The Importance of Family Background and Neighborhood Effects as Determinants of Crime[1]

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Abstract

We quantify the importance of family background and neighborhood effects as determinants of criminal convictions and incarceration by estimating sibling and neighborhood correlations. At the extensive margin, factors common to siblings account for 24 percent of the variation in criminal convictions and 39 percent of the variation in incarceration. At the intensive margin, these factors typically account for slightly less than half of the variation in prison sentence length and between one-third and one-half of the variation in criminal convictions, depending on crime type and gender. Neighborhood correlations, on the other hand, are quite small. We, therefore, conclude that these large sibling correlations are most likely generated by family influences and not by neighborhood influences. Further analysis shows that sibling similarities in criminal behavior appear to be driven mainly by factors common to siblings other than parental income and education. Parental criminality and family structure are particularly important. Sibling spacing also matters.

1. Introduction

There is extensive evidence of similarities in criminal behavior within members of the same family and between households in the same neighborhood. For instance, The Bureau of Justice Statistics reports that approximately 50 percent of fathers and mothers in state prison had at least one other family member that had also been incarcerated: 6 percent had an incarcerated mother, 19 percent had an incarcerated father, 34 percent had an incarcerated brother, 7 percent had an incarcerated sister, 2 percent had an incarcerated child, and 2 percent had an incarcerated spouse (Glaze and Maruschak 2008). What is it about these individuals that cause them to engage in similar anti-social behaviors? Answering this question and identifying the relative contribution of different family and community factors to criminal behavior is crucial in our quest to both identify the fundamental causes of criminal behavior and for developing public policies to combat rising crime rates. If, for instance, parental criminality is the most important background factor in explaining criminal activity, then policymakers may want to use a different set of policies and target a different group of individuals than if neighborhood influences turn out to be the strongest determinants of crime.

Thus, the aim of this paper is to contribute to a better understanding of the importance of family background and neighborhood effects as determinants of crime. We do this in two ways. We first quantify the role of family and community background for criminal activity by estimating sibling correlations in criminal convictions and incarceration. Siblings share (among other things) genes, parents, family values and common influences from peers and neighborhoods. The sibling correlation, therefore, provides us with a broad measure of the importance of family and community factors. It tells us what share of the variation in criminal behavior can be traced back to influences stemming from family background and circumstances. We then go on to explore a set of family-wide variables (parental income and education, parental criminality, family structure, and neighborhoods) in order to ascertain

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their importance (in both absolute and relative terms) for making siblings similar in terms of their criminal behavior. While a literature studying sibling correlations in crime certainly exists, as does a literature studying the importance of family and community background effects on crime,[2] we are aware of little research that has combined these two strands of literature to assess the underlying mechanisms that generate sibling correlations in crime.[3]

Sibling correlations in criminal behavior have been documented in a number of contexts: varying countries, different types of sibling pairs, administrative versus survey data, various crime types, and different measures of criminality. These estimates range from a low of 0.25 (Mazumder 2008) to a high of 0.69 (Johnson 2007).[4] Twin studies also report strong sibling similarities in antisocial behavior and crime.[5] Many of these studies, however, use data from small, selected samples, while studies using data from the NLSY or PSID rely on self-reported data covering a limited time period. Frisell et al. (2011) is an important exception. Their study reports (perhaps for the first time) population wide sibling correlations using police register data in Sweden, albeit only for violent crime at the extensive margin. They find an extensive margin correlation of 0.41 for brothers and 0.48 for sisters.

This paper builds on the existing literature by estimating sibling correlations in criminal convictions and incarceration using Swedish register data on a nationally representative sample of more than 700,000 brothers and sisters born between 1958 and 1968. We have information on all criminal convictions, crime types and sentences received between the years

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[2] From the economics literature see, e.g., Case and Katz (1991), Pezzin (2004), Currie and Tekin (2012), Doyle (2008), Hjalmarsson and Lindquist (2010, 2012, 2013), Akee et al. (2010), Meghir et al. (2012) for work on family background effects and Case and Katz (1991), Ludwig et al. (2001), Kling et al. (2005) and Damm and Dustmann (2013) for work on neighborhood effects.

[3] Important exceptions include twin studies and the early work of Rowe and Farrington (1997).

[4] Using data from the Cambridge Study in Delinquent Development, Rowe and Farrington (1997) report sibling correlations in criminal convictions of 0.45-0.50 for same-sex siblings and 0.27 for opposite-sex siblings. Mazumder (2008) uses data from the NLSY to estimate a sibling correlation in illegal drug use of 0.30 and a brother correlation in incarceration of 0.25. Using a somewhat different approach, Pezzin (2004) argues that 44-55% of the total variation in crime among siblings in the NLSY can be attributed to family influences even after controlling for a number of individual and family attributes. Using PSID data, Johnson (2007) reports a brother correlation in having ever been charged or booked with a crime of 0.31 and in incarceration of 0.69.

[5] See Ishikawa and Raine (2002) and Moffit (2005) for reviews of the behavioral genetics literature concerning antisocial behavior and crime. For an overview of earlier work on sibling similarities in the criminology literature see Lauritsen (1993).

1973 to 2007, which allows us to estimate both extensive and intensive margin sibling correlations for different crime types and for both genders.

At the extensive margin, our estimated sibling correlations indicate that factors shared by siblings account for 24 percent of the variation in convictions and 39 percent of the variation in incarceration. At the intensive margin, we find much larger sibling correlations for higher numbers of crimes and longer prison sentences. For example, the brother correlation in having committed at least one crime is 0.29, while the brother correlation in having committed at least 10 crimes is 0.51. We also see similar patterns for sibling correlations after breaking down the data by crime type: violent, property and other and no systematic difference between brother correlations and sister correlations. Lastly, we show that closely spaced siblings are more similar in terms of their criminal behavior than are siblings who are born many years apart from each other.

We then go on to study the different factors that could potentially explain why siblings are so similar in terms of their criminal behavior. We first look at the effects of family-wide variables that siblings share: parental income and education, parental criminality, and family structure. These variables have been chosen based on our reading of the previous literature on family background and crime. After including these potentially important family characteristics as controls (when estimating the variance components used to construct our sibling correlations), we assess how much of the sibling similarities in criminal behavior they account for. While this decomposition approach has been used to investigate the determinants of sibling similarities in income, health and education (Mazumder 2008, 2011; Björklund et al. 2010; Anger and Schnitzlein 2013), it has not been applied to criminal behavior. The key advantage of this approach is that it allows us to explore the relative importance of potential mechanisms that produce sibling similarities in crime.

Sibling correlations decrease by at most nine percent when we control for parental income and education, by at most 21 percent when we control for parental criminality, and by at most 19 percent when we control for family structure. The largest decrease is seen for the extensive margin measures. Including all of the controls simultaneously decreases the sibling correlations by at most 27 percent. These results imply that sibling associations in criminal behavior appear to be driven mainly by factors common to siblings other than parental income and education. Parental criminality and family structure appear more important. But the largest share remains unexplained.

We continue our analysis by examining the potential effects of shared neighborhood influences (e.g., schools, peers, local labor markets, etc.) by estimating neighborhood correlations that can be viewed as upper bounds on the potential effects of shared neighborhood influences (Solon et al. 2000). These correlations tell us that neighborhoods account for only 1 percent of the variation in aggregate crime at the extensive margin (or 3 percent of sibling similarities) and 2 percent of the variation in incarceration at the extensive margin (or 5 percent of sibling similarities). At the intensive margin, neighborhood correlations tend to be somewhat larger and explain up to 13 percent of the sibling correlation. In a supplementary experiment, we conclude that neighborhood quality may explain part of the neighborhood effect.

Together, family-wide variables and neighborhood effects can account for one-third of the sibling similarities that we observe in our data; leaving the lion's share unexplained. What these other influences on siblings behavior might be is discussed in the conclusion.

In the next section, we outline our statistical model and empirical estimation methods. This is followed, in Section 3, by a presentation of our data along with descriptive statistics. In Section 4, we present extensive and intensive margin sibling correlations in crime and incarceration. We then proceed in Section 5 to see what share of these correlations can be

accounted for by parental income and education, parental criminality, family structure and neighborhood effects. Section 6 concludes.

2. Statistical Model and Estimation Method

Criminal behavior, c_{ifn}, for sibling i in family f living in neighborhood n can be modeled as

$$(1) \qquad c_{ifn} = \mu + a_f + b_n + e_{ifn},$$

where μ is the population mean, a_f is a permanent component common to all siblings in family f, b_n is a permanent component common to all children living in neighborhood n, and e_{ifn} is unique to individual i in family f from neighborhood n. This captures individual deviations from the family and neighborhood components (including measurement error in our crime variable). If we assume that these components are independent, then the variance of c_{ifn} is the sum of the variances of the family, neighborhood and individual components:

$$(2) \qquad \sigma_c^2 = \sigma_a^2 + \sigma_b^2 + \sigma_e^2.$$

We can also allow families to sort into neighborhoods based on (for example) income and education, which induces a covariance term, $2\sigma_{ab}^2$, so that:

$$(3) \qquad \sigma_c^2 = \sigma_a^2 + \sigma_b^2 + 2\sigma_{ab}^2 + \sigma_e^2.$$

The share of the variance in the outcome variable, c_{ifn}, which can be attributed to family background and neighborhood effects, is

$$(4) \qquad \rho = \frac{\sigma_a^2 + \sigma_b^2 + 2\sigma_{ab}^2}{\sigma_a^2 + \sigma_b^2 + 2\sigma_{ab}^2 + \sigma_e^2}.$$

This share coincides with the correlation in the outcome variable of randomly drawn pairs of siblings, which is why ρ is called a sibling correlation.[6]

A sibling correlation can thus be thought of as an omnibus measure of the importance of family background and neighborhood effects. It includes anything shared by siblings: genes, parental income and parental influences such as aspirations and cultural inheritance, as well as things not directly experienced in the home, such as school, church and neighborhood effects. Genetic traits not shared by siblings, differential treatment of siblings, time-dependent changes in neighborhoods, schools, etc. are captured by the individual component e_{ifn}. If such non-shared factors are relatively more important than shared factors for criminal behavior, the variance of the family effects will be small relative to the variance of the individual effects and the sibling correlation will be low. The more important the effects that siblings share are, the larger is the sibling correlation.

The share of the variance in the outcome variable, c_{ifn}, which can be attributed to neighborhood effects alone (net of sorting), is:

$$(5) \qquad \gamma \;=\; \frac{\sigma_b^2}{\sigma_a^2 \;+\; \sigma_b^2 \;+\; \sigma_e^2} \; .$$

In order to calculate, γ, we need an estimate of the between-neighborhood variation, σ_b^2, as well as an estimate of the remaining variation, $\sigma_a^2 + \sigma_e^2$. These can be obtained by ignoring the between-family variation and estimating the following mixed-effects model

$$(6) \qquad c_{in} = \mathbf{x}_{in}\boldsymbol{\beta} + b_n + e_{in} \,,$$

which allows for the inclusion of multiple control variables $\mathbf{x}_{in}$. Note that the family component, a_f, is now subsumed by the individual component, e_{in}. To net out sorting into

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[6] Although this common formulation of the sibling correlation is a well defined statistical entity, it is important to keep in mind that it is still a somewhat arbitrary model of the process which generates sibling similarities. It rules out, for example, the fact that sibling correlations could in theory be negative. Along some dimensions, families may promote inequality.

neighborhoods, we include controls for parents income, education and criminality, and family structure in $\mathbf{x}_{in}$. We also include gender and birth year dummies.

Since our outcome variables are binary, we reformulate equation (6) as a latent linear response model

$$(7) \qquad c_{in}^* = \mathbf{x}_{in}\boldsymbol{\beta} + b_n + e_{in} \, ,$$

where we only observe $c_{in} = I(c_{in}^* > 0)$. We estimate equation (7) using STATA's *xtlogit* command. The variance components σ_e^2 and σ_b^2 are estimated using maximum likelihood. The random neighborhood effect is estimated conditional on the random individual effect being logistically distributed with mean zero, variance $\sigma_e^2 = \pi^2/3$ and independent of b_n.[7]

In order to calculate the total sibling correlation (including neighborhood effects), ρ, we need estimates of the between-family variation, σ_a^2, and of the total remaining variation. Once again, these can be obtained by estimating a mixed-effects model:

$$(8) \qquad c_{if} = \mathbf{x}_{if}\boldsymbol{\beta} + a_f + e_{if} \, ,$$

where the neighborhood effect, b_n, and the covariance term are now subsumed by the family effect, a_f. We estimate this model using STATA's *xtlogit* command as described above. Gender and birth year dummies are included in $\mathbf{x}_{if}$.

