

Peer delinquency and student achievement in middle school<sup>☆</sup>Tom Ahn<sup>a,\*</sup>, Justin G. Trogon<sup>b</sup><sup>a</sup> Department of Economics, University of Kentucky, 225D, Gatton B & E Building, Lexington, KY 40506-0034, United States<sup>b</sup> Gillings School of Global Public Health, University of North Carolina at Chapel Hill, 1101B McGavran-Greenberg Hall, Chapel Hill, NC 27599-7411, United States

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## ABSTRACT

This paper studies the relationship between peer delinquency and student achievement in North Carolina middle schools. We define severity of the delinquent act using the associated punishment and calculate the average exposure to peer delinquency. Our identification strategy uses this new measure, a rich set of control variables including student, peer, and teacher characteristics, and a novel instrumental variable that captures the indirect social network impact of peer misbehavior. The instrument uses lagged delinquent behavior from students who went to 5th grade with peers of the index student's current 6th grade peers but not the index student him/herself. A 10 percent increase in the number of “major” incidents that a student at an average North Carolina school is exposed to was associated with a 6.2 percent of a standard deviation decrease in his or her standardized math score.

## 1. Introduction

Peers undoubtedly have an important role in determining students' educational outcomes. It is standard practice to include peers' demographic characteristics (e.g., gender, race/ethnicity, poverty status, language proficiency) in any education production function.<sup>1</sup> Parents instinctively “know” about the importance of having good classmates, often making residential decisions at least partly on peer characteristics of the school in the catchment area. Many schools track students by academic ability, resulting in increased segregation along socio-economic lines. Disciplinary policies are often aimed at isolating troublesome students away from the rest of the student body, to mitigate potential negative influences. However, despite considerable focus and attention from parents and administrators, the relationship between peers' delinquent behavior and student achievement has been understudied empirically.

Although many studies have acknowledged the potential role for peer delinquency in determining academic performance (Hoxby, 2000; Gaviria and Raphael, 2001; Hanushek et al., 2003; Ding and Lehrer, 2007), we are aware of only a small number of studies that directly investigate it. Figlio (2007) found that behavior problems were associated with increased peer disciplinary problems and reduced peer test scores among 6<sup>th</sup> graders. Neidell and Waldfogel (2010) found that

kindergarten classrooms with the highest numbers of students with externalizing problems (as reported by the teacher) had lower math and reading scores. Carrell and Hoekstra (2010) use the parents' domestic violence records to capture the negative spill-over effects to classmates. Eriksen et al. (2014) and Carrell et al. (2016) also use this approach to investigate impacts of bullying in Denmark and the long-run impacts of these spill-over effects, respectively. Lavy et al. (2012a) use prior year retention in the same grade as an instrument for peer delinquency. Kristoffersen et al. (2015) use variation from students that move schools with the following backgrounds: divorced parents, parents convicted of crime, and a psychiatric diagnosis. Kinsler (2013) studies the potential deterrent effect and academic improvement arising from punishing and removing delinquent peers from the classroom in a structural model. Horoi and Ost (2015) find heterogeneity in the effects of disruptive behavior on academic performance across teachers.

In this study, we use administrative data of public middle schools in North Carolina from 2009–2010 to 2011–2012 to estimate the reduced-form effect of peer delinquency on math and reading end-of-grade (EOG) test scores. Delinquent behaviors can become quite serious in middle school (e.g., Gunter and Bakken 2010), and most delinquent students in high school already have a long established pattern of offenses and punishments. Therefore, middle school is the

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<sup>1</sup> See Angrist and Lang 2004, Boozer and Cacciola 2001, Lavy et al., 2012b, Hanushek et al. 2003, Imberman et al., 2012, Burke and Sass 2013, for example.

natural place to study the early negative impacts of serious peer misbehavior (Loeber and Hay, 1997).

Identification of the effect of peer delinquency on academic outcomes is challenging (Angrist 2014). The correlation between peer delinquency and academic outcomes could be due to true causal effects, non-random sorting of students into schools and classes (e.g., tracking by ability or segregating delinquent students), or shared context both observed and unobserved by the econometrician (Manski, 1993).

To address these challenges, we use a combination of fixed effects, more detailed data, and a novel instrument.<sup>2</sup> We use school fixed effects to account for possible non-random sorting of students into schools and classes. Even if students are “tracked” into classes or schools based on unobserved ability, the model is identified by changes in the number of offenses over time within a student’s cohort. Our specification for academic outcomes also controls for lagged test scores to capture potentially unobserved student ability. To account for common shocks during the school year, we control for student, peer, and teacher characteristics.

Most importantly, we use a new instrument that captures the delinquent behaviors of a student’s current peers’ peers from the previous academic year to whom the student is never exposed. Under the assumption that delinquent behavior spreads through social networks (Figlio, 2007), the delinquent behaviors of these “peers of peers” provide exogenous variation in a student’s exposure to peer delinquency that is orthogonal to the student’s outcomes because he/she has never been a direct peer of these “peers of peers.” This instrument effectively captures the causal component of peer delinquency on own academic outcomes.<sup>3</sup>

In addition, because the instrument uses the same delinquency data from the administrative data set, it has the advantage of being easily reproducible across other education systems that collect similar academic and behavioral data. Most of the studies mentioned above use variables unique to their data (such as the availability of students’ first names or parental criminal records) to instrument or proxy for peer delinquency. Because the causal mechanism we seek to uncover is the transmission of the negative impacts of delinquent behavior from student to student, our peer of peers’ misbehavior is a more direct measure of this peer effect.

