Parents, Neighbors and Youth Crime*

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Abstract

We study the interplay between parental and peer socialization in shaping criminal behavior among adolescents. We develop a simple cultural transmission model where parents affect how the society influences their children's decision. The model predicts that parental and peer socialization are substitutes in the development of juvenile crime. We then take the model to the data using information on a representative sample of adolescents in the United States. Using the geographic distances between residential addresses of individuals in the same grade and school to measure peer influences, we find that negative peer effects on juvenile crime are significantly lower for teenagers with engaged mothers. Consistent with the prediction of our model, this evidence reveals an important role of parents in mediating the impact of neighborhoods on youth crime. The influence of parents is especially important for drug trafficking, assault and battery. JEL: J13, K42, R11, R23, Z13

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I Introduction

While urban youth crime is a common topic in the present policy debate, there is scarce causal evidence about the magnitude and mechanisms of neighborhood effects on adolescents' criminal behavior (Glaeser and Sacerdote, 1999; Sanbonmatsu et al., 2011). In particular, little is known on how parents can help offspring in dealing with negative peer pressure. In this paper, we explore whether parental involvement in their children's life affects adolescents' willingness to conform to peer pressure to engage in criminal acts (Balester et al., 2010; Bayer et al., 2009; Calvó-Armengol and Zenou, 2004; Lee et al., 2020).

Inspired by the literature on cultural transmission initiated by Bisin and Verdier (2000, 2001), we model juvenile criminal behavior as the outcome of a socialization process inside the family (*vertical* socialization) with socialization outside the family (*oblique* or *horizontal* socialization) via imitation and learning from peers and role models. We present a model of cultural transmission of moral values where parents are altruistic agents that decide how much effort to exert in order to minimize their offspring's criminal activity. The main innovation of our model is that parents are able to affect their children's taste for conformity: the more a parent is involved in the offspring's life, the lower is the disutility experienced by the young agent when her crime behavior deviates from that of the peer group. We solve the model and highlight the interplay between the vertical and horizontal channels, finding that the optimal parental involvement in transmitting moral values operates as a substitute to the level of honesty of peers (i.e., the marginal cost of socializing one's child increases with the level of delinquency of peers).

There are three main differences with the standard approach of cultural transmission à la Bisin and Verdier (2000, 2001) and Bisin et al. (2004). In this traditional approach, children are either directly socialized by their parents with a probability of success equal to the parent's effort put into transmitting their own given trait, or, if this direct socialization fails, the child will be socialized by society with the probability of success corresponding to the share of agents with their own given trait in the population. Different from this framework, our model allows parents to affect how society influences their children's decisions. A second difference is that our model allows for peer effects through friends (as opposed to through population averages). Finally, we model the transmission of traits (moral values) that are vertically differentiated (so that everybody agrees that more is better than less).[1] While in the traditional framework each parent spends effort in

[1]Traits like religion or ethnicity are instead horizontally differentiated: it is just a matter of taste which religion or ethnicity is considered better.

transmitting her/his own trait, here only non-criminal parents conform to this behavior since criminal parents spend time with their children trying to help them become different. As a result, there is no heterogeneity in preferences in the parental decision problem in our model.

We bring our theoretical setup to data and test its predictions using the National Longitudinal Survey of Adolescent to Adult Health (Add Health). Three features of the Add Health survey are unique and central to our analysis: (i) the geo-coded information on the respondents' residential location, (ii) the detailed information on parental behavior, including incarceration, (iii) the detailed information on criminal behavior and characteristics of each individual and their peers. We define peers as students attending the same grade and school who live nearby and include in our model network fixed effects. The key (testable) assumption is that conditionally on the neighborhood (chosen by the parents and identified by the network) and the other variables included in the model, the distance between homes is reasonably exogenous. While choices regarding in which specific home to reside within a neighborhood are conditionally random, those choices affect the strength of social interactions between kids (e.g., kids who live close-by spend similar time on the bus to school or are more likely to spend time together outside the classroom).[2] Our empirical strategy is a refined version of the design first proposed by Bayer et al. (2008) to study referral effects in an urban labor market. Using data on the Boston metropolitan area, they compare outcomes for neighbors that reside on the same versus nearby blocks within a neighborhood reference group. Our data provide a more precise measure of the spatial patterns of social interactions within neighborhood by exploiting the precise geographical distance between the students' residential homes.

Our analysis reveals strong evidence of neighborhood spillovers on youth criminal activity and of negative cross-effects with parental involvement. Understanding how socioeconomic and cultural values are transmitted from one generation to another is a question of great policy interest. The basic cultural transmission model of Bisin and Verdier has been applied to several environments, with different variations (see Bisin and Verdier, 2011, for an overview). The papers closest to ours are Patacchini and Zenou (2011) and Patacchini and Zenou (2016). Patacchini and Zenou (2011) studies the intergenerational

[2]Horrace et al. (2019) provide empirical evidence on the relevance of peer effects in academic performance for primary school children in New York City, finding that bus-route and bus-stop peers are as important as gender, country-of-birth and ethnicity peers. Using data from Facebook to explore the spatial structure of social networks in the New York metro area, Bailey et al. (2020) show that a substantial share of urban residents' connections are to individuals who are located nearby. The fact that people geographically close are more likely to be friends and develop close ties between them is also a common finding in a large sociological literature (see, e.g., Coombs, 1973; Feld and Carter, 1998; Festinger et al., 1950; Hare, 1973; Mouw and Entwisle, 2006).

transmission of education. Similar to our context, education is a trait that is vertically differentiated. Different from our approach, peer influences are captured using residential neighborhood education levels. Patacchini and Zenou (2016) studies the intergenerational transmission of religion. It is similar to our model because peer influences are modeled using a social network approach. It is also quite different since we focus on how parents are able to offset negative oblique or horizontal socialization forces, rather than on the consequences of direct vertical socialization efforts exerted by parents. In both papers the successful socialization of children in the second stage is exogenously determined by the norm in the reference group (neighborhood or friends, respectively). The innovation in our model is that parents can affect the offspring's taste for conformity to this norm.[3]

This paper also lies at the intersection of two different literatures that, to the best of our knowledge, have remained separate until now. On the one hand, there is a large literature on peer effects in crime pioneered by Glaeser et al. (1996). Recent studies have shown the presence of agglomeration externalities for youth crime (Billings et al., 2019; Damm and Dustmann, 2014; Rotger and Galster, 2019). Our paper enriches this literature on neighborhood effects in youth crime by suggesting an important mediation effect of parents.

The second strand of literature is comprised of studies looking at the effects of parental involvement on crime and other risk-taking behaviors (Aizer, 2004; Averett et al., 2009; Cobb-Clark and Tekin, 2014). Using a survey of youths living in low-income Boston neighborhoods, Case and Katz (1991) find that neighbors and family adult behaviors are strongly related to analogous youth behavior, highlighting the importance of role model effects. Our study proposes a different mechanism of parental influence: parents may also affect how the society influences their children's decisions. Our novel micro-foundation of the interplay between peers and parents is not rejected by the data.[4]

[3]Parents could also influence their children's decisions by shaping their peer group. Agostinelli et al. (2020) develop a model of skill accumulation where parents adopt their parenting style and are able to interfere in their offspring's peer selection.

[4]Although the literature on the impact of parental engagement on juvenile delinquency in economics is thin, there is a large literature in psychology, ethnographic sociology and criminology on parenting, peers and crime. For example, control theories of crime put the spotlight on social and family bonds as constraints on future offending (e.g., Hirschi, 1969; Gottfredson and Hirschi, 1990). In particular, parents can provide support (i.e., establishing a sound emotional bond) and control (i.e., monitoring), two factors that are key to predict criminal behavior among adolescents. Some studies argue that parents affect offspring's delinquency indirectly through peer association (e.g., Goldstein et al., 2005; Warr, 1993), while others, as we do, note that parents who are able to develop a positive relationship with their offspring may serve as a protective influence against the risk presented by exposure to negative peer associations (e.g., Walters, 2020).