Inspired by the approach used in Mazumder (2008) and Björklund et al. (2010), we then go on to include potentially important family-wide variables, either one at a time or simultaneously, in the $\mathbf{x}_{if}$ matrix. For example, consider the inclusion of parental income and education in $\mathbf{x}_{if}$. These additional control variables should reduce the residual variation in the outcome variable and produce a lower estimate of the between-family variation, σ_a^{2*}, than the

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[7] In practice, we estimate neighborhood correlations after first randomly drawing one child from each family. We do this, so that large families living in small neighborhoods won't dominate the estimation. Alternatively, one could estimate neighborhood, family, and individual variance components simultaneously by applying STATA's xtmelogit to the whole sample and estimating a model with three levels. But due to our large sample, our use of control variables, and to the large number of correlations that we need to calculate in this paper, this approach becomes infeasible; running time and convergence become problematic. In some cases, we have used both methods and the answer does not change. The fact that we randomly sample one child from each family does not seem to matter much either.

estimate produced without the added controls. Abstracting from measurement error, we can interpret the difference between these two estimates, $\sigma_a^2 - \sigma_a^{2*}$, as an upper bound on the amount of the variance in the family component that can be explained by including measures of parental income and education. It is viewed as an upper bound, since it includes other factors that are correlated with parental income and education.[8]

This experiment also produces a new sibling correlation ρ^*. From what we know about the relationship between parents' income and education and children's crime (see, e.g., Hjalmarsson and Lindquist 2012), we expect this new sibling correlation to be lower, but still substantial in magnitude.

The main purpose of this additional exercise is to see which family-wide variables are most important for making siblings similar in terms of their criminal behavior. We will explore the potential roles played by; (i) parental income and education, (ii) parental criminality, and (iii) family structure. The choice of these particular variables is motivated by our reading of the existing literature on family background and crime.

3. Data and Descriptive Statistics

3.1 Data

The sample used in this paper was created in the following manner. We start with 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. We then match on all of their brothers and sisters. This matching is made possible by the fact that all family ties (biological and adoptive) are recorded in Sweden's Multigenerational Register.[9] Those who

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[8] In the presence of measurement error, this difference, $\sigma_a^2 - \sigma_a^{2*}$, is more correctly viewed as a downwardly biased estimate of the upper bound on the amount of the variance in the family component that can be accounted for by the inclusion of parental income and education.
[9] Very few children in these cohorts lived with pure social siblings, i.e. together with other children that they had no blood relationship with.

died or emigrated from Sweden before their 16th birthday are dropped from the sample. We also remove those who immigrated to Sweden after their 25th birthday.

Siblings are defined as those having the same biological or adoptive mother. Nearly 98% of siblings in our data are full-siblings and have the same biological (or adoptive) mother and father; 2.3% are maternal half-siblings.[10]

Our sibling sample was then matched with Sweden's official crime register. This matching is made possible by the unique personal identification number that each Swedish resident possesses. Our data include a full record of criminal convictions for the years 1973 to 2007 for each individual in the data set. Records include crime type and sanctions received.

Given the years for which crime data are available, we choose to restrict our sample to siblings born between 1958 and 1968. This means that siblings are born at most ten calendar years apart. These age restrictions also imply that we have 35 years of crime data for our oldest cohort (born 1958) and that the crime data for this cohort spans the ages of 15 to 49. For the youngest cohort (born 1968), we will use 25 years of crime data that span the ages 15 to 39. The age of criminal majority in Sweden is 15.

We use our crime data to construct a number of different 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.[11] We also create an intensive margin measure of aggregate

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[10] We drop all observations with missing mothers from the analysis. In total, 26,907 observations have missing mothers; 96% of these observations are immigrants. Among the dropped observations, 25% have been convicted of a crime as compared to 29% of the observations kept in the sample.

[11] 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

crime that we label *Number of Crimes*. This variable is the total number of crimes that a person has been convicted of. This variable is also broken down by crime type: violent, property and other.

One conviction may include several crimes. Our crime type variables are created by looking over all of the crimes within every conviction.[12] 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 variables for the extensive and intensive margins for incarceration. The variable *Prison* is equal to one if the individual has ever been sentenced to prison and zero otherwise and *Days Sentenced to Prison* tells us the total number of days an individual has been sentenced to prison between 1973 and 2007. This variable is summed across all prison sentences if the person has received more than one prison sentence during this time period. However, one should keep in mind that even the extensive margin *Prison* variables tells us about the intensity of one's criminal career, as one is only eligible for prison if the intensity of the convicted offense(s) is great enough (in terms of offense severity or quantity) or the criminal history is severe enough.

The crime variables described above are also created for the parents of our sample of siblings. The main difference being that parents are much older when observe them in our crime data. We also have data on parental education and income, as well as family structure when our siblings are young. Siblings can be placed into the neighborhoods they were raised

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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.

[12] 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).

in as children based on their parish of residence. More detailed information concerning parent and neighborhood variables are presented in Sections 5 and 6, respectively.

3.2 Descriptive Statistics

Table 1 shows the number of families having N children and Table 2 presents descriptive statistics. Our final sample consists of 707,613 individuals (363,234 men and 344,379 women) from 414,697 families. The mean number of siblings in each family is 1.7.

In our sample, 29 percent of the individuals are singletons (i.e. they have no siblings in the sample). We include singletons to increase the precision of the estimate of the between-family variation. Our results are not sensitive to the inclusion/exclusion of singletons. Among non-singletons, 98 percent have at least one full sibling in the sample (i.e. 2 percent of the non-singletons have a maternal half sibling, but no full sibling).

Turning to the measures of criminal behavior, 28.5 percent of the sample individuals have been convicted of a crime. Criminal convictions are 3.5 times more common among men than among women; 43.7 percent of the men, and 12.5 percent of the women, have been convicted of a crime. For both men and women violent crimes are least frequent while other crimes are most frequent. Only 5.5 percent of the individuals have been convicted of a violent crime, while 13.7 percent have been convicted of a property crime and 22.5 percent of some other crime.[13]

Among the individuals convicted of a crime, the average number of crimes is 6.8. This number is 7.7 for men and 3.8 for women. Among the individuals convicted of a violent crime, the average number of violent crimes is 2.7. The corresponding number is 4.4 for other crimes and 5.9 for property crimes. Thus, given that an individual has been convicted of a crime of a

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[13] While some of these statistics may seem high, it is important to note that they are (i) comparable to other studies of crime in Sweden (see for instance Hjalmarsson and Lindquist (2013) and Meghir et al (2012)) and (ii) largely driven by the other crime category, which includes a number of alcohol related offenses.

specific type, the intensive margin frequency of that crime type is highest for property crimes and lowest for violent crimes. This pattern applies to both men and women.

4.4 percent of the individuals have been sentenced to prison. Prison sentences are 11.1 times more common among men than among women; 7.8 percent of the men compared to only 0.7 percent of the women have been sentenced to prison. For an individual sentenced to prison, the average time sentenced to prison (summed over all prison sentences) is 455 days. For men this figure is 463 and for women it is 367. The median is 91 days (three months) for both men and women.

4. Sibling Correlations in Criminal Convictions and Incarcerations

4.1 Extensive Margin

We report the extensive margin sibling correlations in Table 3.[14] The overall/pooled correlation in crime is 0.24, suggesting that about one fourth of the variation in crime at the extensive margin can be attributed to factors shared by siblings. The sister correlation is 0.24 and the brother correlation is 0.29. The correlation for mixed siblings is 0.23.[15]

Throughout Table 3, the correlation for mixed siblings is always somewhat less than the sibling correlations reported for brothers and/or sisters. This suggests that siblings of different genders have fewer shared family or community factors; this could be driven by a number of explanations, including that parents treat sons and daughters differently, males and females have different peer groups and school experiences, and that males and females are simply differentially affected by the same family characteristics. It could also be that sibling peer effects are stronger for same sex siblings.

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[14] These correlations are estimated using STATA's *xtlogit* command. The outcome variables are always dichotomous. Year and gender dummies are included in these estimations. Singletons are included, except when estimating the sibling correlations for mixed siblings. The estimated correlations are never sensitive to the inclusion/exclusion of singletons.

[15] Mixed siblings are defined as follows. In a group of siblings of size $N \geq 2$, $x \geq 1$ siblings do not have the same gender as the other N-x siblings. Singletons are, therefore, always excluded.

Investigating one crime type at a time, the sibling correlation is 0.33 for property crime, 0.35 for violent crime and 0.21 for other crime. For prison, the correlation is 0.39. The correlation for all siblings is thus substantially higher for property crimes and violent crimes than for other crimes, and higher for prison than for all crime outcomes. That is, shared family and community factors appear to explain more of the variation in serious crime than minor crime. This pattern also applies to the brother and sister correlations. The brother correlations are slightly higher than the sister correlations for crime (0.29 versus 0.24), property crime (0.38 versus 0.34) and other crime (0.24 versus 0.21). For violent crime the brother and sister correlations are the same (0.37), and for prison the brother correlation is lower than the sister correlation (0.39 versus 0.44). The sister correlation in prison, which is the highest of all extensive margin sibling correlations, suggests that for women 44 percent of the variation in female incarceration at the extensive margin can be accounted for by family and community factors shared by sisters.

4.2 Intensive Margin

The intensive margin correlations are computed using binary outcome variables.[16] For crime, we have constructed binary outcome variables taking the value 1 if an individual has committed at least x crimes (where x is equal to 1, 2, 3, 4, 5, or 10 crimes). For prison sentence length we have constructed binary outcome variables indicating if an individual has spent a total of at least x months in prison (where x is equal to 0.5, 1, 2, 3, 4, 5, 6, or 12 months). These are shown in Figure 1 along with approximate 95% confidence intervals.

The trend line in Figure 1 is upward sloping for sibling correlations in crime. This means that factors shared by siblings account for a larger share of the variation in crime at the intensive margin. For instance, for sisters, the share of the variation that can be attributed to

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[16] These correlations are estimated using STATA's *xtlogit* command. Year and gender dummies are included in these estimations. Singletons are included, except when estimating the sibling correlations for mixed siblings. The estimated correlations are never sensitive to the inclusion/exclusion of singletons.

factors shared by siblings is more than twice as high for "at least 10 crimes" than for "at least 1 crime".

This upward sloping trend line is present across all different crime types (see Appendix Figure 1) and is quite similar for both brothers and sisters. The intensive margin correlations for mixed siblings, however, are noticeably lower than those for same sex siblings, though the same upward trend in the correlation persists. For prison sentence length, there is a weakly upward sloping trend for brothers, but not for sisters; it should be noted, however, that the sister correlations are relatively imprecise due to the low rate of female incarceration.

Taken together, the sibling correlations presented above suggest that family background is a stronger determinant of crime at the intensive margin than it is at the extensive margin. It is responsible for between 33 and 57 percent of the variation in crime at the intensive margin, depending on crime type, the number of crimes committed, and gender. This conclusion is also supported by the findings that: (i) the extensive margin correlations for property and violent crimes, which contain more relatively serious offenses, were greater than those for other crimes and (ii) the extensive margin incarceration correlation was stronger than that for convictions, as having *any* incarceration spells can be seen as a proxy for the severity of criminality since more severe crimes or more convictions (concurrently or in the past) are more likely to result in an incarceration spell.

Thus, while family and community background are important determinants of whether an individual begins a criminal career, they appear to be even more important determinants of the intensity (severity and length) of that criminal career. This naturally leads to the question of why? One possible explanation is social interactions or peer effects within a family: each

sibling's criminal behavior reinforces the criminal behavior of the other.[17] Alternatively, different risk factors may cluster within families or be strongly correlated over time. Parental attitudes, parenting strategies and family resources (broadly defined) may also affect how successful parents are at correcting episodes of deviant behavior that many teenagers experience.

