



An Empirical Test of the Heckman and Rubinstein GED Mixed-Signal: Evidence from Prison

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Abstract: Economists have begun to embrace the notion, already accepted by the market, that GEDs and High School Diplomas signal similar cognitive abilities, but different non-cognitive abilities. To better understand this phenomenon and its implications, this paper presents a study of an education environment, prison, which provides natural controls for non-cognitive abilities. The study reveals similarities in decisions between the two types of agents that are surprising in light of decisions made in standard educational environments. The results support the mixed-signal theory and furthermore suggest that stricter enforcement of discipline and other non-cognitive attributes may help to reduce dropout rates in non-prison educational facilities.

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Introduction

The American Council of Education specifies that a passing score on the General Education Development test signals that the test taker “demonstrate[s] a level of knowledge and skill that meets or surpasses that of approximately 60 percent of graduating high school seniors.”¹ In comparison to high school graduates (HSGs), evidence shows that General Education Development certificate holders (GEDs) are more likely to seek job training, while HSGs are more likely to pursue post-secondary education (Cameron and Heckman 1993). Differences in cognitive abilities between these groups do not seem able to explain this pattern, leaving many to suggest differences stem from relatively lower non-cognitive abilities among the GED group. Several important recent studies focus on the so-called “mixed-signal” hypothesis that the GED signals both relatively high cognitive abilities yet relatively low non-cognitive abilities. This paper sheds new light on the mixed-signal hypothesis through an analysis of voluntary post-secondary education choices made by GEDs and HSGs within prison. The advantage to these data is that prisons constrain choices, and in particular enforce discipline, in a way that would be expected to mitigate effects due to non-cognitive differences. The key finding is that HSGs and GEDs exhibit the same post-secondary choice patterns in this highly disciplined environment, providing evidence in support of the mixed-signal hypothesis.

Cameron and Heckman (1993) were the first to suggest that the GED is a mixed-signal. These authors made the early observation that GED holders engage in relatively less post-secondary education and more job-training programs than HSGs after completing their degree (of HSGs sampled: 60% attended college and 11% job or

¹ <http://www.acenet.edu/AM/Template.cfm?template=/CM/HTMLDisplay.cfm&ContentID=10123>

vocational training; of GEDs sampled: 38% college, 13.3% job or vocational training.) Also, Heckman and Rubinstein (2001, henceforth HR) found lower earnings and employment rates among GED recipients than dropouts without a GED, after accounting for years of schooling and a measure of cognitive abilities (score on the Armed Forces Qualifying Test.) HR attributed inferior labor market outcomes to low non-cognitive abilities and suggested the GED is a test that “separates out bright but non-persistent and undisciplined dropouts”.² Typically, these papers identify low non-cognitive traits through correlation between GED holders and rates of participation in illegal activities or to surveys that identify low non-cognitive traits using questions on topics such as feelings of control over one’s own life (the Rotter and Rosenberg Scales used in Heckman, Stixrud, and Urza 2006.) To the best of my knowledge, no previous paper has analyzed post-secondary choice behavior of GEDs and HSGs in an environment that substantially limits the influence of non-cognitive factors.

Theoretical work in this area includes Cunha and Heckman (2006, 2007), who developed models examining the formation of cognitive and non-cognitive skills. They argue that increased “stocks” of non-cognitive skills, especially at young ages, aid growth of cognitive skills, which in turn can enhance additional development of non-cognitive skills. These findings resonate with the arguments of HR, who suggest it “would be valuable to gather more systematic information on non-cognitive effects of alternative education systems,”³ and that “social policy should be more active in attempting to alter [non-cognitive traits]... This would include mentoring programs and stricter enforcement

² It may still be rational for a person to acquire the “negative” GED signal when it provides holders an opportunity to attend education programs or obtain jobs that require at least a GED to gain admission.

³ HR p.148

of discipline in the schools.”⁴ Such arguments highlight the importance of our and other’s efforts to measure the influence of non-cognitive skills.