II Theoretical Model

Consider a two-period model with two generations: old (parents) and young (offspring) agents, such that each old agent is matched with one young agent. First, old agent i selects the optimal level of parental involvement or parental effort, σ_i^*. Then, young agent i decides how much effort to exert in criminal activities, e_i. Following the logic of backward induction, we start with the optimization problem of the offspring, and then use that result to solve the parent's problem.

II.i Offspring's Optimization Problem

We focus on a finite set of young agents, $N = \{1, \ldots, n\}$, and denote by $e_i(\mathbf{g})$ the level of effort exerted into criminal activities by agent i (in network $\mathbf{g}$). The corresponding adjacency matrix, denoted by $\mathbf{G} = [g_{ij}]$, keeps track of the connections in the undirected graph $\mathbf{g}$ (i.e., $\mathbf{G}$ is symmetric: $g_{ij} = g_{ji}$). We also denote by $\bar{e}_i(\mathbf{g})$ the average crime effort exerted by the peers of i, which is given by:

$$\bar{e}_i(\mathbf{g}) = \frac{1}{g_i} \sum_{j \neq i}^{n} g_{ij} e_j \tag{1}$$

where $g_i = \sum_{j \neq i}^{n} g_{ij}$. From now on, when there is no risk of confusion, we drop the argument $\mathbf{g}$. Each criminal selects an effort $e_i \geq 0$ and obtains a payoff $U_{y,i}(e_i, \bar{e}_i)$, given by the following utility function:[5]

$$U_{y,i}(e_i, \bar{e}_i) = a + b_i\, e_i - p\, e_i\, f - \frac{1}{2}\, e_i^2 + d_i \left[b_i\, e_i - p\, e_i\, f - \frac{1}{2}\, (e_i - \bar{e}_i)^2 \right] \tag{2}$$

with $a, b_i > 0$ for all i, and where b_i is a function of the perfectly observable characteristics, $\mathbf{x}$, of young agent i and her friends:

$$b_i(\mathbf{x}) = \sum_m \beta_m x_i^m + \frac{1}{g_i} \sum_m \sum_{j \neq i}^{n} \theta_m g_{ij}\, x_j^m \tag{3}$$

Following Becker's (1968) seminal paper, young agents will decide the amount of criminal effort, e_i, that maximizes the net benefit of being a criminal, given by (2). As expected, the criminal benefit, $a + b_i e_i$, is increasing in the level of effort, where b_i represents young

[5] Equation (2) is a modified version of the utility function in Patacchini and Zenou (2012). While in Patacchini and Zenou (2012) parental effort is exogenous, equation (2) lets parents affect the payoff that kids obtain from crime by adjusting their parental effort, σ.

agent i's criminal productivity. On the other hand, the cost of committing crime is the result of three factors: (i) the probability of being caught, pe_i, times the monetary equivalent of the punishment, f; (ii) young agent's cost of exerting effort into criminal activities, e_i^2; and (iii) the social cost of deviating from the reference group, $(e_i - \bar{e}_i)^2$.

Assume $b_i > p\,f$ for all i, and $d_i \equiv d(\sigma_i)$, with $d'(\sigma_i) < 0$ and where σ_i represents the level of parental effort. According to (2), the more the parent is involved with the kid and disapproves crime (i.e., higher σ_i): (i) the lower is the idiosyncratic criminal benefit, net of the expected monetary cost of being caught and punished, and (ii) the lower is the disutility when young agent i's crime effort deviates from that of the peer group (i.e., a decrease in i's taste for conformity). In other words, parental involvement affects parental socialization and, as a result, the payoff obtained from crime by young agents.

The first-order condition is given by:

$$e_i^* = b_i - p\ f + \frac{d_i}{1+d_i}\bar{e}_i^* \tag{4}$$

where $*$ denotes an equilibrium variable. According to (2), old agents are able to affect how conformism influences the payoff young agents get from criminal activities. However, (4) tells us that, at equilibrium, parental involvement can only reduce the level of crime effort exerted by young agents by decreasing the influence of the peer group.

In matrix form, (4) can be written as follows:

$$\mathbf{e}^* = \beta + \mathbf{D}\,\widetilde{\mathbf{G}}\,\mathbf{e}^* \tag{5}$$

where

$$\mathbf{e} = \begin{pmatrix} e_1 \\ \vdots \\ e_n \end{pmatrix}, \qquad \beta = \begin{pmatrix} b_1 - p\ f \\ \vdots \\ b_n - p\ f \end{pmatrix}, \qquad \mathbf{D} = \begin{pmatrix} \frac{d_1}{1+d_1} & 0 & \dots & 0 \\ 0 & \frac{d_2}{1+d_2} & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & \frac{d_n}{1+d_n} \end{pmatrix},$$

and $\widetilde{\mathbf{G}} = (g_{ij}/g_i)$ is the row-normalized matrix of $\mathbf{G}$. Solving (5) leads to:

$$\mathbf{e}^* = \left(\mathbf{I} - \mathbf{D}\,\widetilde{\mathbf{G}}\right)^{-1}\beta \tag{6}$$

It can be shown that, under reasonable assumptions, there exists a unique Nash equilibrium where the amount of crime committed by each agent is given by the solution described by (4) and (6).

Proposition. *Consider the model above where all individuals have ex-ante idiosyncratic and peer heterogeneities, and different tastes for conformity. Assume that $b_i > p\,f$ for all i. Then, there exists a unique Nash equilibrium where each individual i provides the crime effort given by* (4) *or* (6).

Proof. We need to show that $\mathbf{I}-\mathbf{B}$ is non-singular (i.e. invertible), where $\mathbf{B} \equiv \mathbf{D}\,\widetilde{\mathbf{G}}$. We know that $\mathbf{I}-\mathbf{B}$ is non-singular if $\rho(\mathbf{B}) < 1$, where $\rho(\mathbf{B})$ is the spectral radius of $\mathbf{B}$ (see, e.g., Meyer, 2000, page 618). This means that, in our case, the condition for invertibility is given by:

$$\rho\left(\mathbf{D}\,\widetilde{\mathbf{G}}\right) < 1$$

First, observing that since $\widetilde{\mathbf{G}}$ is a row-normalized matrix, then $\rho(\mathbf{G}^*) = \mathbf{1}$. Second, observe that, since $\mathbf{D}$ is a diagonal matrix, then $\rho(\mathbf{D}) = \max\left\{\frac{d_1}{1+d_1}, ..., \frac{d_n}{1+d_n}\right\} < 1$. This is because the diagonal entries of $\mathbf{D}$ are the eigenvalues of $\mathbf{D}$. Furthermore, we have:

$$\rho\left(\mathbf{D}\,\widetilde{\mathbf{G}}\right) \leq \left\|\mathbf{D}\widetilde{\mathbf{G}}\right\| \leq \|\mathbf{D}\| \left\|\widetilde{\mathbf{G}}\right\| = \rho(\mathbf{D})\rho(\widetilde{\mathbf{G}}) = \rho(\mathbf{D}) < \mathbf{1}$$

Therefore, $\rho\left(\mathbf{D}\,\widetilde{\mathbf{G}}\right) < 1$ is always true and the result is proved. ■

Observe that $\overline{e}_i$ does not depend on σ_i because the effort of i is not included in $\overline{e}_i$. Thus, differentiating (4), we obtain (recall that $d_i \equiv d(\sigma_i)$ and $d'(\sigma_i) < 0$):

$$\frac{\partial e_i^*}{\partial \sigma_i} = \frac{d'(\sigma_i)}{(1+d_i)^2}\overline{e}_i < 0 \tag{7}$$

Then, when the parent increases σ_i, the offspring has, for example, less taste for conformity and thus the impact of $\overline{e}_i$ on e_i, the crime effort of the young agent, is reduced. Furthermore:

$$\frac{\partial e_i^*}{\partial \overline{e}_i \partial \sigma_i} = \frac{d'(\sigma_i)}{(1+d_i)^2} < 0$$

The higher is σ_i, the lower is d_i and, as a result, the lower is the impact of $\overline{e}_i$ (social norm) on the criminal's effort e_i.

