Believe In A Just Wage?
The Effect Of Personality On Labour Market Outcomes

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February 15, 2013

Abstract

This paper examines the impact of students' non-cognitive skills locus of control and self-esteem on their decision to enroll at college, and on their wages once they enter the labour market. We extend previous research in several ways: a model of belief formation suggests a pathway by which these traits affect economic outcomes and allows to derive testable predictions concerning individuals' decisions to invest in their human capital. The data confirm these predictions: parametric and non-parametric estimation on a dataset not previously used for such a study shows that these skills matter for the decision to go to university and, in the case of locus, for sucessful completion of higher education. For certain groups of workers they affect wages over and beyond the educational choice: for students who only obtained high school education, these skills are rewarded on the labour market, whereas for college graduates their effect is not significant. These results may be explained by signaling models of higher education, and they contribute to the discussion about the direct or indirect impact of non-cognitive skills on wages, emphasizing that any answers to this debate must depend on the type of workers considered. Cognitive and non-cognitive traits affect investment decisions in a comparable way, underlining the importance policy makers should place on fostering the latter among students from disadvantaged backgrounds.

JEL Codes: I20, I24, J24

Keywords: Non-Cognitive Skills, Human Capital Investment, Returns to Education

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1 Introduction

The origin of inequality in educational outcomes and earnings is central to microeconomic policy considerations, and human capital is a key concept in this context. A person's human capital, ie her capacities contributing to production, is traditionally defined as her cognitive ability and a stock of knowledge and skills she acquired, and can be augmented by formal schooling, on-the-job training, or experience. More recently, attention has turned to dimensions of human capital not captured by the aspects mentioned above. Over the past few years, character traits have increasingly been recognised to play an important role in determining individual outcomes, in the educational sector as well as on the labour market.

Early studies suggest that social adaptability and motivation play a key role in the evaluation of human capital interventions (Heckman (1999)), and the impact of personality may be comparable to that of cognition in individual achievement in education or on the labour market (Brunello and Schlotter (2011)).

In earnings equations, a lot of variance is left unexplained when conditioning on observables like the years of schooling, the type of diploma or training received and tests of cognition, and including personality measures has been found to be a means of reducing this residual variance (Heckman and Rubinstein (2003)). Character traits may also account for the strong correlation between parental outcomes and those of their children that is not explained by observable covariates, such as higher financial investment, good schooling or inherited cognitive ability (Carneiro Heckman (2003)). Thus, «the puzzle is, to understand what it is that successful parents pass on to their children» (Bowles, Gintis and Osborne (2001)).

Accordingly, the aim of this research on character traits is to account for some of the variation due to unobservables by attempting to measure different dimensions of personality and including those measures in the estimation of educational achievement and wage equations. It then can inform the debate on public policy targeted at disadvantaged groups of the population with the aim to improve their outcomes in education and on the job market.

There are two main strands of literature hat investigate the effect of personality on economic decisionmaking. Behavioural economists try to elicit the role of emotions and belief formation on the choices of individuals, through models and experimental approaches. Applied work on

personality draws on character traits measured in large data sets and uses them to predict individual economic outcomes. This paper seeks to combine these two approaches, and thus to extend the previous literature, by first building a simple model that allows to derive testable predictions concerning the role of beliefs in an individual's decision to invest in her human capital. We then take these to a data set not previously used for such an inquiry, and find that our results confirm the predictions of our model.

1.1 Measuring Character Traits

In psychological evaluation, personality is described by five main dimensions: agreeableness, conscientiousness, emotional stability, extraversion, and openness to experience. Empirical research needs to use measures of personality available in large data sets, and so papers on this topic have often focused on two traits which are measured in several important panel data sets: «locus of control» and, to a lesser extent, self-esteem.

Locus of control is a psychometric concept which captures an individual's beliefs about the magnitude of the impact she has on shaping her life. It assesses to what extent an individual believes that she has control over her life (internal locus), as opposed to believing that chance or fate control her life (external locus). Feeling able to influence what happens to her thus translates into a high score on the locus of control scale, and feeling powerless to affect events and resigned to letting luck, or fate, control her life, indicates a low score.

Locus of control and self-esteem are thus aspects of the personality linked to motivation, self-confidence, proactiveness and assertiveness. They are measured with the help of a questionnaire, which asks the respondent to indicate how much she agrees with statements that are typical of either high or low locus of control or self-esteem, respectively. (see Appendix A for the list of questions)

1.2 Outline

This study attempts to capture the impact of these two skills on the decision to go to university, and on the salary during the first years after entry into the labour market. The importance of non-cognitive skills, and of locus of control in particular, on education decisions or labour market

outcomes has been shown by previous studies. There is disagreement among different authors, though, on whether the effect that locus of control may have on wages works solely through education decisions, or whether it has a direct effect beyond this. (eg Brunello Schlotter (2011) for a survey).

