvenile Delinquency*, Cambridge, MA: Harvard University Press.

Gregory, Nathan (2004) "Crime and the Family: Like Grandfather, Like Father, Like Son?" *The British Journal of Forensic Practice* 6(4), 32-36.

Hines, Denise A. and Kimberly J. Saudino (2002) "Intergnerational Transmission of Intimate Partner Violence: A Behavioral Genetic Perspective," *Trauma, Violence, & Abuse* 3(3), 210-225.

Hjalmarsson, Randi and Matthew J. Lindquist (2010) "Driving Under the Influence of Our Fathers," *The B.E. Journal of Economic Analysis & Policy* 10(1) Topics, Article 100, November 2010, 1-15.

Hjalmarsson, Randi and Matthew J. Lindquist (2011) "Like Godfather, Like Son: Exploring the Intergenerational Nature of Crime," unpublished manuscript, Swedish Institute for Social Research, Stockholm University.

Holmlund, Helena, Mikael Lindahl and Erik Plug (forthcoming) "The Causal Effect of Parent's Schooling on Children's Schooling: A Comparison of Estimation Methods," *Journal of Economic Literature.*

Hu, Howard, Martha María Téllez-Rojo, David Bellinger, Donald Smith, Adrienne S. Ettinger, Héctor Lamadrid-Figueroa, Joel Schwartz, Lourdes Schnaas, Adriana Mercado-García and Mauricio Hernández-Avila (2006) "Fetal Lead Exposure at Each Stage of Pregnancy as a Predictor of Infant Mental Development," *Environmental Health Perspectives* 114(11), 1730-1735.

Hutchings, B. and S. A. Mednick (1974) "Biological and Adoptive Fathers of Male Criminal Adoptees," in *Major Issues in Juvenile Delinquency*, World Health Organization, Copenhagen, 47-60.

Janson, Carl-Gunnar (1982) "Delinquency among Metropolitan Boys," Project Metropolitan Research Report No. 17, Department of Sociology, Stockholm University.

Ishikawa, Sharon S. and Adrian Raine (2002) "Behavioral Genetics and Crime," Chapter 4 in J. Glickson (ed.) *The Neurobiology of Criminal behavior*, Norwell: Kluwer Academic Publishers, 81-110.

Kendler, Kenneth S. and Scott R. Diehl (1993) “The Genetics of Schizophrenia: A Current, Genetic-Epidemioiogic Perspective,” *Schizophrenia Bulletin* 19(2), 261-285.

Kety, S. S., D. Rosenthal, P. H. Wender and F. Schulsinger (1971) “Mental Illness in the Biological and Adoptive Families of Adopted Schizophrenics,” *American Journal of Psychiatry* 138, 302-320.

Kling, Jeffrey, Jens Ludwig, and Lawrence Katz (2005) “Neighborhood Effects on Crime for Male and Female Youth: Evidence from a Randomized Housing Voucher Experiment” *The Quarterly Journal of Economics* 120(1), 87-130.

Lauritsen, M. B. and H. Ewald (2001) “The Genetics of Autism,” *Acta Psychiatrica Scandinavica* 103, 411-427.

Lochner, Lance (2004) “education, Work, and Crime: A Human Capital Approach,” *International Economic Review* 45(3), 811-843.

Loehlin, John C. (2005), Resemblances in Personality and Attitudes between Parents and Their Children: Genetic and Environmental Contributions, in Samuel Bowles, Herbert Gintis and Melissa Osborne Groves (eds.), *Unequal Chances: Family Background and Economic Success*, 192-207.

Ludwig, Jens, Greg Duncan, and Paul Hirschfield (2001) “Urban Poverty and Juvenile Crime: Evidence From a Randomized Housing-Mobility Experiment,” *The Quarterly Journal of Economcis* 116(2), 655-679.

