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Cognitive Ability and the Division of Labor in Urban Ghettos: Evidence from Gang Activity in U.S. Data

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COGNITIVE ABILITY AND THE DIVISION OF LABOR IN URBAN GHETTOS: EVIDENCE FROM GANG ACTIVITY IN U.S. DATA

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Abstract: I examine the link between IQ and an individual's decision to join a gang. Data from the NLSY97 and Project on Human Development in Chicago Neighborhoods (PHDCN) are used to estimate time-to-first gang participation. Results from a variety of models which account for sibling effects, neighborhood effects, and non-cognitive traits indicate low IQ is a robust predictor of gang participation. However, the PHDCN results reveal gang participation is affected by a person's relative IQ, with respect to one's neighborhood peers. Because the majority of trade and industry is underground, official statistics overlook that neighborhoods where gang activity is prevalent are often at full employment. If gangs provide security and enforce contracts where civil government does not, then low-IQ individuals may have comparative advantage in gang activities. Because gangs are often well-defined social groups within neighborhoods, cognitive traits could be expressed at the neighborhood level through this same economic channel.

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1. INTRODUCTION

Street gangs are endemic to impoverished, urban neighborhoods the world over. Poor infrastructure, lack of access to credit, wide-spread illicit trade, pervasive violence, and dense social/ethnic networks in these areas cause residents to have similar life experiences (Kling, Liebman, & Katz, 2005; Venkatesh, 2000; Venkatesh, 2006; Wilson W. J., 1987). However, the relatively small ratio of gangsters to citizens, even in the poorest neighborhoods, suggests gang participation is determined by characteristics not shared by neighborhood residents.

The psychology literature documents a negative relationship between IQ and the propensity for criminal behavior (see Wilson & Hernstein, 1985 and Hernstein & Murray, 1994). Sociologists have also noted gang members tend to have lower levels of cognitive ability (Short & Strodtbeck, 1965; Hughes & Short, 2005). In this paper, I investigate the link between cognitive ability and an individual's decision to join a gang. Drawing upon the gang literature in sociology and some theoretical research by economists, I present two economic explanations for why cognitive ability is a trait on which selection of gang membership occurs: 1) if gangs provide security and enforce contracts in neighborhoods where civil government does not (Sobel & Osoba, 2009), then low-IQ individuals may have comparative advantage in gang activities, as they generally have fewer legitimate opportunities for socioeconomic advancement and 2) gangs may prefer low-IQ individuals, if they are more likely to identify with the organization because they have fewer outside options, as a way to reduce agency costs (Akerlof & Kranton, 2005). Because gangs are well-defined social groups within neighborhoods, cognitive traits could be expressed at the neighborhood level through these same economic channels.

Recent research shows that non-cognitive traits, such as "self-control," "persistence," and "motivation," which facilitate accumulation of human capital and workplace

interaction/performance are as important as cognitive traits in the determination of criminal outcomes (e.g., Heckman, Stixrud, & Urzua, 2006; Hill, Roberts, Grogger, Guryan, & Sixkiller, 2011). For a study of gang activity, these variables are also crucial as it has been widely reported in the literature that gang members generally are deficient in these characteristics (Jankowski, 1991). Although I account for non-cognitive traits in the empirical specifications, I have chosen to focus on cognitive ability rather than non-cognitive ability for two reasons. First, because cognitive ability varies within both neighborhoods and families, it could explain why individuals from similar life circumstances make different decisions concerning gang participation. Secondly, by the time most individuals join gangs cognitive skills are much less malleable than non-cognitive skills. Hence, it is unlikely that gang participation affects cognitive skill formation.

I extend the literature by addressing the following empirical question. Can IQ scores explain differences in gang participation among individuals from similar socioeconomic backgrounds, the same neighborhood, or even the same family?[1] I use two unique data sets in this study: the 1997 cohort of the National Longitudinal Survey of Youth (NLSY97) and the Project on Human Development in Chicago Neighborhoods (PHDCN). The NLSY97 collects extensive information on criminal activity, family background, socioeconomic variables, as well as cognitive and non-cognitive traits. With the NLSY97, I examine the relationship between measured cognitive ability and the general characteristics of gang participation from a nationally representative sample of the United States. Sibling comparisons are also possible with these data, as the NLSY97 samples a large percentage of multiple-respondent households. The PHDCN also collects roughly the same background information as the NLSY97. However, the

[1] I use IQ and cognitive ability interchangeably throughout the paper. The test scores used in the analysis would also be considered "IQ" scores because they are proxies for general intelligence.

PHDCN is more closely related to the ethnographic data collected by sociologists, as it contains extensive information on the neighborhood experiences of individuals.

Duration analysis is used to estimate the relationship between cognitive ability and gang participation. Results from the NLSY97 sample, which account for sibling effects, indicate low IQ is a robust predictor of gang participation. A one standard deviation increase in IQ corresponds to a 29-64 percent risk reduction for initial gang affiliation. Non-cognitive traits are also statistically and economically significant in the gang participation decision. Although, the NLSY97 data does not allow a direct test of the theoretical predictions presented above, it does allow me to control for unobserved heterogeneity, particularly at the family level, which may drive gang participation. The results from the PHDCN sample suggest that an individual's IQ is a robust predictor of gang participation. Non-cognitive traits again have a proportionate effect on gang participation. However, the PHDCN results demonstrate gang participation is affected by a person's relative IQ, with respect to one's neighborhood peers. Conditional on individual, family, and neighborhood characteristics, an above average IQ (in the neighborhood) corresponds to a 26-43 percent risk reduction for gang membership.

Although the economies of neighborhoods where gang activity is prevalent are generally depressed, the underground economy is often at full employment with individuals working a variety of off-the-books jobs (Venkatesh, 2006). Economic theory predicts that labor-market specialization is determined by comparative advantage. In an environment where property rights are enforced by violence, "gangster" is a prominent occupation and would be most attractive to those individuals with the fewest legitimate economics opportunities. Hence, civil governments' inability to maintain the rule of law in poverty-stricken neighborhoods could reduce the opportunity costs for low-IQ individuals to engage in gang activity. If gangs are able to provide

members with rents, such a division of labor could also distort the expected return to human capital accumulation for other residents.