This paper thus seeks to investigate this question, building a model to suggest a pathway by which these character traits affect human capital investment. To test the predictions from our model we use a data set which has not previously been employed for such a study: the «NLSY Children and Young Adults» is a panel following the children of women who are part of the NLSY79 (National Longitudinal Survey of Youth). These data have the advantage of providing measures of the character traits we are interested in, as well as of early cognitive ability of the child. They also offer detailed information not only on the childhood and family environment of the respondents, but equally on their mothers (who are followed in the NLSY79), which may be used to trace children's character formation to their parents' personality and to their early family environment.

Initially, we include the two character traits of interest in probit estimations of the probability to enroll in college upon leaving high school and of completing a four-year college degree. Measured at the age of 17, immediately before individuals take the decision to go to university, both traits are found to be significant and to have a large effect, compared to that of cognitive ability or of parents' income for the decision to enroll at college, and, in the case of locus of control, for the probability of obtaining a college degree.

The probit model assumes a normal distribution of the error terms, and may lead to biased estimates if this does not hold. A semi-parametric approach allows to relax this assumption and we will use Klein and Spady's single index estimator to check whether our results change if we do not impose a functional form on the error distribution.

In a second step, we follow up the individuals about ten years later, once they have entered the labour market. Distinguishing college graduates from high-school graduates, we obtain the wage they receive, in order to assess the effect on earnings of the character traits discussed above, instrumenting current traits by those measured before finishing high-school.

Selection concerning entry into the labour market is a potential source of bias in wage regres-

sions if the aim is to draw conclusions in terms of potential wages for the whole of the population. We account for this by adding a selection equation accounting for service in the military, illnesses, or parenthood, but find that the correction term is not significant. Selection does not seem to result in biased estimates here, probably for the following reason: The young age of the observed individuals means that their choice to work or not is affected by many different factors: some decide not to aquire further training after high school, or have dropped out of high-school, and do not enter the labour market because their expected wage is too low, others are still enrolled at university, finishing a doctoral degree. That is, both very low skilled and high skilled individuals are somewhat less likely to be employed and it is unlikely, we believe, that on average those who are employed and those who are not differ in their unobserved characteristics.

To take account of possible selection effects due to the correlation of unobservables that influence the education choices and those that affect the salary, we use a switching regression model, with earnings for each group as the variable of interest, and the choice to enroll at college explained by the selection equation, using mothers' education as the exclusion restriction. Again, the parametric assumptions of the Roy model may be restrictive, and estimation using a semi-parametric estimator allows to verify robustness of our results.

An interesting finding is that non-cognitive skills seem to be rewarded to a different extent in the two different segments of the labour market: the effect on the salary of both locus of control and self-esteem is much higher for high-school graduates than for college graduates. This may be accounted for by the young age of the individuals in the context of signaling models: we suggest that it may be due to successful revelation of ability, including all dimensions of skills, for college graduates through their diploma, and their remuneration is fixed accordingly, whereas for high school graduates showing motivation, effort and proactiveness (proxied by the traits we measure) on their first job is crucial to convince employers of their qualities, and thus affect their wages.

Caution is needed of course in infering causal relationships stemming directly, and solely, from the measured traits of *locus of control* and *self-esteem* from any of our estimations: we cannot exclude endogeneity problems, due to unobserved family characteristics for example, which might affect both the development of an individual's personality, and her later outcomes at school or at work. Nonetheless, our results clearly indicate that when controlling for both family income

and education, and an individual's ability, there is an important other dimension, linked to her character and outlook on life, and proxied by our two measures of personality, which has an impact both on education decisions and on success in the labour market, particularly for low-skilled individuals. This is in accordance with the findings of Heckman and coauthors on other data, and reinforces the call for policy makers to place more weight on the enhancement of non-cognitive skills among low-skilled workers to better their chances on the labour market.