II.ii Parent's Optimization Problem

The parent of young agent i maximizes the following altruistic utility function:

$$U_{o,i}(\sigma_i) = -e_i^*(\sigma_i) - C(\sigma_i) \qquad \text{for } i = 1, \ldots, n,$$

where $e_i^*(\sigma_i)$ is the criminal's equilibrium effort given by (4) or (6) and $C(\sigma_i)$ is the cost of providing parental effort σ_i, with $C'(\sigma_i) > 0$ and $C''(\sigma_i) > 0$ (i.e., C is strictly convex).[6] This is equivalent to the following problem:

$$\min_{\sigma_i} [e_i^*(\sigma_i) + C(\sigma_i)]$$

The first-order condition gives:

$$\frac{\partial e_i^*}{\partial \sigma_i} + C'(\sigma_i) = 0$$

Using (7), we obtain:

$$-\frac{d'(\sigma_i)}{[1 + d(\sigma_i)]^2}\bar{e}_i = C'(\sigma_i) \tag{8}$$

Consistently with the assumption of the model that parental effort reduces young agent's taste for conformity, let $d(\sigma_i) = \frac{1-\sigma_i}{\sigma_i}$, where $d'(\sigma_i) = -(\sigma_i)^{-2} < 0$.[7] The level of effort σ_i^* that solves the parent's optimization problem is

$$C'(\sigma_i^*) = \bar{e}_i \tag{9}$$

Since $C''(\sigma_i) > 0$, (9) implies that old agent i's preference for parental involvement is increasing in the average crime effort by young agent i's peers: when $\bar{e}_i$ increases, the offspring increases her crime effort, e_i^*, and thus the parent will select a higher level of σ_i^*, her optimal level of involvement in her offspring's optimization problem. In other words, *vertical* socialization operates as a substitute to *horizontal* socialization.

Then, if we plug $d(\sigma_i) = \frac{1-\sigma_i}{\sigma_i}$ into (4), young agent i's first-order condition can be rewritten as follows:

$$e_i^* = b_i - p\ f + (1 - \sigma_i^*)\,\bar{e}_i^* \tag{10}$$

This equation will be tested in the empirical analysis of this study.

[6] Children's wellbeing is evaluated by parents from their own point of view. This form of paternalistic altruism is referred to as "imperfect empathy" (Bisin and Verdier, 2000, 2001).

[7] This functional form implies a first-order condition that is linear in parental effort, σ_i. Different choices will result in a more complex empirical analysis.

III Empirical Model, Data and Identification Strategy

III.i Empirical Model

According to (1), the average level of crime effort of i's peers is given by

$$\bar{e}_i(\mathbf{g}) = \frac{1}{g_i}\sum_{j\neq i}^{n} g_{ij}e_j$$

where $g_i = \sum_{j\neq i} g_{ij}$ is the number of peers of offspring i. Young agent i's ex-ante *idiosyncratic heterogeneity*, denoted by b_i, is deterministic, perfectly observable and corresponds to the characteristics of i (e.g. sex, age, race, parental education) and the average characteristics of the peers of i (i.e. *contextual effects*). According to (3), the idiosyncratic heterogeneity is given by

$$b_i(\mathbf{x}) = \sum_m \beta_m x_i^m + \frac{1}{g_i}\sum_m\sum_{j\neq i}^{n}\theta_m g_{ij}x_j^m$$

where x_i^m is one of the M variables that accounts for the observable differences in individual characteristics of young agent i, whereas β_m and θ_m are parameters. In particular, θ_m captures the *exogenous or contextual effects* (i.e., how young agent i's crime effort depends on exogenous characteristics of i's peers).

Combining (1) and (3) according to the first-order condition given by (4), for individuals $i = 1, \ldots, n_r$ and networks $r = 1, \ldots, R$, we obtain the following empirical equation:

$$e_{i,r} = \mu\frac{1}{g_{i,r}}\sum_{j\neq i}^{n_{i,r}} g_{ij,r}e_{i,r} + \delta\left(\sum_m \beta_m x_{i,r}^m + \frac{1}{g_{i,r}}\sum_m\sum_{j\neq i}^{n_r}\theta_m g_{ij,r}x_{j,r}^m\right) + \psi p_{i,r} + \epsilon_{i,r} \qquad (11)$$

where $e_{i,r}$ is the crime effort by young agent i in network r, μ represents the *endogenous effect* (i.e. the relationship between young agent i's crime effort and the average crime effort of young agent i's reference group), $p_{i,r}$ represents deterrence, and $\epsilon_{i,r}$ is a white noise error. According to the theoretical model, the endogenous effect in (11) is a function of parental involvement, σ_i.

The first-order conditions represented by equation (10) capture the effect of parental involvement on the strength of peer effects as an interaction term (i.e., $\mu = \rho + \gamma\sigma$):

$$e_{i,r} = \rho\bar{e}_{i,r} + \gamma\bar{e}_{i,r} * \sigma_{i,r} + \delta b_{i,r} + \psi p_{i,r} + \epsilon_{i,r} \qquad (12)$$

If our theory on parental involvement and crime-related peer effects is true, it must be the case that $\rho > 0$ and $\gamma < 0$: the more involved are parents with their offspring, the lower the offspring's willingness to emulate the crime behavior of peers.

The empirical model represented by (12) is a *spatial autoregressive model* (Anselin, 1988). A maximum likelihood approach is used to jointly estimate $\hat{\rho}$, $\hat{\gamma}$, $\hat{\delta}$, $\hat{\beta}$ and $\hat{\theta}$ (e.g., Lee, 2007).

III.ii Data and Estimation Strategy

Add Health, the largest and most comprehensive longitudinal survey of adolescents ever undertaken, was originally developed to study how social environments and behaviors during adolescent years are related to health and achievement outcomes in young adulthood. The survey initially collects information from a sample of about 90,000 students in (7th grade through 12th grade, at 130 private and public institutions, during the 1994-95 school year (Wave I). A subset of students (roughly 17 randomly selected boys and 17 randomly selected girls in each grade in each school) are also asked to compile a longer questionnaire containing more sensitive individual and household information ("in-home interview"). They were interviewed again in 1995-96 (Wave II). The final sample consists of roughly 10,000 panel observations from the two in-home surveys. More information on this sample can be found in Appendix 1. Several features of this data are important for this study: (*i*) it provides information regarding all students in a school and grade, allowing us to identify each individual's social contacts and their characteristics, (*ii*) it has a longitudinal dimension, which provides respondents' information over time, (*iii*) it features a rich set of variables on characteristics, attitudes and preferences, including delinquency and parental involvement, (*iv*) it provides the spatial location of the individuals' homes, and (*v*) it has a large sample size that allows us to find a subsample of students that conforms to the requirements of this analysis.

Juvenile delinquency. The in-home questionnaire contains several questions on juvenile delinquency that can be used to construct an index of delinquency. These questions ask about recent participation in criminal activities that can be grouped in four categories: thefts, vandalism, drug dealing and violent crime (i.e. crime against another person). More specifically, the survey asks students how often they participated in each activity during the past year and each response is coded using an ordinal scale from 0 ("never participated") to 1 ("participated one or two times"), 2 ("participated three or four times"), and 3 ("participated five or more times"). We construct an index of delinquency by first normalizing the responses to each question (0, for "never participated", to 1, for

"participated five of more times") and then taking the average of the responses to the corresponding questions in each crime category.[8]