2. THEORETICAL BACKGROUND

2.1. NATURE VS. NURTURE

In *The Bell Curve*, Hernstein and Murray (1994) argue that higher-order thinking, identified by the scalar '*g*' through standardized tests of mental ability, is a heritable trait which predicts socioeconomic success.[2] The authors cite a wide-ranging literature on social deviance and further argue that '*g*' is a primary predictor of criminal behavior. Heckman (1995) and much of his subsequent (coauthored) research downplays the primary role of cognitive ability in the determination of individual outcomes. Instead, non-cognitive traits—personality characteristics which accentuate (inhibit) the accumulation of human capital—play a commensurate role (Heckman, Stixrud, & Urzua, 2006). The upshot is Hernstein and Murray (1994) leave little room for public policy solutions, whereas Heckman's work emphasizes the potential payoffs of early childhood education, particularly for disadvantaged children (e.g., see Heckman, 2008). A key benefit of programs which promote non-cognitive skill formation is the reduction of crime later in life (Heckman, Stixrud, & Urzua, 2006). The greater malleability of non-cognitive skills relative to cognitive skills is a fundamental justification for public policy measures which help promote an environment where these skills can be accumulated (Heckman, 2008).

In most cities where gang activity is prominent, neighborhoods are stratified along socioeconomic boundaries; hence, disadvantaged children grow up in very different environments. The literature also shows that neighborhood environment and peer groups have a

[2] Following publication, a literature addressing the claims made in *The Bell Curve* emerged. For an introduction to this literature, see Currie & Thomas (1999), Goldberger & Manski (1995), and Heckman (1995).

large effect on observed behavior (Case & Katz, 1991; Costa & Kahn, 2003; Anderson, 1999; Glaeser, Sacerdote, & Scheinkman, 1996; Thornberry, Huizinga, & Loeber, 2004). While it is not yet clear how a child's environment might affect cognitive and non-cognitive traits,[3] it is widely known that impoverished, urban areas have low levels of human capital, persistent unemployment, and high rates of crime (Wilson W. J., 1987; Wilson W. J., 1996), all of which are correlated with lower IQ scores for individuals who register those outcomes (Hernstein & Murray, 1994). As a result, it is difficult to disentangle whether the socioeconomic outcomes which are correlated with latent ability are generated by genetic risk inherited from parents or by environments which promote neither healthy socioeconomic outcomes nor cognitive/non-cognitive development.[4]

A more recent experimental literature in economics attempts to establish the magnitude and direction of neighborhood effects on a variety of socioeconomic outcomes for people from crime-ridden areas (Katz, Kling, & Liebman, 2001; Kling, Liebman, & Katz, 2005; Kling, Ludwig, & Katz, 2005; Kling, Liebman, & Katz, 2007). Although this literature has yielded mixed results, social experiments on neighborhood transition (from low-to-high socioeconomic status areas) reveal that younger people reap the largest economic benefits from a healthier neighborhood environment (Ludwig, et al., 2008).[5] Yet, even with a well-designed social experiment, it is difficult to identify the channels through which the neighborhood affects individuals who live there (Ludwig, et al., 2008).

In this paper, I take a different approach by investigating how latent characteristics, specifically cognitive ability, can manifest to the neighborhood level. The social nature of the

[3] For example, see Hanushek & Lindseth (2009) and Heckman, Moon, Pinto, Savlyev, & Yavitz (2010) for contrary assessments of the HighScope Perry Preschool Program.
[4] See (Dickens & Flynn, 2006).
[5] See Durlauf (2004) for an excellent review of the neighborhood effects literature.

outcome variable—gang participation—offers an opportunity to study the socioeconomic forces which drive criminal group selection and, as a result, the composition of neighborhood economies. Below, I present two economic explanations for the linkage between cognitive ability and gang participation.

2.2. Low IQ Equals Low Opportunity Cost of Gang Activity

To my knowledge, Short and Strodtbeck (1965, pp. 237-238) were the first to measure intelligence quotients for gang and non-gang members. The authors find that gang members consistently scored lower on cognitive achievement tests than did non-gang members from the same race/neighborhood.

> "These findings are impressive because of their consistency and the care with which the test program was developed and administered. They offer convincing evidence that the gang members were disadvantaged with respect to intellectual ability of the sort which is rewarded by the institutions of conventional society." (Short & Strodtbeck, 1965, p. 238) [6]

Hughes and Short (2005) re-examine the data used in Short and Strodtbeck (1965) and find gang members most likely to use violence were of lower cognitive ability. However, recent research reveals that gang members were no less violent before joining gangs but became more prone to violence during their time as gang members (Thornberry, Huizinga, & Loeber, 2004).[7]

For culturally and economically isolated neighborhoods, gangs often provide services (i.e. security) for members of their communities when government does not (Jankowski, 1991; Sobel & Osoba, 2009). Gangs are also common to areas where property rights are not well defined because of wide-spread illicit enterprise (Venkatesh, 2006). Sobel and Osoba (2009) argue that gangs form when the bona fide government does not protect the private property of its citizenry.

[6] With data from the NLSY97, Seals (2009) confirms this interpretation, as gang participation of individuals with lower IQs is more sensitive to the strength of the local labor market than those with higher IQs.

[7] However, other research surveyed by Thornberry, Huizinga, & Loeber (2004) found that gang members fared worse in school and had poor family relations prior to joining gangs.

Sobel and Osoba (2009) then present evidence that crime causes gangs, consistent with their hypothesis, rather than the traditionally held hypothesis that gangs cause crime.

The economies of these neighborhoods are also relatively primitive, with a high ratio of barter-to-cash transactions and little access to credit for residents (Venkatesh, 2006). Although official unemployment and public assistance rates are often high, this does not imply that human resources are idle. The underground economy is often vibrant with individuals sorting into a variety of otherwise legal, off-the-books occupations, such as food service, auto and home repair, and transportation (Venkatesh, 2006). Skaperdas & Syropoulos (1995) develop a model in which the gang takes the form of a primitive government (in a state of nature) and individuals select into gangs based upon comparative advantage in violence.[8] If a neighborhood economy is at full (underground) employment, it could also be argued that lower-IQ individuals have a comparative advantage in the "protection" of their respective neighborhoods.