4.3 Sibling Spacing

In our baseline sample, siblings can be born up to ten years apart from each other. In Figure 2, we estimate the brother and sister correlation in crime between pairs of brothers and sisters born (i) at most four years apart, (ii) four to six years apart, (iii) six to eight years apart, and (iv) eight to ten years apart. At the extensive margin, we see that the share of the variation in crime explained by common family background is similar for those born within four years of each other and those born four to six years apart; given that a majority of siblings in the sample are within six years of each other, these estimates also correspond to our baseline estimates for the full sample. In contrast, the share of crime explained by common family background is lower for those born more than six years apart. This is particularly true for sisters born more than eight years apart.[18] Two patterns emerge at the intensive margin. First, for all siblings, regardless of how far apart they are in age, the same upward trend in the correlation is seen as the number of crimes studied increases. Second, the intensive margin correlation monotonically decreases as the sibling spacing increases: this is true regardless of which intensive margin is being studied (i.e. at least 2 offenses, at least 3 offenses, etc.).

So why might siblings spacing matter for the size of the sibling correlation? We believe that there are two main reasons for this. First, siblings born further apart may, in fact,

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[17] See Altonji, Cattan and Ware (2010) for a study of sibling effects in substance abuse, Bayer, Hjalmarsson, and Pozen (2008) for evidence of similar reinforcing peer effects in juvenile correctional facilities, and Lindquist and Zenou (2013) for peer effects in networks of co-offenders.

[18] One should keep in mind that sibling pairs born many years apart comprise only a small fraction of the baseline sample. The standard errors on these estimates are also very large.

not experience the same types of environments while growing up. This can be true even if siblings grow up with their biological parents in an intact family, as, for instance, they may experience the same factor (e.g. parental earnings) at different ages and corresponding periods in their development. Second, it may be the case that siblings born close together have a stronger influence on each other's behavior. That is, closely spaced siblings may experience stronger sibling peer effects. Regardless of the mechanism, we need to consider sibling spacing when accounting for the size of the sibling correlation. We return to this discussion in Section 5.2 below.

5. Accounting for Sibling Correlations in Criminal Convictions and Incarcerations

5.1 The Role of Parental Education, Income, and Crime and Family Structure

Can family-wide factors explain criminal behavior and sibling similarities in crime? In this section, we explore a number of characteristics that are common to individuals within the same family, but which vary across families, to gauge the extent to which these factors contribute to the high sibling correlation in crime. In particular, we consider parental education and income, parental criminality, and family structure.

We choose these particular variables because of the existing literature demonstrating their relative importance in explaining crime. For instance, an individual's education has been demonstrated to have a causal impact on his own criminal behavior (Lochner and Moretti, 2004; Machin, Marie and Vujić, 2011; and Hjalmarsson, Holmlund, and Lindquist, 2013) and has even been demonstrated to have an impact on the next generation's criminal behavior (Meghir, Palme, and Schnabel, 2012). These facts, combined with the evidence on the intergenerational transmission of education (see, e.g., Holmlund et al. 2011), suggest that parental education may explain a substantial share of the variation in sibling crime correlations. Similar findings have been found for parental income. Akee et al. (2010) demonstrate that parental income has

a causal impact that lowers the probability of minor offences among children and the likelihood that a child self-reports that he/she has sold drugs.

There is also evidence that parental criminality is a strong predictor of child criminality; for example, Hjalmarsson and Lindquist (2013) find that having a father (mother) with at least one conviction increases the sons' chance of conviction by 12.1 (13.4) percentage points respectively.[19] Finally, there is an extensive sociology literature demonstrating the positive relationship between family structure (e.g., teenage mothers, female headed households or single parent households) and children's criminal behavior, though it is often hard to distinguish correlation from causality.[20]

As discussed in Section 3, our measures of parent criminality and incarceration are constructed in the same manner as those for siblings. Mother's and father's educations are measured in seven levels ranging from grade school to graduate school. These levels are included separately for each parent as dummies in our regressions. We also include a dummy for missing education. Parental income is measured as the log of average real income for the years 1968-2007 (zeros are averaged in, while the very few missing observations are left out). Once again, this is entered separately for each parent.

We have created several different measures of family structure and we always include all of them simultaneously. First, we have a measure of family size for when the child was age 15. Second, we include a dummy if the father is unknown. Third, we include the mother's age at her first birth. Lastly, we include a measure of family structure at age 15, which includes six categories: (i) unknown, (ii) single mom, (iii) single dad, (iv) both parents living together, (v) mother and new father, and (vi) father with new mother.

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[19] In addition, Hjalmarsson and Lindquist (2012) 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.

[20] Caceres and Giolito (2012) provide recent evidence of a causal relationship, as they demonstrate that the change in U.S. divorce laws to unilateral divorce (i.e. making divorce easier) increased violent crime rates by almost 9 percent.

We show the sibling correlations estimated with and without controls for up to 10 crimes in Figure 3 and for up to one year in prison in Figure 4. In Appendix Figures 3-5, we show the results broken down by crime type.

When we control for both parental income and education at the same time, the brother correlations decrease by at most nine percent (for "at least 1 violent crime") and the sister correlations decrease by at most eight percent (for "at least 2 crimes"). The brother correlations in prison sentence length decrease by at most nine percent (for "at least 2 weeks in prison"), while none of the decreases in the sister correlations in prison sentence length are statistically significant.

Controlling for parental criminality the correlations in criminal convictions decrease by at most 13 percent for brothers (for "at least 1 other crime") and 17 percent for sisters (for "at least 1 other crime"). The correlations in prison sentence length decrease by at most 11 percent for brothers (for "at least 2 weeks in prison") and 21 percent for sisters (for "at least 1 month in prison"). In general, the percentage decreases are larger for sisters than for brothers.

Are these results in line with what one might expect given the results reported in the literature on intergenerational crime? Hjalmarsson and Lindquist (2013) report a father-offspring association of 0.121 and a mother-offspring association of 0.134 for having at least one conviction of any type. Squaring these numbers (i.e., applying Solon's (1999) approximate decomposition formula) and then dividing by the sibling correlation tells us that parental criminality (and its correlates) should account for between 6 and 7 percent of the sibling correlation if only one parent has a conviction.[21] If both parents are convicted, then the parent-offspring association is 0.228 (Hjalmarsson and Lindquist 2013) and can account for 21 percent of the sibling correlation in crime.[22] Thus, our new findings appear to be in line with what one might expect from the results reported in the intergenerational crime literature.

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[21] $0.121^2/0.244 = 0.060$, $0.134^2/0.244 = 0.074$
[22] $0.228^2/0.244 = 0.213$

Despite this, we are still concerned that we might be underestimating the importance of parental criminality. The parents used in this study are quite old, which means that their crime data is heavily censored (recall that our crime data starts in 1973 when parents in our data are on average 39 years old). In order to examine this potential issue of measurement error in parental crime, we split our sample into two groups; the older cohorts born 1958-1962 with (on average) older parents and the younger cohorts born 1964-1968 with (on average) younger parents. If crime among the younger cohorts of parents accounts for a larger share of the sibling correlation than does crime among the older cohorts of parents, then this may indicate that measurement error in parental criminality is biasing our measures of its quantitative importance downwards.[23]

After splitting the sample this way, we see that the amount of the brother correlation in *Crime* that can be accounted for by parental criminality rises from 10 to 14 percent. The amount of the sister correlation explained by parental criminality, however, remains fairly constant across samples, changing from 13 to 12 percent when moving from the older to the younger parents. Similar increases for brothers, and no increases for sisters, can be seen across all extensive margin variables. Importantly, we do not see the same increase in explanatory power of parental income and education if we re-run that experiment after splitting the sample into younger and older cohorts. Thus, we conclude that measurement error in parental criminality may bias the explanatory power of parental criminality downwards by about 29 percent for brothers,[24] but not for sisters. It is, therefore, likely that parental criminality explains the same amount of the variation among brothers as among sisters.

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[23] As we suspected, only 23 percent of the older fathers have a conviction and 4 percent have a prison sentence, while 27 percent of the younger fathers have a conviction and 5 percent have a prison sentence. For mothers, we see that 8 percent of the older mothers have a conviction and 0.2 percent have a prison sentence, while 9 percent of the younger mothers have a conviction and 0.4 percent have a prison sentence.

[24] $100*(14-10)/14$

When we add controls for family structure, the correlations in criminal convictions decrease by at most 19 percent for brothers (for "at least 1 crime") and 16 percent for sisters (for "at least 1 crime"). The correlations in prison sentence length decrease by at most 15 percent for brothers (for "at least 2 weeks in prison"), while for sisters the decrease is never statistically significant.

These results suggest that both parental criminality and family structure are relatively more important in explaining sibling correlations in crime than parental education and income. One possible explanation for this is that both the parental criminality and family structure variables are themselves impacted by parental education and income, and thus controlling for either of these variables actually captures some of parental education effect in addition to the direct effect of parental criminality or family structure. While this is true to some extent, a factor analysis of our explanatory variables concludes that there are three clearly distinct factors. Factor 1 is based on parents' education and income. Factor 2 represents parental criminality. Factor 3 represents household structure. Mother's age at first birth, however, loads equally onto all three factors.

When we include all the above controls at once, the correlations in criminal convictions decrease by at most 27 percent for brothers (for "at least 1 crime") and 26 percent for sisters (for "at least 1 crime"), and the correlations in prison sentence length decrease by at most 23 percent for brothers (for "at least 2 weeks in prison") and 26 percent for sisters (for "at least 1 month in prison"). We, therefore, conclude that around one-fourth of the sibling similarities in criminal outcomes can be accounted for by our set of family-wide controls, suggesting that sibling associations in criminal behavior are driven mainly by factors common to siblings other than parental income and education, parental criminality, and family structure.

5.2 Sibling Spacing

Siblings born many years apart may, in fact, experience quite dissimilar home environments. This could explain why our set of family-wide variables does not account for the majority of the sibling correlation. Family structure at age 15 and household size at age 15 vary across siblings. But our measures of parental income, parental education, parental crime and mother's age at first birth do not. The influence that these variables may have on the environments experienced by children is not allowed to vary over time.

To gauge the importance of sibling spacing for our accounting exercise, we re-run the experiment using pairs of brothers and sisters born at most four years apart and compare these results to the results obtained when using sibling pairs born six to ten years apart. In Figure 5, we see that our family-wide variables account for as much of the sibling correlation among widely spaced siblings as it does for closely spaced siblings. (For instance, the extensive margin correlations for brothers born within four years of each other and those born six or more years apart are both reduced by 26 percent when including the full set of controls). This implies that the larger correlation between closely spaced siblings is being driven by unobserved family factors that differ between these two types of siblings. It also implies that these unobservables are quite important. Sibling peer influences might be one such factor. Other factors could include time varying family factors or time varying neighborhood influences.

5.3 Neighborhood Effects

Although we have been able to account for a significant share of the sibling correlation, an even larger share remains unexplained. A final mechanism that we wish to explore is the potential role of neighborhood effects that are shared by siblings. Studies in economics suggest that neighborhoods may have causal effects on individual crime (Ludwig et al. 2001,

Kling et al. 2005, and Damm and Dustmann 2013). Most Swedish studies, however, tend to find limited influences of neighborhoods on children's outcomes (Brännström 2004, Lindahl 2011). Using population wide data for Sweden, Sariaslan et al. (forthcoming) present evidence that neighborhoods do not have a causal effect on violent crime and substance abuse among youths aged 15 to 20, at least not at the extensive margin.

In this section, we present neighborhood correlations in crime at the extensive and intensive margin broken down by crime type and gender. These neighborhood correlations act as an upper bound on the part of the sibling correlation that shared neighborhood environments could potentially account for (see Solon et al. 2000 and our discussion in Section 2). To net out sorting into neighborhoods, we include all of the family-wide control variables used in the previous section. Thus, our neighborhood correlations should be viewed as "tight" upper bounds on the potential causal effect of neighborhoods on crime.

We define a neighborhood as the parish that a child lived in at (or around) age 15.[25] Parishes are the smallest administrative unit in Sweden. For the cohorts that we study in this paper, parishes correspond quite closely to school districts (catchment areas). We use data from the 1975, 1980, and 1985 bidecennial censuses to assign parish codes. From the 1980 census we have, for example, information from 2,602 parishes. The smallest parish contains only 1 family; the median number of families is 43, the mean is 157, and the largest contains 3034 families.

We report the extensive margin neighborhood correlations in Table 4. The neighborhood correlation in crime for all individuals is 0.01, suggesting that (at most) one percent of the total variation in crime can be explained by factors that individuals growing up in the same neighborhood share. Investigating the neighborhood correlations for each of the crime types separately, the correlation is 0.02 for property crime, 0.02 for violent crime, and

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[25] We cannot get information on schools attended nor on the Small Area Marketing Statistics used to define neighborhoods in Sariaslan et al. (2013), since the cohorts we study are too old.

