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The relative importance of adolescent skills and behaviors for adult earnings: A cross-national study

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Seeking convergent findings in five data sets from four countries, we assess the relative importance of adolescent skills and behaviors for completed schooling and labor market success in adulthood. We provide a framework for classifying "noncognitive" skills and use data designed by developmental psychologists to provide reliable measures of a variety of achievement and behavioral skills assessed between ages 13 and 16. Results show that adolescent achievement, particularly math achievement, is a stronger predictor of completed schooling than measures of noncognitive skills. Achievement skills also out-predict noncognitive skills with regard to adult earnings, although the differences are not as striking.

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The relative importance of adolescent skills and behaviors for adult earnings: A cross-national study

The ability of cognitive performance measured at various ages to predict economic outcomes is well established (Almlund et al., 2011; Jencks et al. 1979). A growing literature is highlighting the importance of "softer" skills—often referred to as "noncognitive" skills—for labor market outcomes (again, see the Almlund et al., 2011 review). Yet while there is evidence to suggest that employers ascribe greater importance to characteristics such as communication skills and attitude than to academic performance or years of schooling (Bureau of Census, 1998; Heckman, Hsee, & Rubinstein, 1999; Cameron & Heckman, 1993), there is little consensus on the valuation of noncognitive versus cognitive skills with regard to labor market outcomes.

This paper examines the relative importance of adolescent skills and behaviors for future schooling and labor market success. It diverges from most previous work in two important ways. First, data are drawn from five data sets from four countries (the U.K., the United States, Sweden and Finland), all of which provide representative samples of children drawn from national or large community populations followed from early or middle childhood through at least age 28. As with Robins's (1978) classic study of juvenile and adult anti-social behavior, our approach seeks to identify replicable results across divergent longitudinal developmental studies.

Second, all of the data sets were designed by or based on insights from developmental psychologists. Much of the past work in this area has been based on labor market-oriented studies that include a few noncognitive measures (e.g., the National Longitudinal Survey of Youth), U.S. Department of Education studies that measure the details of the educational process but not social and emotional skills (e.g., National Education Longitudinal Study of 1988) or administrative data that happen to include personality measures (e.g., Lindqvist & Vestman's 2011 study of Swedish men at the time of their induction into the armed forces). All of our studies provide reasonably comparable measures of cognitive skills as well as a broad set of noncognitive skills assessed between ages 13 and 16.

Taken together, our results offer a coherent cross-country story about the different kinds of skills and behaviors that matter for later educational and economic attainment. They show that adolescent achievement, particularly math achievement, is a much more powerful predictor of completed schooling than any of the adolescent-based measures of noncognitive skills. Academic achievement also out-predicts noncognitive skills with regard to adult earnings, although here the differences are not as striking. As with Lindqvist and Vestman (2011), we find that noncognitive abilities appear to matter more at the lower than the higher end of the earnings distribution. But in contrast to their analysis, we find considerably greater explanatory power for cognitive than noncognitive skills at all points of the earnings distribution.

The paper is organized as follows: the next section discusses the existing evidence on these issues. Section II describes our five data sets and discusses our empirical strategy. Section III presents the main results for the relative importance of cognitive and noncognitive skills and behaviors, as well as composite indices of these measures in predicting years of completed schooling and adult earnings. Our final empirical section explores the distributional effects of the cognitive and noncognitive composites and other robustness issues. Section IV concludes.

I. Background

A. Cognitive and noncognitive skills

Duncan and Magnuson (2011) classify competencies into four groups: achievement, attention, problem behaviors and mental health.[1] "Achievement" refers to concrete academic skills such as reading (e.g., literacy, reading comprehension) and mathematics (e.g., proficiency with fractions or algebra). Economists often use the term "cognitive skills" to lump together both purer cognitive abilities that are generally insensitive to instruction with these kinds of concrete achievement skills. Although scores on tests of cognitive ability and academic achievement tend to show substantial correlations, there is an important conceptual difference between cognitive ability as a relatively stable trait and the concrete achievement skills that develop in tandem with schooling and other environmental inputs.

We use the term "attention skills" to refer to the ability to control impulses and focus on tasks (Posner and Rothbart, 2009; Raver, 2004). Although these skills are fundamentally cognitive in nature, economists typically categorize them as "noncognitive." Since they increase the time children are engaged and participating in academic endeavors, attention-related skills such as task persistence and self-regulation should predict children's achievement and school outcomes and, if stable over time, perhaps labor market success as well. Consistent evidence suggests that the ability to control and sustain attention as well as participate in classroom activities predicts achievement test scores and grades during preschool and elementary school, even when children's academic ability is held constant (Currie and Stabile, 2007; Duncan et al., 2007; Raver, et al., 2005).

Children's dysregulated behaviors, particularly what developmental psychologists call "externalizing" behavior, are expected to affect both individual learning and later attainment. They include a cluster of related behaviors including antisocial behavior, conduct disorders, and more general aggression. Problem behavior may lead to child-teacher conflict, disciplinary actions, and social exclusion and also, in adolescence and adulthood, arrests and incarceration (Newcomb, Bukowski, & Pattee, 1993).

What we refer to as "withdrawn behavior" includes children's emotional negativity and expressions of sadness, which can lead to social withdrawal, anxiety and other behaviors commonly termed "internalizing" behavior problems (Eisenberg et al., 2005; Posner and Rothbart, 2000). These depressive behaviors are often measured by questions that ask how frequently children appear to be in a sad or irritable mood, and whether they demonstrate low self-esteem or low energy. "Anxiety" captures a set of factors including children's fears of separation from caregivers, obsessive/compulsive behavior and social reticence. Anxiety is a risk factor, particularly among females, for poor school achievement, which is further related to low career orientation (Pulkkinen, Ohranen, & Tolvanen, 1999).

B. The importance of adolescent skills and behaviors for adult earnings

Although we report results from models relating skills to both completed schooling and earnings, we concentrate our review on the literature on earnings outcomes, much of which has focused on cognitive skills. [2] Murnane et al. (1995), for example, show positive

[1] There exist other classifications of individual differences in the areas of personality and developmental psychology. Many studies have centered on the "big five" personality traits – conscientiousness/constraint, openness, agreeableness, neuroticism/negative emotionality and extraversion/positive emotionality – as predictors of labor market outcomes (e.g., Seibert, & Kraimer, 2001; Shiner & Caspi, 2003). Their predictive power is compared to the predictive of cognitive ability. Although these traits have traditionally been viewed as highly stable across the life span, a growing body of evidence indicates that that personality traits can indeed change in response to general life experiences (e.g., Roberts, Walton, and Viechtbauer, 2006; Almlund et al., 2011).

[2] For reviews of the literature linking adolescent skills and behaviors to subsequent academic attainment, see Lleras, 2008 and Melguizo, 2011

links between the math tests scores of two cohorts of high school seniors and their wages at age 24. Looking at U.S. National Longitudinal Survey of Youth (NLSY) participants who were 15-18 year olds when they took the Armed Forces Qualifications Test (AFQT), Neal and Johnson (1996) found strong positive links between test scores and earnings measured a decade later. Currie and Thomas (1999) used data from the British National Child Development Study (NCDS) to relate reading and math achievement assessed during middle childhood to wages and employment at age 33. Even in the presence of extensive family background controls, their models show 10%-20% earnings differentials when comparing males and females in the top quartile of each test score distribution with those in the bottom quartile. However, despite a large literature confirming a robust relationship between cognitive ability and labor market success, the fraction of wage variation explained by these measures is modest (see Cawley, Heckman, & Vytlacil, 2001, for further discussion).