2.3. LOW IQ AND DEMAND FOR GANG MEMBERS

Unlike most economic studies of criminal participation (e.g., Grogger, 1998), demand-side behavior—the gang—should be considered in an analysis of gang participation.[9] From TV and movies, stereotypical gangsters are portrayed as ruthless, nihilistic, and violent. Incompetence in other economically viable activities may also be an important characteristic a gang looks for in prospective members (Gambetta, 2009).[10] If an individual has few outside options, then gang members may believe the person is more likely to identify with the organization. Although the

[8] Holcombe (1994) makes a similar argument where individuals in a primitive setting specialize in activities which provide them the most rights to market surplus. However, the level of violence in which gang members participate will also be a function of the organizational structure of the gang (Levitt & Venkatesh, 2000) and prevailing economic conditions which gang members face (Poutvaara & Priks, forthcoming).

[9] While gang affiliation does not necessarily imply a person is a criminal, gang affiliation may not always be legal. See Grogger (2002) on civil gang injunctions in California.

[10] Because there are gains from cooperation between criminals, in order to realize those gains individual criminals must to some extent gain the trust of other criminals. Incompetence in other endeavors allows criminals to signal to other potential criminal partners their legitimate options are severely limited: "*You can count on me, for even if I wanted to, I would not be able to cheat you*" (Gambetta, 2009, p. 50).

more intelligent members of the gang may rise to administer the organization, as implied by Venkatesh (2000) and Levitt & Venkatesh (2000), it may be advantageous to staff the gang with a disproportionate amount of low-IQ members in order to reduce agency costs.

In the early urban sociology literature, gangs were thought to be the product of temporary social disorganization (Thrasher, 1927). However, Hagedorn (2007) argues that these traditional sociological explanations for gang behavior are not confirmed, as some gangs have operated in cities like Chicago and Los Angeles for generations. Hagedorn (2007a, 2007b, and 2008) applies some basics of organizational theory and presents evidence that street gangs can evolve into rational institutions. One of the key characteristics of institutionalized gangs is the practice of myth-making: e.g., "the gang helps the community" or "the gang lives on forever." Establishing a constitution (Leeson, 2007; Skarbek, Putting the "Con" into Constitutions: The Economics of Prison Gangs, 2010) for the gang could also be interpreted as a manifestation of this kind of behavior. Conditional on the organization of the gang, low-IQ gang members may be more likely to follow a code of conduct or other sets of rules established by the gang.

3. DATA AND ECONOMETRIC METHODOLOGY

3.1. GANG ACTIVITY IN THE NLSY97

The NLSY97 is an ongoing, annual survey from the cohort of 12-16 year olds living in the United States in 1997. The initial sample contains 8,984 respondents: composed of a nationally representative cross-section of the population and an oversample of Blacks and Hispanics. Survey participants are asked a battery of questions on family background, socioeconomic status, as well as a variety of cognitive and non-cognitive ability measures. The NLSY97 also contains a large number of households with multiple respondents—out of the initial 6,819 unique

households, 1,862 include more than one respondent—which allow for the comparison of cognitive and non-cognitive traits within a household.

The NLSY97 has several features which facilitate the study of gang participation. The data set contains detailed information on gang and other criminal activity, along with a variety of other risky behaviors. To help ensure anonymity (and presumably truthfulness), the responses to these sensitive questions are recorded using computer-assisted, self-interview technology without an interviewer present. Gang activity is recorded for each year of the survey up to 2005. NLSY participants are asked a variety of questions related to gang affiliation, such as whether they have friends or relatives in a gang; ever been in a gang; age first joined a gang; and whether they had been in a gang in the past year.

The consistency of the interview questions across time allows me to construct event study data using successive waves of the NLSY97. First, I treat time before the survey began is one long episode. Each survey-year of the NLSY represents an additional time period. The time-to-first gang participation is coded by following the individual through the survey until the first admission of gang affiliation occurs. Persons who exit the sample or who never join a gang during the survey are treated as censored.

Approximately 80 percent of initial respondents were administered the Armed Services Vocational Aptitude Battery (ASVAB) exam. The ASVAB is used by the U.S. military to help match individuals to specific jobs within the military. The test is composed of ten subtests of which four of those subtests evaluate mathematical and verbal ability. From these four subtests the NLSY staff constructed a measure of cognitive ability similar to the Armed Forces

Qualifying Test (AFQT) from the NLSY79 used by Hernstein and Murray (1994) and many others as an IQ score. The score is weighted by respondent's age at the time of the test.[11]

FIGURE 1 shows kernel density estimates of standardized ASVAB scores from the NLSY97 for gang members and non-gang members. The distribution of scores for gang members in the NLSY97 is noticeably right skewed and the average IQ for gang members is 0.63 standard deviations below that of non-gang members.[12]

The NLSY97 also collects information on non-cognitive, personality traits which could influence both the decision to join a gang and the value of the ASVAB score. An analysis of the effect of cognitive ability on criminal behavior should also incorporate these non-cognitive characteristics, as "common sense" would indicate their relevance (Heckman, Stixrud, & Urzua, 2006). Non-cognitive traits are also likely correlated with measured cognitive ability, which if omitted could bias estimates of the effect of cognitive ability on gang participation. The NLSY97 does not contain the same non-cognitive traits as the NLSY79 used by Heckman, Stixrud, & Urzua (2006).[13] However, there are a number of personality trait measures in the NLSY97 I use in this paper, which closely resemble those in the NLSY79: 1) has trouble paying attention; 2) lies or cheats; 3) doesn't get along well with others; 4) often unhappy; 5) generally optimistic about the future.

TABLE 1 displays population-weighted means and definitions of the NLSY97 variables used in the econometric analysis. Gang members report greater exposure to violence at young ages and presence of gangs in their neighborhoods and schools than do non-gang members. However,

[11] See the NLSY97 Appendix 10: http://www.nlsinfo.org/nlsy97/nlsdocs/nlsy97/codesup/mapp10.html.
[12] Sample means are weighted using the panel population weights created by NLSY staff. Difference in means is statistically significant at the 1 percent level.
[13] Heckman, Stixrud, & Urzua (2006) use the Rotter Locus of Control and the Rosenberg Self-Esteem scales.

the differences in non-cognitive traits are not as pronounced between gang and non-gang members.

