

# Hard Evidence on Soft Skills

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Table 1: Cognitive Ability Validities

Test	Validation Domain	Estimate(s)	Source(s)
SAT (Achievement)	1st Year College GPA	0.35 - 0.53	Kobrin et al. (2008)
ACT (Achievement)	Early College GPA	0.42	ACT, Inc. (2007)
GED (Achievement)	HS Senior GPA	0.33 - 0.49	GED Testing Service (2009)
DAT (Achievement)	College GPA	0.13 - 0.62 <sup>†</sup>	Omizo (1980)
AFQT (Achievement)	9th Grade GPA	0.54	Borghans et al. (2011a)
WAIS (IQ)	College GPA	0.38 - 0.43	Feingold (1982)
WAIS (IQ)	HS GPA	0.62	Feingold (1982)
Various IQ**	9th Grade GPA	0.42	Borghans et al. (2011a)
WISC (IQ)	WRAT (Achievement)	0.44 - 0.75 <sup>‡</sup>	Hartlage and Steele (1977)

Table 1: Cognitive Ability Validities

Test	Validation Domain	Estimate(s)	Source(s)
WISC-R (IQ)	WRAT (Achievement)	0.35 - 0.76 <sup>‡</sup>	Hartlage and Steele (1977)
Various IQ**	AFQT (Achievement)	0.65	Borghans et al. (2011a)
Stanford Binet (IQ)	WISC-R (IQ)	0.77 - 0.87	Rothlisberg (1987), Greene et al. (1990)
Raven's (IQ)	WAIS-R (IQ)	0.74 - 0.84	O'Leary et al. (1991)
WIAT (Achievement)	CAT/2 (Achievement)	0.69 - 0.83*	Michalko and Saklofske (1996)

† Large range is due to varying validity of eight subtests of DAT

‡ Ranges are given because correlations vary by academic subject

\* Ranges are given because correlations vary by grade level

\*\* IQ is pooled across several IQ tests using IQ percentiles

**Notes:** WISC – Wechsler Intelligence Scale for Children, WISC-R – Wechsler Intelligence Scale for Children - Revised, WAIS - Wechsler Adult Intelligence Scale, Raven's IQ – Raven's Standard Progressive Matrices, GED – General Educational Development, DAT – Differential Aptitude Test, WIAT – Wechsler Individual Achievement Test, CAT – California Achievement Test, WRAT – Wide Range Achievement Test

**Table 2: Predictive Validities in Outcomes that Matter (Adjusted R-Squared)**

	<i>IQ Sample</i>			<i>AFQT Sample</i>			<i>GPA Sample</i>		
	Pers	IQ	Both	Pers	AFQT	Both	Pers	GPA	Both
<b>Males</b>									
Earnings at Age 35	0.05	0.07	0.09	0.07	0.16	0.18	0.06	0.09	0.11
Hourly Wage at Age 35	0.03	0.09	0.09	0.06	0.14	0.15	0.06	0.07	0.09
Hours Worked at Age 35	0.04	0.01	0.04	0.02	0.04	0.04	0.01	0.02	0.02
Jail by Age 35	0.04	0.02	0.05	0.07	0.07	0.10	0.03	0.02	0.04
Welfare at Age 35	0.01	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.01
Married at Age 35	0.03	0.01	0.03	0.03	0.03	0.04	0.02	0.02	0.04
BA Degree by Age 35	0.09	0.11	0.16	0.10	0.20	0.23	0.10	0.14	0.18
Depression in 1992	0.04	0.01	0.05	0.04	0.04	0.06	0.03	0.02	0.04
<b>Females</b>									
Earnings at Age 35	0.01	0.01	0.02	0.04	0.08	0.09	0.03	0.05	0.06
Hourly Wage at Age 35	0.03	0.04	0.05	0.05	0.11	0.12	0.04	0.05	0.08
Hours Worked at Age 35	0.01	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00
Jail by Age 35	0.01	0.00	0.01	0.02	0.01	0.02	0.01	0.01	0.02
Welfare at Age 35	0.02	0.02	0.03	0.05	0.09	0.12	0.05	0.04	0.07
Married at Age 35	0.04	0.03	0.06	0.03	0.05	0.07	0.03	0.02	0.04
BA Degree by Age 35	0.09	0.09	0.14	0.09	0.17	0.20	0.08	0.10	0.14
Depression in 1992	0.03	0.02	0.04	0.05	0.04	0.07	0.05	0.01	0.05