2 Past Literature on Non-Cognitive Skills and Locus of Control

In the literature on behavioural economics, self-esteem is a character trait that has been extensively studied, the role of «overconfidence», or inflated self-assurance, on decisionmaking has been highlighted in experiments as well as explained by theoretical models. Benabou and Tirole (2002) show that agents may find it beneficial to selectivly process information in order to maintain high self-esteem, as this may give them the confidence needed to invest in projects that they might otherwise shy away from. An individual's sense of control over her life, and her belief that her efforts will be rewarded, the second trait we are interested in, is the focus of Benabou and Tirole (2006), which points to the benefits in terms of motivation and thus effort exerted, translating into advantageous economic outcomes, that results from an individual's belief in a fair reward to any effort exerted. This belief incites to higher investments in human capital, and in order to achieve those investments, individuals may find it once again beneficial to selectively memorize information that allows them to maintain the belief that their efforts will be rewarded and thus their investments will pay off. Thus, these two papers model the benefits these character traits provide, and show that individuals, taking these benefits as given, have an incentive to acquire or sustain such traits.

As predicted by these theoretical approaches, the empirical literature establishes positive effects of these traits on economic outcomes suggested by such models. This empirical literature on non-cognitive skills is quite recent, and its most prominent promoter over the past years has been James Heckman, who, together with many coauthors, published numerous papers on this

topic. All of them stress the importance of these skills for outcomes in various areas, such as education, delinquency, or teenage pregnancy, and call for policy changes, in order to promote the aquisition of such skills early in life (eg, Heckman 2006).

They point to early parental involvement as a crucial factor in shaping them, which is in accordance with the psychological literature, and urge policymakers to foster the aquisition of such skills, particularly by children of disadvantaged families, whose early environment may not be favourable to their development (Carneiro Heckman (2003)).

In works on the «technology of skill formation» they investigate how cognitive and non-cognitive skills interact, and trace the early origins of non-cognitive skill formation to the family environment of the infant. They also show that early skills facilitate their further acquisition later in life, which explains why early gaps are hard to close and likely to widen over time ((Cunha Heckman (2007), (Cunha, Heckman Schennach (2010)).

Heckman, Stixrud and Urzua (2006) study the effect non-cognitive skills, proxied by measures of self-esteem and locus of control, on school achievement, and find that moving an individual from the 25th to the 75th percentile of non-cognitive test scores, keeping cognitive skills constant, results in a 25 percentage point increase in the probability of being a four-year college graduate by the age of 30. This is similar to the effect obtained by keeping non-cognitive skills constant and moving the individual from the 25th to the 75th percentile in the distribution of cognitive skills, which underlines the importance of seeking to enhace childrens skills in both areas, rather than focusing on cognition solely.

In a similar vein, Duckworth and Seligman (2005) show that self-discipline of eight grade students accounts for twice as much variance as final grades as IQ. Carneiro, Crawford and Goodman (2006), using data from the British National Child Development Survey, measure the effect of social maladjustment at age 11 on indicators of educational attainment, and find that individuals with high cognitive but poor social skills are unlikely to stay at school beyond the age of 16.

Coleman and DeLeire (2003) use NELS data to estimate the effect of a measure of locus of control on the probability of graduating from high school and from college, respectively. They find that locus of control has a significant and large effect in most of their specifications, and

devise a method allowing them to test if locus of control is distinct from some unmeasured component of cognitive ability.

Their findings are challenged by Cebe (2007), who, using NLSY data, finds that once she controls for ability (measured by AFQT scores), locus of control no longer affects the choice to go to college, but does affect adult wages. She does, however, not discriminate between labour market outcomes for college or high school graduates.

Piatek and Pinger (2010) estimate the effect of locus of control on wages with GSOEP data, and find it affects wages only through the channel of education. As locus of control measures have only recently been included in the GSOEP questionnaire however, they need to match the subsample on which it is observed to an older subsample in order to obtain salary measures. They also suggest that it affects the costs of education, rather than the expected payoff, and impose this restriction on their model, whereas this is certainly not the only way to model its effect; section 3 will discuss its potential effects on the expected payoff to education.

Finally, evidence by Caliendo et al (2010) on German unemployment data shows that locus of control is a behavioural trait that affects the subjective probability of finding a job, which in turn leads to an increased search effort and higher reservation wages.

All these papers provide evidence on the importance of non-cognitive skills for outcomes in education and on the labour market. As mentioned above, there is disagreement among different authors, though, on whether the effect that locus of control may have on wages works solely through education decisions, or whether it has a direct effect beyond this.

Our study seeks to contribute to previous research in the follwing respects: It uses different data and includes both self-esteem and locus of control in the analysis, which capture related but distinct dimensions of a person's character, instead of aggregating their impact in a single non-cognitive trait as in some other studies. It also suggests a possible explanation for the inconclusive results of previous studies regarding the direct effect of non-cognitive skills on wages, beyond the indirect one working through education decisions: as mentioned above, we distinguish between different labour markets, and find that the importance of character traits is different for each. In the light of the disagreement about the impact of non-cognitive skills on wages, this shows the importance of distinguishing between segments of the labour market for high- and low-skilled

workers when seeking answers to this question.