Network definition. One of the key challenges in the social networks literature is related to the endogeneity of the network formation: because friends are selected, it is hard to actually identify peer effects. In our analysis, instead of using self-nominated friends to map social interactions, we use unique information provided by the Add Health data on the spatial distance between residential homes of students in the same grade and school to generate exogenous variation in the average criminal activity of peer groups. For each student i we calculate the inverse of the Euclidean distance between the home of a selected student i, and that of each student in her school and grade, $j \neq i$,

$$g_{ij}^{d} = \left[\left(X_i^{home} - X_j^{home} \right)^2 + \left(Y_i^{home} - Y_j^{home} \right)^2 \right]^{-\frac{1}{2}},$$

where X and Y denote the geographical coordinates for each individual's home.[9] The negative power function represents diminishing spatial effects in the distance between homes, due to fewer opportunities for peer interaction. These spatial weights are then used to compute the weighted average of her peers' criminal activity,

$$\overline{e}_i(\mathbf{g}) = \frac{1}{g_i^d} \sum_{j \neq i}^{n} g_{ij}^d e_j,$$

where $g_i^d = \sum_{j \neq i} g_{ij}^d$. We exclude students with weights below the 5th percentile of the empirical distribution of weights (i.e. those who live too far away from their peers). Appendix Figure A.1 shows the distribution of Euclidean distances between pairs of students in the same school and grade. The median distance is 2.2 miles, with minimum and maximum distances of 26.77 feet and 21.23 miles, respectively. More than 60% of the students in the same grade and school live less than 3 miles away from each other. The key assumption is that conditionally on the residential neighborhood (chosen by the parents and here defined by the network), children take the location of their residential home as given. This location however shapes the strengths of social interactions with their peers. Channels include (but are not limited to) shared activities within the neighborhood (e.g., church, sport facilities, camps within communities) and bus routes to school. This is particularly so for kids of similar ages.

[8] See Appendix Tables A.1 and A.2 for details.

[9] Add Health provides pseudo-geographical coordinates that can be used to calculate distances between students' residential locations. The distribution of distances is truncated at the 99th percentile (i.e., 21.24 miles), thus dropping 1% of the student pairs with unreasonably long distances.

Our strategy is made possible by the richness of our data. Because different geographic distances between residential homes provide variation in the strength of social interactions within grade, we can include network fixed effects (i.e., school-by-grade fixed effects), η_r, in our analysis. The empirical model that we bring to the data is

$$e_{i,r,t} = \rho \bar{e}_{i,r,t} + \gamma \bar{e}_{i,r,t} * \sigma_{i,r,t-1} + \delta b_{i,r,t-1} + \psi p_{i,r} + \eta_r + \epsilon_{i,r} \tag{13}$$

η_r captures not only residential sorting effects but also common shocks shared by individuals in the same group: students in the same grade and school may be exposed, for example, to the same anti-crime campaign. In Table 1, we investigate the validity of the identification strategy by examining whether the variation in the key peer variable (leave-one-out average crime level) is related to variation in a number of predetermined student characteristics. These regressions include own crime level as not doing so mechanically introduces a correlation between the peer variable and a series of outcomes (Angrist, 2014). Results are contained in Table 1. We report correlations without and with network fixed effects. Perhaps unsurprisingly, if we do not include network fixed effect, then we have a statistically significant correlation between the crime rate and individual characteristics (such as race, residential building quality and the strength of religious faith), as well as with the local expenditure for police protection. When we include network fixed effects, the correlations disappear. Only one of the estimated correlations is significantly different from zero at the ten percent level, which is less than what would be expected by chance. Altonji et al. (2005) suggest that the degree of selection on observables can provide a good indicator of the degree of selection on unobservables. In light of this argument, the evidence of Table 1 supports the hypothesis that the model specification identifies an exogenous source of variation.

[Insert Table 1 Here]

Parental involvement. We measure parental involvement using the Add Health's question that asks if the respondent agrees or disagrees with the following statement: "When you do something wrong that is important, your mother talks about it with you and helps you understand why it is wrong".[10] The possible answers are "strongly disagree," "disagree," "neither agree nor disagree," "agree," and "strongly agree." Despite the fact

[10]This question refers to the woman who functions as a mother in the respondent's household (also known as "resident mother") and could be the biological mother, step mother, foster mother, adoptive mother, grandmother or aunt. Unfortunately, Add Health does not provide a similar question referring to "resident fathers". Students with no resident mothers are less than 6% of the sample and we exclude them from our final sample.

that finding a good measure of parental involvement is always challenging, this question exhibits an interesting advantage when we try to identify parents with a preference for low parental engagement. In contrast to other measures (e.g. having family meals, practicing sports together, monitoring academic activities, etc.), even busy parents and busy adolescents should have time to talk, especially when children did "something wrong that is important." In other words, mothers whose kids answer "strongly disagree," "disagree" or even "neither agree nor disagree," could be identified as parents with a preference for low or no involvement in their offspring's decisions. If we have that $\sigma_i \in [\underline{\sigma}, \overline{\sigma}]$, for $i = 1, \ldots, n$, then $\underline{\sigma}$ and $\overline{\sigma}$ are equivalent to "strongly disagree" and "strongly agree," respectively.

Appendix Table A.3 shows the distribution of answers for the original sample: almost 1 out of 5 students in the sample reports to have a mother with low or no parental involvement. The last column of Table A.3 reports the values for the parental involvement/effort variable, σ. Contrary to the cultural transmission literature where each parent wants his/her children to be like him/her, the value of σ is not expected to change with the parent's criminal record. In fact, it appears that the value of our parental involvement variable remains practically unchanged when we compare students with mothers that have spent time in jail or prison (4.11) and students with mothers who have never been in jail or prison (4.12). The difference in parental effort between these two groups is not statistically significant.[11]

To mitigate a possible reverse causality issue due to the fact that parental involvement can be the consequence of their children's criminal activity, we use information on parental involvement lagged in time. The empirical model that we bring to the data is

$$e_{i,r,t} = \rho \bar{e}_{i,r,t} + \gamma \bar{e}_{i,r,t} * \sigma_{i,r,t-1} + \delta b_{i,r,t-1} + \psi p_{i,r} + \eta_r + \epsilon_{i,r} \tag{14}$$

where we use crime data from Wave II ($e_{i,r,t}$), but parental involvement ($\sigma_{i,r,t-1}$) and the rest of the controls from Wave I. The identification assumption is that there are no unobserved factors correlated with parental involvement that are common at time t and at time t-1. We will use a different approach to test our theory in Subsection IV.i.

In Figure A.2.a in the Appendix, we show the relationship between parental involvement and total crime in the raw data, whereas in Figure A.2.b we use the raw data to show the relationship between parental involvement and peers' total crime. A visual inspection of these figures reveals that, in spite of the fact that students with different levels of parental engagement are exposed to almost identical levels of peers' crime (Fig-

[11] The Add Health Wave IV contains the question: "(Has/did) your biological mother ever (spent/spend) time in jail or prison?", with 4% of affirmative answers.

ure A.2.b), their own criminal effort is decreasing in the level of their mother's parental involvement (Figure A.2.a). Figures A.3 to A.6 contain the same graphs for the different crime activities separately. The pattern is the same for all of them.[12]

Deterrence. We take advantage of the Add Health's supplemental contextual data and measure deterrence using the per-capita expenditure in police by the county where the school is located. Endogeneity due to simultaneity and reverse causality is not a problem here because we are looking at a very small portion of the total population of each county.[13]

IV Empirical Results

Table 2 presents the maximum likelihood estimation of model (14) with an increasing set of controls.[14]

[Insert Table 2 Here]

Peer effects are positive and statistically significant, but decreasing with parental involvement (i.e., $\hat{\rho} > 0$ and $\hat{\gamma} < 0$). This evidence suggests that the resistance to a negative peer influence is higher with additional parental involvement.

Table 2 also reports the peer effects for different values of parental involvement σ (i.e. $\hat{\rho} + \hat{\gamma} * \sigma$) . It appears that the mediating effects through parental engagement are relevant in magnitude: the peer influence for adolescents with highly engaged mothers is about 20% of the peer influence that is observed for adolescents with mothers with the lowest level of parental involvement. In terms of the adolescent's criminal activity, a one standard deviation (SD) increase in the criminal activity of young agent i's reference group translates roughly into a 18% increase in SDs of young agent i's own criminal activity for adolescents whose mothers have low or no involvement (σ=1), whereas this increase drops to 4% for adolescents with highly engaged mothers (σ=5) and to 7% for

[12]To further investigate the validity of our proxy for parental involvement, we look at whether it captures other dimensions of the socialization process. In Appendix Table A.4 we show the relationship between our indicator and several questions (answered by the "resident mothers") about sex education. The results show that mothers who are expected to follow a disengaged parenting style according to our proxy also exhibit low confidence levels in their ability to effective communicate with her offspring about sex and birth control.