Evidence on the importance of noncognitive skills on labor market outcomes is mixed. Both U.K. and U.S. employer surveys suggest that employers value noncognitive behaviors, such as communication skills and attitude, more than academic performance or years of schooling (see Green, Machin & Wilkinson, 1998 for examples from the U.K.; and Bureau of Census, 1998; Heckman, Hsee, & Rubinstein, 1999; Cameron & Heckman, 1993 for comparable U.S. findings). In work relating noncognitive skills to employment, several studies show associations between aggressive or antisocial behavior during adolescence and poor employment outcomes in adulthood (Caspi, et al., 1998; Kokko & Pulkkinen, 2000; Richards et al., 2009). Prior research also highlights the particular importance of social competence with peers for positive employment outcomes over and above academic achievement (Masten, et al., 2010).

With respect to adult earnings more specifically, indicators including measures of task persistence (Andersson & Bergman, 2011), individual motivation (Goldsmith, Veum & Darity, 1997), leadership skills (Kuhn & Weinberger, 2005), as well as self-esteem (Goldsmith, Veum & Darity, 1997; Murnane et al., 2001), locus of control (Goldsmith, Veum & Darity, 1997; Coleman & DeLeire, 2000; Heckman, Stixtud, & Urzua, 2006, who combine adolescent locus of control with self-esteem), sociability (Borghans, ter Weel, & Weinberg, 2005) and child constructive social behavior and adult extraversion (Viinikainen et al., 2010) have each been shown to positively predict earnings. In contrast, attention deficit and anxiety problems (Knapp, et al., 2011), aggressive behaviors and antisocial conduct (Cawley, Heckman & Vytlacil, 2001; Moffitt & Scott, 2008; Osborne-Groves, 2005), and adolescent internalizing problem behaviors (Osborne-Groves, 2005) have been shown to negatively predict adult wages. Heckman and Rubinstein (2001) further establish the importance of adolescent behavioral profiles in understanding why GED holders earn much less than high school graduates despite having virtually identical distributions of cognitive test scores.

Carneiro et al. (2007) use data from the British NCDS to relate earnings to a wide variety of achievement and behavioral measures assessed when the participants were 11 years old. The diversity of these latter measures is reflected in their names: “anxiety for acceptance,” “hostility toward adults,” “withdrawal,” and “restlessness.” When summed into a single index, a one standard deviation increase in this collection of absence of risk factors is found to be associated (net of parental background) with a 3.3% increase in age 42 earnings – about one-fifth of the estimated impact of a standard deviation increase in achievement test scores (see also Machin et al., 2001). Ironically, an examination of the social and behavioral subscales found the greatest explanatory power for what survey designers termed “inconsequential behavior” – a heterogeneous mixture of items related to inattention (“too restless to remember for long”), anti-social behavior (“in informal play starts off with others in scrapping and rough play”) and inconsistency (“sometimes eager, sometimes doesn’t

bother") that cannot be disaggregated. Their ability to tell a coherent story about the different kinds of skills that matter for successful adult outcomes is thus rather limited.

Lindqvist and Vestman (2011) use data from the Swedish military enlistment to investigate the differential effects of single index measures of cognitive and noncognitive skills on adult economic outcomes. Their noncognitive measure is based on a psychologist's assessment of the suitability of the potential recruit for military service. They find that, prior to controlling for completed schooling, a one standard deviation increase in cognitive ability is associated with a wage premium of 8.9 percent, compared with 6.9 percent for noncognitive ability. Men who fare poorly in the labor market, defined as being either unemployed or having low annual earnings, lack noncognitive rather than cognitive abilities. Moreover, they find strong evidence that the relative importance of noncognitive and cognitive skills for predicting earnings varies across the earnings distribution: noncognitive skills have a much stronger effect on earnings than cognitive skills at the low end of the earnings distribution, while cognitive ability is a stronger predictor of wages in the top half of the wage distribution. And finally, they show that cognitive and noncognitive skills interact to raise earnings more than their additive effects would imply. We are able to test for both distributional and interactive effects in the five data sets available to us.

C. The present study

We use roughly comparable data from five longitudinal cohort studies conducted in four countries to assess the relative predictive power of different skills and behaviors assessed during adolescence for later schooling and labor market success. We test a number of hypotheses related to how different skills and behaviors are associated with successful adult outcomes. In line with the robust evidence demonstrating the predictive capability of cognitive performance at different ages with respect to economic outcomes, we expect cognitive measures in adolescence to more strongly predict both completed schooling and adult earnings than noncognitive measures. Attention-related skills have also been shown to be particularly strong predictors of subsequent academic outcomes, even when prior achievement is controlled for (Duckworth & Schoon, 2010; Duncan et al., 2007; Grissmer et al., 2010), and so we anticipate that a lack of attention problems will predict completed schooling over and above the other noncognitive measures considered. However, the existing evidence also highlights the negative consequences in adulthood of earlier aggressive behaviors (Cawley et al., 2001; Kokko & Pulkkinen, 2000; Moffitt & Scott, 2008; Osborne-Groves, 2005), leading us to expect that the absence of aggressive behaviors will predict adult outcomes more consistently than prosocial behaviors and the absence of mental health problems, particularly with regard to earnings. Based on findings from Lindqvist and Vestman's Swedish study, we predict that a certain level of noncognitive skills are a prerequisite for avoiding failure in the labor market and so will matter more at the lower end of the earnings distribution, whereas cognitive ability will show relatively stronger associations at the higher end of the earnings distribution.

II. Methods

As summarized in Table 1 and detailed in the appendix, the five data sets we use are the U.S. Baltimore Beginning School Study (BSS), the Finnish Jyväskylä Longitudinal Study of Personality and Social Development (JYLS), the Swedish Study of Individual Development and Adaptation (IDA), the British National Child Development Study (NCDS; 1958 birth cohort) and the British Cohort Study (BCS; 1970 birth cohort). All are based on

probability samples drawn from either national populations or diverse communities and all attained reasonably high response rates. In keeping with much of the past earnings literature, all of our analyses are restricted to males only.

[Table 1 here]

The BSS followed a group of 838 individuals from their first grade year in 1982 (Entwisle, Alexander, & Olson, 2007). The study drew a stratified random sample of classrooms in 20 Baltimore, Maryland public schools. Second is IDA, a study that sampled second-grade students in Örebro, a city in central Sweden (Magnusson, 1988). Third is the JYLS, which drew its sample of second graders from schools in the city of Jyväskylä, which is located in central Finland (Pulkkinen, 2009). Fourth, the BCS is a nationally representative longitudinal study which has followed into adulthood a cohort of children born in Britain during one week in 1970 (Elliott & Shepherd, 2006). Fifth, the 1958 NCDS is a longitudinal survey of over 17,000 people born in Britain between the 3rd and 9th March, 1958 (Shepherd, 1985).

While both British studies reflect nationally representative samples, data from the U.S., Sweden and Finland are drawn from community samples, leading to concerns that the limited variability in these three studies could result in misleading results. Our choices were dictated by the fact that there are no nationally representative data sets in these countries with comprehensive measures of skills and behaviors in adolescence as well as measures of completed schooling and earnings reported in adulthood. Comparisons of the Finnish sample at ages 36 and 42 to national population statistics compiled by Statistics Finland show similar distributions (Pulkkinen, 2006). Although children living in Baltimore are hardly representative of U.S. children, it is important to note that children living in the city of Baltimore at a time (1982) when Baltimore public schools were more racially diverse than they are now; 45% of the first graders in the sample are white.