**Table 3: Correlations Among NLSY79 Measures of Cognition**

	Correlation between IQ, AFQT, and GPA		
	IQ	Achievement (AFQT)	Grade Point Average (GPA)
IQ	1		
AFQT	0.65	1	
GPA(9th)	0.42	0.54	1

Source: National Longitudinal Survey of Youth (NLSY79). Pooled male and female random sample. Notes: The Armed Forces Qualifying Test (AFQT) was administered in 1980 when subjects were 15-22. AFQT is adjusted for schooling at the time of the test conditional on final schooling, following the procedure in Hansen et al. (2004). AFQT is constructed from Arithmetic Reasoning, Word Knowledge, Math Knowledge, and Paragraph Comprehension tests. IQ and GPA are from high school transcripts. IQ is pooled across several IQ tests using IQ percentiles. GPA is the individual's core-subject GPA measured in 9th grade when virtually all sample participants are enrolled. Differences between males and females are slight. For the sake of brevity we report pooled results.

**Table 4:** Validities in Labor Market Outcomes from the National Longitudinal Survey of Youth, 1979

NLSY79 R <sup>2</sup> (tests and school performance)						
	Males			Females		
<u>Outcomes</u>	<u>IQ</u>	<u>GPA (10<sup>th</sup> grade)</u>	<u>AFQT</u>	<u>IQ</u>	<u>GPA (10<sup>th</sup> grade)</u>	<u>AFQT</u>
Hourly Wage Age 35	0.03	0.05***	0.05***	0.11***	0.10***	0.13***
Hours Worked Age 35	0.10***	0.12***	0.21***	0.02	0.10***	0.17***
Any Welfare Age 35	-0.09***	-0.11***	-0.23***	-0.20***	-0.23***	-0.36***

Source: Borghans et al. (2011a).

Table 5: The Big Five Domains and Their Facets

Big Five Personality Factor	American Psychology Association Dictionary description	Facets (and correlated trait adjective)	Related Traits	Childhood Temperament Traits
Conscientiousness	“the tendency to be organized, responsible, and hardworking”	Competence (efficient), Order (organized), Dutifulness (not careless), Achievement striving (ambitious), Self-discipline (not lazy), and Deliberation (not impulsive)	Grit, Perseverance, Delay of gratification, Impulse control, Achievement striving, Ambition, and Work ethic	Attention/(lack of) distractibility, Effortful control, Impulse control/delay of gratification, Persistence, Activity*
Openness to Experience	“the tendency to be open to new aesthetic, cultural, or intellectual experiences”	Fantasy (imaginative), Aesthetic (artistic), Feelings (excitable), Actions (wide interests), Ideas (curious), and Values (unconventional)		Sensory sensitivity, Pleasure in low-intensity activities, Curiosity

Table 4: The Big Five Domains and Their Facets

Big Five Personality Factor	American Psychology Association Dictionary description	Facets (and correlated trait adjective)	Related Traits	Childhood Temperament Traits
Extraversion	"an orientation of one's interests and energies toward the outer world of people and things rather than the inner world of subjective experience; characterized by positive affect and sociability"	Warmth (friendly), Gregariousness (sociable), Assertiveness (self-confident), Activity (energetic), Excitement seeking (adventurous), and Positive emotions (enthusiastic)		Surgency, Social dominance, Social vitality, Sensation seeking, Shyness*, Activity*, Positive emotionality, and Sociability/affiliation
Agreeableness	"the tendency to act in a cooperative, unselfish manner"	Trust (forgiving), Straight-forwardness (not demanding), Altruism (warm), Compliance (not stubborn), Modesty (not show-off), and Tender-mindedness (sympathetic)	Empathy, Perspective taking, Cooperation, and Competitiveness	Irritability*, Aggressiveness, and Willfulness