[13]Since school districts can have boundaries in two different counties, students in the same network could be exposed to different levels of deterrence.

[14]We present the results that include GPA among the controls as a different specification because GPA may be an endogenous variable. In addition, we have also performed the analysis excluding parental education from all the specifications since parental education may be considered a proxy for parental behavior. Results remain qualitatively unchanged and are available upon request

the average level of parental involvement (σ=4.14). These results are in line with those of Patacchini and Zenou (2012), who find that a one SD increase in the average criminal activity of the peers translates roughly into a 9% increase in SDs of the adolescent's own criminal effort.[15]

In Table 3, we replicate the estimation separately for each type of crime using the full set of controls from the last column of Table 2: vandalism (i.e. graffiti and property damage), theft (i.e. larceny and burglary), drug trafficking, and violent crimes (i.e. fights, bodily harm, use of weapons and the threat of use of weapons). According to these results, the estimates of the parameters of model (14)are statistically significant and their signs consistent with those in column (4) of Table 2 (i.e. $\hat{\rho} > 0$ and $\hat{\gamma} < 0$).

[Insert Table 3 Here]

Interestingly, although the values of $\hat{\rho}$ are similar in magnitude across the different specifications of model (14), the drops in the peer effects ($\hat{\rho}+\hat{\gamma}*\sigma$) when increasing parental involvement (σ) are higher for drug dealing and violent crime compared to vandalism and thefts. This evidence suggests that drug trafficking, assault and battery are the types of juvenile crimes most susceptible to changes in parental engagement.

IV.i Structural Approach

An alternative strategy for bringing the model to the data is to add more structure to our theoretical model. Let us assume the cost of providing parental effort, σ_i, is given by the convex function $C(\sigma_i) = \frac{1}{2}\sigma_i^2$. Then the parent of young agent i will solve the following problem:

$$\min_{\sigma_i} \left[e_i^* (\sigma_i) + \frac{1}{2}\sigma_i^2 \right]$$

By plugging $C'(\sigma_i^*) = \sigma_i^*$ into (9), we get the new version of old agent i's first-order condition:

$$\sigma_i^* = \bar{e}_i \tag{15}$$

Therefore, old agent i's preference for parental involvement is directly proportional to the average crime effort by young agent i's peers: an increase in the average level of crime

[15] Appendix Table A.5 reports the correlation between the average criminal activity of individual i's reference group and individual i's level of total crime, ρ, for subsamples with different values of σ. It shows that $\hat{\rho}$ is higher for those kids whose mother exhibits a preference for low or no parental involvement (i.e. "strongly disagree," "disagree" or "neither agree nor disagree"). In fact, the correlation for this group of adolescents is about 20% higher than for the sons and daughters of fairly engaged mothers. With the exception of crime against the person, we get similar results when we analyze different types of offenses.

committed by young agent i's peers results in a one-to-one increase in the effort old agent i exerts to socialize his/her offspring.

If we plug (15) into (10), young agent i's first-order condition can be rewritten as follows:

$$e_i^* = b_i - p\ f + (1 - \overline{e}_i^*)\,\overline{e}_i^* \tag{16}$$

As a result, the new version of our baseline empirical model,

$$e_{i,r,t} = \rho \bar{e}_{i,r,t} + \gamma \bar{e}_{i,r,t}^2 + \delta b_{i,r,t-1} + \psi p_{i,r} + \eta_r + \epsilon_{i,r}, \tag{17}$$

is a quadratic spatial autoregressive model that excludes σ from the interaction term. Given the identification strategy described in Section III, $\hat{\rho}$ and $\hat{\gamma}$ should be unbiased.

Table 4 presents the maximum likelihood estimates for model (17). The results strongly resemble those in Table 1: the coefficient estimates $\hat{\rho}$ and $\hat{\gamma}$ are statistically significant and their signs are consistent with the predictions of our theoretical model (i.e. $\hat{\rho} > 0$ and $\hat{\gamma} < 0$).

[Insert Table 4 Here]

V Conclusions

The interplay between parents and peer socialization is crucial for understanding the evolution of cultural and economic traits. The evidence on the relative importance of these two forces in shaping moral values and, in particular, criminal behavior among adolescents is scarce. Our analysis presents a first step in understanding this complicated question. We develop a simple theory where parents affect how the society influences their children's decisions that is based on a novel mechanism: the more involved are parents with their offspring, the lower the willingness to emulate crime behavior among fellow teenagers. Using detailed data on criminal activity and residential location of adolescents and their peers, we estimate the model and reveal strong evidence of neighborhood spillovers on youth crime and of negative cross effects with parental engagement. The evidence is in line with the idea that parents and peers are "cultural substitutes."

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Table 1: Balance Tests

	(1) Peer Crime	(2) Peer Crime
age	−3.708***	0.129
	(0.486)	(0.267)
female	0.035	−0.114
	(0.142)	(0.208)
black	−0.714***	0.009
	(0.117)	(0.155)
other_ races	0.584***	−0.157
	(0.113)	(0.134)
gpa	−0.217	−0.110
	(0.215)	(0.254)
household_ size	0.442	−0.329
	(0.425)	(0.579)
both_ parents	−0.066	−0.016
	(0.124)	(0.169)
building_ quality	0.765***	0.395
	(0.244)	(0.389)
urban	0.522***	0.333*
	(0.136)	(0.188)
religion_ importance	−0.793***	0.053
	(0.142)	(0.185)
parental_ education	0.444	−0.042
	(0.725)	(1.142)
involvement	−0.165	−0.161
	(0.256)	(0.357)
police_ expenditure	136.029***	−3.839
	(13.878)	(2.769)
Network Fixed Effects	No	Yes
Observations	10,047	10,047

Parameter estimates and robust standard errors (in parentheses) for OLS regressions of individual characteristics on peer group's crime level, controlling for individual's own crime effort. The estimates are for separate regressions in which the dependent variable is the name in the row ($^{*}p < .1$, ** $p < .05$, *** $p < .01$). Precise definitions of variables can be found in Appendix Table A.1.

Table 2: Conformism, Parental Involvement and Crime
Maximum Likelihood Estimation of Equation (14)

Peer Effects ($\hat{\rho}$, $\hat{\gamma}$)	(1) *crime*	(2) *crime*	(3) *crime*	(4) *crime*
Peer Crime: $\bar{e}_{i,r} = \frac{1}{g^d_{i,r}} \sum_{j \neq i}^{n_{i,r}} g^d_{ij,r} e_{i,r}$	0.366***	0.362***	0.357***	0.354***
	(0.023)	(0.023)	(0.023)	(0.023)
Peer Crime*Parental Involvement: $\bar{e}_{i,r} * \sigma_{i,r}$	−0.058***	−0.058***	−0.059***	−0.058***
	(0.004)	(0.004)	(0.004)	(0.004)
Marginal Effect: $\hat{\rho} + \hat{\gamma} * \sigma$				
(a) Very Low Parental Involvement: $\sigma = 1$	0.308	0.304	0.298	0.296
(b) Very High Parental Involvement: $\sigma = 5$	0.076	0.072	0.062	0.064
(c) Ratio: (c) = (b)/(a)	0.247	0.237	0.208	0.216
Individual Characteristics : $\sum_{m=1}^{M} \beta_m x^m_{i,r}$				
Parental Involvement	−0.006***	−0.006***	−0.005***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Other Personal Characteristics	No	Yes	Yes	Yes
Family Characteristics	No	No	Yes	Yes
GPA	No	No	No	Yes
Contextual Effects: $\frac{1}{g^d_{i,r}} \sum_{m=1}^{M} \sum_{j \neq i}^{n_r} \theta_m g^d_{ij,r} x^m_{j,r}$	Yes	Yes	Yes	Yes
Network Fixed Effects: η_r	Yes	Yes	Yes	Yes
Observations	10,047	10,047	10,047	10,047

Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$. *Other Personal Characteristics* include age, sex and race. *Family Characteristics* include family size, presence of both parents at the household, parental education, house and neighborhood characteristics, and religiosity. Precise definitions of variables can be found in Appendix Table A.1.