McClearn, Gerald E., Boo Johansson, Stig Berg, Nancy L. Pederson, Frank Ahern, Stephen A. Petrill and Robert Plomin (1997) “Substantial Genetic Influence on Cognitive Abilities in Twins 80 or More Years Old,” *Science* 276, 1560-1563.

Mednick, S. A., W. H. Gabrielli and B. Hutchings (1984) “Genetic Influences in Crime Convictions: Evidence from and Adoption Cohort,” *Science* 224, 891-894.

Mednick, Sarnoff A. and Elizabeth Kandel (1988) ”Genetic and Perinatal Factors in Violence,” in Moffit, Terrie E. and Sarnoff A. Mednick (eds.), *Biological Contributions to Crime Causation*, 121-131.

Meghir, Costas, Mårten Palme and Marieke Schnabel (2011) "The Impact of Education Policy on Crime: Can Schooling Break the Vicious Circle of Intergenerational Associations of Crime," unpublished manuscript, Department of Economics, Stockholm University.

Moffit, Terrie E. and Sarnoff A. Mednick (eds.) (1988) *Biological Contributions to Crime Causation*, Martinus Nijhoff Publishers, Dordrecht, The Netherlands.

Murray, Joseph, Carl-Gunnar Janson and David P. Farrington (2007) “Crime in Adult Offspring of Prisoners: A Cross-National Comparison of Two Longitudinal Samples,” *Criminal Justice and Behavior* 34(1): 133-49.

Murata, Katsuyuki, Pál Wiehe, Esben Budtz-Jørgensen, Poul J. Jørgensen and Phillipe Gradjean (2004) "Delayed Brainstem Auditory Evoked Potential Latencies in 14-Year Old Children Exposed to Methylmercury," *The Journal of Pediatrics* 144(2), 177-183.

Nordlöf, Barbro (2001) *Svenska adoptioner i Stockholm 1918-1973*, FoU-rapport 2001:8, Socialtjänstförvaltningen.

O'Dougherty, Margaret, Keith H. Nuechterlein and Bram Drew (1984) "Hyperactive and Hypoxic Children: Signal Detection, Sustained Attention, and behavior," *Journal of Abnormal Psychology* 93(2), 178-191.

Plomin, Robert (2003) "General Cognitive Ability," in Robert Plomin, John C. Defries, Ian W. Craig and Peter McGuffin (eds.), *Behavioral Genetics in the Postgenomic Era*, American Psychological Association, Washington, DC, US, 183-201.

Plug, Erik (2004) "Estimating the Effects of Mothers' Schooling on Children's Schooling Using a Sample of Adoptees," *The American Economic Review* 94(1), 358-368.

Plug, Erik and Wim Vijverberg (2003) "Schooling, Family Background, and Adoption: Is It Nature or Is It Nurture," *The Journal of Political Economy* 11(3), 611-641.

Raine, Adrian (1993) *The Psychopathology of Crime: Criminal Behavior as a Clinical Disorder*, Academic Press, Harcourt Brace & Co., San Diego.

Reuter, M., C. Montag, S. Altmann, F. Bendlow, C. Elger, P. Kirsch, B.Weber, and Armin Falk (2009), "Genetically Determined Differences in Human Trust Behavior: The Role of the Oxytocin Receptor Gene," Working paper, Department of Economics, University of Bonn.

Reyes, Jessica Wolpaw (2007) "Environmental Policy as Social Policy? The Impact of Childhood Lead Exposure on Crime," *The B.E. Journal of Economic Analysis & Policy* 7(1) (Contributions), Article 51.

Rhee, Soo Hyun and Irwin D. Waldman (2002) "Genetic and Environmental Influences on Antisocial Behavior: A Meta-Analysis of Twin and Adoption Studies," *Psychological Bulletin* 128(3), 490-529.

Rowe, David C. and David P. Farrington (1997), "The Familial Transmission of Criminal Convictions," *Criminology* 35(1), 177-201.