3.2. GANG ACTIVITY IN THE PHDCN

The Project on Human Development in Chicago Neighborhoods incorporates longitudinal and community surveys to create a comprehensive study of the social and family processes which cause delinquency. The community surveys were conducted by randomly selecting households from all of Chicago's neighborhoods. Respondents were asked about violence, socioeconomic status, political composition, and other environmental characteristics of their neighborhood. Eighty neighborhoods from the community survey sample were selected for a longitudinal cohort study. The study includes cohorts of 3, 6, 9, 12, 15, and 18 year olds, as well as a birth cohort. The first wave of data for longitudinal study was collected from 1994-1997, second wave from 1997-2000, and the third wave during 2000-2002. From the National Institute of Justice, I obtained restricted access data which allows me to link respondents to their respective neighborhoods across waves of the survey.

The longitudinal survey is composed of approximately 7,000 individuals. Respondents and/or their primary caregivers are asked questions concerning their family, neighborhood, and school environments, in addition to a variety of personality and health questions. Participants also take a number of standardized tests which measure cognitive ability, which are discussed later. A much richer set of variables on the gang and other criminal activity of respondents and their friends than in the NLSY97 are also recorded. TABLE 2 shows the different responses to questions about gangs from those who are or have been gang members, those who live in neighborhoods where gangs are present. Gang members overwhelmingly report that gangs are present at school and in their neighborhoods. Gang members also report at a higher rate that the

neighborhood gang helps kids and other neighborhood residents, which indicates that gangs may indeed provide services to their community.

Because gang activity is the focus of only one component in the third wave of the longitudinal survey, I create the dependent variable differently than in the NLSY97. I use the variable "age first joined a gang" to construct event data. The data are transformed such that the time intervals are defined by age integers. Variables are matched from each wave of the study to the age of the respondent in that wave. I also make use of other components of the longitudinal study, the first, second, and third waves of the Self-Report of (Delinquent) Offending. In the first and second waves, respondents are asked if they were ever involved in a gang fight. If they answered in the affirmative, those responses were matched to their respective age and coded as a gang member. In the second wave of the Self-Report Offending component, participants were asked if, "they identified themselves as a gang member." The answers to this question were matched to the age of the individual in that wave and those answering in the affirmative were also coded as gang members.

The PHDCN staff administered a variety of intelligence tests to participants of the longitudinal study. I use the Wechsler Intelligence Scale for Children (WISC) because it is a widely known measure of general intelligence and was given to the highest number of participants within the sample.[14] The WISC test was given to the 6, 9, 12, and 15 year-old cohorts of the longitudinal study for which information on gang activity is available. As a result, I limit the sample of at-risk gang members to these cohorts.

The PHDCN staff also administered the Emotionality, Activity, Sociability, and Impulsivity (EASI) Temperament Survey to the primary caregivers of cohorts 3, 6, 9, 12, 15 from the longitudinal survey. The EASI is a forty-question instrument designed to measure a person's

[14] See http://www.icpsr.umich.edu/cocoon/PHDCN/STUDY/13604.xml for a more complete description.

temperamental tendencies. For example, sociability questions were designed to measure the person's desires to be around others and impulsivity a measure of how well one controls his/her impulses, etc. Each question is scaled: 1 = uncharacteristic, 2 = somewhat uncharacteristic, 3 = neither, 4 = somewhat characteristic, and 5 = characteristic. The mean of the responses to certain questions were converted into continuous index variables which measure *impulsivity*, *inhibitory control*, *sensation-seeking*, *persistence*, *activity*, *emotionality*, and *sociability*. For example, *inhibitory control* was constructed by taking the mean of the responses to five questions which scale the person's ability to control his/her impulses.

Table 3 presents means for key variables used in the analysis of the PHDCN. Almost all differences in means between gang and non-gang members are as expected. However, gang members perform better, on average, than non-gang members on the *wisc*.[15] . While this result is opposite to what is found in the NLSY97, the PHDCN is a much different sample, as individuals are drawn randomly from neighborhoods. Additionally, an unconditional mean for the wisc variable could be misleading as several different cohorts which could be as much as nine years apart are used to compute the mean, whereas in the NLSY97 the age difference of respondents is a maximum of four years. The mean age for gang members is also approximately two years greater than non-gang members.

4. RESULTS

4.1. ECONOMETRIC SPECIFICATION

Survival analysis is used to estimate the effect of cognitive ability on time-to-first gang involvement. The unit of observation is the individual at risk to join a street gang. The approach is attractive because it focuses attention on the initial connection to gang activity—an important

[15] The difference in means between the groups is statistically significant at the 1 percent confidence level.

issue for public policy, as gang activity is associated with greater criminality (Thornberry, Huizinga, & Loeber, 2004) and corresponds well to the longitudinal data of the NLSY97 and PHDCN.

I estimate time-to-first gang participation with a Weibull proportional hazard model of the form: $h_i(t) = h_i(0)\exp(\beta_1 cognitive_i + Z'_{i,t}\theta + X'_{i,t}\gamma)$, in which *cognitive* is a measure of cognitive ability taken from a standardized test; *Z* is a vector of neighborhood characteristics; *X* represents a vector of family and individual specific variables which explain the transition into a gang; and $\beta_1, \theta, and\ \gamma$ are parameters to be estimated. The baseline hazard is assumed to take the functional form: $h_0(t) = pt^{p-1}\exp(\beta_0)$, where *t* represents time, $\exp(\beta_0)$ is the scale parameter, p is the shape or duration dependence parameter of the Weibull distribution (Cleeves, Gould, Gutierrez, & Marchenko, 2008). The shape parameter represents whether individuals who forgo gang membership longer become more or less dedicated to a non-gang lifestyle. Parameter estimates are presented as hazard ratios.