Table 3: Conformism, Parental Involvement and Type of Crime
Maximum Likelihood Estimation of Equation (14)

Peer Effects ($\hat{\rho}$, $\hat{\gamma}$)	(1) *total*	(2) *vandalism*	(3) *theft*	(4) *trafficking*	(5) *violent*
Peer Crime: $\bar{e}_{i,r} = \frac{1}{g^d_{i,r}} \sum_{j \neq i}^{n_{i,r}} g^d_{ij,r} e_{i,r}$	0.354***	0.364***	0.358***	0.368***	0.368***
	(0.023)	(0.024)	(0.025)	(0.023)	(0.022)
Peer Crime*Parental Involvement: $\bar{e}_{i,r} * \sigma_{i,r}$	−0.058***	−0.051***	−0.050***	−0.067***	−0.057***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Marginal Effect: $\hat{\rho} + \hat{\gamma} * \sigma$					
(a) Very Low Parental Involvement: $\sigma = 1$	0.296	0.313	0.308	0.301	0.311
(b) Very High Parental Involvement: $\sigma = 5$	0.064	0.109	0.108	0.033	0.083
(c) Ratio: (c) = (b)/(a)	0.216	0.348	0.351	0.110	0.267
Individual Characteristics : $\sum_{m=1}^{M} \beta_m x^m_{i,r}$					
Parental Involvement	−0.005***	−0.006***	−0.004***	−0.005***	−0.003***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Other Personal Characteristics	Yes	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes	Yes
GPA	Yes	Yes	Yes	Yes	Yes
Contextual Effects: $\frac{1}{g^d_{i,r}} \sum_{m=1}^{M} \sum_{j \neq i}^{n_r} \theta_m g^d_{ij,r} x^m_{j,r}$	Yes	Yes	Yes	Yes	Yes
Network Fixed Effects: η_r	Yes	Yes	Yes	Yes	Yes
Observations	10,047	10,047	10,047	10,047	10,047

Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$. *Other Personal Characteristics* include age, sex and race. *Family Characteristics* include family size, presence of both parents at the household, parental education, house and neighborhood characteristics, and religiosity. Precise definitions of variables can be found in Appendix Table A.1.

Table 4: Structural Approach
Maximum Likelihood Estimation of Equation (17)

Peer Effects ($\hat{\rho}$, $\hat{\gamma}$)	(1) *crime*	(2) *crime*	(3) *crime*	(4) *crime*
Peer Crime: $\bar{e}_{i,r} = \frac{1}{g^d_{i,r}} \sum_{j \neq i}^{n_{i,r}} g^d_{ij,r} e_{i,r}$	0.360***	0.350***	0.341***	0.338***
	(0.022)	(0.023)	(0.023)	(0.023)
Peer Crime*Peer Crime: $\bar{e}_{i,r} * \bar{e}_{i,r}$	−0.583***	−0.571***	−0.564***	−0.551***
	(0.041)	(0.041)	(0.041)	(0.041)
Marginal Effect: $\hat{\rho} + 2\hat{\gamma} * \bar{e}_{i,r}$				
(a) Very Low Peers' Crime: $\bar{e}_{min} = 0.0$	0.360	0.350	0.341	0.338
(b) Very High Peers' Crime: $\bar{e}_{max} = 0.2$	0.127	0.122	0.115	0.118
(c) Ratio: (c) = (b)/(a)	0.352	0.347	0.338	0.348
Individual Characteristics : $\sum_{m=1}^{M} \beta_m x^m_{i,r}$				
Personal Characteristics	No	Yes	Yes	Yes
Family Characteristics	No	No	Yes	Yes
GPA	No	No	No	Yes
Contextual Effects: $\frac{1}{g^d_{i,r}} \sum_{m=1}^{M} \sum_{j \neq i}^{n_r} \theta_m g^d_{ij,r} x^m_{j,r}$	Yes	Yes	Yes	Yes
Network Fixed Effects: η_r	Yes	Yes	Yes	Yes
Observations	10,047	10,047	10,047	10,047

Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$. *Personal Characteristics* include age, sex and race. *Family Characteristics* include family size, presence of both parents at the household, parental education, house and neighborhood characteristics, and religiosity. Precise definitions of variables can be found in Appendix Table A.1.

Online Appendix

Parents, Neighbors and Youth Crime

Carlos Díaz Eleonora Patacchini

Appendix 1: Data - Additional Details and Tables

We estimate equation (14) with a final sample of 10,047 panel observations from the in-home surveys conducted in Add Health's first two waves. The size of the sample of students interviewed at home in both Wave I and Wave II is 14,738 individuals. The decrease in sample size with respect to the original longitudinal sample is due to three reasons: first, we eliminate those individuals with missing values in crime and control variables (2,509 students), school grades with less than 10 students (627 students) and, as mentioned in the paper, we do not include those students that live very far away from the rest of the others in their grade (1,555 students).

Table A.1 describes the data, including variable definitions and summary statistics. Female students make up to 52% of our sample, whereas 62% of the students are white and 33% live in urban areas. More than 70% of students in our sample come from a two-parent household, with an average household size of around 3.64. Parents have, on average, 15 years of formal education. When comparing summary statistics of our sample with the ones that are obtained using the 2008 American Community Survey (weighted to reflect the age distribution in the Add Health sample), it appears that the composition of our sample is broadly similar to the U.S. population as calculated from the ACS survey. Results available upon request. For a more detailed description of the survey, please visit `http://www.cpc.unc.edu/projects/addhealth`.

Table A.1: Data Description

		Mean	SD	Min	Max
crime	Indicates how often the student participated in criminal activities during the last 12 months, ranging from 0 (i.e., "never participated") to 1 (i.e., "participated five or more times"). See Table A.2 for the questions included in this variable.	0.04	0.1	0	1
vandalism	Indicates how often the student participated in vandalism activities during the last 12 months, ranging from 0 (i.e., "never participated") to 1 (i.e., "participated five or more times"). See Table A.2 for the questions included in this variable.	0.05	0.1	0	1
theft	Indicates how often the student participated in theft activities during the last 12 months, ranging from 0 (i.e., "never participated") to 1 (i.e., "participated five or more times"). See Table A.2 for the questions included in this variable.	0.04	0.1	0	1
trafficking	Indicates how often the student participated in drug related crimes during the last 12 months, ranging from 0 (i.e., "never participated") to 1 (i.e., "participated five or more times"). See Table A.2 for the questions included in this variable.	0.04	0.2	0	1
violent	Indicates how often the student participated in crimes against the person during the last 12 months, ranging from 0 (i.e., "never participated") to 1 (i.e., "participated five or more times"). See Table A.2 for the questions included in this variable.	0.05	0.1	0	1
involvement	Indicates how much the student agrees with the statement: "when you do something wrong that is important, your mother talks about it with you and helps you understand why it is wrong", ranging from 1 (i.e., "strongly disagrees") to 5 (i.e., "strongly agrees").	4.14	0.9	1	5
sex_ education	Indicates how much the resident mother, on average, agrees with statements related to her active role in the student's sex education and brith control: (i) "You really don't know enough about sex and birth control to talk about them with (him/her);" (ii) "It would embarrass (him/her) to talk to you about sex and birth control;" (iii) "It would be difficult for you to explain things if you talked with (him/her) about sex and birth control;" (iv) "(He/She) will get the information somewhere else, so you don't really need to talk to (him/her) about sex and birth control;" (v) "Talking about birth control with (him/her) would only encourage (him/her) to have sex." Answers range from 1 (i.e., "strongly agrees", lowest degree of involvement) to 5 (i.e., "strongly disagrees", highest degree of involvement).	4.20	0.7	1	5
Control Variables		Mean	SD	Min	Max
age	Student's age in years.	15.12	1.6	11	20
female	Dummy equal to 1 if the respondent is a female.	0.52	0.5	0	1
black	Dummy equal to 1 if the respondent is African American.	0.21	0.4	0	1
other_ races	Dummy equal to 1 if the individual is neither African American nor white.	0.17	0.4	0	1
gpa	Average of grades in English, mathematics, history and science; 1=A, 2=B, 3=C and 4=D (or lower).	2.20	0.8	1	4
household_ size	Number of people living in the same household as the student.	3.64	1.5	0	15
both_ parents	Dummy equal to 1 if the respondent resides with both parents.	0.72	0.4	0	1
building_ quality	Indicates how well kept is the building where the respondent lives, ranging from 1 (i.e., "very poorly kept, needs major repairs") to 4 (i.e., "very well kept").	1.61	0.8	1	4
urban	Dummy equal to 1 if the interviewer describes the immediate area or street (one block, both sides) where the respondent lives as an "urban, residential only" area.	0.33	0.5	0	1
religion_ importance	Dummy equal to 1 if the individual considers religion very important to her.	0.43	0.5	0	1
parental_ education	Maximum of the numbers of years of education received by each of the parents, where 9 indicates "Grade 8 or less" and 19 indicates "professional training beyond a four-year college or university".	14.94	2.6	9	19
police_ expenditure	Per-capita local government direct general expenditures on police by respondent's county (in USD).	83.69	43.2	8	194