Sacerdote, Bruce (2002) "The Nature and Nurture of Economic Outcomes," *The American Economic Review* 92(2), 344-348.

Sacerdote, Bruce (2007) "How Large Are the Effects from Changes in Family Environment? A Study of Korean American Adoptees," *The Quarterly Journal of Economics* 122(1), 119-157.

Sacerdote, Bruce (2010) “Nature and Nurture Effects on Children’s Outcomes: What Have We Learned from Studies of Twins and Adoptees?” in Jess Benhabib, Matthew Jackson and Alberto Besin (eds.) *Handbook of Social Economics,* Amseterdam: North Holland.

Sigvardsson, Sören, C. Robert Cloninger, Michael Bohman and Anne-Liis von Knorring (1982) “Predisposition to Petty Criminality in Swedish Adoptees: Sex Differences and Validation of the Male Typology” *Archives of General Psychology* 39, 1248-1253.

Thornberry, Terence P. (2009) “The Apple Doesn’t Fall Far from the Tree (or Does It?): Intergenerational Patterns of Anti-Social Behavior – The American Society of Criminology 2008 Sutherland Address,” *Criminology* 47(2), 297-325.

Tielmann van Dusen, Katherine, Sarnoff A. Mednick, William F. Gabrielli Jr. and Barry Hutchings (1983) “Social Class and Crime in an Adoption Cohort,” *The Journal of Law & Criminology* 74(1), 249-269.

van de Rakt, Marieke, Paul Nieuwbeerta and Robert Apel (2009) “Association of Criminal Convictions between Family Members: Effects of Siblings, Fathers and Mothers,” *Criminal Behaviour and Mental Health* 19(2), 94-108.

Williams, Jenny and Robin Sickles (2002) “An Analysis of the Crime as Work Model: Evidence from the 1958 Philadelphia Birth Cohort Study,” *The Journal of Human Resources*. 37(3), 479-509.

Wilson, Harriett (1987) “Parental Supervision Re-examined,” *British Journal of Criminology* 27(3), 275-301.

Table 1. Sample Restrictions

| Sample Restriction | Index Non-Adoptees | All Adoptees | Change in Non-Adoptees | Change in Adoptees |
|---|---|---|---|---|
| All individuals adopted by at least one parent | | 143,490 | | |
| Keep Only those Adopted by both parents | | 91,447 | | 52,043 |
| All non-adopted individuals | 7,408,029 | | | |
| All index non-adopted individuals | 2,448,397 | | 4,959,632 | |
| Keep those for whom both biological parents are identified | 1,995,876 | 12,296 | 452,521 | 79,151 |
| Keep Non-immigrants | 1,896,197 | 12,226 | 99,679 | 70 |
| Drop individuals born in 1968 or later | 849,378 | 9,553 | 1,046,819 | 2,673 |
| Drop individuals born in 1942 or earlier | 670,201 | 9,316 | 179,177 | 237 |
| Omit those who died or emigrated from Sweden before 1974 | 659,908 | 9,250 | 10,293 | 66 |
| Omit those who had at least one parent die or emigrate from Sweden before 1974 | 611,139 | 7,732 | 48,769 | 1,518 |
| Keep males | 312,747 | 4,061 | 298,392 | 3,671 |