0.01 for other crime. For prison, the neighborhood correlation is 0.02. The neighborhood correlation is thus lower for other crimes than for property crimes, violent crimes and prison.

The highest correlations are the correlations for property crime for men and women, which are both 0.03. These correlations indicate that at most 3 percent of the variation in property crime can be attributed to shared neighborhood factors. These should be contrasted with our brother and sister correlations in "at least 1 property crime", which are 0.38 and 0.34, respectively. Thus, neighborhoods effects appear to be able to explain approximately 7 percent of the sibling correlation in property crime at the extensive margin. Given that we have included all of the family-wide controls used in Section 5, these 7 percent can be added on to the 27 percent explained in the previous section. Thus, it appears that we can account for as much as one-third of the sibling correlation at the extensive margin.

The intensive margin neighborhood correlations are computed using binary outcome variables. We show the neighborhood correlations for up to 10 crimes and up to 1 year in prison in Figure 6. In Appendix Figure 2, we show separate figures for each crime type.

Similar to our sibling correlations, neighborhood correlations also increase along the intensive margin. For women the increase in the neighbor correlation in aggregate crime is from 0.011 (for "at least 1 crime") to 0.045 (for "at least 10 crimes") and for prison it rises from 0.021 (for "at least 2 weeks") to 0.059 (for "at least 1 year). For men the increase in the neighbor correlation in aggregate crime is from 0.010 (for "at least 1 crime") to 0.033 (for "at least 10 crime") and for time in prison it rises from 0.021 (for "at least 2 weeks") to 0.048 (for "at least 1 year").

Overall, neighborhood correlations are quite small for all but the most severe offenders, and even these are much lower than their corresponding sibling correlations. This result indicates that factors shared by siblings other than shared neighborhoods are more important for an individual's criminality, than factors shared by individuals growing up in the same

neighborhood. At the same time, if we relate the size of the neighborhood correlation to the size of the comparable sibling correlation, neighborhood effects have the potential to explain between 7 and 13 percent of the sibling correlation beyond that explained by family-wide variables. It is similar to the amount accounted for by parental education and income.

One potential explanation for our small estimated neighborhood correlations is that our definition of neighborhoods is too broad, both in the geographical sense and in the sense that neighborhoods may not map well into peer groups. Alternatively, one might want to focus more on the schools that children attend (as in Gaviria and Raphael 2001, Calvó-Armengol et al. 2009, and Liu et al. 2012) or on close neighbors. Sariaslan et al. (forthcoming) study younger cohorts and, therefore, have access to more narrow measures of neighborhoods. They look within the Small Area Marketing codes created by Statistics Sweden to define small, homogenous neighborhoods. They also look within schools. But they still find no large neighborhood effect.

Brännström (2004) argues that these small neighborhood effects may be due to the success of the Swedish welfare state. This is certainly one possibility. For the U.S., Johnson (2007) reports large neighborhood correlations in criminal behavior and incarceration. He also reports that growing up in low quality neighborhoods increases the likelihood that one has ever been incarcerated. On the other hand, neighborhood correlations in educational attainment are quite similar in the U.S. and Sweden and quite small.[26] It may, therefore, be hard to argue that our result is "Sweden specific". Lastly, one should keep in mind that we are studying average neighborhood effects and not the effect of growing up in an extremely disadvantaged neighborhood.[27]

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[26] For the U.S. see Solon et al. (2000). For Sweden see Lindahl (2011).
[27] The Moving To Opportunity program focuses more on helping families leave extremely low quality neighborhoods (Ludwig et al. 2001, Kling et al. 2005). Krivo and Peterson (1996) also study the connection between particularly disadvantaged neighborhoods and crime.

To assess the impact that neighborhood quality might have on our sibling correlations, we run one final experiment. We start by defining a measure of neighborhood quality based on the average education level of parents in the neighborhood, the average income level of parents, and the share of immigrant parents in each neighborhood.[28] We then create a dummy variable equal to one for the 10 percent of our sibling sample living in the highest quality neighborhoods and a second dummy variable equal to one for the 10 percent of our sibling sample living in the lowest quality neighborhoods. We estimate neighborhood correlations for high and low quality neighborhoods and we produce new estimates of the sibling correlation for siblings living in these high and low quality neighborhoods.

In Table 5, we see that the neighborhood correlations are consistently higher in low quality neighborhoods than in high quality neighborhoods. More importantly, the ratio between the neighborhood correlation and the sibling correlation is always larger for low quality neighborhoods than for high quality neighborhoods. This means that neighborhood effects can potentially explain more of the sibling correlation in low quality neighborhoods, which leads us to conclude that neighborhood quality may be one of the factors that makes siblings similar in terms of their criminal behavior. However, such neighborhood effects are still smaller in magnitude than the roles played by parental criminality and family structure.

6. Conclusion

Our analysis of sibling correlations in criminal behavior yields four main findings. First, we find that family background and community factors shared by siblings account for 24 percent of the variation in the likelihood of having any conviction, i.e. entering into a criminal career.

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[28] Neighborhood quality refers to the characteristics of all of the parents living in the same parish as the sibling when the sibling was 15 years old. We first create three different percentile rankings for each parish; one based on parental education, a second based on parental income, and a third based on the share of parents who were not born in Sweden. Immigration status has been included in order to reflect the potential effects of segregation, discrimination, and the feeling of social exclusion that is often discussed in the Swedish debate concerning troubled neighborhoods. These three percentile rankings are then weighted equally into a final percentile ranking of neighborhood quality.

Second, we find even larger sibling correlations for measures of the intensity and severity of the criminal career: violent and property offenses versus other offenses, the likelihood of incarceration, the number of convictions, and longer prison sentences. These patterns are similar across: (i) crime types, (ii) male, female, and mixed sibling pairs, and (iii) siblings more and less closely spaced. Third, our analysis of which family and community background characteristics are underlying the sibling crime correlations suggest that neighborhood identifiers and parental education and income play a relatively less important role than parental criminality and family structure. These results are in line with the previous literature on intergenerational crime. Neighborhood effects, however, tend to receive much more attention in the US literature. Fourth, all of these controls taken together still only explain one-third of the sibling crime correlation, even for siblings spaced close together.

This leaves us with the question of what actually does explain the sibling correlation in crime. Of course, we recognize that there are a number of mechanisms that our limited set of control variables do not capture. One possibility is genes and inherited characteristics that are correlated with criminal behavior. For instance, adoption studies that use the criminal records of the biological and adoptive parents to disentangle the importance of pre-birth (genes, prenatal environment and perinatal conditions) and post-birth factors for generating intergenerational criminal relationships find evidence that pre-birth factors do play a significant role (Hjalmarsson and Lindquist, 2013). Twin studies also report an important role for genetic factors in the etiology of antisocial behavior and crime (Ishikawa and Raine 2002, Eley et al. 2003). We would argue, however, that by controlling for the education, income, and criminal behavior of both biological parents, we have indeed controlled for most of the relevant genetic factors (albeit very imprecisely).

Using survey data from the Stockholm Birth Cohort, Björklund et al. (2010) show that parental involvement in school work, parenting practices and maternal attitudes are important

for generating sibling similarities in their adult incomes. In particular, a mother's willingness to plan and save for the future appears to matter. These remain important even after controlling for measures of parental income and education, family structure, and social problems. There is also increasing evidence that siblings may have a large influence on each other through sibling peer effects (Altonji et al. 2010; Rowe and Farrington 1997). Continued work in the area of peer effects, sibling peer effects and sibling similarities in criminal behavior is one avenue for moving beyond the analysis of statistical risk factors and into the realm of understanding the mechanisms underlying antisocial behavior and crime.

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Table 1. Number of Families with N Children.

N children	Nr of Families	Nr of Individuals
1	206901	206901
2	144096	288192
3	47872	143616
4	11798	47192
5	2909	14545
6	804	4824
7	228	1596
8	68	544
9	15	135
10	3	30
11	1	11
12	1	12
15	1	15
Total	414,697	707,613

All children of the same mother are defined as belonging to the same family.

Table 2. Descriptive Statistics.

	All	Men	Women
Number of Observations	707,613	363,234	344,379
	(100%)	(51.33%)	(48.67%)
Year of Birth	1963.1	1963.1	1963.1
	(3.130)	(3.130)	(3.130)
Crime	0.285	0.437	0.125
	(0.452)	(0.496)	(0.331)
Property Crime	0.137	0.207	0.064
	(0.344)	(0.405)	(0.245)
Violent Crime	0.055	0.095	0.012
	(0.228)	(0.294)	(0.109)
Other Crime	0.225	0.363	0.079
	(0.418)	(0.481)	(0.270)
Nr of Crimes | Nr of Crimes > 0	6.825	7.655	3.764
	(21.248)	(23.118)	(11.543)
Nr of Property Crimes | Nr of Property Crimes > 0	5.944	6.661	3.514
	(14.926)	(16.403)	(7.633)
Nr of Violent Crimes | Nr of Violent Crimes > 0	2.663	2.779	1.688
	(3.549)	(3.683)	(1.841)
Nr of Other Crimes | Nr of Other Crimes > 0	4.372	4.691	2.826
	(12.465)	(13.110)	(8.518)
Prison	0.044	0.078	0.007
	(0.204)	(0.269)	(0.083)
Prison | Nr of Crimes > 0	0.153	0.179	0.055
	(0.360)	(0.384)	(0.229)
Days Sentenced to Prison | Days Sentenced to Prison > 0	455.258	462.639	367.062
	(927.970)	(947.832)	(638.470)

Standard deviations (or %) in parentheses.

Table 3. Extensive Margin Sibling Correlations.

	All Siblings	Brothers	Sisters	Mixed Siblings
Crime	0.244	0.287	0.242	0.228
	(0.003)	(0.005)	(0.007)	(0.004)
Property Crime	0.331	0.375	0.335	0.308
	(0.004)	(0.005)	(0.009)	(0.005)
Violent Crime	0.348	0.371	0.374	0.315
	(0.006)	(0.007)	(0.021)	(0.007)
Other Crime	0.213	0.243	0.209	0.196
	(0.003)	(0.005)	(0.009)	(0.004)
Prison	0.387	0.386	0.435	0.364
	(0.006)	(0.007)	(0.026)	(0.008)
Nr of Observations	707,613	363,234	344,379	311,020

Sibling correlations are estimated using STATA's *xtlogit* command. All outcome variables are dichotomous. Birth year and gender dummies are included. Standard errors are in parentheses. Singletons are included, except in the estimation of the mixed siblings. Estimates are not sensitive to the inclusion/exclusion of singletons.

Table 4. Extensive Margin Neighborhood Correlations.

	Men and Women	Men	Women
Crime	0.008	0.010	0.011
	(0.001)	(0.001)	(0.001)
Property Crime	0.023	0.025	0.026
	(0.002)	(0.002)	(0.003)
Violent Crime	0.016	0.017	0.012
	(0.002)	(0.002)	(0.004)
Other Crime	0.007	0.009	0.007
	(0.001)	(0.001)	(0.001)
Prison	0.020	0.021	0.021
	(0.002)	(0.002)	(0.007)
Nr of Observations	409,207	269,672	259,674

Neighborhood correlations are estimated using STATA's *xtlogit* command after first randomly drawing one individual from each family. This random draw is done separately for each of the three sample used. All outcome variables are dichotomous. Birth year and gender dummies are included. Controls for parental education and income, parental criminality, and family structure are also included in order to net out sorting into neighborhoods. Standard errors are in parentheses.

Table 5. Sibling and Neighborhood Correlations in High- and Low Quality Neighborhoods.