Add Health, Waves I and II.

Table A.2: Delinquency-Related Questions and Crime Variables

In the past 12 months...	
...how often did you deliberately damage property that didn't belong to you?	*vandalism*
...how often did you paint graffiti or signs on someone else's property or in a public place?	*vandalism*
...how often did you steal something worth less than $50?	*theft*
...how often did you steal something worth more than $50?	*theft*
...how often did you go into a house or building to steal something?	*theft*
...how often did you sell marijuana or other drugs?	*trafficking*
...how often did you get into a serious physical fight?	*violent*
...how often did you use or threaten to use a weapon to get something from someone?	*violent*
...how often did you take part in a physical fight where a group of your friends was against another group?	*violent*
...how often did you hurt someone badly enough in a physical fight that he or she needed care from a doctor or nurse?	*violent*
Answers: 0 (i.e., "never"), 1 (i.e., "one or two times"), 2 (i.e., "three or four times"), or 3 (i.e., "five or more times").	

Each crime variable is the normalized (i.e., 0 to 1) simple average of the responses to the corresponding questions.

Appendix 2: Empirical Results - Additional Tables and Figures

Table A.3: Parental Involvement

"When you do something wrong that is important, your mother talks about it with you..."				
	N	%	Cum. %	σ
Strongly Disagree	283	1.46	1.46	1
Disagree	1,156	5.94	7.40	2
Neither Agree nor Disagree	2,107	10.83	18.23	3
Agree	8,756	45.02	63.26	4
Strongly Agree	7,145	36.74	100.00	5
Total	19,447	100.00		

Add Health, Wave I.

Table A.4: Sex Education and Parental Involvement
Ordered Probit

	(1) *involvement*	(2) *involvement*
sex_education	0.166***	0.168***
	(0.016)	(0.017)
Cut Point 1 (μ_1)	−1.565	−2.914
	(0.075)	(0.172)
Cut Point 2 (μ_2)	−0.852	−2.192
	(0.070)	(0.168)
Cut Point 3 (μ_3)	−0.281	−1.608
	(0.069)	(0.167)
Cut Point 4 (μ_4)	0.993	−0.299
	(0.070)	(0.167)
Individual Characteristics	No	Yes
Observations	9,006	9,006

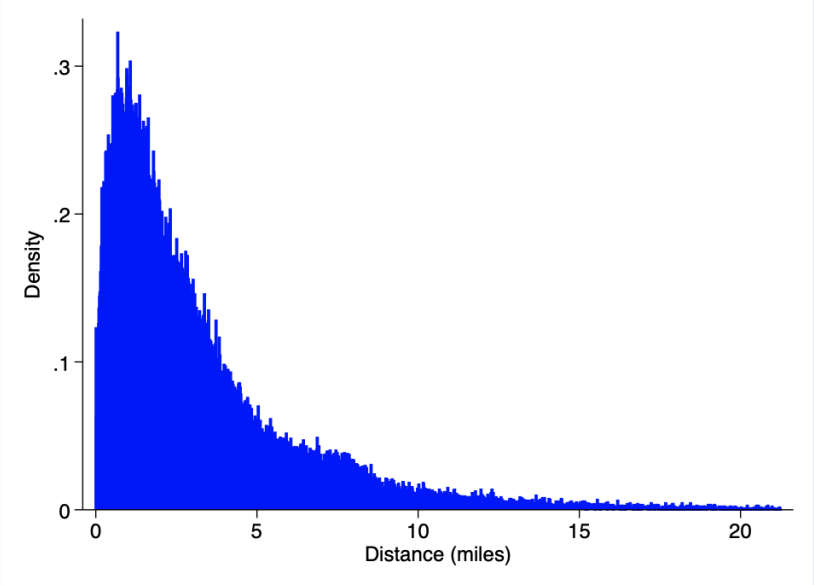
Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$. Individual characteristics include age, sex, race, family size, presence of both parents at the household, parental education, house and neighborhood characteristics, and religiosity. Precise definitions of variables can be found in Appendix Table A.1.

Table A.5: Individual and Peers' Crime Correlation

	$\hat{\rho}$		
	$\sigma \leq 3$	$\sigma = 4$	$\sigma = 5$
Total Crime	0.329***	0.281***	0.260***
	(0.122)	(0.062)	(0.062)
Vandalism	0.343***	0.292***	0.211***
	(0.131)	(0.062)	(0.067)
Theft	0.449***	0.227***	0.352***
	(0.115)	(0.072)	(0.057)
Trafficking	0.301*	0.248***	0.127*
	(0.160)	(0.077)	(0.065)
Violent	0.187*	0.289***	0.230***
	(0.123)	(0.068)	(0.071)
Observations	3,098	7,730	6,351

Add Health Wave I data. Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$. Precise definitions of variables can be found in Appendix Tables A.1 and A.2.

Figure A.1: Distribution of Dyads by Distance



This figure shows the distribution of Euclidean distances between pairs of students in the same school and grade. The median distance is 2.2 miles, with minimum and maximum distances of 26.77 feet and 21.23 miles, respectively.

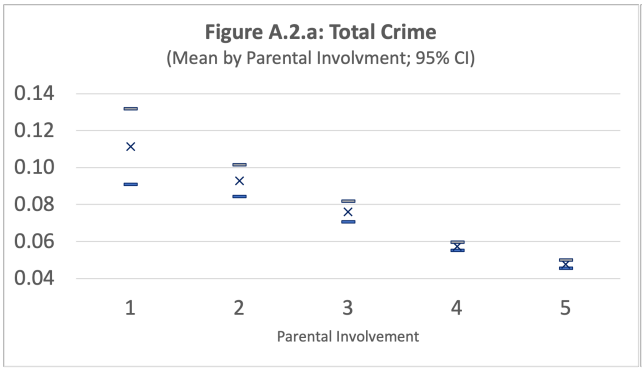


Figure A.2.a: Total Crime
(Mean by Parental Involvment; 95% CI)
0.14
0.12
0.10
0.08
0.06
0.04
1
2
3
4
5
Parental Involvement

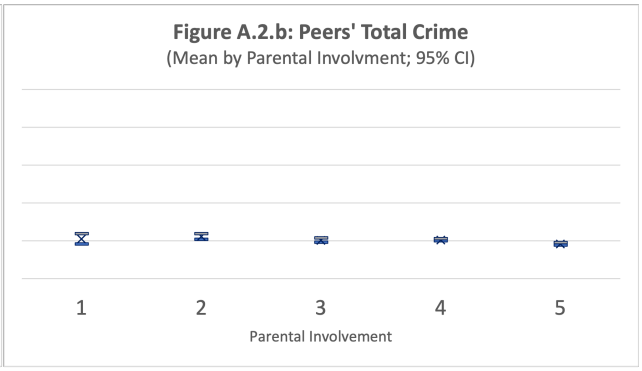


Figure A.2.b: Peers' Total Crime
(Mean by Parental Involvment; 95% CI)
1
2
3
4
5
Parental Involvement