Table 2. Descriptive Statistics

| | *Own birth children* | | *Adopted Children* | |
|---|---|---|---|---|
| | *Mean* | *SD* | *Mean* | *SD* |
| Son's Crime | 0.36 | 0.48 | 0.51 | 0.50 |
| Son's Violent Crime | 0.07 | 0.25 | 0.13 | 0.33 |
| Son's Property Crime | 0.14 | 0.35 | 0.26 | 0.44 |
| Son's Other Crime | 0.31 | 0.46 | 0.45 | 0.50 |
| Son's Crime > 1 | 0.21 | 0.40 | 0.34 | 0.48 |
| Son's age in 2007 | 51.63 | 7.34 | 49.20 | 6.52 |
| Son's birth year | 1955.37 | 7.34 | 1957.80 | 6.52 |
| | | *Birth Parents* | | |
| Mother's Crime | 0.06 | 0.23 | 0.16 | 0.37 |
| Mother's Violent Crime | 0.002 | 0.04 | 0.012 | 0.11 |
| Mother's Property Crime | 0.02 | 0.15 | 0.10 | 0.30 |
| Mother's Other Crime | 0.04 | 0.19 | 0.09 | 0.28 |
| Mother's Crime > 1 | 0.02 | 0.13 | 0.08 | 0.27 |
| Mother's Age in 1973 | 45.50 | 10.01 | 39.19 | 8.76 |
| Father's Crime | 0.19 | 0.39 | 0.41 | 0.49 |
| Father's Violent Crime | 0.02 | 0.13 | 0.09 | 0.28 |
| Father's Property Crime | 0.05 | 0.21 | 0.18 | 0.38 |
| Father's Other Crime | 0.16 | 0.37 | 0.33 | 0.47 |
| Father's Crime > 1 | 0.08 | 0.27 | 0.25 | 0.44 |
| Father's Age in 1973 | 48.91 | 10.58 | 42.78 | 9.77 |
| | | *Adoptive Parents* | | |
| Mother's Crime | | | 0.05 | 0.21 |
| Mother's Violent Crime | | | 0.000 | 0.02 |
| Mother's Property Crime | | | 0.02 | 0.13 |
| Mother's Other Crime | | | 0.03 | 0.18 |
| Mother's Crime > 1 | | | 0.01 | 0.09 |
| Mother's Age in 1973 | | | 48.50 | 9.63 |
| Father's Crime | | | 0.14 | 0.35 |
| Father's Violent Crime | | | 0.010 | 0.07 |
| Father's Property Crime | | | 0.02 | 0.15 |
| Father's Other Crime | | | 0.12 | 0.32 |
| Father's Crime > 1 | | | 0.04 | 0.20 |
| Father's Age in 1973 | | | 51.24 | 9.77 |

Table 3. Baseline Results (Any Conviction)

| | (1) | (2) | (3) |
|---|---|---|---|
| *Own Birth Children* | | | |
| crime_biofather | 0.121*** | | 0.113*** |
| | [0.002] | | [0.002] |
| crime_biomother | | 0.134*** | 0.115*** |
| | | [0.004] | [0.004] |
| *Adoptive Children* | | | |
| crime_biofather | 0.072*** | | 0.058*** |
| | [0.018] | | [0.020] |
| crime_biomother | | 0.108*** | 0.097*** |
| | | [0.024] | [0.026] |
| crime_adfather | 0.089*** | | 0.090*** |
| | [0.025] | | [0.028] |
| crime_admother | | 0.132*** | 0.138*** |
| | | [0.041] | [0.045] |
| Sum of biological and adoptive father coefficients | 0.162 | | 0.148 |
| | [0.030] | | [0.034] |
| | 0.102-0.221 | | 0.082-0.214 |
| Sum of biological and adoptive mother coefficients | | 0.24 | 0.235 |
| | | [0.048] | [0.052] |
| | | 0.147-0.333 | 0.132-0.337 |
| Year of Birth Dummies | YES | YES | YES |
| 5 Year County of Residence Dummies | YES | YES | YES |
| Biological Observations | 312747 | 312747 | 312747 |
| Adoptive Observations | 4061 | 4061 | 4061 |

This table presents results from OLS regressions of a dummy variable indicating whether the child has been convicted of at least one crime on a dummy variable indicating whether the parent has been convicted of at least one crime. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Extensive Margin Baseline Results by Crime Type: Violent, Property and Other.