We find that peer delinquency negatively impacts a student’s test scores. An increase by ten percent in the average number of major (suspension-resulting) delinquent acts by peers at a representative school in North Carolina results in a 6.2 percent of a standard deviation decrease in math test scores. A similar sized increase in the average number of any reportable delinquent acts by peers leads to a 5.3 percent of a standard deviation decrease in math test scores.

Section 2 describes the data used in the study. Section 3 presents the econometric model and a detailed analysis of the instrument used. We present results in Section 4 and conclude in Section 5.

## 2. Data

We use an administrative data set of North Carolina public schools covering three school years: 2009–2010 through 2011–2012. The data set contains information on all public school students, teachers, and schools in North Carolina. Because the data is collected annually with a

<sup>2</sup> A previous version of the paper utilized a fixed-effects value-added approach and generated smaller point estimates on the impact of peer behavior (Hanushek et al., 2003; Arcidiacono and Nicholson, 2005; Ding and Lehrer, 2007; Neidell and Waldfogel, 2010). Another specification that used first differences and Arellano and Bond (1991) type instruments yielded qualitatively similar results. These results are available in the online appendix: [sites.google.com/site/tomsyahn/](https://sites.google.com/site/tomsyahn/).

<sup>3</sup> Gibbons and Telhaj (2008) and Lavy et al. (2012b) are the only other examples of studies that exploit the re-mixing of compulsory school transitions and use information of peers who had different peers beforehand, to estimate peer effects.

unique student identifier, students can be matched across years to create a panel.

We restrict our analytic sample to 6<sup>th</sup> grade students. We use these students because they are in the first year of middle school. Using middle school data is important because there are fewer major offenses for students below 5<sup>th</sup> grade. The fact that these students have moved to a new school this academic year is important for our identification strategy, because this (involuntary) change results in a wide-scale remixing of peers. We drop students in grades with less than 10 students and in schools with less than 30 students. The majority of students in these categories are already placed in alternative schools/programs (schools of last resort).<sup>4</sup>

### 2.1. End-of-grade test scores

Two academic outcome variables of interest are standardized exam scores. North Carolina uses standardized scores, which are similar to z-scores, in its accountability calculations. In the standard setting year (1993–1994), grade-level scores are rescaled to mean zero, standard deviation one. This score is continued to use as a benchmark for subsequent years, such that it is feasible for all students (in a particular grade) to score above “zero,” if these students perform better than students in that grade in the standard setting year.<sup>5</sup>

All students in grades 3 through 8 in North Carolina must take EOG exams in reading and mathematics. These scores are aggregated to the level of the school and are used for school report cards, which are published on-line as well as for No Child Left Behind sanction purposes. In addition, the EOG exam scores are part of the final grade calculation for students. In this sense, the exams are high-stakes for schools as well as students.

### 2.2. Offense-discipline data

Offenses recorded in the administrative data range from disruptive behavior in classes, excessive tardiness, and disrespecting teachers, to physical altercations resulting in serious injury, drug use, bringing (or discharging) weapons in the school, and other serious and/or illegal acts of delinquency.<sup>6</sup> In general, the number and severity of disciplinary incidents increase dramatically starting in middle school. In the North Carolina data, the average number of disciplinary incidents per pupil per academic year in elementary schools is 0.27. As young adolescents transition to a new school building, meet new peers and teachers, and attempt to adjust to a tougher curriculum, the number jumps to 0.72 (see for example, Table 1 (Summary Statistics) of this study or Mushkin et al. 2014). Unsurprisingly, misbehavior in 5<sup>th</sup> grade is strongly correlated with misbehavior in middle school.

Each reportable offense is linked to a disciplinary measure meted out by the school administration. The punishments range from detention to expulsion or reporting to law enforcement. All disruptive behaviors are not created equal, and merely summing up the number of incidents at the student or peer level does not fully capture the disruptive impact of different types of offenses.

While the seriousness of the offense is readily discernable by the description in many cases, there are a substantial number of incidents where categorization is difficult. For instance, “Property Damage” may indicate simple minor vandalism or extensive damage to school buildings or teachers’ personal property. As such, the discipline meted out to students who commit “property damage” ranges from in-school detention to arrest/expulsion from the school. As another example, the nebulously termed “Disruptive Behavior” is the most oft-reported offense, accounting for roughly eight percent of all reported incidents

<sup>4</sup> Including these students does not qualitatively change the results.

<sup>5</sup> For more details, see <http://www.ncpublicschools.org/docs/accountability/reporting/abc/2011-12/academicchange.pdf>, and Ahn and Vigdor (2014).

<sup>6</sup> See the Appendix A for a more extensive list of the most common offenses.

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