In our estimation of a switching regression model we relax the assumption of joint normality of the error terms in the selection equation and the equations of interest. This allows us to compare estimated choice probabilities for the selection equation from both models and to verify whether the normality assumption significantly modifies the estimates. Finally, we simulate the effect of changing an individual's level of locus of control and self-esteem on the predicted probabilities for college choice, and on expected earnings, and find that particularly for low ability individuals improving their non-cognitive skills significantly increases their probability of obtaining a college degree. Research on this topic is crucial to informing policymaking targeted at disadvantaged groups and facilitate their access to higher education and better their chances on the labour market.

3 Modeling the Impact of Character Traits on Education Decisions

How may the character traits we measure affect economic outcomes? Consider some individual economic outcome Y to be determined by three different factors: an individuals (innate) ability A, the effort she exerts, E, and circumstances or events beyond her control, Ω, that impact this outcome. Thus, with Γ describing a production function of the individual's contribution to the outcome through her effort and ability, we may write:

$Y = \alpha \cdot \Gamma(E, A) + (1 - \alpha) \cdot \Omega$

where α is the weight carried by the individual's contribution towards the outcome, relative to factors external to her.

Individuals have an idea of the shape of the production function for a certain outcome, but they may not know the exact contribution of each factor, and in particular, they may not know the true size of α but form beliefs about it.

This belief about the size of the impact of their own contribution to an outcome, compared to external factors, our α, corresponds to the above definition of the trait of locus of control that we are interested in. It is a subjective assessment of how much your effort, combined with your

ability, will be rewarded, a belief about how much your initiative will be reflected in favourable outcomes.

An individual with a high (ie internal) locus of control believes that what happens to her in life (so, for example, the wage she receives) depends on her own effort and initiative, rather than on luck or fate. She feels powerful to strongly affect future outcomes, whereas an individual with a low (external) locus of control sees herself as powerless to exert such an influence. This belief about high or low power to affect outcomes translates into high or low motivation, respectively, to exert effort; individuals who believe in their ability to affect outcomes are naturally motivated to attempt to do so, whereas those who expect their actions to have little impact adopt a more resigned and passive attitude.

Similarly, individuals have some perception of their own abilities, A, which may or may not be close to the truth. This confidence in their own capacities is related to the concept of self-esteem, or self-efficacy, the second character trait whose impact we seek to measure.

As is standard, we may consider an individual to take her decision of whether or not to invest effort to obtain a certain outcome, and how much effort to exert, based on the utility she derives from this outcome compared to the cost of obtaining it. In the framework we propose, this evaluation of costs and benefits that determines her decision depends on

1) her perception of her own capacities, her self-esteem, which affects the productivity of her effort and the cost of exerting it and

2) her perception of the rewards to her effort, her locus of control, which affects the expected benefits of exerting it.

Accordingly, in a model where individuals maximize the expected discounted utility of future income with respect to education, we may imagine cognitive ability, and the non-cognitive traits locus of control and self-esteem, to affect the perceived benefits and costs of higher education, and thus the decision to enroll at university, in the following way:

As is standard in the literature (eg in Becker 1993), we suppose that the individual decides to enroll at university or not by weighing the expected costs and benefits of doing so. Monetary payoffs are measured as the difference in discounted expected future wages conditional on obtaining a college degree or a high school degree. If the difference between those wages, minus the

expected cost (monetary and psychological), of earning a college degree is positive, the individual decides to enroll:

Enroll iff $\sum_{t=5}^{\infty} E[Y^c(t)] - \sum_{t=0}^{\infty} E[Y^h(t)] - Cost(College) \geq 0$

We model locus of control as affecting the subjective probability of receiving a high or low wage, conditional on the education choice, and to regard self-esteem and cognitive ability as affecting the expected psychological cost of studying for a degree; the following two subsections justify this conjecture and detail the pathway by which they might do so.

3.1 Expected Benefits of College Education and Locus of Control

Applied to education choices, and human capital accumulation in general, the above discussion should intuitively translate into individuals with a high locus of control being more motivated to make investments and to supply effort to increase their human capital, as they expect such investments to be rewarded on the labour market: their future wages depend on their human capital and thus on any effort they made to aquire it. Individuals with a low locus on the other hand would feel that regardless of their previous choices regarding human capital aquisition, a great deal of luck is involved when it comes to remuneration and job allocation, and so they would expect their education choices to make little difference for their future career and thus feel less motivated to make any such investments.