| | Violent Crime | | | Property Crime | | | Other Crime | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (1) | (2) | (3) | (1) | (2) | (3) |
| Own Birth Children | | | | | | | | | |
| crime_biofather | 0.117*** | | 0.113*** | 0.155*** | | 0.143*** | 0.104*** | | 0.099*** |
| | [0.003] | | [0.003] | [0.003] | | [0.003] | [0.002] | | [0.002] |
| crime_biomother | | 0.134*** | 0.124*** | | 0.153*** | 0.133*** | | 0.107*** | 0.092*** |
| | | [0.010] | [0.010] | | [0.004] | [0.004] | | [0.004] | [0.004] |
| Adoptive Children | | | | | | | | | |
| crime_biofather | 0.069*** | | 0.073*** | 0.098*** | | 0.105*** | 0.104*** | | 0.088*** |
| | [0.022] | | [0.024] | [0.021] | | [0.023] | [0.019] | | [0.021] |
| crime_biomother | | 0.139*** | 0.169*** | | 0.160*** | 0.151*** | | 0.115*** | 0.108*** |
| | | [0.051] | [0.058] | | [0.026] | [0.029] | | [0.031] | [0.034] |
| crime_adfather | -0.055 | | -0.042 | 0.005 | | -0.027 | 0.086*** | | 0.094*** |
| | [0.085] | | [0.091] | [0.051] | | [0.056] | [0.027] | | [0.030] |
| crime_admother | | - | - | | 0.104* | 0.122* | | 0.141*** | 0.108** |
| | | | | | [0.061] | [0.067] | | [0.049] | [0.054] |
| Sum of biological and adoptive father coefficients | 0.014 | | 0.031 | 0.103 | | 0.078 | 0.19 | | 0.182 |
| | [0.088] | | [0.094] | [0.055] | | [0.060] | [0.032] | | [0.035] |
| | -0.158-0.186 | | -0.153-0.215 | -0.004-0.210 | | -0.040-0.196 | 0.128-0.253 | | 0.113-0.251 |
| Sum of biological and adoptive mother coefficients | | 0.139 | 0.169 | | 0.265 | 0.273 | | 0.255 | 0.216 |
| | | [0.051] | [0.058] | | [0.066] | [0.073] | | [0.057] | [0.063] |
| | | 0.039-0.238 | 0.055-0.284 | | 0.134-0.395 | 0.130-0.416 | | 0.143-0.368 | 0.092-0.339 |
| Biological Observations | 312747 | 312747 | 312747 | 312747 | 312747 | 312747 | 312747 | 312747 | 312747 |
| Adoptive Observations | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 |

Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All specifications include year of birth dummies and five year county of residence dummies.

Table 5. Baseline Results (Convicted of Two or More Crimes)

| | (1) | (2) | (3) |
|---|---|---|---|
| *Own Birth Children* | | | |
| crime_biofather > 1 | 0.164*** | | 0.153*** |
| | [0.003] | | [0.003] |
| crime_biomother > 1 | | 0.212*** | 0.180*** |
| | | [0.007] | [0.007] |
| *Adoptive Children* | | | |
| crime_biofather > 1 | 0.079*** | | 0.071*** |
| | [0.020] | | [0.022] |
| crime_biomother > 1 | | 0.102*** | 0.082** |
| | | [0.033] | [0.037] |
| crime_adfather > 1 | 0.135*** | | 0.145*** |
| | [0.043] | | [0.047] |
| crime_admother > 1 | | 0.214** | 0.256** |
| | | [0.103] | [0.105] |
| Sum of biological and adoptive father coefficients | 0.214 | | 0.215 |
| | [0.047] | | [0.052] |
| 95% confidence interval | 0.123-0.305 | | 0.114-0.317 |
| Sum of biological and adoptive mother coefficients | | 0.316 | 0.338 |
| | | [0.107] | [0.110] |
| 95% confidence interval | | 0.106-0.527 | 0.120-0.491 |
| Year of Birth Dummies | YES | YES | YES |
| 5 Year County of Residence Dummies | YES | YES | YES |
| Biological Observations | 312747 | 312747 | 312747 |
| Adoptive Observations | 4061 | 4061 | 4061 |