			Men and Women	Men	Women
Crime	Low Quality	Neighborhood Corr.	0.009 (0.002)	0.008 (0.002)	0.014 (0.004)
		Sibling Corr.	0.187 (0.010)	0.232 (0.016)	0.199 (0.025)
		$100 * \frac{Neighbor\ Corr}{Sib\ Corr} =$	5%	3%	7%
	High Quality	Neighborhood Corr.	0.002 (0.001)	0.002 (0.001)	0.113 (0.030)
		Sibling Corr.	0.168 (0.011)	0.226 (0.017)	0.005 (0.002)
		$100 * \frac{Neighbor\ Corr}{Sib\ Corr} =$	1%	1%	4%
At Least 10 Crimes	Low Quality	Neighborhood Corr.	0.033 (0.008)	0.027 (0.007)	0.094 (0.035)
		Sibling Corr.	0.438 (0.020)	0.458 (0.025)	0.458 (0.078)
		$100 * \frac{Neighbor\ Corr}{Sib\ Corr} =$	8%	6%	21%
	High Quality	Neighborhood Corr.	0.014 (0.006)	0.014 (0.006)	0.007 (0.018)
		Sibling Corr.	0.385 (0.031)	0.406 (0.038)	0.591 (0.079)
		$100 * \frac{Neighbor\ Corr}{Sib\ Corr} =$	4%	3%	13%
Prison	Low Quality	Neighborhood Corr.	0.022 (0.006)	0.016 (0.005)	0.072 (0.031)
		Sibling Corr.	0.328 (0.021)	0.318 (0.025)	0.345 (0.101)
		$100 * \frac{Neighbor\ Corr}{Sib\ Corr} =$	7%	5%	21%
	High Quality	Neighborhood Corr.	0.007 (0.004)	0.008 (0.004)	0.000 (0.000)
		Sibling Corr.	0.327 (0.030)	0.332 (0.036)	0.380 (0.136)
		$100 * \frac{Neighbor\ Corr}{Sib\ Corr} =$	2%	2%	0%

Neighborhood correlations are estimated using STATA's *xtlogit* command after first randomly drawing one individual from each family. This random draw is done separately for each of the three sample used. All outcome variables are dichotomous. Birth year and gender dummies are included. Controls for parish size, parental education and income, family structure and parental criminality are also included in order to net out sorting into neighborhoods. Sibling correlations are estimated using STATA's *xtlogit* command. All outcome variables are dichotomous. Birth year and gender dummies are included. Controls for parental education and income, parental criminality, and family structure are also included as are controls. Singletons are included, except in the estimation of the mixed siblings.

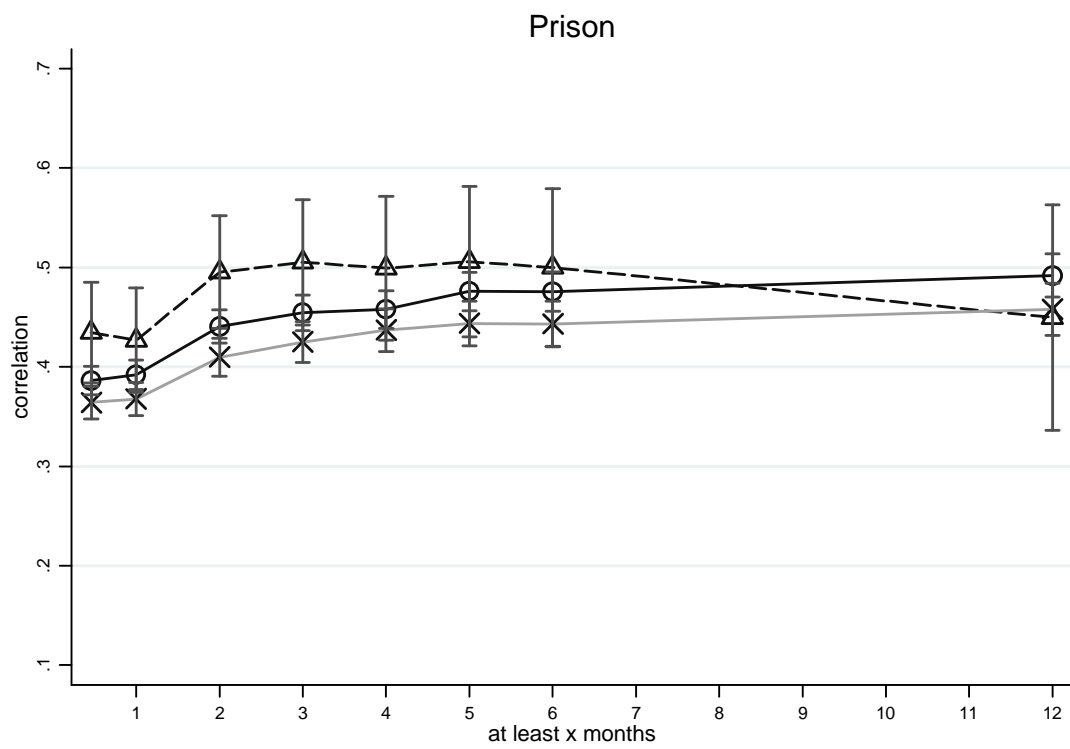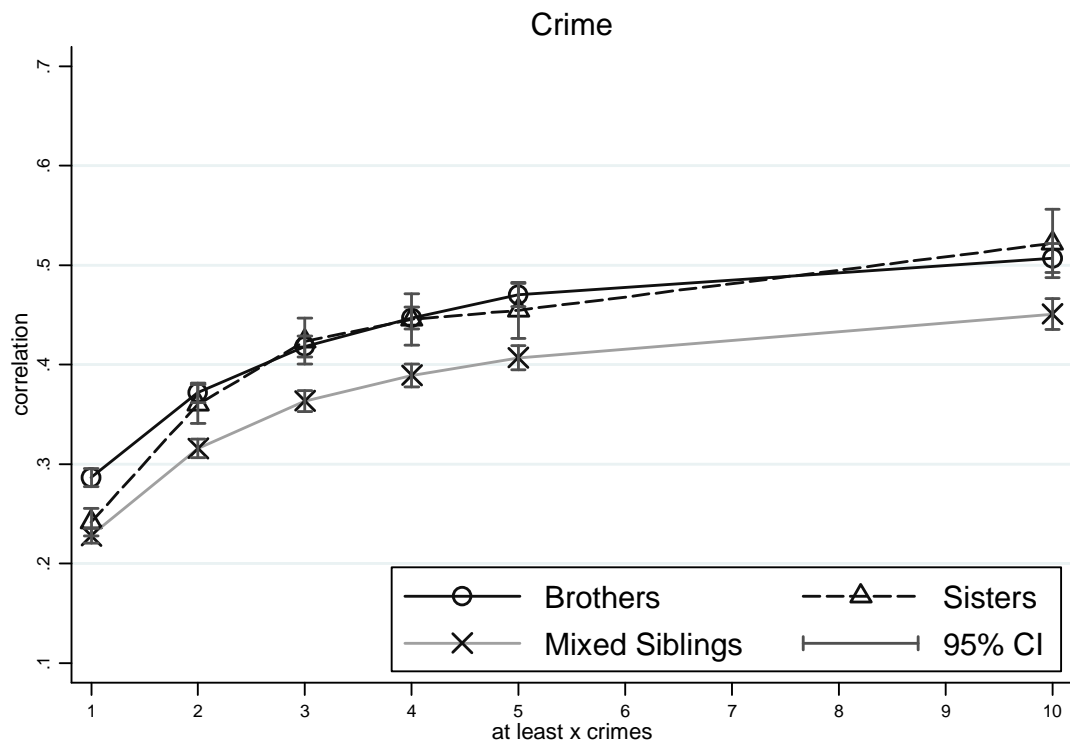Figure 1. Sibling Correlations in Crime and Prison.

Figure 2. Sibling Correlations in Crime for Brother and Sister Pairs Born *X* Years Apart.