4.2. Survival Analysis Results from the NLSY97

Estimates of the hazard function for gang participation in the NLSY97 are presented in Table 4. Models 1-4 show how the estimated effect of cognitive ability on gang participation varies with additional control variables. The estimates of *asvab* are consistent across all specifications. A one standard deviation increase in *asvab* decreases the risk of first joining a gang by 28.9-31.9 percent.[16]

The results are also roughly consistent across models for the other covariates. Exposure to gangs and violence increases the risk of gang membership dramatically. Males are three-to-five times more likely to become gang members. All non-cognitive traits except *attention* are also

[16] Coefficient estimates for test scores from the NLSY97 and PHDCN are standardized for ease of comparison.

significant predictors of gang membership. Each additional year of education decreases the risk of gang membership by 17.2-26.0 percent, a huge effect.

The results in TABLE 5 show the estimated effect of cognitive ability on gang participation for the sample of siblings in the NLSY97. Using data from households with multiple respondents, I control for the number of gang members in each household (*#familygangmembers*) and sibling fixed effects.[17] Sibling fixed effects reduce possible bias due to omitted, genetic characteristics correlated with IQ that also affect criminality.[18] The sample of siblings does not include step or half siblings, which allows me to control for genetic risk of criminality (gang behavior) inherited from the mother and father. To mitigate concerns of omitted within-family variation in family characteristics not shared by siblings, I control for the presence of a father figure (*fatherfigure)* when the respondent was twelve years-old.

The estimated effect of cognitive ability on gang participation is statistically significant and negative across all four specifications. However, there are significant differences between the models in TABLE 4 and those in TABLE 5. In Models 1 and 2, holding constant number of gang members in the household, a one standard deviation increase in ASVAB score decreases the risk of first gang affiliation by 25.0 and 23.7 percent, respectively. In Models 3 and 4, which also include sibling fixed effects, a one standard deviation increase in ASVAB scores decreases the

[17] I also estimate a series of models with sibling differences with quantitatively similar results to Models 1 and 2 from Table 5 (results available upon request). Because the process of meiosis randomly distributes genes across siblings, sibling differences rules out genetic risk for gang membership from both parents (D'Onofrio, et al., 2009). Because the sample used to compute sibling differences has only full siblings, differential genetic risk from other fathers can also be ruled out. However, sibling differences cannot rule out time-varying, risk factors which may not be shared by siblings that are correlated with IQ and affect gang participation, such as, family dissolution (D'Onofrio, et al., 2009).

[18] Aaronson (1998) uses sibling fixed effects to estimate neighborhood effects by assuming that family characteristics which cause selection into neighborhoods is constant across siblings. In a similar fashion, I am trying to rule out family background as a confounding selection factor with these specifications.

gang hazard from 63.9 and 44.7 percent, respectively.[19] The effect of education on gang membership is no longer statistically significant. Only two of the non-cognitive traits—*unhappy* and *optimistic*—have a statistically significant effect on the gang membership hazard. The impact of these variables is also considerably different between the models with and without sibling effects.

4.3. SURVIVAL ANALYSIS RESULTS FROM THE PHDCN

Estimation results from the PHDCN sample are presented in TABLE 6. The estimated effect of cognitive ability on gang participation is again consistent across all specifications. A one standard deviation increase in *wisc* corresponds to a 17.8-22.5 risk reduction for gang affiliation.

The inclusion of neighborhood variables does not substantially affect the magnitude or statistical significance of *wisc*. Gang activity in the neighborhood increases the gang membership hazard by 62.8-74.1 percent. Living in a predominately Hispanic neighborhood increases the chance of gang membership almost three-fold. The estimated coefficients for the non-cognitive traits are not statistically different from unity, with the exception of *inhibitory*. However, a one unit increase in this variable corresponds to a 35.2 percent increase in risk of gang membership. Children of women who drop out of high school are 5 times more likely to become a gang member in the PHDCN.

TABLE 7 shows results for models where a dummy (*neighborIQ*) for whether or not the i_{th} individual's IQ is above the mean level of IQ in a neighborhood is included. The dummy captures whether the estimated effect of *wisc* on the gang hazard depends on the level of measured cognitive ability in one's neighborhood. The mean level of IQ in a neighborhood is

[19] All the models from the Tables 4 and 5 were estimated with variables which gauge the respondent's interest in the ASVAB test. Specifically, effort level, whether or not money was the prime motivator for taking the ASVAB, and the respondent's interest in a military career were included in the regressions. The coefficient for *std(asvab)* remained quantitatively similar and statistically significant in each of these specifications. These results are available upon request.

calculated by averaging the wisc scores of each respondent in a neighborhood/year cell, less the i_{th} individual's score. The coefficients for *wisc* and *neighborIQ* are statistically significant and less than one in Model 1. However, the coefficient for *wisc* is not statistically different from unity in the remaining models, which indicates that individual heterogeneity alone is not driving gang participation. An above average IQ, with respect to your neighborhood peers, reduces the risk of gang participation by 26.3-43.0 percent.

Including *neighborIQ* offers a plausible test of the hypothesis that gang members may have lower opportunity cost (and possibly a comparative advantage) in gang activity, within their respective neighborhood. Given these data it is not possible to rule out the hypothesis that gangs prefer low-IQ individuals as a way to solve the principal-agent problem. However, recent evidence from a longitudinal study of at risk youth reveals gang activity causes youth to increase criminal behavior—gangs cause individuals to commit more crimes rather than gangs selecting those who are more prone to crime (Thornberry, Krohn, Lizotte, Smith, & Tobin, 2003). Neighborhoods with a strong gang presence are also likely to have a bustling underground economy (Venkatesh, 2006), which would imply that labor market specialization based upon comparative advantage. If gangs regulate underground market activity and provide security to neighborhood inhabitants (Sobel & Osoba, 2009), a more plausible argument is that an individual can have a comparative advantage in gang activity based upon relative cognitive ability to their neighborhood peers.

5. CONCLUSION

Gangs are a common element of communities trapped in poverty (Wilson W. J., 1987). However, because the majority of trade and industry is underground, official statistics overlook

that the economies of these neighborhoods are often at full employment (Venkatesh, 2006). From the viewpoint of an economist (and likely the citizenry in these areas), gangs function as de facto governments—providing security, regulating trade, and taxing the population—when civil authority is weak (Sobel & Osoba, 2009).