This table presents results from OLS regressions of a dummy variable indicating whether the child has been convicted of at least two crimes on a dummy variable indicating whether the parent has been convicted of at least two crimes. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Testing for Non-Random Assignment: Regressions of Adoptive Parent Crime on Biological Parents

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| Dependent Variable: | | Crime_adfather | | | | Crime_admother | | |
| *Extensive Margin: Any Crime Conviction* | | | | | | | | |
| crime_biofather | 0.039*** | 0.039*** | 0.025** | 0.027** | | -0.001 | -0.006 | -0.007 |
| | [0.011] | [0.011] | [0.012] | [0.013] | | [0.007] | [0.008] | [0.008] |
| crime_biomother | | 0.015 | -0.005 | -0.002 | 0.001 | 0.001 | -0.005 | -0.005 |
| | | [0.015] | [0.016] | [0.016] | [0.009] | [0.009] | [0.010] | [0.010] |
| R-squared | 0 | 0 | 0.14 | 0.14 | 0 | 0 | 0.15 | 0.15 |
| *Intensive Margin: 2 or More Convictions* | | | | | | | | |
| crime_biofather | 0.017** | 0.017** | 0.006 | 0.004 | | 0.001 | 0 | 0 |
| | [0.007] | [0.007] | [0.008] | [0.008] | | [0.003] | [0.004] | [0.004] |
| crime_biomother | | -0.006 | -0.01 | -0.008 | 0.005 | 0.005 | 0.005 | 0.004 |
| | | [0.012] | [0.013] | [0.013] | [0.005] | [0.005] | [0.006] | [0.006] |
| R-squared | 0 | 0 | 0.14 | 0.14 | 0 | 0 | 0.11 | 0.11 |
| Year of Birth and 5-year region of residence dummies | NO | NO | YES | YES | NO | NO | YES | YES |
| Education and Income controls | NO | NO | NO | YES | NO | NO | NO | YES |
| Observations | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 | 4061 |

Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Sensitivity Analysis: Alternative Samples and Specifications for the Overall Crime Conviction Variable

| | | Fathers | | Mothers | | |
|---|---|---|---|---|---|---|
| | | Bio | Adopt | Bio | Adopt | N |
| | Adopted Children | | | | | |
| (1) | Baseline Results (from Table 3) | 0.072*** | 0.089*** | 0.108*** | 0.132*** | 4,061 |
| | | [0.018] | [0.025] | [0.024] | [0.041] | |
| | *Test for Non-Random Assignment* | | | | | |
| (2) | Exclude biological parent crime and characteristics | | 0.091*** | | 0.128*** | 4,061 |
| | | | [0.024] | | [0.039] | |
| (3) | Exclude adoptive parent crime and characteristics | 0.078*** | | 0.114*** | | 4,061 |
| | | [0.017] | | [0.023] | | |
| (4) | Include biological parent education and income | 0.062*** | 0.090*** | 0.104*** | 0.132*** | 4,061 |
| | | [0.018] | [0.025] | [0.024] | [0.041] | |
| (5) | Include adoptive parent education and income | 0.072*** | 0.088*** | 0.108*** | 0.134 | 4,061 |
| | | [0.018] | [0.025] | [0.024] | [0.041] | |
| | *Missing Biological Fathers* | | | | | |
| (6) | Include all with identified biological mothers | | | 0.078*** | 0.075*** | 8,403 |
| | | | | [0.016] | [0.027] | |
| | Own-Birth Children | | | | | |
| | *Comparable Samples* | | | | | |
| (7) | Baseline Results (column (3) of Table 3) | 0.113*** | | 0.115*** | | 312747 |
| | | [0.002] | | [0.004] | | |
| (8) | Positively Selected Parents: Characteristics match those of adoptive parents | 0.138*** | | 0.186*** | | 3921 |
| | | [0.026] | | [0.040] | | |
| (9) | Negatively Selected Parents: Characteristics match those of biological parents with adopted away children | 0.123*** | | 0.111*** | | 3538 |
| | | [0.020] | | [0.026] | | |