Completed schooling of child. All studies provide measures of the child's eventual completed schooling that are drawn from interviews taken at age 28 or later. Although the structure of primary, secondary and tertiary schooling differs across countries, conversion tables enable us to code years of completed schooling from the ISCED codes for the various education levels across our countries (UNESCO, 2006). As shown in Appendix Table 1, children averaged between 12 and 14 years of completing schooling, with higher averages in the English speaking than the Nordic countries.[3]

Adult earnings. – All studies also provide measures of the child's eventual earnings, again reported at age 28 or older. Our measure of earnings is based on annual income from employment and excludes income received from unemployment or other benefits.[4] Maximum earnings are set at $100,000.[5] Appendix Table 1 shows adult earnings averaged between $28,000 and just over $60,000, with higher averages (and correspondingly higher variation) in Sweden and the U.S. Earnings in Finland are the lowest across the four countries. All of our regression analyses are based on log-transformed earnings, using a minimum of $500 per annum prior to the log transformation.

[3] In the case of levels of schooling such as a university degree that may take varying numbers of years to complete, we took the normal completion time. See the note about schooling for the Finnish data in the appendix.

[4] Zero-earners are included in all analyses but, with the exception of the JYLS, self-employed individuals are excluded as their income is deemed too problematic. For the purposes of our descriptive tables, adult earnings data are converted into 2009 U.S. dollar equivalents using a two-step process: first we bring all other currencies up to 2009 levels using country-specific Consumer Price Index (CPI) values; second we convert each currency into U.S. dollars using the Purchasing Power Parities (PPP).

[5] We carried out extensive robustness checks for treatment of large earnings values in our two largest data sets – the BCS and NCDS – and only in one case, noted below, were the results sensitive to such treatment.

Age 13-16 skill and behavior measures. – Comparability of age 13-16 skill and behavior measures varies somewhat by domain (Appendix Table 2). Four of the five studies provide both reading and math achievement test scores; the Finnish study contains information about grade point averages collected from school archives. Four of the five studies include teacher reports of items that reflect attention-related skills and anti-social behavior/aggression; the 1970 British Cohort Study uses comparable items from parent reports at age 16. The same is true with regard to prosocial behavior. Only three studies provide middle childhood measures of prosocial behavior.

Our analysis examines the relationship of individual skills and behaviors, as well as composite cognitive and noncognitive indices, with subsequent adult outcomes. Across the five datasets, all of these skills and behavior measures are standardized using whole-sample means and standard deviations. To further aid interpretation and comparability across the datasets, we scale all adolescent skill and behavior measures positively, so that higher scores reflect better individual adjustment. The resulting measures are labeled reading, math, school grades, absence of attention problems, absence of aggressive behavior, prosocial behavior, and absence of withdrawn behavior. Composite measures were derived by summing the constituent cognitive scores (reading and math) or noncognitive scores (absence of attention problems, absence of aggressive behavior, prosocial behavior, and absence of withdrawn behavior) and restandardizing, again using whole-sample means and standard deviations. Finally, we investigate the robustness of our results to additional noncognitive measures available in the two British data sets. These measures are listed in Appendix Table 3.

Parental schooling and other controls. – To facilitate comparability across the five data sets, we use parental schooling as our sole measure of parent socioeconomic status.[6] All studies provide measures of years of completed schooling for the parent as reported by the parent in the BSS and British studies and by the grown children in the Swedish and Finnish studies. As with children's eventual completed schooling, we use ISCED conversion tables to code equivalent years of schooling from reports of type of completed education. As shown in Appendix Table 1, parent schooling averages were higher in the U.S. and U.K. than in the two Nordic countries. We employ a modest set of additional background measures: number of siblings and, where available, age when outcome was measured, race/ethnicity and birth weight.

The much greater scope of data collection in the two British studies enabled us to conduct a number of robustness checks, including the addition of a much larger set of family background measures, the inclusion of a measure of IQ taken at age 10/11, and assessing the predictive power of a broader set of age 13-16 noncognitive skills not available in the other datasets. These additional control measures are listed in Appendix Table 3. We were also able to compare results to those from regression models in which earnings were averaged across three time points in adulthood.

To account for missing data in each of the longitudinal data sets, we used multiple imputation by chained equations (ICE) as implemented in Stata (Royston, 2005b) or the Sequential Regression Imputation Method as implemented in IVEware (Raghunathan et al, 2001; Raghunathan, Solenberger, & Van Hoewyk, 2002) to generate 20 multiply imputed data sets for each study.

III. Results

A. Completed schooling

[6] None of the studies included non-twin siblings nor sufficient numbers of twins to control for family differences with family fixed effects.

We begin by presenting regression coefficients relating the child's years of completed schooling to adolescent skills and behaviors (Table 2). Coefficients can be interpreted as the fraction of a year of child's eventual completed schooling associated with a one standard deviation increase in each of the given adolescent skills and behaviors, controlling for other skills and behaviors, parent education, child age, number of siblings, and where available race/ethnicity, mothers' age at birth and child birth weight. The rightmost columns present a simple average of the coefficients in a given row and a weighted average of the coefficients (and standard errors) in which weights are the inverse of each coefficient's squared standard error and thereby adjust for the differential precision of the various estimates.

[Insert Table 2 about here]

Looking first at the weighted averages, math scores are clearly most predictive of completed schooling, with one standard deviation increases in math scores associated with .72 years of added schooling. Coefficients on reading and (lack of) attention problems also passed conventional thresholds for statistical significance. A look across the "math" row shows that the coefficients are positive and statistically significant in all four of the studies in which math achievement was measured. For reading, however, while the coefficients are all positive, only those for the two British studies reach statistically significant levels. With the exception of absence of attention problems, average coefficients are smaller and patterns of individual coefficients less consistent in the case of the various behavior measures.

To gauge the relative predictive power of the skill and behavior composites, we combined the measures into single index composites of cognitive and noncognitive abilities. Results, reported in Table 3, show that across all five studies, the cognitive achievement composite was a more powerful predictor of completed schooling than noncognitive skills. The weighted average suggests that the magnitude of this difference is more than 6:1, with a one standard deviation increase in the cognitive skills composite associated with one added year of schooling. The biggest differences between the composite scores are observed for the Finnish JYLS, where the coefficient on noncognitive skills is negative.[7]

[Insert Table 3 about here]

B. Adult earnings

Turning to the results for adult earnings, Table 4A shows the association between the individual skills and behaviors and log-transformed earnings, conditional on the same set of covariates as in Tables 2 and 3. Table 4B repeats these regressions but adds completed schooling as a predictor.

[Insert Table 4A about here]

[Insert Table 4B about here]

In Table 4A, the weighted average coefficients again show math achievement to be most predictive, although in this case the reading coefficient is much closer in size to the math coefficient than was the case for completed schooling. Each standard deviation increase in math test scores is associated with an increase in adult earnings of about 15 percent. And while the individual study coefficients on math are all positive, only those for the British studies achieve statistically significant levels. For reading, only the coefficient for the large sample British NCDS is significant. Looking across the weighted average coefficients for the noncognitive skills and behaviors, coefficients fall into the .02 to .06 range. In contrast to the

[7] In the JYLS, teachers rated both the social behavior of the children and their school achievement which resulted in unusually high correlations among school achievement, noncognitive skills and completed schooling.

results for completed years of education reported above, only absence of attention-related problems fails to predict adult earnings.