If the neighborhood economy is at full (underground) employment and gang members register lower levels of cognitive ability, this implies that the division of labor within neighborhoods is determined by the ability to perform mental work. Two economic explanations, which may not be mutually exclusive, are presented to explain the relationship between cognitive ability and an individual's decision to engage in gang activity. First, conditional on neighborhood characteristics, low-IQ individuals may have comparative advantage in violence, relative to their peers. Secondly, gangs may prefer low-IQ individuals as a way to reduce agency costs.

I estimate the effect of cognitive ability on time-to-first gang involvement with data from the NLSY97 and PHDCN. The effect of measured cognitive ability on gang participation is negative and statistically significant across a number of specifications. The results appear all the more robust as the estimates are obtained from two fundamentally different samples of data using two different tests of cognitive ability. In the NLSY97, these estimated effects are also robust to the inclusion of non-cognitive traits, gang activity of siblings, as well as time-invariant sibling effects. From the PHDCN, I find that after conditioning on a number of other neighborhood and individual characteristics, persons below the mean level of IQ in the neighborhood are far more likely to join a gang. The PHDCN results, interpreted in context of the existing literature (Thornberry, Huizinga, & Loeber, 2004; Venkatesh, 2006), point to

neighborhood-level, economic processes which generate a comparative advantage in gang activities for those with a lower IQ.

Hernstein and Murray (1994) argue that society has become more meritocratic and, as a result, social mobility is increasingly dependent upon cognitive ability. Hence, the division of labor in the United States is determined by the ability to perform mental work. When evaluated in conjunction with existing ethnographic studies of urban neighborhoods (Venkatesh, 2006) and research on gang formation (Sobel & Osoba, 2009) and gang-member delinquency (Thornberry, Huizinga, & Loeber, 2004), the results in this paper from the PHDCN sample are consistent with labor-market specialization within neighborhoods based upon the ability to perform mental work.

Although the estimation results in this paper are obtained from observational data, the analysis offers insight on the composition of neighborhood economies that experimental data is unlikely to provide. Lack of security in poverty-stricken, urban areas may cause persons with relatively lower levels of cognitive ability to specialize in violence. Because the division of labor is limited by the extent of the market, a significant portion of the population—otherwise not at risk for gang membership—in underdeveloped urban areas could be incentivized by gangs. If gangs are powerful enough to capture most of the available rents in a neighborhood, the sorting of individuals with lower intelligence into gangs may also affect beliefs of non-gang members concerning expected returns to human capital investment. Hence, a variety of social pathologies often associated with inner-city ghettos and low IQs of the inhabitants may instead be caused by an absence of the rule of law. Public policies, such as the Harlem Children's Zone (Dobbie & Fryer Jr., Forthcoming), which focus on both cognitive skill formation and providing adequate security in the neighborhood environment could mitigate the ill-effects of a perverse division of labor within neighborhoods.

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TABLE 1: DEFINITIONS AND MEANS OF KEY VARIABLES FROM NLSY97

	Definition	Full Sample	Gang Members	Non-Gang Members
Gangs and Violence				
gang	=1 if ever a gang member	0.144		
gangarea	=1 if gangs inhabit school or neighborhood	0.171	0.755	0.162
bully	=1 if bullied before 12 years old	0.200	0.323	0.198
shot	=1 if saw someone shot before 12 years old	0.078	0.257	0.075
Cognitive Ability				
asvab	percentile score for ASVAB	52.468	32.487	52.772
Non-Cognitive Traits				
attention	=1 if has trouble paying attention	0.902	0.903	0.902
liescheats	=1 if lies or cheats	0.877	0.898	0.877
dontgetalong	=1 if doesn't get along well with others	0.851	0.808	0.852
unhappy	=1 generally unhappy	0.862	0.834	0.862
optimistic	=1 generally optimistic	0.482	0.495	0.482
Individual Characteristics				
male	=1 if sex is male	0.507	0.764	0.503
age	age (integer) at survey date	18.939	17.403	18.963
Black	=1 if race is Black	0.145	0.256	0.143
Hisp	=1 if race is Hispanic	0.116	0.194	0.115
urban	=1 if resides in urban area	0.732	0.736	0.732
hgc	highest grade completed (integer)	11.366	9.661	11.393
fatherfigure	=1 if male parental figure present	0.746	0.620	0.750
obs		47,777	935	46,842

Notes: 'Full Sample' is the sample used for estimation and reflects number of *obs* after list-wise deletion. Sample means are calculated using panel weights generated by NLSY staff. There are 1,114 respondents (approximately 12.24 percent of the initial sample) who admit some gang activity during the sample. However, because only 80 percent of the initial 8,984 took the ASVAB and because of missing values for other explanatory variables the number of gang members is 935 out of 6,491 (approximately 14.4 percent of the remaining sample) respondents remaining from the initial sample.

TABLE 2: ATTITUDES TOWARD GANGS IN THE PHDCN

Dummy = 1 if response is yes	full sample	gang members	non-gang members
any gangs in neighborhood?	0.611	0.8738	0.59412
neighborhood gangs involved in community activities?	0.186	0.2486	0.1802
neighborhood gangs protect members?	0.7736	0.8155	0.76953
neighborhood gangs help residents?	0.213	0.3262	0.2024
neighborhood gangs fight w/ other gangs?	0.8736	0.9278	0.86828
neighborhood gangs help neighborhood kids?	0.2916	0.3823	0.2826
neighborhood gangs do illegal things?	0.8925	0.9197	0.8898
neighborhood gangs do fun (legal) things together?	0.5189	0.5909	0.5117
presence of gangs impact where you go?	0.3512	0.4065	0.34746
any kids at school belong to gang?	0.4558	0.8695	0.4436

Notes: Means are calculated from the available observations from the 3, 6, 9, 12, 15, and 18 year-old cohorts.