Crime, Brothers Born X Years Apart
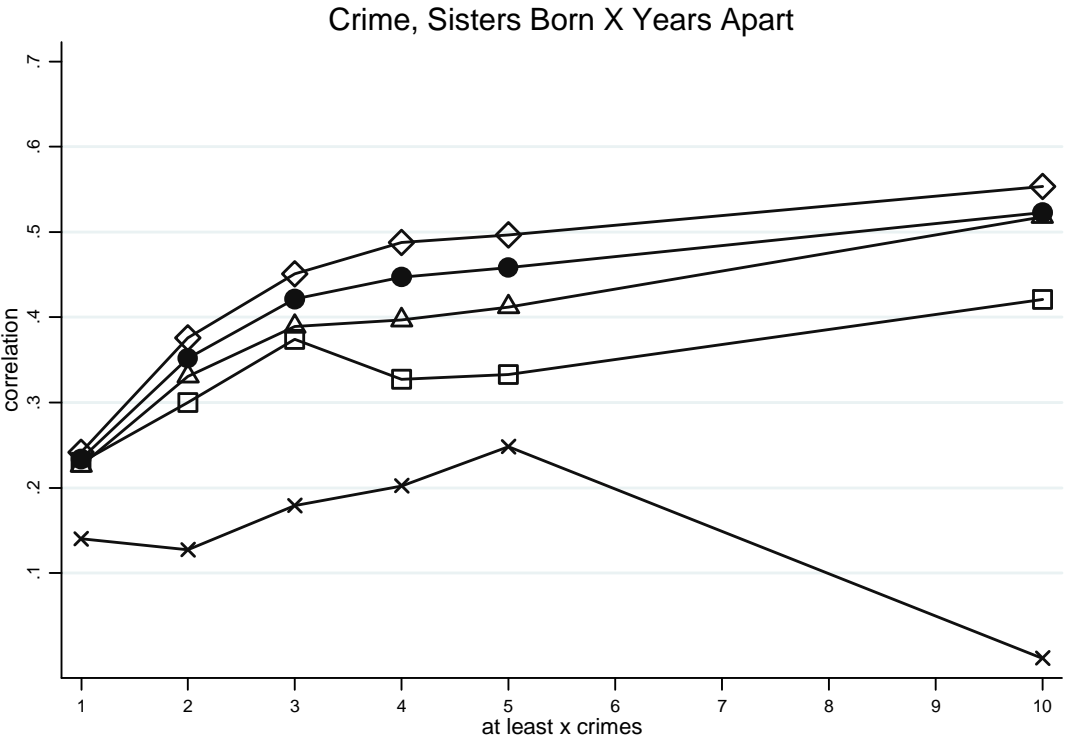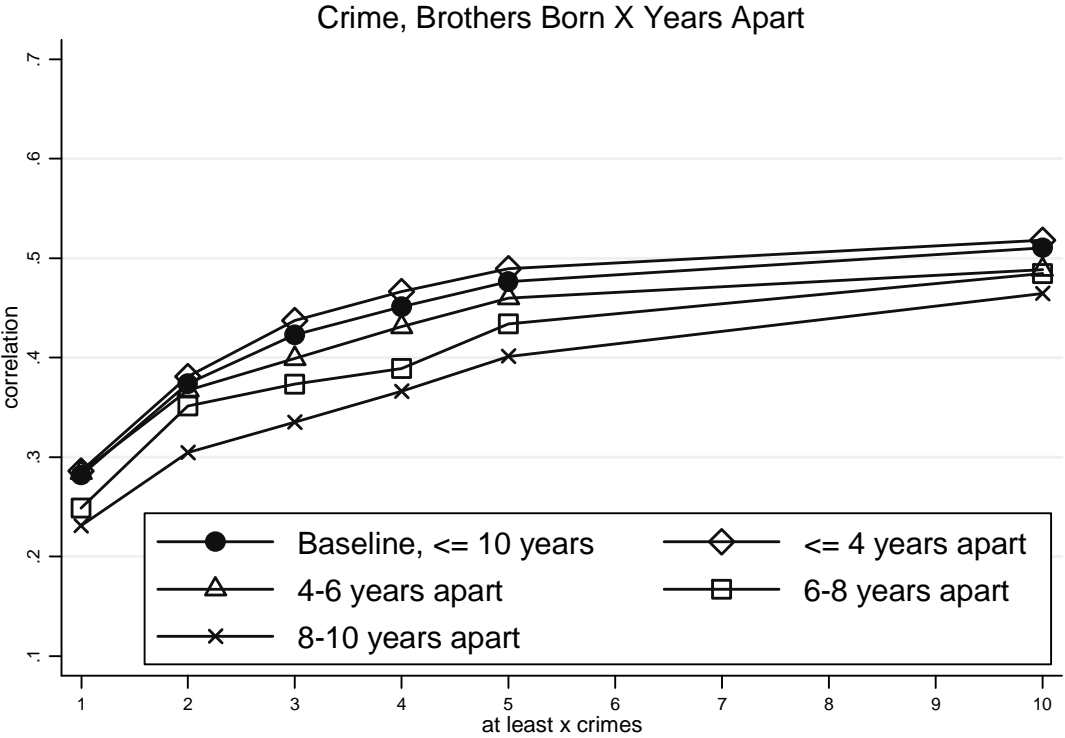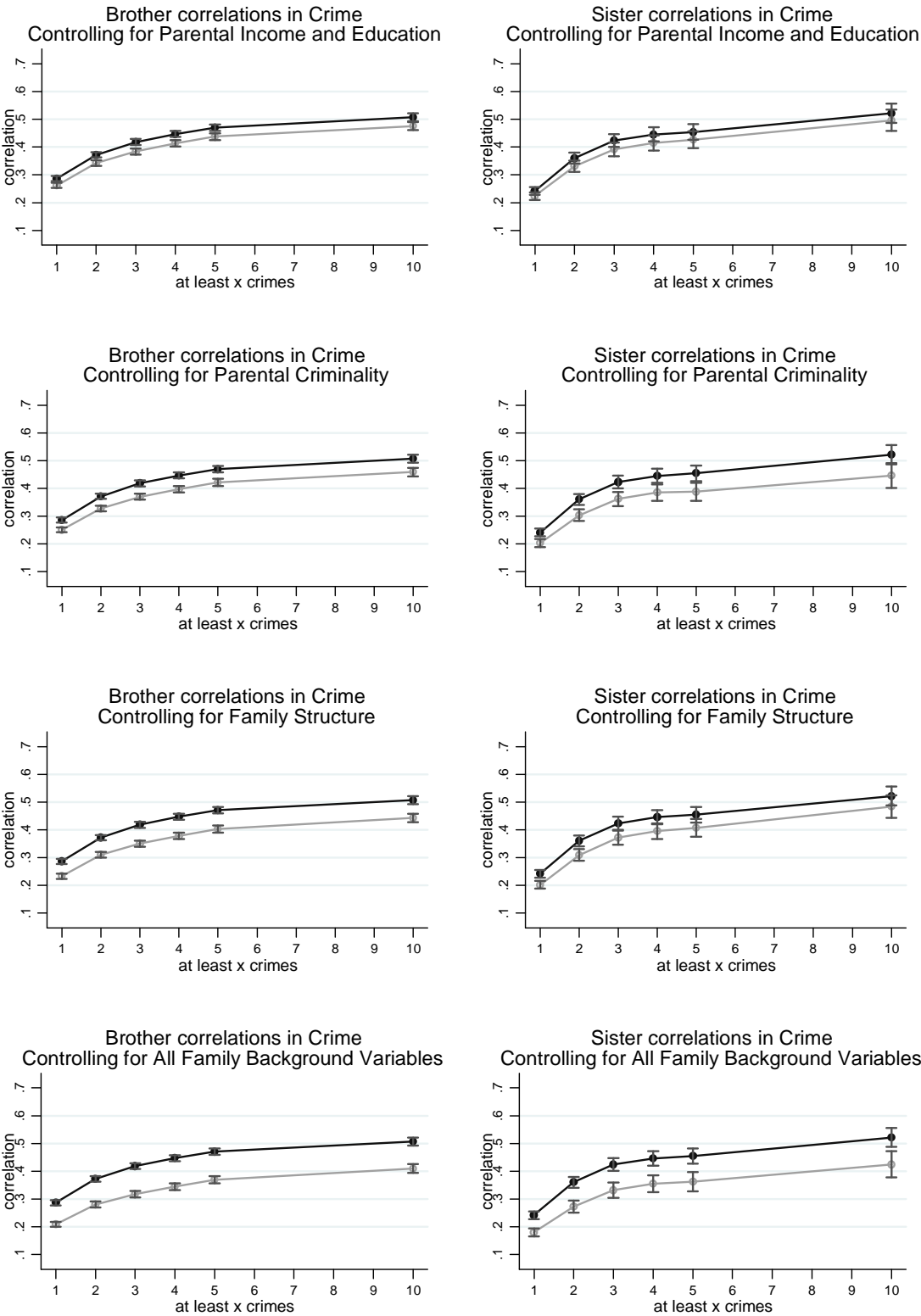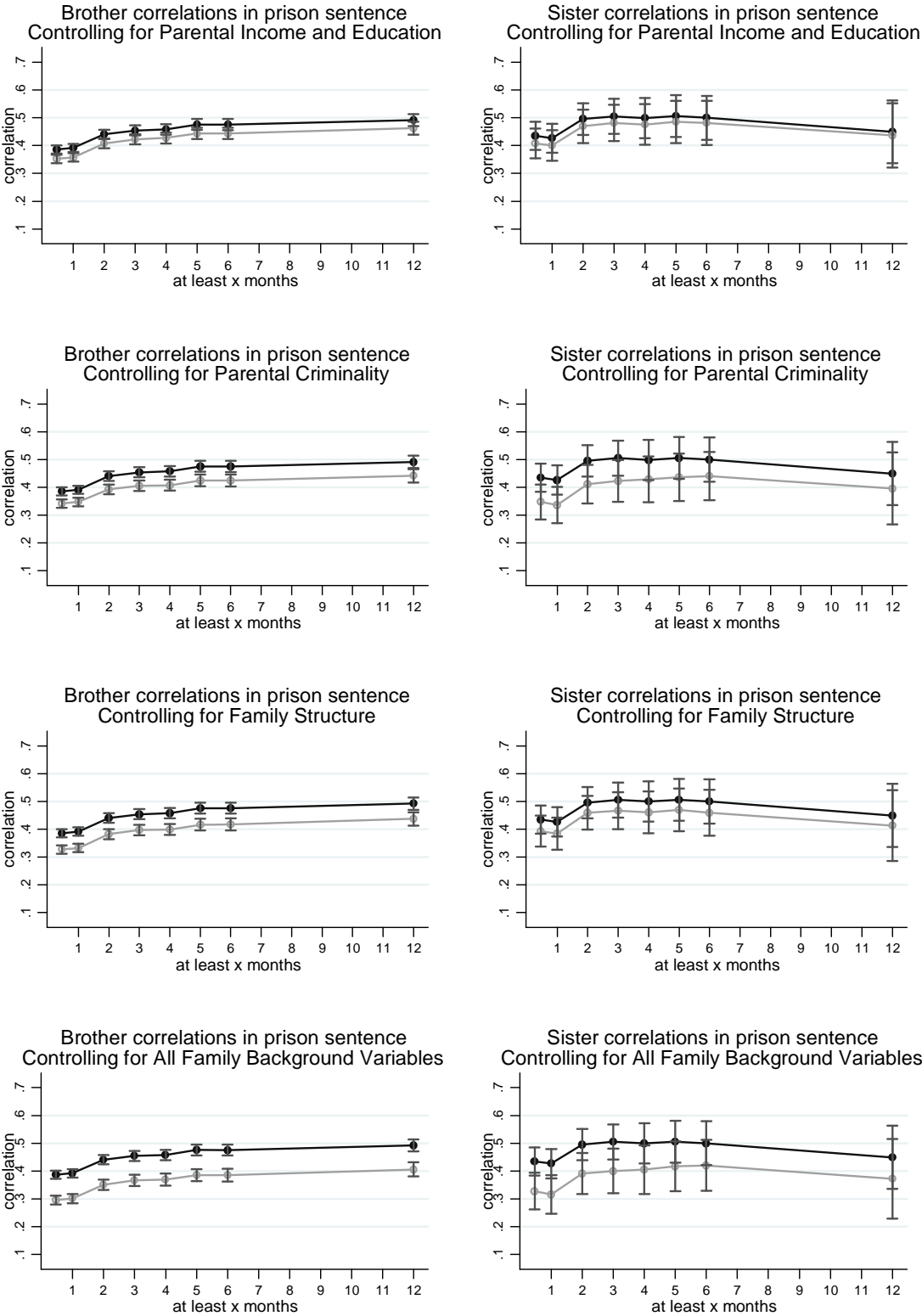

Crime, Sisters Born X Years Apart

Figure 3. Sibling Correlations in Crime Controlling for Parental Income and Education, Parental Criminality and Family Structure.

Note: We show the sibling correlations estimated with (without) controls in grey (black).

Figure 4. Sibling Correlations in Prison Controlling for Parental Income and Education, Parental Criminality and Family Structure.

Note: We show the sibling correlations estimated with (without) controls in grey (black).