Table 4B shows that the overall pattern of estimates is repeated when completed schooling is added into the model. Coefficients on the measures of cognitive achievement fall, particularly for math achievement, while those for the adolescent skills and behaviors remain almost unchanged.[8] Table 5 reports results from earnings regressions involving the skill composites, first without ("Regression 1") and then with ("Regression 2") controls for completed schooling. Top panel averages show that adolescent cognitive achievement is more predictive of adult earnings than are noncognitive skills. The magnitude of this difference, however, is considerably smaller than when completed schooling is the outcome, with cognitive skills being only twice the size of the noncognitive skills composite in predicting earnings. Results shown in the second panel suggest that the inclusion of completed years of schooling reduces the coefficient on cognitive skills much more than the coefficient on noncognitive skills.

[Insert Table 5 about here]

IV. Extensions

Although our cognitive composite appears to have twice the predictive power of the noncognitive composite for log earnings, they could still have differential effects at different quantiles of the earnings distribution (Lindqvist & Vestman, 2011). We test this hypothesis with quantile regressions run for each of our five studies at the 10th, 25th, 50th, 75th and 90th percentiles (Table 6).

[Insert Table 6 about here]

Looking first at the weighted averages, it appears that for both cognitive and noncognitive skills, the strength of their associations with earnings is greater at the bottom end of the distribution than at the top. At the tenth percentile, an increase in the achievement composite by one standard deviation is associated with a .80 increase in logged annual earnings. By contrast, the same increase for noncognitive ability would increase annual earnings by .31 log points. Moving up the earnings distribution, the importance of both cognitive and noncognitive skills declines, but coefficients on the cognitive skill composite are at least 50 percent higher than corresponding coefficients on noncognitive skill composites.[9]

Following the analysis by Lindqvist and Vestman (2011), who found a small, positive and statistically significant interaction between their cognitive and noncognitive skills composites, we also investigated whether the cognitive and noncognitive skill composites had an interactive effect on earnings. Results presented as "Regression 1" in Appendix Table 4 show negative but nonsignificant interaction coefficients in five of the six studies. The greater power of the meta-analytic average estimate boosts the small negative average interaction coefficient just above the .05 threshold for statistical significance.

We worried that our small number of parent measures might not control sufficiently for family background. Both the British BCS and NCDS studies contain the extensive set of family background measures listed in Appendix Table 3. However, as shown in Appendix

[8] The education coefficient for the U.S. is not significantly associated with earnings, possibly reflecting the young age (28) at which earnings questions were asked and the BSS's somewhat homogeneous disadvantaged sample.

[9] In our robustness checks for treatment of large earnings, there is only one case – 10^{th} and 25^{th} percentile results for the BCS – where the results are sensitive to the maximum earnings being set at $100,000.

Table 5, the addition of these measures hardly changes the estimated coefficients on our cognitive and noncognitive measures.

We also explored the extent to which the coefficients estimated for our achievement (particularly math achievement) measures might reflect IQ rather than genuine differences in academic achievement. Both the British BCS and NCDS studies contain assessments of IQ at age 10/11 based on the British Ability Scales, an individually administered cognitive test battery for children aged between 3 and 17 years that is designed to provide diagnostic information on cognitive strengths and weaknesses. As shown in Appendix Table 5, the inclusion of this IQ measure in the schooling and earnings regressions also had relatively little effect on the estimated coefficients for math achievement. For example, including IQ reduces the math coefficient from .15 to .14 in the BCS and .13 to .10 in the NCDS.

A final concern was that our set of noncognitive measures did not include some of the measures (e.g., locus of control and self-esteem in the 2006 Heckman, Stixtud, & Urzua study) that other researchers had found to matter. Here again the two British data sets are useful, with the BCS providing measures of self-esteem and locus of control and the NCDS measuring several dimensions of personality . Appendix Tables 6A and 6B show that the locus of control measure significantly predicts schooling but not earnings, while the self-esteem measure significantly predicts earnings but not schooling. Among the personality measures included in the NCDS, only "hardworking" was predictive, in this case for schooling but not earnings. All in all, there are few consistent patterns for these added noncognitive measures.

The inclusion of the additional measures produced at most modest reductions in the coefficients on our standard set of cognitive and noncognitive measures. However, the predictive power of the extra measures elevates the relative importance of the noncognitive skill index, particularly in the BCS earning regressions.

As a final robustness check, we inflated and then averaged the log earnings measures across the three occasions in which they were asked in the two British data sets. Appendix Table 8 shows that this averaging results in almost no change in the estimated relative importance of the cognitive and noncognitive skills composites.

V. Discussion

Consensus on the relative importance of cognitive versus noncognitive skills with regard to labor market outcomes has eluded researchers interested in understanding what skills promote economic success. Our study examines the relative importance of adolescent skills and behaviors in the labor market, building on previous research by using consistent measures across countries and considering both individual skills and behaviors as well as aggregate measures in cognitive and noncognitive domains.

In line with other research, we find that school achievement, particularly math achievement, is a consistently stronger predictor of completed schooling and adult earnings than any of the problem behaviors we measured. For completed schooling, absence of attention-related problems is the strongest predictor among the noncognitive skills and behaviors considered. In contrast, for adult earnings, our results highlight the relative importance of the absence of aggressive behavior, absence of withdrawn behavior, and prosocial behavior.

When combined into aggregate indices, cognitive skills are consistently shown to be stronger predictors of adult outcomes than noncognitive skills, by a magnitude of more than 6:1 for completed schooling, but only about 2:1 in the case of adult earnings. Our findings also indicate that educational attainment only partially accounts for the association between

prior achievement and adult earnings and none of the association between noncognitive skills and earnings. Investigation of the differential effects of adolescent skills and behaviors at different quantiles of the earnings distribution suggest that both cognitive and noncognitive skills matter more at the lower than upper end of the distribution.

Prior research relating noncognitive skill to subsequent labor force outcomes covers a wide range of skills; we would expect that the explanatory mechanisms linking skill to outcome would vary by skill. For example, Heckman, Stixtud, and Urzua, (2006) found that people with higher levels of noncognitive skills (measured as self-esteem and sense of personal effectiveness) were more likely to apply for higher-paying jobs. In this case, noncognitive skills appeared to matter via individuals' aspirations or motivation to seek particular kinds of jobs. However, a different subset of noncognitive skills might alter the likelihood of being hired, conditional on applying for a given job. In short, the causal mechanism linking noncognitive skill to labor force outcomes likely depends on how "noncognitive skill" is defined. Differences in this definition could explain the seeming inconsistency of findings across studies.

VI. Data Appendix

A. The U.S. Beginning School Study (BSS)

The Beginning School Study (BSS) has followed a group of 838 individuals from their first grade year, aged 6 or 7, in 1982 (Entwisle, Alexander, & Olsen, 2007). Sampling began with a stratified random sample of 20 Baltimore, Maryland (U.S.) public schools. From there, roughly 12 first graders were randomly sampled from each first grade classroom, with a participation rate of 97% among those selected.

Interviews were conducted recurrently between first grade and ages 28/29. For adult outcomes, the BSS's "Mature Adult" survey consists of 660 (79%) of the original participants at the age of 28/29. Many children attending Baltimore public schools in the early 1980s came from disadvantaged families, although these children were not as uniformly disadvantaged as the children in many urban school districts today. Of the respondents in the age 28/29 interviews, 56% are African-American, with virtually all of the remainder Caucasian. Only about a third of the analytic sample lived with a single parent at the baseline year, but over two-thirds were eligible for a free or reduced price lunch at some point during their elementary school years.