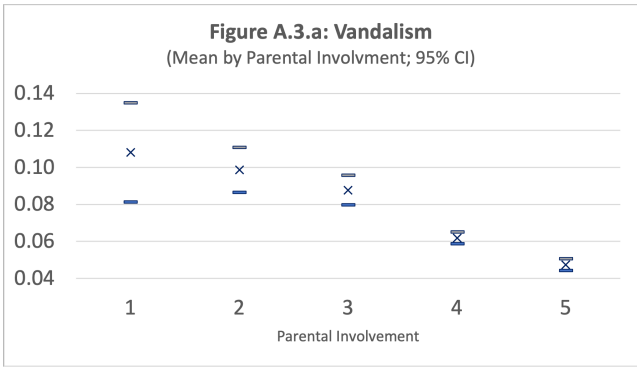


Figure A.3.a: Vandalism
(Mean by Parental Involvment; 95% CI)
0.14
0.12
0.10
0.08
0.06
0.04
1
2
3
4
5
Parental Involvement

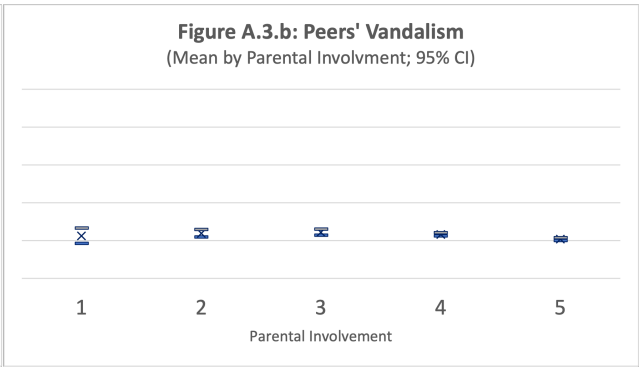


Figure A.3.b: Peers' Vandalism
(Mean by Parental Involvment; 95% CI)
1
2
3
4
5
Parental Involvement

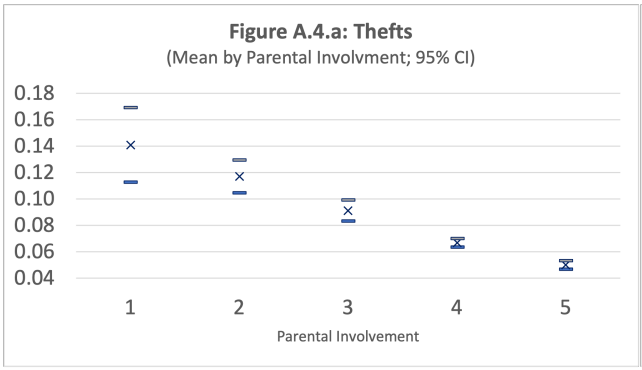


Figure A.4.a: Thefts
(Mean by Parental Involvment; 95% CI)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
1
2
3
4
5
Parental Involvement

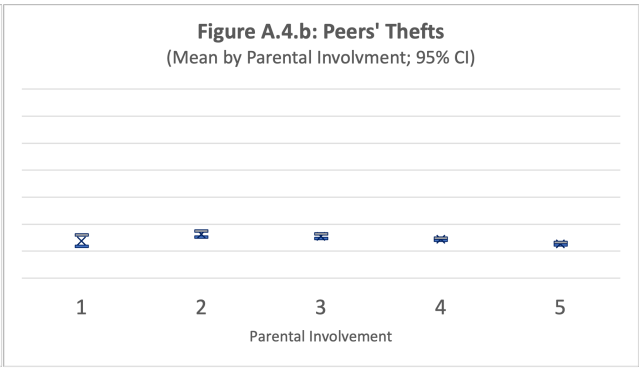


Figure A.4.b: Peers' Thefts
(Mean by Parental Involvment; 95% CI)
1
2
3
4
5
Parental Involvement

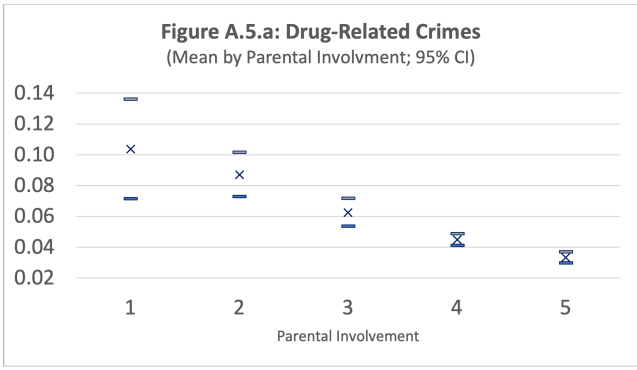


Figure A.5.a: Drug-Related Crimes
(Mean by Parental Involvment; 95% CI)
0.14
0.12
0.10
0.08
0.06
0.04
0.02
1
2
3
4
5
Parental Involvement

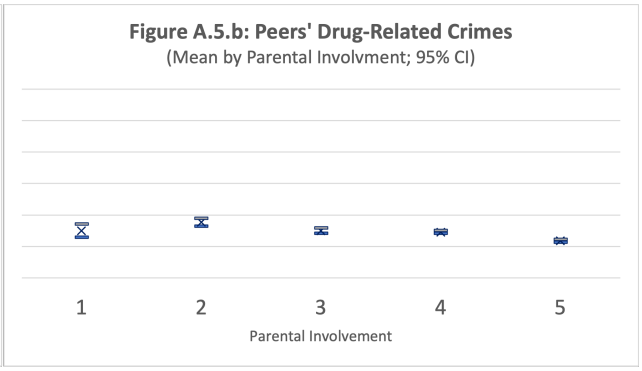


Figure A.5.b: Peers' Drug-Related Crimes
(Mean by Parental Involvment; 95% CI)
1
2
3
4
5
Parental Involvement

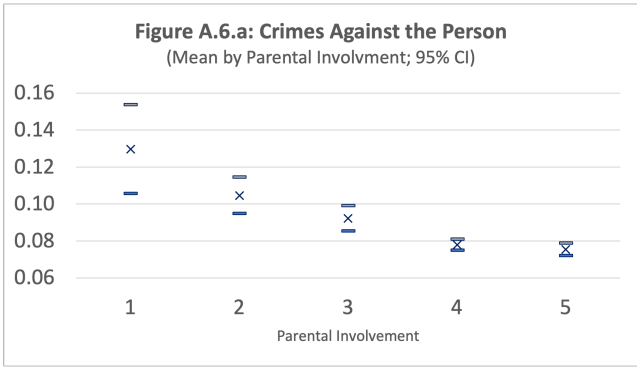


Figure A.6.a: Crimes Against the Person
(Mean by Parental Involvment; 95% CI)
0.16
0.14
0.12
0.10
0.08
0.06
1
2
3
4
5
Parental Involvement

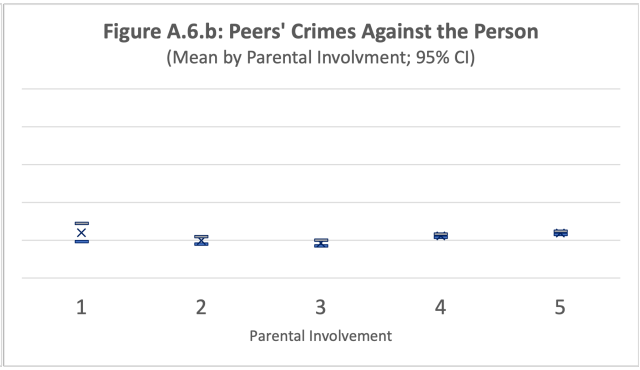


Figure A.6.b: Peers' Crimes Against the Person
(Mean by Parental Involvment; 95% CI)
1
2
3
4
5
Parental Involvement