Adopting Coleman and DeLeire's (2003) model, suppose there are only two different wage paths, high and low, and the probabilities of receiving each depend on the education choice: they are different for highschool graduates and college graduates, with high school graduates being more likely to obtain the high wage path:

$$\begin{aligned} E[Y^h(t)] &= P^h \cdot Y_1(t) + (1 - P^h) \cdot Y_2(t) \\ E[Y^c(t)] &= P^c \cdot Y_1(t) + (1 - P^c) \cdot Y_2(t) \end{aligned}$$

where Y_1 is the high wage path and P^c and P^h are the probabilities of obtaining it, conditional

on college graduation or high school graduation, respectively, and $P^c > P^h$.

The exact probablitities of receiving each wage path conditional on a chosen level of education are likely to be unknown to students when making their education choices (see Manski 1993), so they will form expectations of them, and these subjective probabilities are assumed by the above reasoning to depend, among other things, on their locus of control. Let individuals' locus of control be represented by a continuous variable θ, distributed on $(-\infty; +\infty)$, with negative values indicating external locus and positive values indicating internal locus. The probabilities of obtaining the high wage path conditional on graduating from college or high school thus depend on θ: $P^h = P^h(\theta)$ and $P^c = P^c(\theta)$

The above discussion about individuals' beliefs concerning the impact of human capital investments suggested that individuals with a high locus believe that their human capital investments will pay off in terms of their future salary, and that failure to invest will be penalized, whereas individuals with a low locus are doubtful about the benefits of such investments. This should translate into their subjective probabilities of obtaining the high wage path conditional on their education choice in the following way: we assume that for $\theta \to \infty$, the probability of obtaining the high wage path upon graduating from college is one, $(P^c(+\infty) = 1)$, whereas it is zero upon graduating from high school: $P^h(+\infty) = 0$. Similarly, by the above discussion, for individuals with a low (external) locus the difference in these subjective probabilities will be low, as they believe their investments to have little impact on their future remuneration. We thus posit that for $\theta \to -\ infty$ the two probabilities of obtaining a high wage are equal: $P^h(-\infty) = P^c(-\infty) = \bar{P}$.

Graphically, we can represent the two probabilities conditional on college or high school graduation as a function of locus of control as in figure 1.

To obtain conditional probabilities that behave in this way, we employ a distribution function $\Phi(\cdot)$ that takes on the value 0 in $-\infty$ and the value 1 in $+\infty$:

$$\begin{aligned} P^c(\theta) &= \Phi(\theta) + (1 - \Phi(\theta)) \cdot \bar{P} \\ P^h(\theta) &= (1 - \Phi(\theta)) \cdot \bar{P} \end{aligned}$$

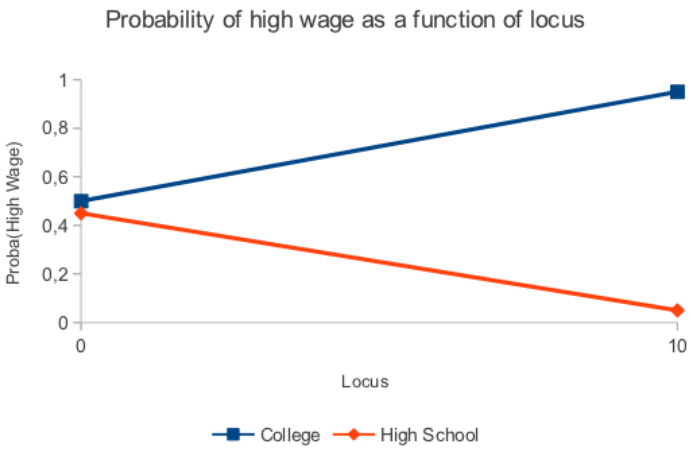

Figure 1: Probability of receiving a high wage conditional on college graduation (uppermost) or high school graduation (lower line)

This yields the following: the perceived probability of obtaining the high wage path upon graduating from college increases in θ, whereas the perceived probability of obtaining the high wage path when graduating from high school decreases in θ:

$$\begin{aligned} \frac{\partial P^c}{\partial \theta} &= \phi(\theta)(1-\bar{P}) > 0 \\ \frac{\partial P^h}{\partial \theta} &= -\phi(\theta)\cdot\bar{P} < 0 \end{aligned}$$

Accordingly, we find that expected wages upon graduating from college are increasing in θ and expected wages upon highschool graduation decreasing in θ:

$$\begin{aligned} \frac{\partial E[Y^c(t,\theta)]}{\partial \theta} &= \phi(\theta)(1-\bar{P})(Y_1(t)-Y_2(t)) > 0 \\ \frac{\partial E[Y^h(t,\theta)]}{\partial \theta} &= \phi(\theta)\cdot\bar{P}(Y_2(t)-Y_1(t)) < 0 \end{aligned}$$

Therefore, we obtain that the difference in expected wages between high school and college

graduates increases in θ, and thus, for costs of college education being held constant, individuals with a higher locus of control find it more beneficial to enroll at college compared to obtaining only a high school degree, all other factors affecting this decision being equal. Such a model suggests a pathway by which an individual's locus of control may affect her motivation and thus her decision to invest in human capital by making the expected payoffs to such investments subjective and individual specific.