Figure 5. Sibling Correlations in Crime for Closely Spaced Siblings and Widely Spaced Siblings With and Without Controls for Family Background.
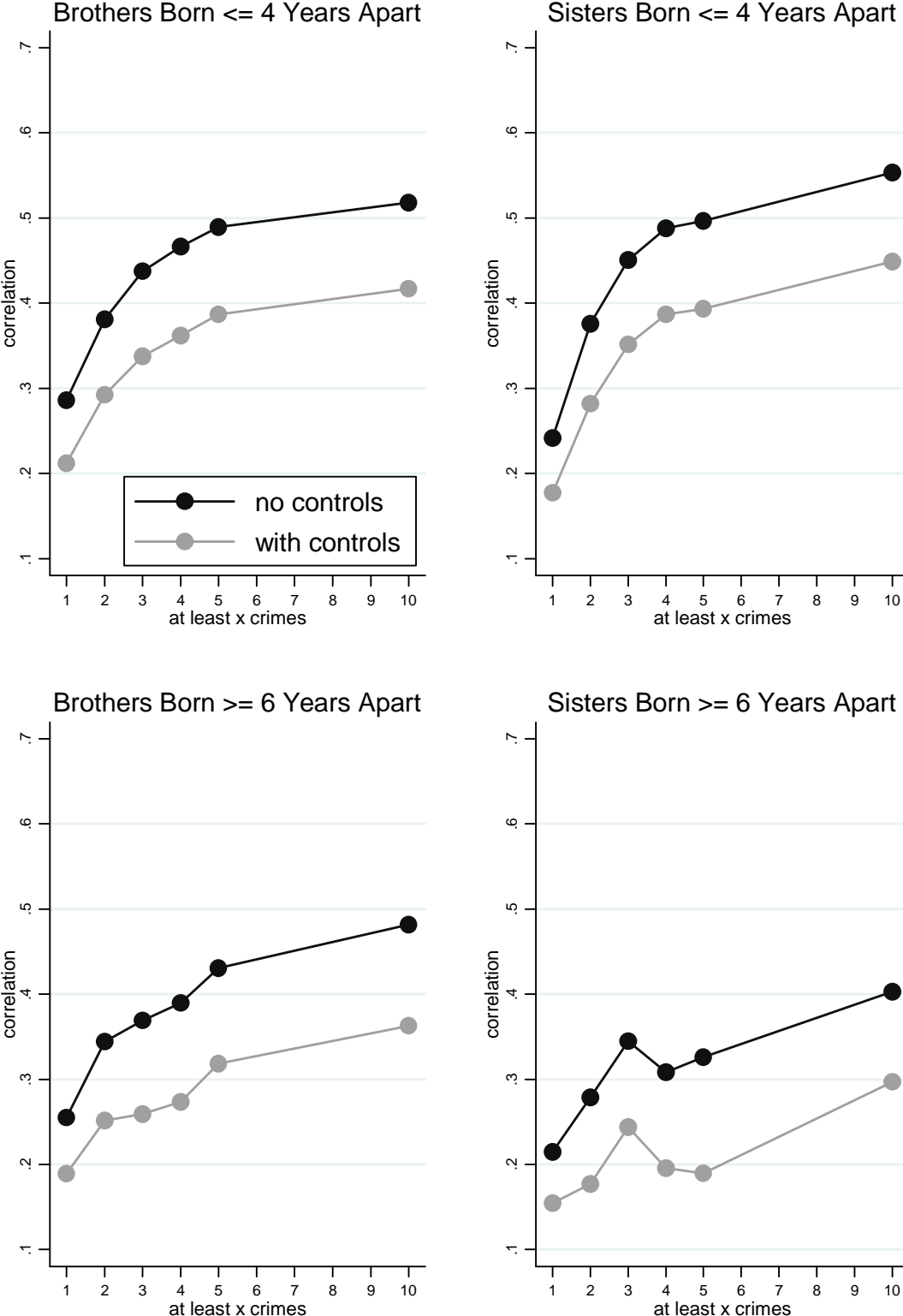
Figure 6. Neighborhood Correlations in Crime and Prison.
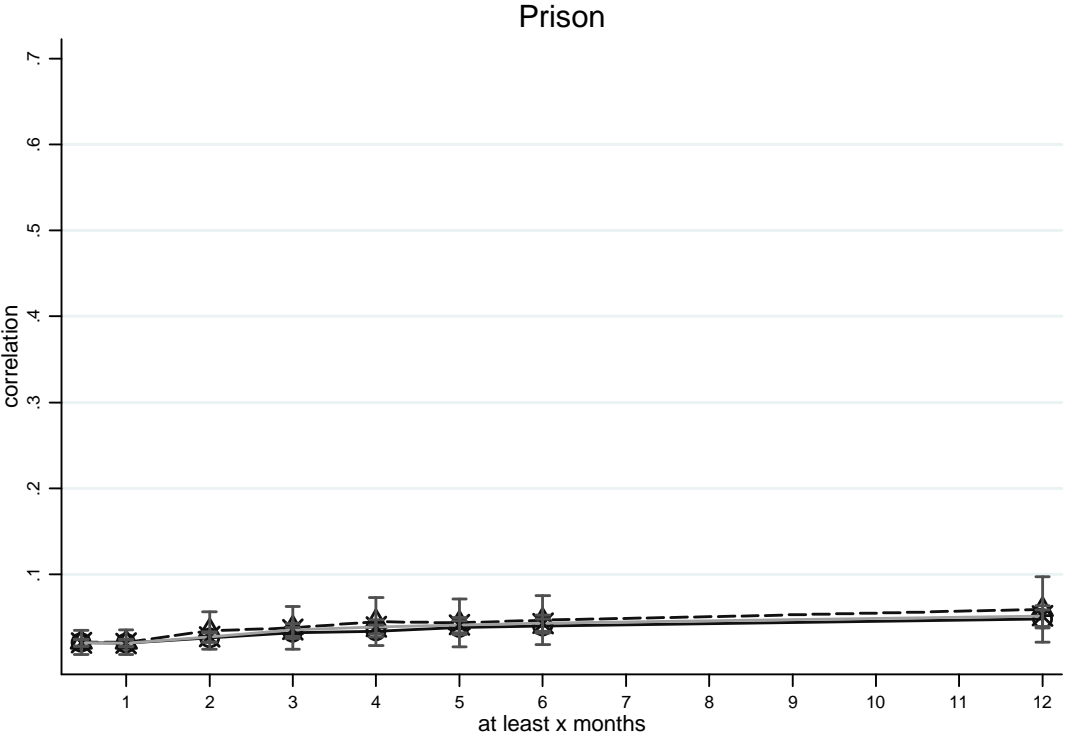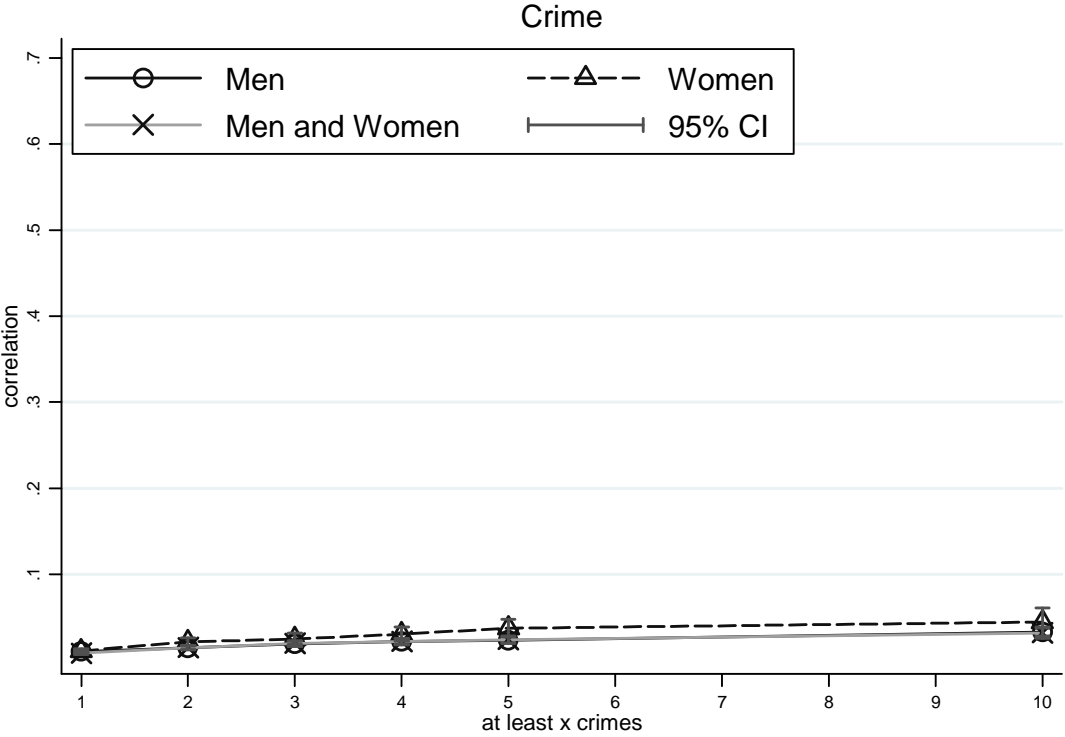
Appendix Figure 1. Sibling correlations in property crime, violent crime and other crime.
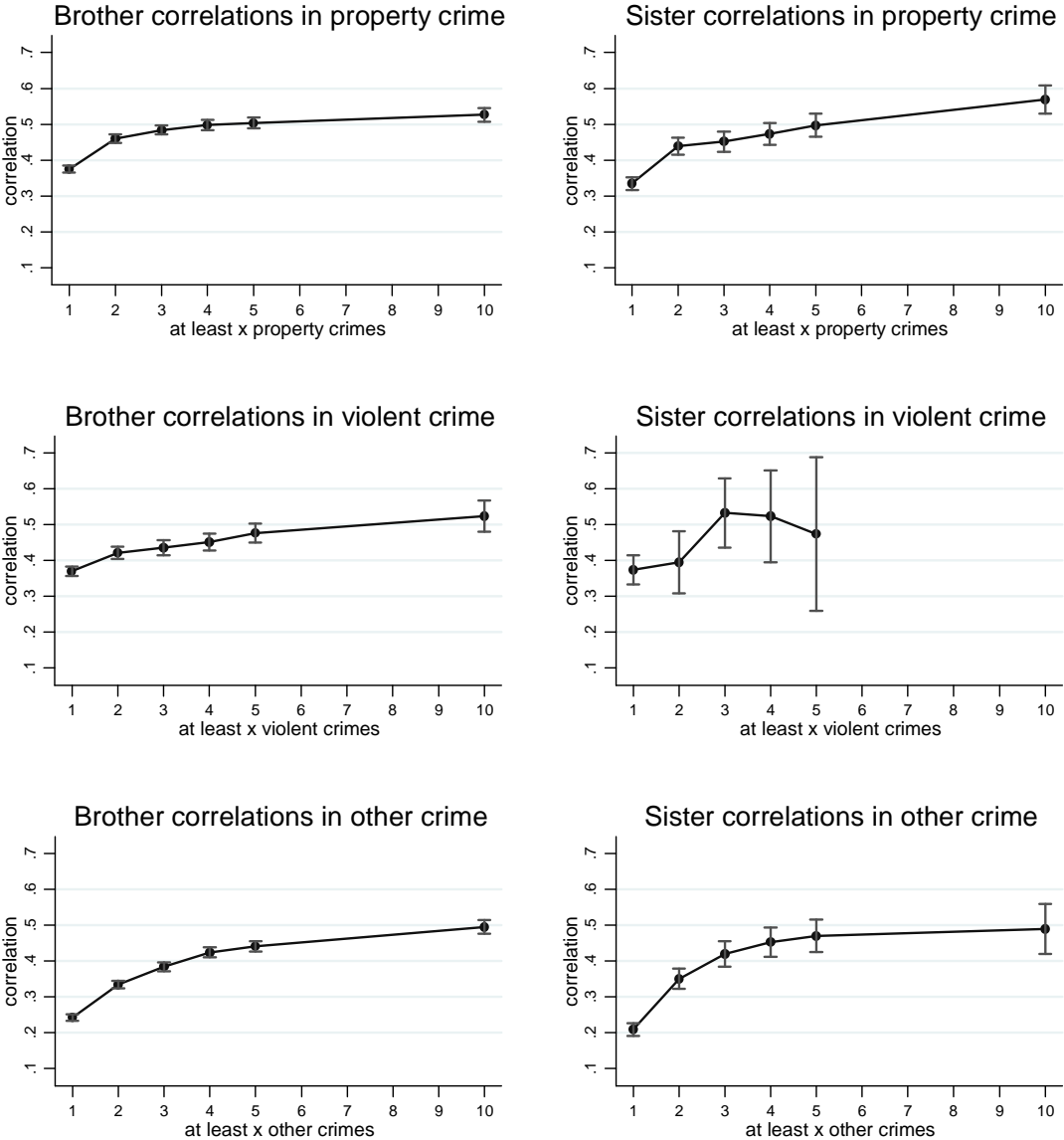
Appendix Figure 2. Neighborhood Correlations in Property Crime, Violent Crime and Other Crime.
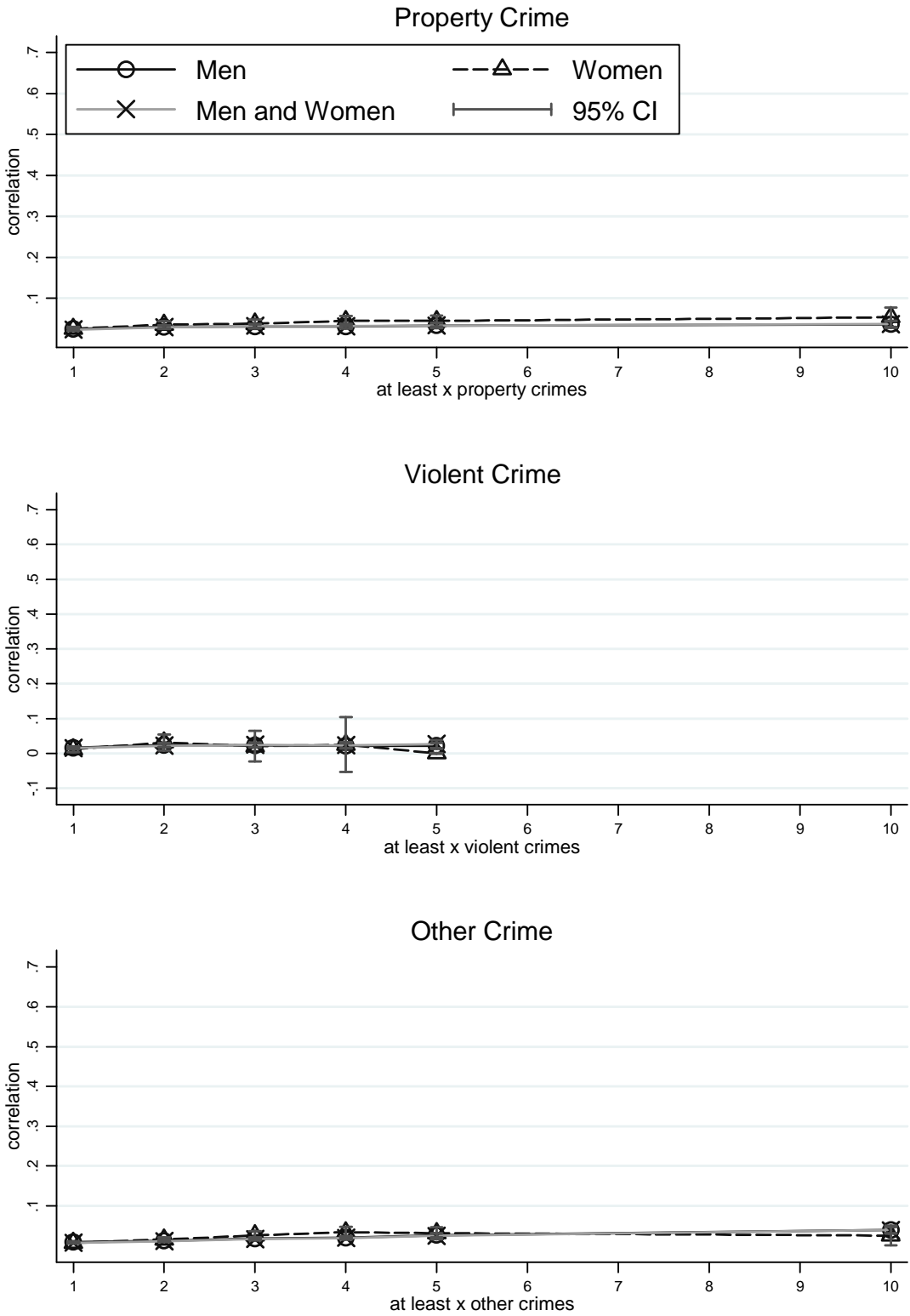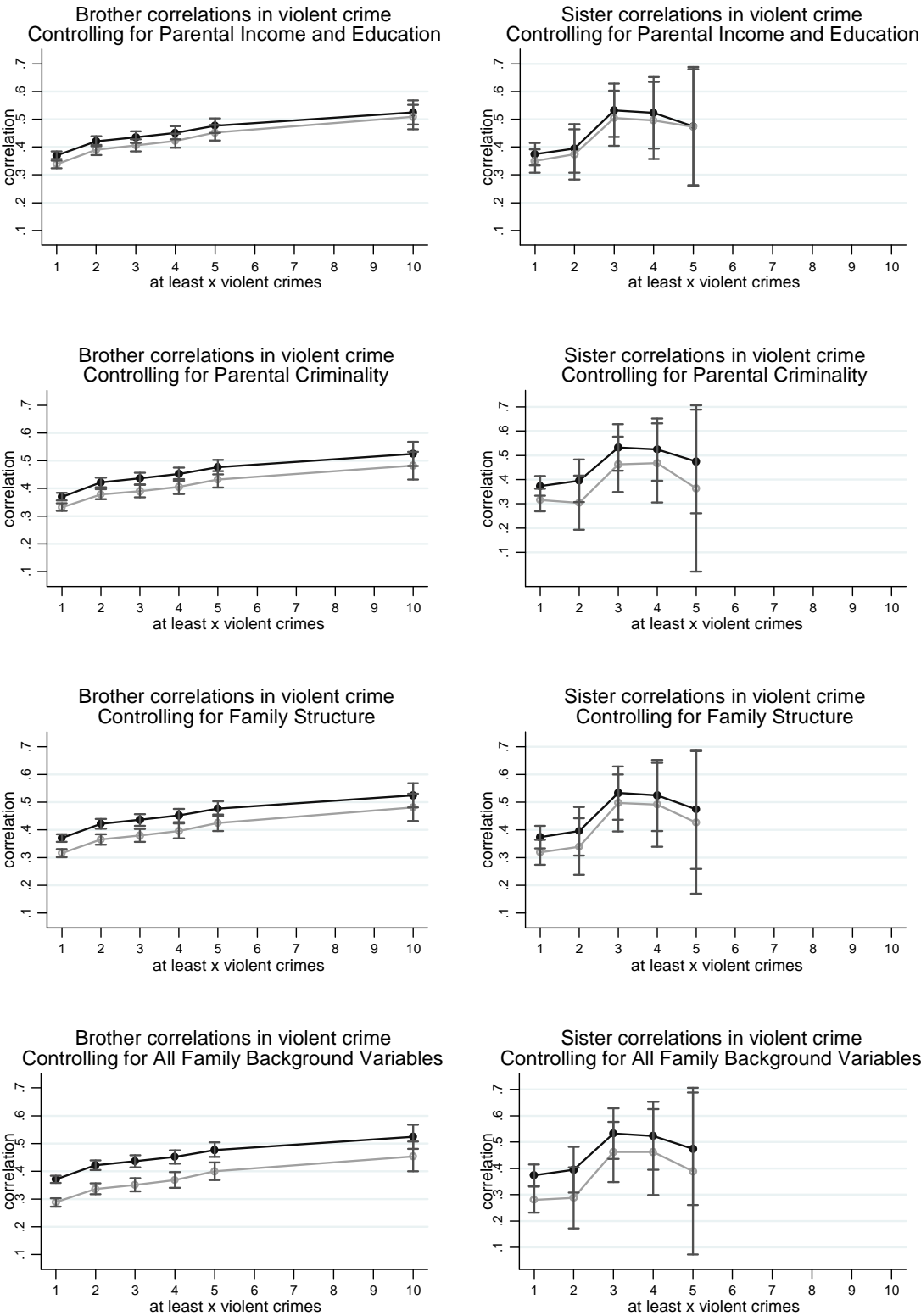
Appendix Figure 3. Sibling correlations in property crime controlling for parental income and education, parental criminality and family structure.