### Table 4: The Big Five Domains and Their Facets

Big Five Personality Factor	American Psychology Association Dictionary description	Facets (and correlated trait adjective)	Related Traits	Childhood Temperament Traits
Neuroticism/ Emotional Stability	Emotional stability is “predictability and consistency in emotional reactions, with absence of rapid mood changes.” Neuroticism is “a chronic level of emotional instability and proneness to psychological distress.”	Anxiety (worrying), Hostility (irritable), Depression (not contented), Self-consciousness (shy), Impulsiveness (moody), Vulnerability to stress (not self-confident)	Internal vs. External, Locus of control, Core self-evaluation, Self-esteem, Self-efficacy, Optimism, and Axis I psychopathologies (mental disorders) including depression and anxiety disorders	Fearfulness/behavioral inhibition, Shyness*, Irritability*, Frustration (Lack of) soothability, Sadness

Notes: Facets specified by the NEO-PI-R personality inventory (Costa and McCrae, 1992). Trait adjectives in parentheses from the Adjective Check List (Gough and Heilbrun, 1983). \*These temperament traits may be related to two Big Five factors.

Source: Table adapted from John and Srivastava (1999).

Table 5: Correlations between Stella Marris Measures

ALL RESPONDENTS									
	DAT	RAVEN	GPA	OPENNESS	CONSCIENTIOUSNESS	EXTRAVERSION	AGREEABLENESS	NEUROTICISM	GRIT
DAT	1								
RAVEN	0.3783	1							
GPA	0.3164	0.1115	1						
OPENNESS	0.2204	0.0995	0.0517	1					
CONSCIENTIOUSNESS	-0.0123	0.1	0.2	0.1223	1				
EXTRAVERSION	-0.0872	-0.0714	-0.0414	0.238	0.0272	1			
AGREEABLENESS	0.0046	0.0153	0.0256	0.2669	0.16	0.2861	1		
NEUROTICISM	-0.0546	-0.0834	-0.0563	0.0441	-0.1595	-0.1384	-0.0342	1	
GRIT	-0.0094	0.0682	0.235	0.3121	0.614	0.1131	0.2106	-0.0728	1
	0.869	0.2149	0.0001	0	0	0.0389	0.0001	0.1842	

Table 5: Correlations between Stella Marris Measures

WOMEN ONLY									
	DAT	RAVEN	GPA	OPENNESS	CONSCIENTIOUSNESS	EXTRAVERSION	AGREEABLENESS	NEUROTICISM	GRIT
DAT	1								
RAVEN	0.4218	1							
GPA	0.4705	0.1401	1						
OPENNESS	0.2635	0.1452	0.1955	1					
CONSCIENTIOUSNESS	0.0555	0.139	0.0862	0.1937	1				
EXTRAVERSION	-0.0756	-0.0547	-0.064	0.1467	0.1044	1			
AGREEABLENESS	0.0319	-0.0493	0.0306	0.2471	0.2459	0.2821	1		
NEUROTICISM	-0.0349	-0.0529	0.0514	-0.0374	-0.2138	-0.1843	-0.162	1	
GRIT	0.1213	0.1043	0.2837	0.4234	0.5913	0.0761	0.288	-0.0737	1
	0.1434	0.1894	0.0007	0	0	0.3386	0.0002	0.3542	

Table 5: Correlations between Stella Marris Measures

MEN ONLY									
	DAT	RAVEN	GPA	OPENNESS	CONSCIENTIOUSNESS	EXTRAVERSION	AGREEABLENESS	NEUROTICISM	GRIT
DAT	1								
RAVEN	0.3601 0	1							
GPA	0.2011 0.011	0.0804 0.3185	1						
OPENNESS	0.1771 0.0194	0.069 0.3546	-0.084 0.2938	1					
CONSCIENTIOUSNESS	-0.0652 0.3924	0.0698 0.349	0.2928 0.0002	0.0628 0.3971	1				
EXTRAVERSION	-0.094 0.2175	-0.0887 0.234	-0.0281 0.7255	0.3262 0	-0.0397 0.5931	1			
AGREEABLENESS	0.0359 0.6379	0.0115 0.8771	-0.0466 0.5611	0.3398 0	0.1165 0.1151	0.3143 0	1		
NEUROTICISM	-0.0452 0.5534	-0.1459 0.0494	-0.2161 0.0064	0.1455 0.0487	-0.121 0.1017	-0.1055 0.154	-0.0799 0.2811	1	
GRIT	-0.1329 0.0899	0.0311 0.6851	0.1751 0.0315	0.2097 0.0055	0.6386 0	0.1488 0.0501	0.1442 0.0577	-0.0977 0.1995	1

Source: Borghans et al. (2011b). Note: The upper number is the correlation coefficient, the lower number is the  $p$ -value. GPA is the average first year high school grade in Dutch, English, Math, Geography, French, History, Biology, Technology, Computer science. DAT is the principal component of the DAT subscores. All traits are principal components of the items underlying the trait. All measures (including GPA and DAT) are standardized with mean 0 and standard deviation 1.