3.2 Expected Costs of College Education: The Role of Cognitive Ability and Self-Esteem

As hinted at above, the psychological costs of higher education, ie the possible distress from facing challenging tasks and the effort that needs to be exerted to master them, or, on the other hand, the pleasure that can be derived from facing these same tasks, is likely to largely depend on the individual's cognitive abilities, which allow her to acquire new knowledge and solve problems more easily, and thus make these tasks more enjoyable.

The expectation of these psychological costs or benefits, which affects the student's decision to enroll or not, is accordingly likely to be determined by her perception of her own ability. This perception of her own academic ability is captured by the concept of academic self-efficacy, where self-efficacy is a term employed in the psychological literature that designates self-esteem concerning a certain area of competence. Thus, we may consider our measure of an individual's self-esteem to give an indication of her expectation of her academic capabilities and thus of the psychological cost that attending college would entail.

We write the cost of attending college as a decreasing function of ability:
$Cost = C(a)$ with $\frac{\partial C(a)}{\partial a} < 0$
and the expectation of this cost before enrolling as a function of the individual's self-esteem, where self esteem is the individual's prior on her academic abilities:
$E[C] = E_\eta[C(\eta)]$
with a contained in $]-\infty;+\infty[$, η contained in $]-\infty;+\infty[$ and $\eta \sim \mathcal{N}(a, \sigma^2)$

The decision criterion is thus:

Enroll iff $V^c - V^h - E_\eta[C(\eta)] \geq 0$

For individuals who decide to enroll, the first year at college provides an informative signal of their true academic capacities (through exam grades, feedback from professors, pleasure or distress they feel when studying), which allows them to update their beliefs about their ability. Thus, each year students that decide to continue studying for a degree based on their expectation of their ability will receive a new signal that allows them to update their beliefs and have a more and more accurate perception of their true ability.

4 Data

4.1 The NLS

The National Longitudinal Survey (NLS) is a US panel data set which started over four decades ago to gather information on individuals' labour market activities and significant life events. The NLSY79 is a nationally representative sample of 12,686 young men and women who were 14-22 years old when they were first surveyed in 1979; again, the interest lay on labour market behaviour and educational attainment, but includes questions on many areas of life, and personality measures. In this study we use data on the children of female NLSY79 respondents, who from 1988 onwards have been registered in a panel called « NLSY, Children and Young Adults» (NLSCYA).

The panel starts in 1986, with new waves being added biennially, and the latest one available dating from 2010. There are two subsamples, one containing information about children up to the age of 13, the other one, named *young adults* follows them from 14 years of age onwards. Children are assessed by their mothers and teachers, and older children are directly asked questions and given cognitive tests. For *young adults* the assessment is via a questionnaire, similar to the method used elsewhere in the NLS.

This data set has several advantages: Firstly, it provides detailed information on the respondents' childhood environment, and their relationship to their parents. In the psychological

literature these early influences are considered formative for the development of character traits such as those we are interested in. in future research it could therefore be illuminating to try to trace back their development to the respondents' early childhood, which might also allow to construct instruments for the character traits we are interested in. Secondly, we obtain information related to the mother, beyond measures of socio-economic status and educational attainment. For instance, we can construct indicators of the mothers' character traits of locus of control and self-esteem, and link them to their children's, as an indication of whether there is strong transmission of these traits across generations. Lastly, these data have not yet been used for such an investigation, and it is thus interesting to compare results obtained here to previous studies using other data, for instance the GSOEP (Piated and Pinger(2011)) the NELS (Coleman and DeLeire(2003) or the NLSY79 (Heckman, Stixrud and Urzua (2006), Cebe (2007)).