B. The Swedish Individual Development and Adaptation (IDA)

The longitudinal research program Individual Development and Adaptation (IDA) was initiated by David Magnusson in the early 1960s; and he directed it until 1996, when Lars Bergman became the principal investigator. General descriptions of the IDA data base are provided in Bergman (2000), Magnusson (1988) and Trost and Bergman (2004). The data base consists of three whole school grade cohorts, but the present study uses only data from the cohort born in 1955. The sample characteristics of this cohort are described below.

In the present study, data were used from the first data collection in 1965 for the complete school grade cohort of children in grade 3 from the town of Örebro, who were then about 10 years of age. This cohort constituted our target sample and included 517 boys and 510 girls. Basic data from grade 3 were available for 958 of these children or 93 percent of the target sample. It is fairly representative of a Swedish urban population, except that the socioeconomic level of the children´s families was slightly above average (Bergman, 1973). Two extensive data collections were performed when the individuals in question were middle-aged, one for females in 1998 when they were 43 and one for males in 2002 when they were 47. Four hundred and thirty females and 390 males took part (84 percent and 75

percent of the target sample, respectively). With regard to school achievement and the parents´ education in grade 3, there were no significant differences between those who took part in the data collections in middle age and those who did not.

C. The Finnish Jyväskylä Longitudinal Study of Personality and Social Development (JYLS)

The Jyväskylä Longitudinal Study of Personality and Social Development (JYLS) was begun by Lea Pulkkinen in 1968 when she randomly selected 12 second-grade school classes in the town of Jyväskylä, Finland to become part of the study sample (http://www.jyu.fi/ytk/laitokset/psykologia/en/research/jyls and Pulkkinen, 2009). All the participants in the 12 classes participated in the study. The initial sample included 173 girls and 196 boys. Ninety-five percent of the participants were born in 1959 (the rest either in 1958 or 1960); the participants were about 8 years old. At age 8, children's social behavior (the main focus was on emotional and behavioral regulation) was assessed using teacher ratings and peer nominations, and information about school success was collected from teachers. The next main data collection phase took place in 1974 when the participants were 14 years old.

All of the participants from the initial sample were again contacted in 1986, at the age of 27, in 1995 at the age of 36, in 2001 at the age of 42, and, most recently, in 2009 at the age of 50. Schooling data were drawn from the age 42 follow-up and earnings data were drawn from registers concerning age 43 . The retention rate of the JYLS has remained high over the years. The adult participants have represented well both the initial sample and the Finnish age-cohort group born in 1959.

The Finnish measure of completed schooling represents highest level of education rather than actual years spent in school. Since university schooling is state-supported (but the support is time-limited), there is less pressure to graduate quickly than in those countries where there are tuition fees. Individuals can spend five to seven years at the university or three years in vocational school and then another three years in vocational college. Consequently, all the university graduates were assigned the same number of study years. The same logic applies to all the other educational institutions. The ISCED years refer to the years assumed to be used to obtain the highest level of completed education. This may have underestimated the schooling years of those who have first graduated from, let's say vocational school and then from the vocational college.

D. The National Child Development Study 1958 Birth Cohort (NCDS)

The 1958 National Child Development Study is a longitudinal study of British children who were born during the week of March 3 through 9, 1958 (Shepherd, 1985). A total of 17,414 mothers, representing 98% of all births that week, were interviewed. Follow-up interviews were conducted when the children were age 7 (1965; n = 15,468), 11 (1969; n = 15,503), and 16 years (1974; n = 14,761). These three ages were selected since they were important transition points in the children's educational progress through the British school system. Adult follow-up survey interviews were conducted when the participants were 23 (1981; n = 12,537), 33 (1991; n = 11, 469), 42 (2000; n = 11, 419) and 46 (2004; n = 9,534) years of age.

E. The 1970 British Cohort Study (UK)

The UK 1970 British Birth Cohort (BCS) is a nationally representative longitudinal study which has followed into adulthood a cohort of children born in England, Scotland, Wales and Northern Ireland during one week in April 1970. The birth sample of 17,287 infants was approximately 97% of the target birth population. Since the birth survey there

have been seven other major data collection sweeps aimed at monitoring these children's health, education, social and economic circumstances. These were carried out in 1975 (age 5), 1980 (age 10), 1986 (age 16), 1996 (age 26), 2000 (age 30), 2004 (age 34), and 2008 (age 38).

A teacher strike in 1986 in England and Wales meant that much of the educational data for age 16 is totally missing for approximately half of the cohort. Moreover, the age 16 maths data was only recently (and only partially) made available. There are only N=3,677 maths test scores available to analyse while there are N=6,003 spelling and vocabulary assessments. Furthermore, schools who did administer the tests (i.e. those not on strike) are likely to the more advantaged schools meaning the data available may not be as representative of the full cohort as in the NCDS sample.

Attrition reduced the achieved sample to 9,665 in the age-34 survey (Dodgeon, Elliott, Hancock, & Johnson, 2006). Representativeness of the original birth cohort has been maintained with only slight biases in the currently participating sample towards women and towards the more educated (Ferri, Bynner, & Wadsworth, 2003).

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TABLE 1: STUDY CHARACTERISTICS

Study	Population	Sample	Sample sizes and response rates	
			1st wave	Other relevant waves
U.S. Beginning School Study	First graders in Baltimore public schools in 1982	12 students selected at random from each class	1st grade: 838 (97%)	Age 14/15: 412-668 (49-80%) Age 27/28: 660 (79%)
Swedish IDA study	All third grade students in Örebro, Sweden in 1965	100% sampling rate	3rd grade (age 10): 958 (93%)	Age 13: 90% Age 48 for males (75%)
Finnish JYLS	Second grade classrooms in Jyväskylä, Finland in 1968	All students in 12 randomly-selected classrooms	Age 8: 369 (100%)	Age 14: 356 (96%) Age 42: 285 (79%)
British BCS	British births in one April, 1970 week	100% sampling rate	Birth: 17,287 (97%)	Age 16: 11,206 (65%) Age 34: 9,316 (54%)
British NCDS	British births in one March, 1958 week	100% sampling rate	Birth: 17,416 (98%)	Age 16: 13,917 (80%) Age 33: 10,986 (63%)

Notes: JYLS response rate excludes deceased study participants from the denominators. Earnings detail for the JYLS was obtained via tax records and refer to age 43.

TABLE 2: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF CHILD'S YEARS OF COMPLETED SCHOOLING ON ADOLESCENT (AGE 13-16) SKILLS AND BEHAVIORS

	U.S. BSS		Swedish IDA		Finnish JYLS		British BCS		British NCDS		Simple average	Weighted average	
Adolescent skills/behaviors													
Reading	.02		0.16				.39	***	.34	***	.23	.33	***
	(.22)		(.17)				(.08)		(.04)			(.04)	
Math	.91	***	.68	***			.65	***	.73	***	.74	.72	***
	(.22)		(.17)				(.09)		(.04)			(.04)	
School grades					1.37	***							
					(.18)								
Absence of attention problems	.32	*	.32	*	.09		.28	***	.04		.21	.10	***
	(.18)		(.15)		(.22)		(.09)		(.04)			(.03)	
Absence of aggressive behavior	.42	**	0.02		-.33	*	.13		.05		.06	.06	
	(.20)		(.13)		(.20)		(.08)		(.04)			(.03)	
Prosocial behavior	.23		0.05		.08				.04		.10	.05	
	(.21)		(.11)		(.18)				(.04)			(.04)	
Absence of withdrawn behavior	.20		0.15		-.31	*	-.03		.01		.00	.01	
	(.18)		(.11)		(.18)		(.08)		(.04)			(.03)	
Controls	incl.		incl.		incl.		incl.		incl.				
Observations	419		436		183		1,686		6,086				
R-squared	.44		.40		.45		.31		.24				

Notes: all independent variables are standardized.

**** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.*

TABLE 3: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF CHILD'S YEARS OF COMPLETED SCHOOLING ON ADOLESCENT (AGE 13-16) COGNITIVE AND NONCOGNITIVE SKILL COMPOSITES

	U.S. BSS		Swedish IDA		Finnish JYLS		British BCS		British NCDS		Simple average	Weighted average	
Cognitive achievement composite	.92	***	.87	***	1.35	***	.96	***	.96	***	1.01	.97	***
	(.16)		(.13)		(.18)		(.07)		(.04)			(.03)	
Noncognitive skill composite	.34	*	.27	*	-.36	*	.33	***	.10	**	.14	.15	***
	(.17)		(.12)		(.16)		(.07)		(.04)			(.03)	
Controls	incl.		incl.		incl.		incl.		incl.				
Observations	419		436		183		1,686		6,086				
R-squared	.39		.42		.44		.30		.23				

Notes: all independent variables are standardized.

**** Significant at the 1 percent level*

*** Significant at the 5 percent level*

** Significant at the 10 percent level*

TABLE 4A: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF LOG EARNINGS ON ADOLESCENT (AGE 13-16) SKILLS AND BEHAVIORS, WITHOUT CONTROLS FOR COMPLETED SCHOOLING

	U.S. BSS	Swedish IDA	Finnish JYLS	British BCS	British NCDS	Simple average	Weighted average
Reading	.15	-.06		.06	.14 ***	.07	.11 ***
	(.13)	(.11)		(.05)	(.03)		(.03)
Math	.10	.19		.17 ***	.14 ***	.15	.15 ***
	(.13)	(.14)		(.05)	(.03)		(.03)
School grades			.30 **				
			(.12)				
Absence of attention problems	.16	.18	.09	.05	-.01	.09	.02
	(.12)	(.14)	(.14)	(.05)	(.03)		(.02)
Absence of aggressive behavior	.05	-.03	-.08	.04	.07 **	.01	.05 **
	(.11)	(.11)	(.13)	(.05)	(.03)		(.02)
Prosocial behavior	.12	.10	.05		.06 **	.08	.06 ***
	(.11)	(.08)	(.12)		(.02)		(.02)
Absence of withdrawn behavior	.12	-.05	.15	.06	.05 *	.07	.05 ***
	(.11)	(.09)	(.12)	(.04)	(.02)		(.02)
Controls	incl.	incl.	incl.	incl.	incl.		
Observations	419	436	183	1,686	6,086		
R-squared	.11	.08	.12	.07	.06		

Notes: all independent variables are standardized.

**** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.*

TABLE 4B: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF LOG EARNINGS ON ADOLESCENT (AGE 13-16) SKILLS AND BEHAVIORS, WITH CONTROLS FOR COMPLETED SCHOOLING

	U.S. BSS	Swedish IDA	Finnish JYLS	British BCS	British NCDS	Simple average	Weighted average
Reading	.15	-.08		.05	.12 ***	.06	.09 ***
	(.13)	(.11)		(.05)	(.03)		(.03)
Math	.10	.11		.14 **	.09 ***	.11	.10 ***
	(.14)	(.14)		(.05)	(.03)		(.03)
School grades			.09				
			(.14)				
Absence of attention problems	.16	.14	.08	.04	-.02	.08	.01
	(.12)	(.14)	(.14)	(.05)	(.03)		(.02)
Absence of aggressive behavior	.05	-.03	-.03	.03	.06 **	.02	.05 *
	(.11)	(.10)	(.13)	(.05)	(.03)		(.02)
Prosocial behavior	.06	.11	.03		.05 **	.06	.05 ***
	(.14)	(.09)	(.11)		(.02)		(.02)
Absence of withdrawn behavior	.12	-.07	.20 *	.07	.05 *	.07	.05 ***
	(.11)	(.09)	(.12)	(.04)	(.02)		(.02)
Controls	incl.	incl.	incl.	incl.	incl.		
Observations	419	436	183	1,686	6,086		
R-squared	.11	.11	.17	.08	.07		

Notes: all independent variables are standardized.

**** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.*

TABLE 5: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF LOG EARNINGS ON ADOLESCENT (AGE 13-16) COGNITIVE AND NONCOGNITIVE SKILL COMPOSITES, WITHOUT AND WITH CONTROLS FOR COMPLETED SCHOOLING

	U.S. BSS		Swedish IDA		Finnish JYLS		British BCS		British NCDS		Simple average	Weighted average	
Regression 1: Log earnings on adolescent (age 13-16) skills/behaviors and background controls													
Cog achievement composite	.25	**	.16		.29	**	.21	***	.25	***	.23	.24	***
	(.10)		(.11)		(.12)		(.04)		(.03)			(.02)	
Noncog skill composite	.18		.16	*	.16		.13	**	.11	***	.15	.12	***
	(.11)		(.09)		(.11)		(.05)		(.02)			(.02)	
Controls	incl.		incl.		incl.		incl.		incl.				
R-squared	.09		.07		.10		.07		.06				
Regression 2: Log earnings on adolescent (age 13-16) skills/behaviors and background controls and completed years of schooling													
Cog achievement composite	.25	**	.06		.07		.16	***	.18	***	.14	.17	***
	(.11)		(.11)		(.14)		(.04)		(.03)			(.02)	
Noncog skill composite	.18	*	.12		.20	*	.11	**	.10	***	.14	.11	***
	(.11)		(.08)		(.11)		(.05)		(.02)			(.02)	
Completed years of schooling	.00		.12	***	.16	**	.05	***	.07	***	.08	.07	***
	(.04)		(.04)		(.05)		(.02)		(.01)			(.01)	
Controls	incl.		incl.		incl.		incl.		incl.				
R-squared	.09		.10		.16		.07		.07				
Observations	419		436		183		1,686		6,086				

Notes: all independent variables are standardized.

**** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.*

TABLE 6: COEFFICIENTS AND STANDARD ERRORS FROM QUANTILE REGRESSIONS OF LOG EARNINGS ON ADOLESCENT (AGE 13-16) COGNITIVE AND NONCOGNITIVE SKILL COMPOSITES, WITHOUT CONTROLS FOR COMPLETED SCHOOLING

		U.S. BSS		Swedish IDA		Finnish JYLS		British BCS		British NCDS		Simple average	Weighted average	
Quantile regression of log earnings on adolescent (age 13-16) skills/behaviors and background controls														
Cog achievement	10th percentile	.23		.51		.63		.44	***	.97	***	.56	.80	***
		(.33)		(.52)		(.41)		(.14)		(.08)			(.07)	
	25th percentile	.45	**	.11		.39	*	.19	***	.18	***	.26	.18	***
		(.20)		(.09)		(.21)		(.03)		(.02)			(.02)	
	50th percentile	.16	**	.08	**	.17	**	.15	***	.14	***	.14	.14	***
		(.06)		(.03)		(.08)		(.02)		(.01)			(.01)	
	75th percentile	.12	**	.11	**	.09		.13	***	.12	***	.11	.12	***
		(.06)		(.05)		(.06)		(.02)		(.01)			(.01)	
	90th percentile	.08		.11	*	.01		.10	***	.10	***	.08	.10	***
		(.09)		(.06)		(.07)		(.02)		(.02)			(.01)	
Noncog skills	10th percentile	.39		.51		.34		.26	*	.32	***	.36	.31	***
		(.32)		(.49)		(.41)		(.14)		(.12)			(.08)	
	25th percentile	.39	*	.11		.08		.12	***	.11	***	.16	.12	***
		(.20)		(.09)		(.18)		(.04)		0.03			(.02)	
	50th percentile	.12	*	.05		.07		.07	***	.04	***	.07	.05	***
		(.06)		(.03)		(.07)		(.03)		(.01)			(.01)	
	75th percentile	.04		.07	*	.05		.07	***	.01		.05	.03	***
		(.06)		(.04)		(.05)		(.02)		(.01)			(.01)	
	90th percentile	.00		.05		.13	*	.05	***	-.01		.04	.03	**
		(.08)		(.05)		(.07)		(.02)		(.02)			(.01)	
Observations		419		436		183		1,686		6,086				

Notes: all independent variables are standardized.

**** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level.*

APPENDIX TABLE 1: DESCRIPTIVE STATISTICS ON THE STUDY SAMPLES

		U.S. BSS	Swedish IDA study	Finnish JYLS	British BCS	British NCDS
Child education (years)						
	Mean	13.2	12.3	12.0	13.7	13.5
	SD	3.0	2.3	2.6	2.6	2.4
Child's adult earnings (in 2009 dollars)						
	Mean	50,155	60,286	28,567	49,433	32,757
	SD	36,822	35,654	19,510	26,108	20,462
Age 13-16 Skills and behaviors			(All standardized with study means and sds)			
Background controls						
Fraction Ethnic minority		0.56	-	0.00	0.01	0.02
Parent education(years)	Mean	12.2	9.0	9.7	12.5	11.1
	SD	2.6	2.2	2.8	2.5	2.07
Mother's age at study child's birth	Mean	23.7	-	27.6	25.9	27.6
	SD	5.5	-	6.3	5.2	5.7
Number of siblings	Mean	1.3	1.4	2.3	1.5	2.1
	SD	1.3	1.1	1.5	1.0	1.6
Birth weight (lbs)	Mean	-	-	8.1	7.5	7.4
	SD	-	-	1.2	1.2	1.2
Observations		419	436	183	1,686	6,086

Notes: With the exception of fraction male, all descriptive statistics are based on males only.

APPENDIX TABLE 2: STUDY MEASURES OF AGE 13-16 SKILLS AND BEHAVIORS

	U.S. BSS Age 14-16	Finnish JYLS Age 14	Swedish IDA study Age 13	British NCDS Age 16	British BCS Age 16
Math	California Achievement Test (CAT) math score mean	Math and reading tests are not available; however, information about grade-point average, collected from school archives, is available	Standardized achievement test in Mathematics; school grade in Mathematics	Reading Comprehension Test. Constructed by the National Foundation for Educational Research in England and Wales (NFER) specifically for the NCDS.	Timed arithmetic test consisting of 60, progressively harder, questions
Reading	CAT reading score mean		Standardized achievement test in Swedish; school grade in Swedish	Arithmetic/Mathematics Test Constructed by the NFER specifically for the NCDS.	Achievement in literacy is assessed by separate tests in advanced spelling and vocabulary
(Absence of) attention problems	Teacher report of, e.g., is awfully restless, fidgets all the time, can't sit still; Can't concentrate, can't pay attention. 2 items, α=.79	Teacher ratings: is impulsive, lacks concentration, changes moods	Teacher reports of motor restlessness and concentration difficulties	Teacher reports of, e.g., Cannot settle more than a few moments; restless, difficulty staying seated; squirmy, fidgety (3 items, α=.84)	Mother reports of: cannot settle more than a few moments; is inattentive; fails to finish things; difficulty concentrating (4 items, α=.81)
(Absence of) aggressive behavior	Teacher report of, e.g., Fights too much, teases, picks on, or bullies other children; Has a strong temper. 4 items, α =.77	Teacher ratings of: attacks without reason, teases others, says naughty things	Teacher report of aggressiveness	Teacher report of, e.g., Detroys/damages own and others' property; bullies other children; is often disobedient (5 items, α= .87).	Mother reports of e.g. destroys own and others' property; frequently fights with others; is often disobedient (8 items, α=.78)
Prosocial behavior	Teacher report of, e.g., Enthusiastic, interested in things, expresses ideas; Is polite, helpful, considerate of others. 4 items, α =.81.	Teacher ratings of: is energetic, always on the go, often has contact with others	Peer rank-ordering of popularity, completed by same-sex classmates (2.5-month test-retest *r*= .84).	Teacher report of popularity with peers and social skills, e.g., Not much liked by other children; sociable vs. withdrawn; flexible vs. rigid (3 items, α=.59).	
(Absence of) withdrawn behavior	Teacher reports of, e.g., Keeps to him/herself, tends to withdraw. 2 items, α=.77.	Teacher ratings of: is fearful, helpless in others' company, target of teasing, unable to defend self	Teacher report of timidity, e. g., bashful, shy, low self-esteem and shyness; have poor self-esteem; are inhibited	Teacher report of, e.g., Is withdrawn, tends to be on own-rather solitary, fearful of new situations and things, often worries about many things (4 items, α= .66).	Mother report of, e.g., cries for little cause; solitary, fearful of new situations and things; worries about many things (7 items, α= .67).

APPENDIX TABLE 3: ADDITIONAL BACKGROUND CONTROLS AND EXPANDED NON-COGNITIVE MEASURES

	British BCS	British NCDS
Additional non-cognitive measures:		
Youth self-reports:		
Self-esteem score	X	
Locus of control score	X	
Teacher-ratings of personality/behavior (5 point scale)		
Cautious (vs. impulsive)		X
Even-tempered (vs. moody)		X
Aggressive (vs. timid)		X
Flexible (vs. rigid)		X
Sociable (vs. withdrawn)		X
Hardworking (vs. lazy)		X
Additional background controls		
Mother's age at child's birth	X	X
Income and SES proxies:		
Household income	X	
Experience of financial hardship		X
Social class	X	X
Housing tenure	X	X
Persons per room / overcrowding	X	X
Family has own telephone	X	
Family has an indoor toilet		X
Child is eligible for free school meals	X	X
School:		
Child attends a private school	X	X
Proportion of pupils in child's school with fathers' in highest social class (Professional/Managerial)	X	
Parenting:		
Parent reads to child	X	X
Parents' interest in child's education	X	X
Parents' educational expectations for child	X	X

APPENDIX TABLE 4: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF LOG EARNINGS ON ADOLESCENT (AGE 13-16) COGNITIVE AND NONCOGNITIVE SKILL INDEXES AND INTERACTION TERM

	U.S. BSS	Swedish IDA	Finnish JYLS	British BCS	British NCDS	Simple average	Weighted average
Cognitive achievement composite	.24 **	.16	.31 **	.20 ***	.25 ***	.23	.23 ***
	(.09)	(.11)	(.12)	(.04)	(.03)		(.02)
Noncognitive skill composite	.16	.16 *	.16	.13 ***	.09 ***	.14	.11 ***
	(.11)	(.09)	(.11)	(.05)	(.03)		(.02)
Cognitive x Noncognitive	-.16	.00	-.14	-.02	-.04	-.07	-.04 ***
	(.10)	(.08)	(.09)	(.04)	(.02)		(.02)
Controls	incl.	incl.	incl.	incl.	incl.		
R-squared	.11	.07	.12	.07	.06		
Observations	419	436	183	1,686	6,086		

Notes: all independent variables are standardized.