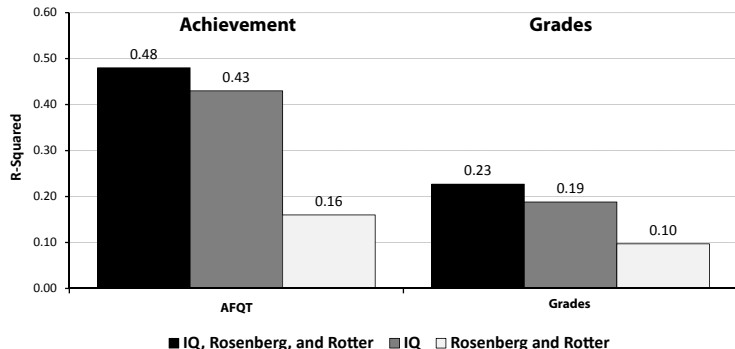
Table 6: DAT, RAVEN AND PERSONALITY

	(1) DAT	(2) DAT	(3) DAT, women	(4) DAT, women	(5) DAT, men	(6) DAT, men
Raven	0.376*** (0.052)	0.341*** (0.052)	0.453*** (0.081)	0.418*** (0.082)	0.337*** (0.067)	0.297*** (0.068)
Openness		0.242*** (0.058)		0.207** (0.086)		0.226*** (0.083)
Conscientiousness		-0.014 (0.067)		-0.064 (0.102)		0.033 (0.090)
Extraversion		-0.134** (0.056)		-0.103 (0.080)		-0.156* (0.080)
Agreeableness		0.001 (0.056)		0.026 (0.104)		0.037 (0.074)
Neuroticism		-0.065 (0.053)		-0.045 (0.078)		-0.051 (0.079)
Grit		-0.085 (0.069)		0.039 (0.102)		-0.202** (0.098)
Constant	-0.007 (0.052)	-0.013 (0.051)	-0.129* (0.077)	-0.112 (0.087)	0.088 (0.070)	0.058 (0.077)
Observations	320	309	148	147	172	162
R-squared	0.14	0.20	0.18	0.23	0.13	0.20

Source: Borghans et al. (2011b). Note: Each column shows the results of an OLS regression.

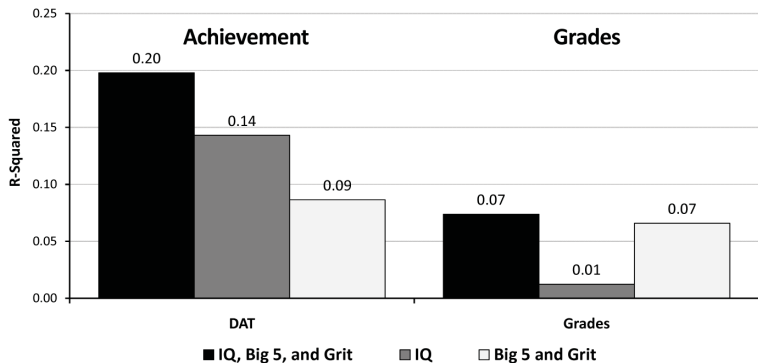
All variables are standardized principal components of several items. A description of the variables is given in the appendix. Standard errors in parentheses, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

**Figure 1:** Decomposing Achievement Tests and Grades into IQ and Personality [NLSY79]



Source: Borghans et al. (2011a).