4.2 Sample

The main variables we use include controls for sex, ethnicity, parental income and education, cognitive test scores, grades in high school, years of schooling, a dummy for college education, and the two main variables of interest: indicators for locus of control and self-esteem, that we constructed from the answers to the questionnaire. We also contruct a measure for the mother's locus of control and self-esteem, which we use to predict their children's traits. There are approximately as many male as female respondents in our sample. The variables indicating ethnicity are dummies for «white», «black» and «hispanic». There is some oversampling of black and hispanic respondents, which can be corrected using the weights provided in the documentation. Parental income is average annual income measured for most families over at least 15 years (fewer years if observations are missing), divided by 1000. Parental education is measured by the years of schooling or the highest grade obtained for mother and father of the respondent («deg mother» and «deg father»). «Military» is a dummy indicating whether the individual served in the armed forces, «illness» is a dummy for an individual having suffered from any major illness or accident over the past 24 months, and «children» is a dummy for parenthood; all three serve to explain participation in the labour market.

Cognitive test scores, named «ability», are constructed from answers given by the children at

age 8 or 9 to questions testing their mathematical capabilities, as well as reading comprehension and recognition. This choice is motivated by findings from psychology that suggest cognitive capacities are stable from this age onwards, and it was thus desirable to have such an early score to obtain as pure a measure as possible of intellectual capacity, in order to avoid using measures which are influenced by both cognitive and non-cognitive capacities, such as later achievement test scores. Grades in the last year of high school are directly available for the young adult sample and are used to predict college enrollment (variable «grade»). «College1» is a dummy for enrolling at college and completing the first year, «College4» is a dummy for obtaining a first (four-year) college degree.

The measures of locus of control and self-esteem are constructed using the questions listed in appendix A, which are part of the Rotter test (locus) and Rosenberg test (esteem), respectively. The tests consist in seven to ten phrases which describe an attitude or belief, and the individual is asked how much they can identify themselves with this statement. (They can «strongly agree», «agree», «disagree» or «strongly disagree»). We then construct scores by assigning 1 to 4 points to responses and adding them up. [1] These evaluations are obtained at the age of 16 and 17, thus shortly before the individual takes the decision to enroll at college or not, in order to avoid concerns about reverse causality, ie of the decision of going to university affecting the personality traits that we measure.

Summary statistics for the main variables are given in table 1:

5 Estimation

5.1 Education Choices

Our interest lies in estimating the probability that an individual opts for college education, given the observed covariates. We distinguish between the decision to enroll at college and complete the first year (outcome: «College1») and the completion of a four-year degree («College4»). We first use probit specifcations with control variables describing gender, ethnicity and socio-economic

[1] This is an arbitrary way of aggregating the replies, and is refined by using principal component analysis. Using the first factor for each trait (explaining respectively between 65 and 73 percent of the variance of locus of control and self-esteem) does not affect results in the estimations, and we will thus keep the initial measure to use all the information contained in the answers.

	Mean	Min	Max	Std
Individual characteristics				
Age	27.18	23.00	32.08	2.37
Male	.49	0.00	1.00	0.50
White	.23	0.00	1.00	0.42
Black	.43	0.00	1.00	0.49
Hispanic	.34	0.00	1.00	0.47
Parental Income	23660	5760	243227	17770
Mother's Education	11	3	20	2.44
Individual outcomes				
Grades	.00	-3.10	1.53	1
College Enrollment	.48	0	1	.49
College Degree	.17	0	1	.37
Employment	.71	0	1	.45
Earnings (/1000)	30.384	4.300	175	18.82
Military Service	.21	0	1	.32
Children	.42	0	1	.49
Major Illness	.38	0	1	.48
Cognitive skills				
Ability	0	-3.14	3.07	1
Non-cognitive skills				
Self-Esteem	0	-3.88	1.94	1
Locus	0	-3.80	2.14	1

Table 1: Descriptive Statistics

background, as well as cognitive ability, grades at high school and the main variables of interest, locus of control and self-esteem. We would like to verify whether the way we modeled the possible influence of the two character traits we are concerned with in section 3 is compatible with our data.

Our model predicts that both character traits should play a role in the decision to enroll at university (outcome variable «College1» in our estimation): we conjectured that a higher (more internal) locus of control should increase the relative payoffs to university education compared to a high school degree, ie the gap between expected wages conditional on obtaining a college or high school diploma, respectively, increases in locus of control. Higher self-esteem, insofar as it proxies a prior the individual has on their academic capacities, should lower the expected psychological costs of university education and thus favor enrollment. Thus, we would expect

both traits to be significant in the probit estimation.