Regressions include birth year dummies and county dummies (at 5 year intervals) for all persons. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8. A Comparison of Crime Outcomes to Educational Outcomes.

| | Convicted of one or more crimes | Education level: 3-year high school or more |
|---|---|---|
| *Own birth children* | | |
| Birth father | 0.113*** | 0.263*** |
| | [0.002] | [0.002] |
| Birth mother | 0.115*** | 0.201*** |
| | [0.004] | [0.003] |
| *Adopted children* | | |
| Biological father | 0.058*** | 0.088*** |
| | [0.020] | [0.034] |
| Biological mother | 0.097*** | 0.107*** |
| | [0.026] | [0.030] |
| Adoptive father | 0.090*** | 0.212*** |
| | [0.028] | [0.044] |
| Adoptive mother | 0.138*** | 0.058 |
| | [0.045] | [0.039] |

| | Convicted of two or more crimes | Years of schooling |
|---|---|---|
| *Own birth children* | | |
| Birth father | 0.153*** | 0.222*** |
| | [0.003] | [0.002] |
| Birth mother | 0.180*** | 0.160*** |
| | [0.007] | [0.002] |
| *Adopted children* | | |
| Biological father | 0.071*** | 0.080*** |
| | [0.022] | [0.022] |
| Biological mother | 0.082** | 0.091*** |
| | [0.037] | [0.024] |
| Adoptive father | 0.145*** | 0.074*** |
| | [0.047] | [0.020] |
| Adoptive mother | 0.256** | 0.042* |
| | [0.105] | [0.022] |

Regressions include birth year dummies and county dummies (at 5 year intervals) for all persons. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9. Non-linear Specifications for Adopted Children.

| | (1) | (2) |
|---|---|---|
| crime_biofather | 0.069*** | |
| | [0.019] | |
| crime_biomother | | 0.103*** |
| | | [0.025] |
| crime_adfather | 0.078** | |
| | [0.034] | |
| crime_admother | | 0.118*** |
| | | [0.045] |
| crime_biofather*crime_adfather | 0.024 | |
| | [0.050] | |
| crime_biomother*crime_admother | | 0.084 |
| | | [0.109] |
| Adoptive observations | 4061 | 4061 |

Regressions include birth year dummies and county dummies (at 5 year intervals) for all persons. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10. Pre-Birth/Post-Birth Interaction Effects.

| | *Full Sample* | | *Education Difference > 0* | | *Education Difference <= 0* | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Own –Birth Children* | | | | | | |
| crime_biofather | 0.123*** | | | | | |
| | [0.003] | | | | | |
| crime_biomother | | 0.136*** | | | | |
| | | [0.004] | | | | |
| education_biofather | -0.062*** | | | | | |
| | [0.002] | | | | | |
| education_biomother | | -0.070*** | | | | |
| | | [0.003] | | | | |
| crime_biofather*education_biofather | -0.017*** | | | | | |
| | [0.006] | | | | | |
| crime_biomother*education_biomother | | -0.029** | | | | |
| | | [0.011] | | | | |
| *Adopted Children* | | | | | | |
| crime_biofather | 0.065*** | | -0.085 | | 0.073* | |
| | [0.024] | | [0.072] | | [0.038] | |
| crime_biomother | | 0.131*** | | 0.081 | | 0.152*** |
| | | [0.027] | | [0.081] | | [0.048] |
| crime_adfather | 0.075*** | | 0.060 | | 0.092* | |
| | [0.027] | | [0.066] | | [0.050] | |
| crime_admother | | 0.116*** | | 0.160 | | 0.094 |
| | | [0.044] | | [0.104] | | [0.085] |
| education_adfather | -0.066** | | -0.184*** | | -0.169** | |
| | [0.029] | | [0.065] | | [0.085] | |
| education_admother | | 0.014 | | 0.018 | | -0.081 |
| | | [0.032] | | [0.066] | | [0.137] |
| crime_biofather*education_adfather | 0.112** | | 0.323*** | | 0.064 | |
| | [0.044] | | [0.096] | | [0.144] | |
| crime_biomother*education_admother | | -0.133* | | 0.177 | | -0.633* |
| | | [0.077] | | [0.154] | | [0.344] |
| Own-Birth observations | 271999 | 292221 | | | | |
| Adoptive observations | 3404 | 3603 | 1300 | 1300 | 1649 | 1649 |