**Figure 2:** Decomposing Achievement Tests and Grades into IQ and Personality [Stella Maris]

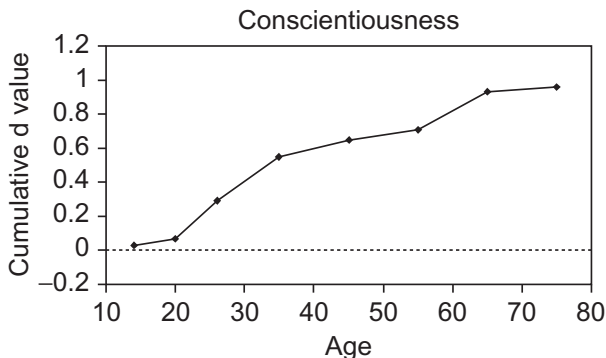


Source: Borghans et al. (2011a).





Figure 4: Cumulative Mean-Level Changes in Personality Across the Life Cycle



Note: Cumulative d values represent total lifetime change in units of standard deviations (“effect sizes”).

Source: Figure taken from Roberts et al. (2006) and Roberts and Mroczek (2008). Reprinted with permission of the authors.

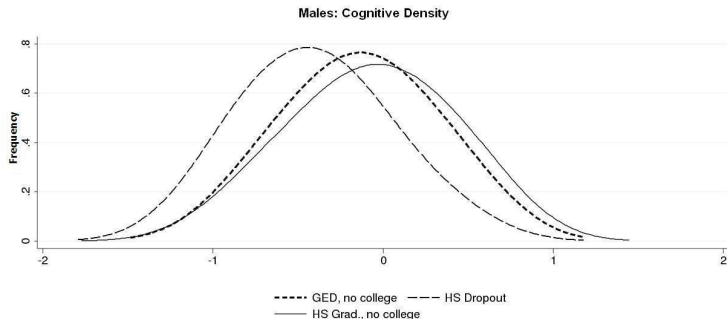
Table 7: Validities of GED Test

Test	Correlation	Source(s)
Armed Forces Qualification Test (AFQT)	0.75 - 0.79 †	Means and Laurence (1984)
Iowa Test of Educational Development	0.88 †	Means and Laurence (1984)
American College Test (ACT)	0.80 †	Means and Laurence (1984)
Adult Performance Level (APL) Survey	0.81 †	Means and Laurence (1984)
New York's Degrees of Reading Power (DRP) Test	0.77 †	Means and Laurence (1984)
Test of Adult Basic Education (TABE)	0.66-0.68 †	Means and Laurence (1984)
General Aptitude Test Battery (GATB)	0.61-0.67 †	Means and Laurence (1984)
National Adult Literacy Survey (NALS) factor	0.78 ‡	Baldwin (1995)

† Uses mean GED subtest scores

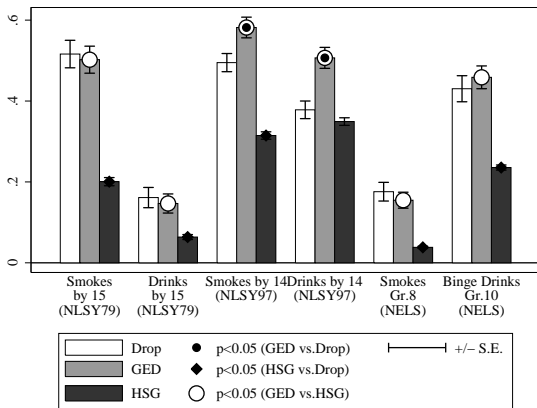
‡ Uses a general GED factor

## Figure 5: Cognitive ability by educational status



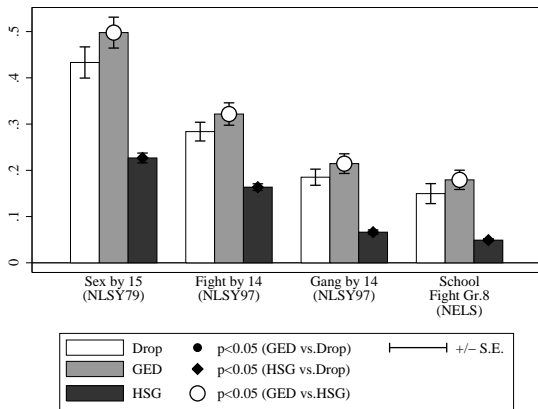
**Source:** Reproduced from Heckman et al. (2011), which uses data from the National Longitudinal Study of Youth 1979 (NLSY79). **Notes:** The distributions above represent cognitive ability factors estimated using a subset of the Armed Services Vocational Aptitude Battery (ASVAB) and educational attainment as laid out in Hansen et al. (2004). The sample is restricted to the cross-sectional subsample for both males and females. Distributions show only those with no post-secondary educational attainment. The cognitive ability factors are normalized by gender to be mean zero standard deviation one.