TABLE 3: MEANS OF KEY VARIABLES FROM PHDCN

Variables	Definition	Full Sample	Gang Members	Non-Gang Members
gangmember	=1 if individual was ever in a gang	0.085		
Cognitive Ability				
wisc	Wechsler Intelligence Scale for Children Revised	25.394	30.298	24.940
Neighborhood Characteristics				
gangarea	=1 if any gangs in neighborhood	0.698	0.883	0.680
mostlyblack	=1 if neighborhood population majority Black	0.165	0.267	0.156
mostlyhisp	=1 if neighborhood population majority Hispanic	0.100	0.081	0.102
high-ses	=1 if neighborhood is high socioeconomic status	0.200	0.169	0.203
low-ses	=1 if neighborhood is low socioeconomic status	0.306	0.310	0.305
Non-Cognitive Traits				
impulsivity	scales (1-5) level of impulsivity	2.705	2.915	2.686
inhibitory control	scales (1-5) self-control, where 5 is least self-control	2.489	2.840	2.457
sensation-seeking	scales (1-5) need to seek out new experiences	2.776	2.908	2.764
persistence	scales (1-5) persistence in performing tasks	2.475	2.742	2.451
activity	scales (1-5) energy and activity level	3.716	3.594	3.728
emotionality	scales (1-5) emotional response to different situations	2.828	2.742	2.835
sociability	scales (1-5) desire to be around others	3.736	3.662	3.743
Individual Characteristics				
male	=1 if sex is male	0.491	0.747	0.467
Black	=1 if race is Black	0.340	0.556	0.320
Hisp	=1 if race is Hispanic	0.450	0.308	0.463
Asian	=1 if race if Asian	0.012	0.002	0.013
momdropout	=1 if mother dropped out of high school	0.127	0.138	0.125
no. obs		4937	419	4518

Notes: Number of observations reflects the sample used in estimation. Due to the sampling procedure of the PHDCN with respect to *wisc*, only 6, 9, 12, and 15 year old cohorts are used.

Table 4: Results from Survival Analysis for the NLSY97

	Model 1		Model 2		Model 3		Model 4	
Cognitive Ability	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error
std(asvab)	0.681***	0.054	0.697***	0.058	0.692***	0.053	0.711***	0.060
Gangs and Violence								
gangarea					11.754***	1.196	10.534***	1.102
bully					1.396***	0.155	1.420***	0.176
shot					1.619***	0.200	1.480***	0.207
Non-Cognitive Traits								
attention			1.155	0.259			1.067	0.226
liescheats			1.931***	0.363			1.837***	0.329
dontgetalong			1.574***	0.230			1.412**	0.198
unhappy			2.179***	0.358			2.031***	0.320
optimistic			0.356***	0.036			0.375***	0.040
Individual Characteristics								
male	2.861***	0.323	5.115***	0.662	2.670***	0.308	4.134***	0.545
Black	1.304*	0.206	1.363**	0.224	0.916	0.129	1.035	0.156
Hisp	1.424**	0.215	1.423***	0.226	1.072	0.158	1.092	0.168
urban	1.017	0.132	1.065	0.133	0.733**	0.097	0.789*	0.107
hgc	0.740***	0.030	0.771***	0.036	0.798***	0.034	0.828***	0.036
fatherfigure	0.736**	0.096	0.865	0.118	0.765*	0.109	0.865	0.114
mom educ dummies	X		X		X		X	
age dummies	X		X		X		X	
region dummies	X		X		X		X	
Duration dependence parameter	7.444***	0.034	7.617***	0.028	7.460***	0.0336	7.616***	0.028

Notes: ***, **, * denotes hazard ratio is statistically different from unity at the 1, 5, and 10 percent levels, respectively. All models use 47,721 observations. Estimates are weighted using panel weights generated by NLSY staff. Standard errrors are clustered at the individual level. The variable *std(asvab)* is created by standardizing *asvab*.

TABLE 5: RESULTS FROM ANALYSIS OF SIBLINGS IN THE NLSY97

	Model 1		Model 2		Model 3		Model 4	
Cognitive Ability	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error
std(asvab)	0.750**	0.097	0.763**	0.105	0.361**	0.183	0.553*	0.177
Gangs and Violence								
gangarea	11.189***	1.623	10.043 ***	1.484	7.800***	1.909	5.973***	1.396
#familygangmembers	2.144***	0.319	1.983***	0.300	0.779	0.228	0.885	0.216
bully	1.374*	0.228	1.346*	0.236	3.872**	2.594	2.914*	1.652
shot	1.437**	0.266	1.411*	0.273	1.356	0.862	2.358	1.742
Non-Cognitive Traits								
attention			1.288	0.418			2.066	2.569
liescheats			1.329	0.390			13.533**	15.628
dontgetalong			1.259	0.277			2.622	3.128
unhappy			2.438 ***	0.584			0.587	0.653
optimistic			0.391 ***	0.062			0.036***	0.022
Individual Characteristics								
male	3.075***	0.504	4.522***	0.856	8.594***	4.222	7.528***	4.007
urban	0.799	0.157	0.873	0.178	0.645	0.159	0.644*	0.163
hgc	0.913	0.053	0. 952	0.044	1.075	0.087	1.0367	0.089
fatherfigure	0.573*	0.101	0.582***	0.113	0.808	0.639	0.936	0.718
mom educ dummies	X		X		X		X	
Sibling effects					X		X	
age dummies	X		X		X		X	
region dummies	X		X		X		X	
Duration dependence parameter	7.461***	0.047	7.608***	0.039	7.891***	0.073	8.234***	0.067

Notes: ***, **, * denotes hazard ratio is statistically different from unity at the 1, 5, and 10 percent levels, respectively. All models use 21,824 observations. Estimates are weighted using panel weights generated by NLSY staff. Standard errrors are clustered at the household level. The variable *std(asvab)* is created by standardizing *asvab*.