Regressions include birth year dummies and county dummies (at 5 year intervals) for all persons. Robust standard errors in brackets; * significant at 10%;** significant at 5%; *** significant at 1%.

Appendix Table 1. Robustness to Upper Sample Selection Year

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Own Birth Children | | | | | | | | | | | |
| crime_biofather | 0.122*** | 0.122*** | 0.122*** | 0.122*** | 0.121*** | 0.120*** | 0.119*** | 0.116*** | 0.114*** | 0.111*** | 0.107*** |
| | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] | [0.002] |
| crime_biomother | 0.124*** | 0.124*** | 0.124*** | 0.123*** | 0.121*** | 0.119*** | 0.118*** | 0.117*** | 0.115*** | 0.113*** | 0.109*** |
| | [0.002] | [0.003] | [0.003] | [0.003] | [0.003] | [0.003] | [0.003] | [0.003] | [0.004] | [0.004] | [0.004] |
| Adoptive Children | | | | | | | | | | | |
| crime_biofather | 0.058*** | 0.057*** | 0.060*** | 0.061*** | 0.058*** | 0.053*** | 0.051*** | 0.052*** | 0.051*** | 0.057*** | 0.033 |
| | [0.017] | [0.017] | [0.017] | [0.018] | [0.018] | [0.018] | [0.018] | [0.019] | [0.019] | [0.021] | [0.024] |
| crime_biomother | 0.107*** | 0.105*** | 0.105*** | 0.102*** | 0.100*** | 0.095*** | 0.098*** | 0.095*** | 0.096*** | 0.091*** | 0.063** |
| | [0.021] | [0.021] | [0.021] | [0.022] | [0.022] | [0.023] | [0.023] | [0.024] | [0.026] | [0.028] | [0.032] |
| crime_adfather | 0.052** | 0.054** | 0.047** | 0.054** | 0.053** | 0.057** | 0.067*** | 0.073*** | 0.091*** | 0.077*** | 0.093*** |
| | [0.023] | [0.023] | [0.024] | [0.024] | [0.024] | [0.025] | [0.026] | [0.026] | [0.027] | [0.030] | [0.034] |
| crime_admother | 0.111*** | 0.110*** | 0.117*** | 0.114*** | 0.108*** | 0.104*** | 0.118*** | 0.112*** | 0.141*** | 0.140*** | 0.147*** |
| | [0.038] | [0.038] | [0.038] | [0.039] | [0.039] | [0.040] | [0.041] | [0.042] | [0.044] | [0.048] | [0.054] |
| Sample Years: 1943 - | 1984 | 1982 | 1980 | 1978 | 1976 | 1974 | 1972 | 1970 | 1968 | 1966 | 1964 |
| # Own Birth Males | 517922 | 506144 | 482346 | 457842 | 433924 | 408489 | 380704 | 352664 | 326295 | 298235 | 268775 |
| # Adoptive Males | 5186 | 5162 | 5083 | 5004 | 4903 | 4784 | 4629 | 4443 | 4208 | 3844 | 3355 |

Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All specifications include year of birth dummies and five-year county of residence dummies.