**Figure 6:** Measures of Adolescent Behaviors for Male Dropouts, GED Recipients, and High School Graduates: Smoking and Drinking



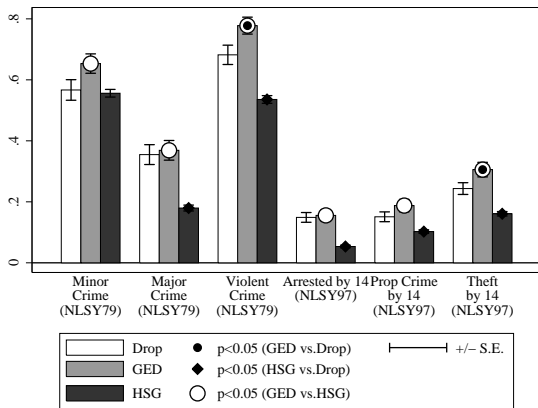
**Sources:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979, National Longitudinal Survey of Youth 1997, National Educational Longitudinal Survey. **Notes:** Minor crime includes vandalism, shoplifting, petty theft, fraud, holding or selling stolen goods. Major crime includes auto theft, breaking/entering private property, grand theft. Violent crime includes fighting, assault, aggravated assault.

**Figure 6:** Measures of Adolescent Behaviors for Male Dropouts, GED Recipients, and High School Graduates: Sex and Violent Behavior



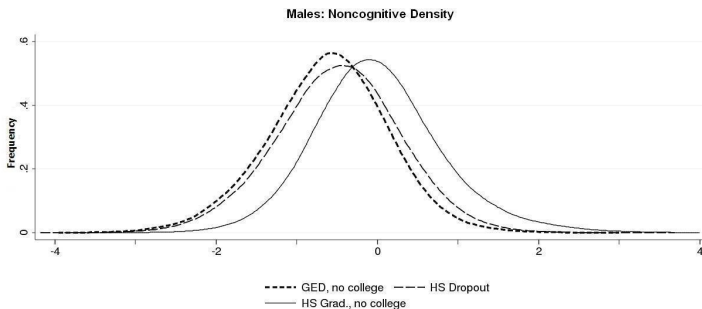
**Sources:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979, National Longitudinal Survey of Youth 1997, National Educational Longitudinal Survey. **Notes:** Minor crime includes vandalism, shoplifting, petty theft, fraud, holding or selling stolen goods. Major crime includes auto theft, breaking/entering private property, grand theft. Violent crime includes fighting, assault, aggravated assault.

**Figure 6:** Measures of Adolescent Behaviors for Male Dropouts, GED Recipients, and High School Graduates: Criminal Behavior



**Sources:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979, National Longitudinal Survey of Youth 1997, National Educational Longitudinal Survey. **Notes:** Minor crime includes vandalism, shoplifting, petty theft, fraud, holding or selling stolen goods. Major crime includes auto theft, breaking/entering private property, grand theft. Violent crime includes fighting, assault, aggravated assault.

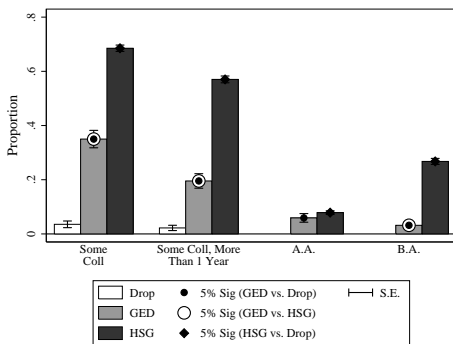
Figure 7: Distribution of Risky Behavior by Education Group



**Source:** Reproduced from Heckman et al. (2011), which uses data from the National Longitudinal Study of Youth 1979 (NLSY79). **Notes:** The distributions above represent non-cognitive ability factors estimated using measures of early violent crime, minor crime, marijuana use, regular smoking, drinking, early sexual intercourse, and educational attainment as in Hansen et al. (2004). Sample restricted to the cross-sectional subsample for both males and females. Distributions show only those with no post-secondary educational attainment.