**** Significant at the 1 percent level*

*** Significant at the 5 percent level*

** Significant at the 10 percent level*

APPENDIX TABLE 5: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF LOG EARNINGS ON ADOLESCENT (AGE 13-16) SKILLS AND BEHAVIORS, WITHOUT AND WITH CONTROLS FOR IQ AND AN EXTENSIVE SET OF BACKGROUND CONTROLS

	BCS			NCDS		
Reading	.06	.04	.03	.13 ***	.11 ***	.08 **
	(.05)	(.05)	(.05)	(.03)	(.03)	(.03)
Math	.17 ***	.15 ***	.14 ***	.15 ***	.13 ***	.10 ***
	(.05)	(.05)	(.05)	(.03)	(.03)	(.03)
Absence of attention problems	.05	.06	.06	.00	.00	.00
	(.05)	(.05)	(.05)	(.03)	(.03)	(.03)
Absence of aggressive behavior	.04	.02	.02	.06 **	.05 *	.05 *
	(.05)	(.05)	(.05)	(.03)	(.03)	(.03)
Prosocial behavior				.05 *	.05 *	.05 *
				(.02)	(.02)	(.02)
Absence of withdrawn behavior	.06	.07	.07	.06 **	.06 **	.06 **
	(.04)	(.04)	(.04)	(.03)	(.03)	(.03)
IQ *(measured at age 10/11)*			.05			.07 **
			(.05)			(.03)
Limited set of background controls	incl.	incl.	incl.	incl.	incl.	incl.
Full set of background controls		incl.	incl.		incl.	incl.
Observations	1,686	1,686	1,686	6,086	6,086	6,086
R-squared	.07	.09	.09	.06	.07	.07

Notes: all independent variables are standardized.

**** Significant at the 1 percent level; ** Significant at the 5 percent level; * Significant at the 10 percent level*

APPENDIX TABLE 6A: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS THAT INCLUDE EXPANDED SETS OF NONCOGNITIVE MEASURES IN THE BCS AND NCDS

	Dependent variable = years of completed schooling			
	BCS (same as Table 3)	BCS expanded noncog vars	NCDS (same as Table 3)	NCDS expanded noncog vars
Adolescent (age 13-16) skills/behaviors				
Reading	.39 ***	.35 ***	.34 ***	.35 ***
	(.08)	(.10)	(.04)	(.05)
Math	.65 ***	.59 ***	.73 ***	.68 ***
	(.09)	(.08)	(.04)	(.05)
Absence of attention problems	.28 ***	.27 ***	.04	.00
	(.09)	(.09)	(.04)	(.04)
Absence of aggressive behavior	.13	.12	.05	.03
	(.08)	(.11)	(.04)	(.05)
Prosocial behavior			.04	.01
			(.04)	(.06)
Absence of withdrawn behavior	-.03	-.05	.01	.00
	(.08)	(.08)	(.04)	(.04)
Expanded noncognitive variables				
Locus of Control		.21 ***		
		(.08)		
Self Esteem		.04		
		(.07)		
Cautious (vs. impulsive)				.00
				(.04)
Even-tempered (vs. moody)				.01
				(.04)
Aggressive (vs timid)				.03
				(.04)
Flexible (vs. rigid)				.02
				(.04)
Sociable (vs. withdrawn)				.00
				(.05)
Hardworking (vs. lazy)				.17 ***
				(.04)
Controls	incl.	incl.	incl.	incl.
Observations	1,686	1,686	6,086	6,086
R-squared	.31	.33	.24	.24

Notes: all independent variables are standardized.

**** Significant at the 1 percent level*

*** Significant at the 5 percent level*

** Significant at the 10 percent level*

APPENDIX TABLE 6B: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS THAT INCLUDE EXPANDED SETS OF NONCOGNITIVE MEASURES IN THE BCS AND NCDS

	Dependent variable = log earnings			
	BCS (same as Table 3)	BCS expanded noncog vars	NCDS (same as Table 3)	NCDS expanded noncog vars
Adolescent (age 13-16) skills/behaviors				
Reading	.06	.07	.14 ***	.13 ***
	(.05)	(.05)	(.03)	(.03)
Math	.17 ***	.15 ***	.14 ***	.15 ***
	(.05)	(.05)	(.03)	(.03)
Absence of attention problems	.05 ***	.04 ***	-.01	.00
	(.05)	(.04)	(.03)	(.03)
Absence of aggressive behavior	.04	.04	.07 **	.06 *
	(.05)	(.06)	(.03)	(.03)
Prosocial behavior			.06 **	.04
			(.02)	(.03)
Absence of withdrawn behavior	.06	.05	.05 *	.06
	(.04)	(.05)	(.02)	(.03)
Expanded noncognitive variables				
Locus of Control		.02		
		(.04)		
Self Esteem		.10 ***		
		(.04)		
Cautious (vs. impulsive)				-.02
				(.02)
Even-tempered (vs. moody)				-.01
				(.03)
Aggressive (vs timid)				-.02
				(.03)
Flexible (vs. rigid)				-.01
				(.02)
Sociable (vs. withdrawn)				.01
				(.03)
Hardworking (vs. lazy)				.01
				(.02)
Controls	incl.	incl.	incl.	incl.
Observations	1,686	1,686	6,086	6,086
R-squared	.07	.08	.06	.06

Notes: all independent variables are standardized.

**** Significant at the 1 percent level*

*** Significant at the 5 percent level*

** Significant at the 10 percent level*

APPENDIX TABLE 7: COEFFICIENTS AND STANDARD ERRORS FROM UNEXPANDED AND EXPANDED NONCOGNITIVE COMPOSITES IN THE BCS AND NCDS

	Dependent variable = years of completed schooling				Dependent variable = log earnings			
	BCS (same as Table 3)	BCS expanded noncog vars	NCDS (same as Table 3)	NCDS expanded noncog vars	BCS (same as Table 5)	BCS expanded noncog vars	NCDS (same as Table 5)	NCDS expanded noncog vars
Cognitive skills	.96 ***	.89 ***	.96 ***	.94 ***	.21 ***	.18 ***	.25 ***	.25 ***
	(.07)	(.08)	(.04)	(.04)	(.04)	(.05)	(.03)	(.02)
Noncognitive skills	.33 ***	.40 ***	.10 ***	.15 ***	.13 ***	.18 ***	.11 ***	.10 ***
	(.07)	(.08)	(.04)	(.03)	(.05)	(.04)	(.02)	(.02)
Controls	incl.	incl.	incl.	incl.	incl.	incl.	incl.	incl.
Observations	1,686	1,686	6,086	6,086	1,686	1,686	6,086	6,086
R-squared	.30	.32	.23	.23	.07	.08	.06	.06

Notes: all independent variables are standardized.

**** Significant at the 1 percent level*

*** Significant at the 5 percent level*

** Significant at the 10 percent level*

APPENDIX TABLE 8: COEFFICIENTS AND STANDARD ERRORS FROM REGRESSIONS OF SINGLE-YEAR AND AVERAGE LOG EARNINGS ON ADOLESCENT (AGE 13-16) COGNITIVE AND NONCOGNITIVE SKILL INDEXES

	BCS at age 34 (same as Table 4)	NCDS at age 33 (same as Table 4)	BCS averaged over ages 30, 34 and 38	NCDS averaged over ages 33 and 42
Cognitive achievement composite	.21 ***	.25 ***	.19 ***	.24 ***
	(.04)	(.03)	(.04)	(.02)
Noncognitive skill composite	.13 **	.11 ***	.13 **	.12 ***
	(.05)	(.02)	(.04)	(.02)
Controls	incl.	incl.	incl.	incl.
R-squared	.07	.06	.06	.06

Notes: all independent variables are standardized.

**** Significant at the 1 percent level*

*** Significant at the 5 percent level*

** Significant at the 10 percent level*