Using data from US state and federal prisons, the present paper demonstrates that, in a controlled prison environment, differences in decisions between HSGs and GEDs vanish. These results support HR’s argument that non-cognitive differences are a primary source of the widely documented differences in post-secondary education decisions between GEDs and HSGs.

Environment and Methodology

The forced discipline within prison walls naturally controls for low non-cognitive attributes, forcing minimum levels of social behavior upon inmates as well as restricting their personal lives. While prison cannot control the effort levels of prisoners, it can place restrictions on sleep, work hours, exercise, eating, general daily regimen, etc., factors that would be thought to contribute to laziness and non-persistence. Federal prisons also generally require inmates to undertake education classes until they earn a GED or reach a certain number of hours of class time.⁵ Many states have similar rules. Beyond this minimum level of education, prisoners often have a choice to undertake further education and training programs voluntarily. These are the decisions investigated in this paper.

Testable hypotheses regarding voluntary education and training decisions by inmates follow directly from HR’s claim that the GED is a mixed signal and the typically observed educational differences between HSGs and GEDs.

⁴ HR p.149

⁵ http://www.bop.gov/inmate_programs/edu.jsp - have requested citation info for policy or rule

Hypothesis 1: *There will be no significant difference in the decisions HSG and GED holders make about participating in post-secondary education while in prison.*

Hypothesis 2: *There will be no significant difference in the decisions HSG and GED holders make about participating in post-secondary job-training while in prison.*

The 1997 *Survey of Inmates in State and Federal Correctional Facilities*⁶ provides novel data to examine these hypotheses. The results of a logit analysis on the decisions of inmates to undertake voluntary education or job-training serve to provide test evidence towards the hypotheses. Prison level fixed-effects control for effects within a specific prison that could skew the results (such as lack of education or training facilities.) To control for factors potentially influencing the education decision, the analysis includes demographic controls (e.g., age, race, marriage status, past college experience, etc.) and criminal record controls (e.g., recidivism, sentence length, offense type, drug use, etc.)

Ensuring that only voluntary inmate decisions are considered, we include only the portion of the prison population sample “exempt” from forced prison education. The final sample includes only those inmates who were HSGs or GEDs and only those who did not earn their GED while in prison.⁷ Finally, the definition of education classes used omits “English as a Second Language” classes, which prisons often force non-English speaking prisoners to take regardless of degree status. Table 1 provides summary statistics.

<Table 1>

⁶ An over 2000 variable survey was carried out on a sub-sample of 315 prisons out of the 1536 prisons across the country, consisting of 14,285 State inmates and 4,041 Federal inmates.

⁷ Prison GED holders might have earned their GED involuntarily, but there does not exist a comparable group of inmates with involuntary prison high school degrees. While not considered in this study, future analysis exploring these prison GED data may be profitable.

Results

Column I (table 2) shows a model of the educational decisions by inmates.⁸ In prison, HSGs decisions to participate in education are not different from GEDs decisions to participate in education, which forms the basis for the first result.

<Table 2>

Result 1: When controls on non-cognitive abilities are present, within prison, there are no significant differences between the decisions of HSGs and GEDs to participate in voluntary education programs ($p=.511$).

The model in the second column captures job-training participation by inmates. Just as there were no educational decision differences between HSGs and GEDs, the job-training decisions made by these inmates are statistically indistinguishable, leading to result 2.

Result 2: There are no significant differences in job-training decisions, within prison, between HSGs and GEDs ($p=.249$).

The immediate implication of the first and second results is that we cannot reject hypotheses 1 and 2. In an environment with heavy institutional restrictions on non-cognitive attributes, HSGs and GEDs make statistically indistinguishable training and education decisions. As the cognitive differences present outside of prison are still present within the prison walls, we can attribute the lack of decision differences to the non-cognitive controls prison imposes.⁹ These results provide supporting evidence for

⁸ The regression results for some of the control variables are suppressed in the table, see appendix A for the remaining regression results.