The non-cognitive ability factors normalized to be mean zero standard deviation one.

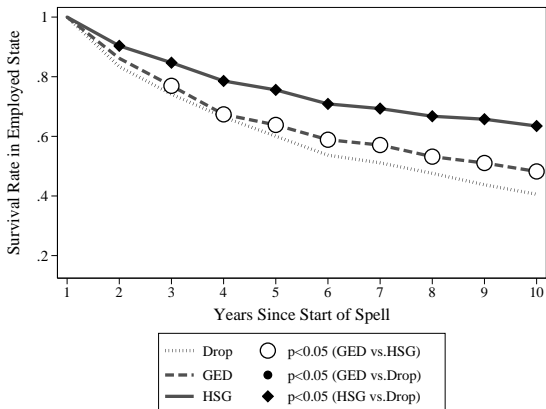
**Figure 8: Post-Secondary Educational Attainment Across Education Groups Through Age 40 (NLSY79) - Males**



**Sources:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979. **Notes:** The graph represents post-secondary educational attainment of dropouts, GED recipients and high school graduates. **Variable Definitions:** "Some College" represents people who entered any post-secondary institution ever. "Some College, More Than a Year" represents people who completed at least a year of some post-secondary education ever. "Certificate" represents people who obtained any certificate or license ever. "A.A." represents people who obtained associate's degrees ever. "B.A." represents people who obtained bachelor's degrees ever. "B.A." also includes people with higher education: M.A. Ph.D and professional degrees.

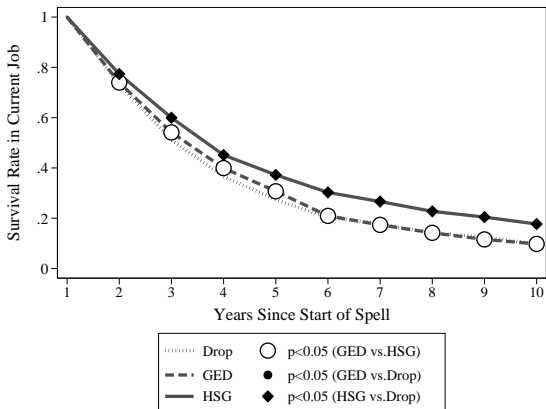


**Figure 9:** Survival Rates in Various States for Male Dropouts, GED Recipients, and High School Graduates: Survival Rate in Employment



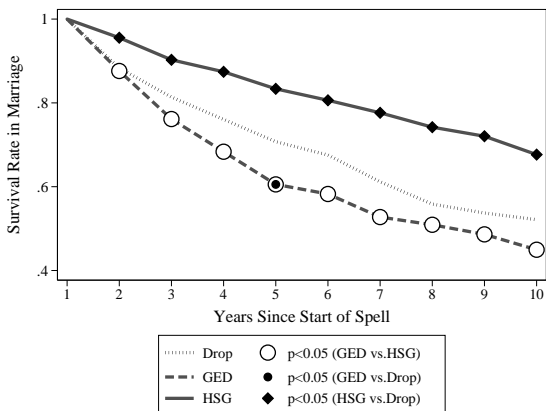
**Source:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample. Notes: The spell to first time being incarcerated begins in the first year that individuals exit school.

**Figure 9:** Survival Rates in Various States for Male Dropouts, GED Recipients, and High School Graduates: Survival Rate in Same Job



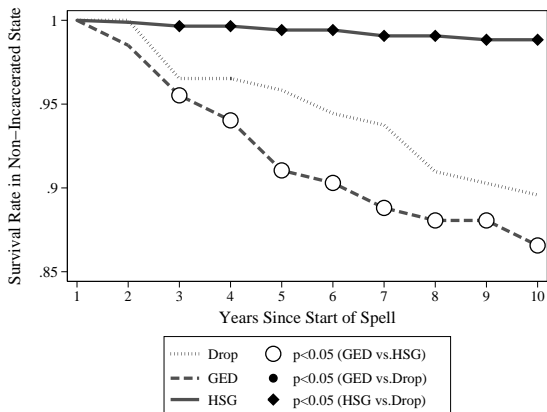
**Source:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample. Notes: The spell to first time being incarcerated begins in the first year that individuals exit school.