TABLE 6: RESULTS FROM SURVIVAL ANALYSIS OF THE PHDCN

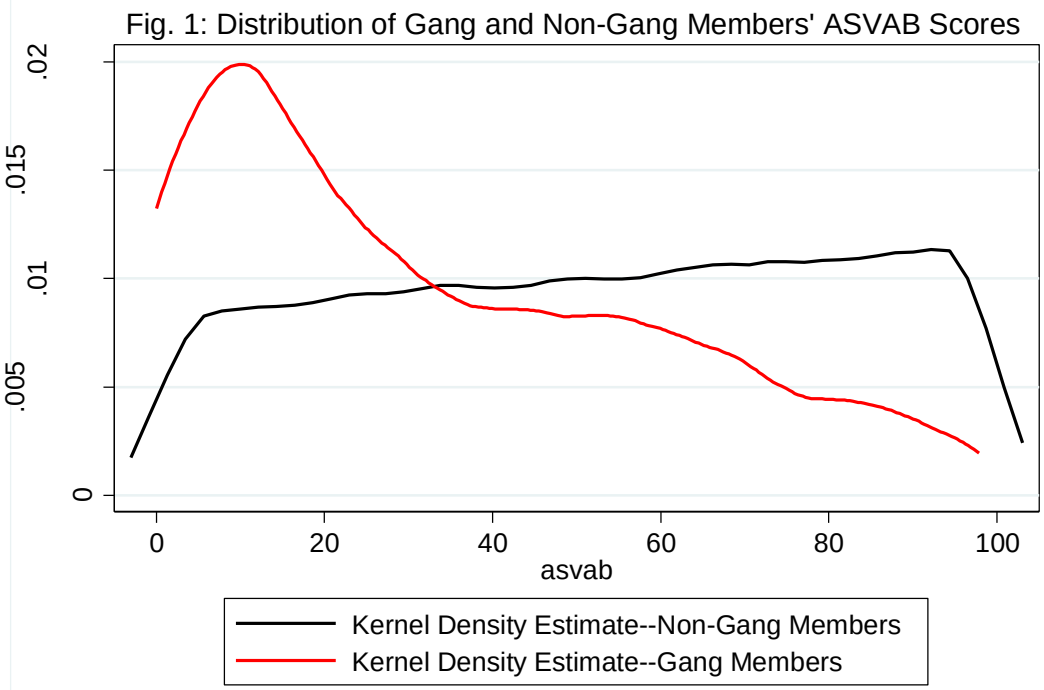
	Model 1		Model 2		Model 3		Model 4	
Variables	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error
Cognitive Ability								
std(wisc)	0.775***	0.066	0.776***	0.068	0.814**	0.068	0.822**	0.074
Neighborhood Characteristics								
gangarea			1.628***	0.362			1.741**	0.403
mostlyblack			1.452	0.667			1.346	0.655
mostlyhisp			2.711**	1.091			2.621**	1.021
high-ses			1.190	0.215			1.165	0.204
low-ses			1.216	0.365			1.256	0.375
Individual Characteristics								
male	3.285***	0.470	3.712***	0.548	3.079***	0.493	3.402***	0.545
Black	1.963***	0.344	1.742**	0.427	1.981***	0.378	1.599*	0.419
Hisp	0.763	0.162	0.952	0.246	0.880	0.203	1.057	0.289
Asian	0.605	0.632	2.733	2.450	0.737	0.758	3.357	2.689
momdropout	5.346***	0.862	5.187***	0.859	5.355***	0.880	5.495***	0.924
neighborhood dummies			X				X	
Non-Cognitive Traits								
impulsivity					0.954	0.294	0.981	0.385
inhibitory					1.252*	0.147	1.352**	0.201
sensation-seeking					1.002	0.126	0.940	0.143
persistence					1.177	0.170	1.178	0.188
activity					0.994	0.076	1.012	0.087
emotionality					0.980	0.077	0.927	0.091
sociability					1.068	0.111	1.074	0.119
Duration dependence parameter	2.067***	0.035	2.115***	0.038	2.057***	0.034	2.114***	0.037
no. obs	4,617		4,617		4,614		4,614	

Notes: ***, **, * denotes hazard ratio is statistically different from unity at the 1, 5, and 10 percent levels, respectively. Standard errrors are clustered at the neighborhood level. The variable *std(wisc)* is created by standardizing the variable *wisc* described in Table 3.

TABLE 7: "NEIGHBORHOOD EFFECTS" IN THE PHDCN

	Model 1		Model 2		Model 3		Model 4	
	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error	Hazard Ratio	Std. Error
Cognitive Ability								
std(wisc)	0.839**	0.076	0.925	0.102	0.881	0.080	0.983	0.111
neighborIQ	0.753*	0.119	0.594**	0.139	0.737**	0.112	0.570**	0.136
Neighborhood Characteristics								
gangarea	1.774***	0.377	1.724**	0.389	1.771***	0.371	1.817***	0.419
mostlyblack			1.464	0.745			1.4606	0.700
mostlyhisp			2.796***	0.937			2.668***	0.853
high-ses			1.224	0.214			1.182	0.208
low-ses			1.396	0.418			1.458	0.437
Individual Characteristics								
male	3.198***	0.460	3.719***	0.550	3.044***	0.491	3.3957***	0.555
Black	1.988***	0.374	1.730*	0.463	2.168***	0.446	1.693*	0.468
Hisp	0. 804	0.184	0. 972	0.269	0.987	0. 239	1.136	0.323
Asian	0.589	0.616	1.7157	2.037	0.769	0. 793	2.114	2.464
momdropout	5.330***	0.847	5.204***	0.858	5.416***	0.878	5.444***	0.917
neighborhood dummies			X				X	
Non-Cognitive Traits								
impulsivity					0. 998	0.318	0.907	0.367
inhibitory					1.235*	0.148	1.3758**	0.207
sensation-seeking					0.988	0.126	0.951	0.145
persistence					1.158	0.166	1.206	0.189
activity					1.002	0.076	1.024	0.088
emotionality					0.993	0.080	0.935	0.093
sociability					1.073	0.114	1.091	0.127
Duration dependence parameter	2.068***	0.035	2.117***	0.038	2.059***	0.034	2.117***	0.036
no. obs	4,617		4,617		4,614		4,614	

Notes: ***, **, * denotes hazard ratio is statistically different from unity at the 1, 5, and 10 percent levels, respectively. Standard errrors are clustered at the neighborhood level. The variable *std(wisc)* is created by standardizing the variable *wisc* described in Table 3.



Notes: Density estimates calculated using NLSY sample weights. kernel = epanechnikov, bandwidth = 3.0205