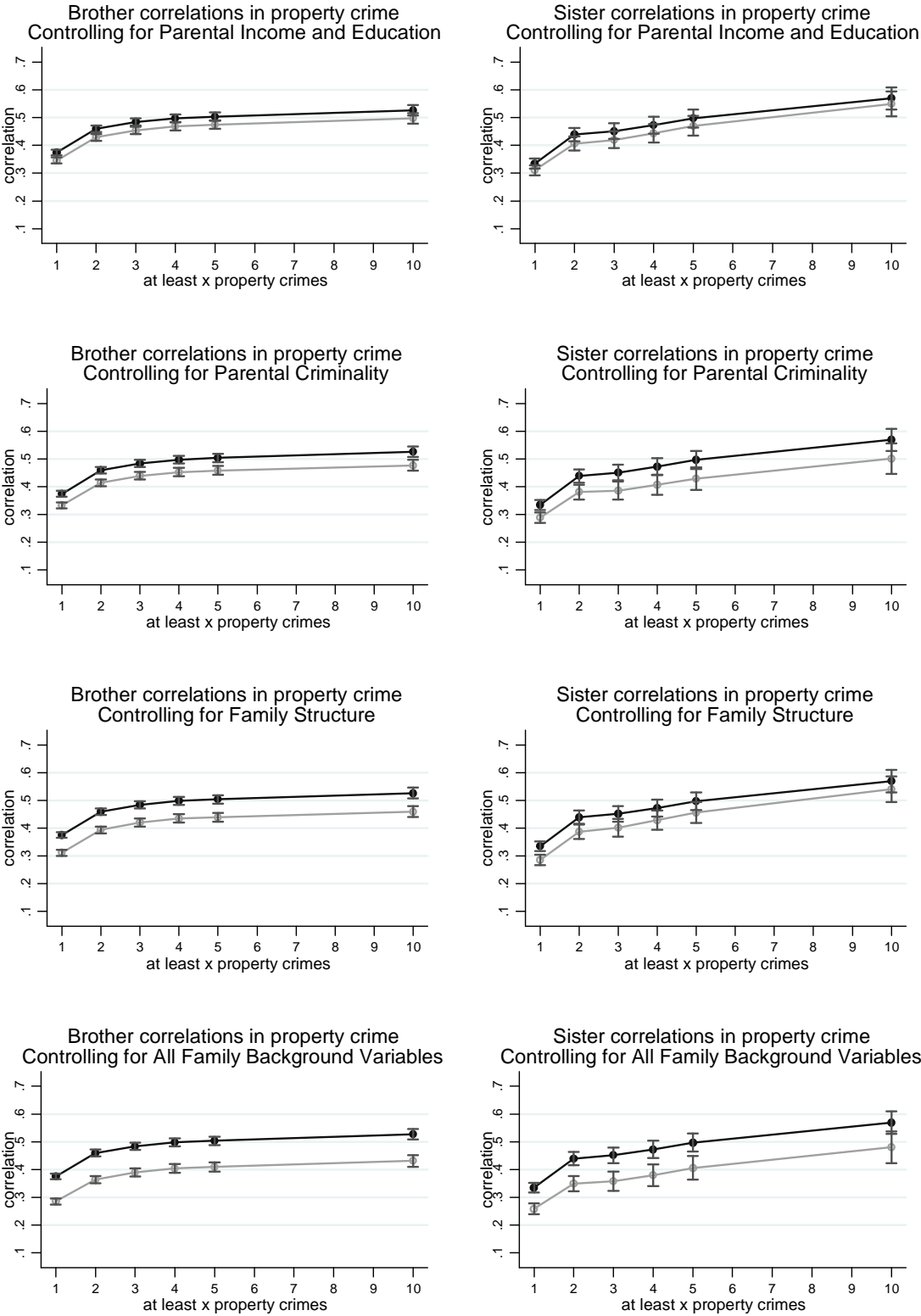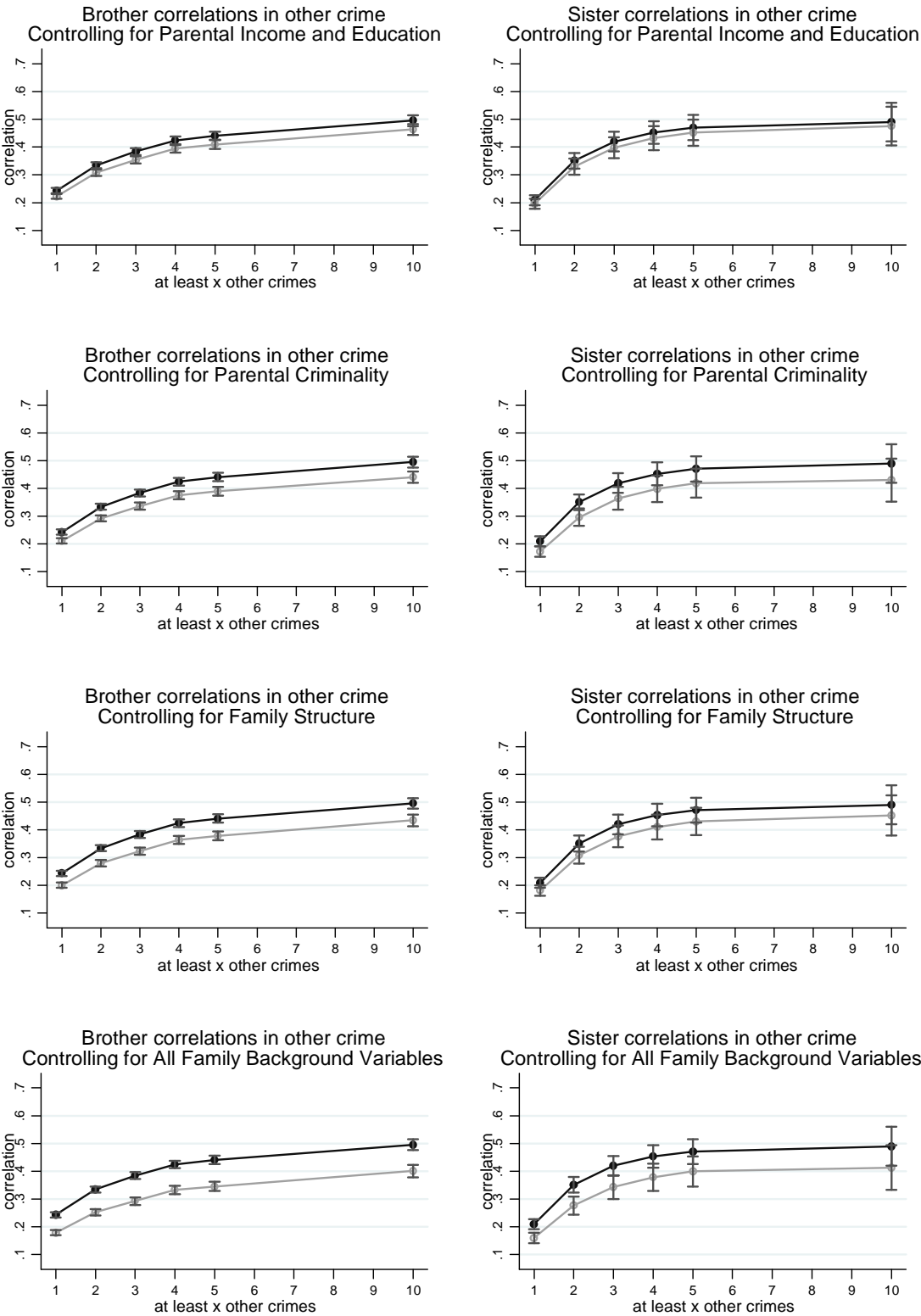

Note: We show the sibling correlations estimated with (without) controls in grey (black).

Appendix Figure 4. Sibling correlations in violent crime controlling for parental income and education, parental criminality and family structure.

Note: We show the sibling correlations estimated with (without) controls in grey (black).

Appendix Figure 5. Sibling correlations in other crime controlling for parental income and education, parental criminality and family structure.

Note: We show the sibling correlations estimated with (without) controls in grey (black).