**Figure 9:** Survival Rates in Various States for Male Dropouts, GED Recipients, and High School Graduates: Survival Rate in Marriage



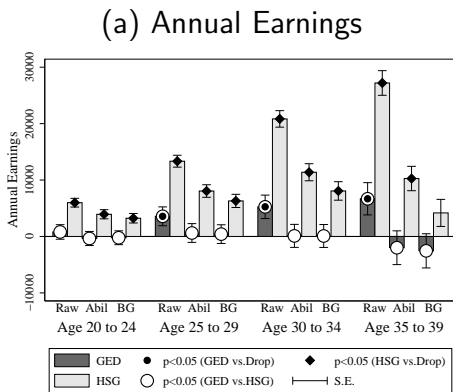
**Source:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample. Notes: The spell to first time being incarcerated begins in the first year that individuals exit school.

**Figure 9:** Survival Rates in Various States for Male Dropouts, GED Recipients, and High School Graduates: Survival Rate in Not Having Been Incarcerated



**Source:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979 (NLSY79), nationally representative cross sectional sample. Notes: The spell to first time being incarcerated begins in the first year that individuals exit school.

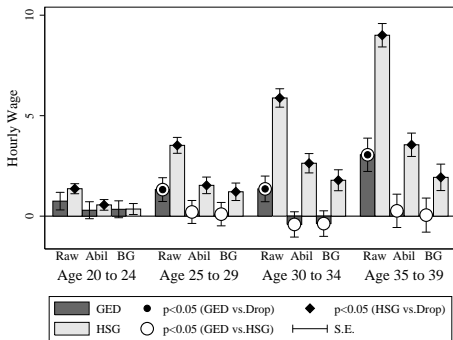
Figure 10: Labor Market Outcomes Differences - By Age - NLSY79 - Males



**Source:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979. **Controls:** "Raw" – age, race, and region of residence; "Abil" – age, race, region of residence, and AFQT adjusted for schooling at time of test; "BG" – mother's highest grade completed, urban status at age 14, family income in 1979, broken home status in 1979, south at age 14, AFQT, and factors based on adolescent behavioral measures, crime and school performance. Regressions exclude those reporting earning more than \$300,000 or working more than 4,000 hours. **Notes:** All regressions allow for heteroskedastic errors and when appropriate clustering at the individual level.

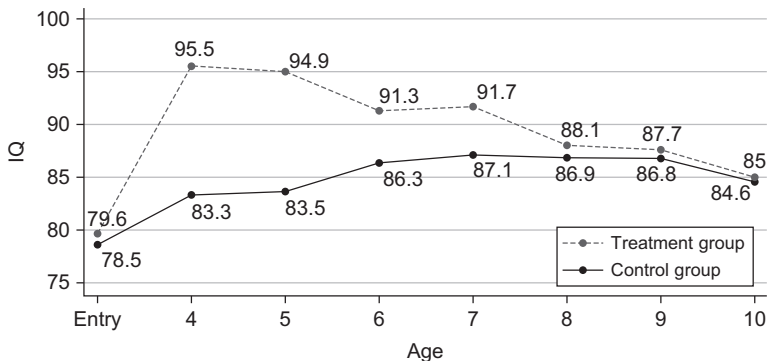
Figure 10: Labor Market Outcomes Differences - By Age - NLSY79 - Males

(b) Hourly Wage



**Source:** Heckman et al. (2012, Chapter 3). National Longitudinal Survey of Youth 1979. **Controls:** "Raw" – age, race, and region of residence; "Abil" – age, race, region of residence, and AFQT adjusted for schooling at time of test; "BG" – mother's highest grade completed, urban status at age 14, family income in 1979, broken home status in 1979, south at age 14, AFQT, and factors based on adolescent behavioral measures, crime and school performance. Regressions exclude those reporting earning more than \$300,000 or working more than 4,000 hours. **Notes:** All regressions allow for heteroskedastic errors and when appropriate clustering at the individual level.

Figure 11: Perry Preschool Program: IQ, by Age and Treatment Group



Notes: IQ measured on the Stanford-Binet Intelligence Scale (Terman and Merrill, 1960). The test was administered at program entry and at each of the ages indicated. Source: Cunha et al. (2006) and Heckman and Masterov (2007) based on data provided by the High Scope Foundation.