⁹ Running a similar logit model, on whether the prisoner has been written up for breaking rules while in prison, reveals no significant differences between HSGs and GEDs ($p=.312$), demonstrating the ability of prison to control non-cognitive abilities.

HR's claim that the GED is a mixed signal of high cognitive and low non-cognitive abilities.

In exploring the prison education environment, we follow HR's suggestion for further systematic study of discipline in schooling systems. The results suggest that forced non-cognitive controls can cause changes in inmate educational decision making. Likewise, social policy aimed towards stricter discipline and mentoring in schools (improving non-cognitive attributes) may similarly affect the educational decision making for students. In line with Heckman et al. (2006) these findings are consistent with a model where improved non-cognitive skills lead to increased cognitive skills, through the effect on education.

The results in this paper, and work like HR's, raise doubts about the value of the GED as a signal for those who obtain it. The growth of GED acquisition since its inception suggests that many see the GED as a positive signal, regardless of the negative market effects. The market currently appears to use the additional signals that the GED sends. The work of Tyler and Kling (2004) illustrate the market's adaptability to the GED mixed-signal, showing that the returns to a Prison GED fade rapidly upon release for minorities and are negligible for whites.

Conclusion

The data presented here, from the United States prison system, provides empirical support for Heckman and Rubinstein's (2001) notion that education provides a multi-faceted signal well beyond the standard signaling model of Spence (1973). Many facets of the non-cognitive portion of human capital signals remain open for investigation.

Future work may also find it profitable to investigate the mechanisms by which markets incorporate information contained within these signals.

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Table 1
Summary Statistics by Category

	Total Sample	All Males	Exempt & Male
Observations *	18326	14530	5433
Outside Earned GED	9.77%	9.26%	24.19%
High School Diploma	30.00%	28.81%	75.81%
Prison Earned GED	22.99%	24.86%	-----
Age	34.44	34.28	36.32
Married	25.96%	24.80%	27.66%
Has Children	69.98%	67.36%	70.28%
Disability	35.17%	34.28%	32.14%
Hours Worked (per week)	21.47	21.12	23.92
College Experience	17.77%	16.96%	38.03%
Time Served (years)	3.90	4.25	3.92
Sentence (years)	12.05	13.10	12.47
Sentence Remaining (years)	7.26	7.96	7.52
Participating in Education	48.53%	38.82%	25.07%
Participating in Job-Training	45.99%	30.46%	28.74%

*The number of observations used for each control variable differs based on number of nonmissing responses for each.

Table 2
Education and Job-Training
Logit Regression Results

	I	II
	Education	Job-Training
GED	0.064 <i>(0.097)</i>	0.106 <i>(0.092)</i>
Age	-0.013** <i>(0.005)</i>	-0.040*** <i>(0.005)</i>
Married	0.092 <i>(0.094)</i>	-0.059 <i>(0.092)</i>
Has Children	-0.144 <i>(0.095)</i>	0.072 <i>(0.090)</i>
Disability	-0.130 <i>(0.092)</i>	-0.134 <i>(0.088)</i>
Hours Worked (per week)	0.003 <i>(0.002)</i>	0.002 <i>(0.002)</i>
College Experience	0.307*** <i>(0.086)</i>	0.084 <i>(0.083)</i>
Sentence (years)	0.009** <i>(0.004)</i>	-0.008* <i>(0.004)</i>
Sentence Remaining (years)	-0.011 <i>(0.008)</i>	-0.016* <i>(0.008)</i>
# of Inmates (Observations)	4126	4230
# of Prisons (Fixed Effects)	223	232
Log Likelihood	-1684.873	-1804.530

Standard errors are in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels. Variables for race, religious, trouble maker, recidivism, drug use, drug offense, violent offense, military service, and unemployment are suppressed for space.