For the probability of completing a four-year degree, our model predicts a slightly different effect for these traits: while locus of control should still play a role, as it affects expected payoffs just as it did for the decision to enroll, we expect self-esteem as measured before entry to college to have no impact any more. As outlined above, we regard our initial measure of self-esteem as the individual's prior on their academic capacities, and posit that during their time spent at college individuals update it as they receive better information about their true capacities. Thus, we would expect that by the fourth year students have a rather accurate perception of their true academic potential, and that this potential should be closely correlated to their cognitive abilities and their average grades during the last year of high school, so that when controlling for these factors any variation in self-esteem as measured before entry to college should play no role. Ideally we would be able to obtain information on grades received during college, and dispose of another measure of self-esteem closer to the end of college education to examine the relationship between these two, but unfortunately the data do not provide us with grades obtained at university.

As the first column of table 2 indicates, results for college entry are as expected: all variables except the dummy for hispanic origin are significant in this specification, in particular our measures for early cognitive ability and for both non-cognitive skills. The ratio of the coefficients for cognitive ability on the one hand, and locus or self-esteem on the other is about 2. Once again, results need to be interpreted with caution, and we do not claim to obtain exact marginal effects for «Locus of Control» or «Self-Esteem», but still, we see that factors related to motivation, effort and confidence play an important role, compared to cognitive ability. As mentioned above, our aim is to capture some of the variation due to unobservable characteristics of the individual, and so to improve on specifcations that do not take personality traits into account. Estimation results for the probability of completing a four-year degree (outcome «College4») are equally compatible with our model: the coefficient on locus of control is still significant and its size is unchanged, whereas the one on self-esteem is no longer so, as we predicted. Results from the latter estimation is displayed in the third columns of table 2.

We saw above that the different skills we measure are correlated, although not very strongly. One may be concerned that the effects attributed here to the personality traits we measure are in

Variable	College1	College1(orth)	College4	College4(orth)
(Intercept)	-4	-4	-6.29	-6.29
	(0.489)	(0.489)	(0.604)	(0.604)
Parental Income	0.317	0.317	0.486	0.486
	(0.0505)	(0.0505)	(0.0621)	(0.0621)
Parental Education	0.0806	0.0806	0.0292	0.0292
	(0.0127)	(0.0127)	(0.0154)	(0.0154)
Male	-0.372	-0.372	-0.127	-0.127
	(0.0568)	(0.0568)	(0.0708)	(0.0708)
Non-White	0.114	0.114	-0.142	-0.142
	(0.0695)	(0.0695)	(0.0908)	(0.0908)
GPA High School	0.331	0.331	0.507	0.507
	(0.0303)	(0.0303)	(0.0414)	(0.0414)
Cognitive Ability	0.245	0.279	0.272	0.297
	(0.0324)	(0.0323)	(0.0407)	(0.041)
Locus of Control	0.0985	0.0985	0.0998	0.0998
	(0.0366)	(0.0366)	(0.0458)	(0.0458)
Self Esteem	0.109	0.109	0.0487	0.0487
	(0.0362)	(0.0362)	(0.045)	(0.045)

Table 2: Probit Estimation of Choice to Attend College

fact due to the formation of these traits, in turn, being influenced by the early cognitive ability of the child. To exclude this, we construct two supplementary measures of locus of control and self-esteem, which are orthogonal to cognitive ability, by regressing both traits on ability and using the residuals from these regressions in the probit estimation. Results of these estimations are shown in the second and ofurth columns of table 2; the coefficients we obtain are almost identical to those of the original estimation.

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To relax the normality assumption we then carry out semi-parametric estimations of these choice probabilities, using the single-index model proposed by Klein and Spady (1993). We choose this one over other semi-parametric single-index estimators due to its efficiency properties (see Newey(2009)).

For most variables, the ratios of the semi-parametric estimates we obtain do not differ much from those of the probit specification; for the main variables of interest, however, locus and esteem, we find that while the ratio of the probit coefficients is close to one, and between cognitive ability and the non-cognitive traits it is about two, for the semi-parametric estimates the ratio

Variable	Probit Estimates	Semi-Parametric Estimates
Parental Income	0.317	0.262
Parental Education	0.0806	0.105
Male	-0.372	-0.463
Non-White	0.114	0.0888
GPA High School	0.331	0.332
Cognitive Ability	0.245	0.245
Locus of Control	0.0985	0.0767
Self-Esteem	0.109	0.134
Observations	2409	2409

Table 3: Comparison of Probit and Semi-Parametric Estimates

between locus and esteem is now almost one to two, as shown in table 3.

We can compare the number of correct predictions for each model by looking at the confusion matrices, shown here for the decision to enter college. In table 4 we can see that both models seem to provide reasonably good predictions with the semi-parametric one performing slightly better.

Observed	Probit		Single-Index	
	Predicted			
	High School	College	High School	College
High School	1157	267	1174	243
College	455	531	454	562

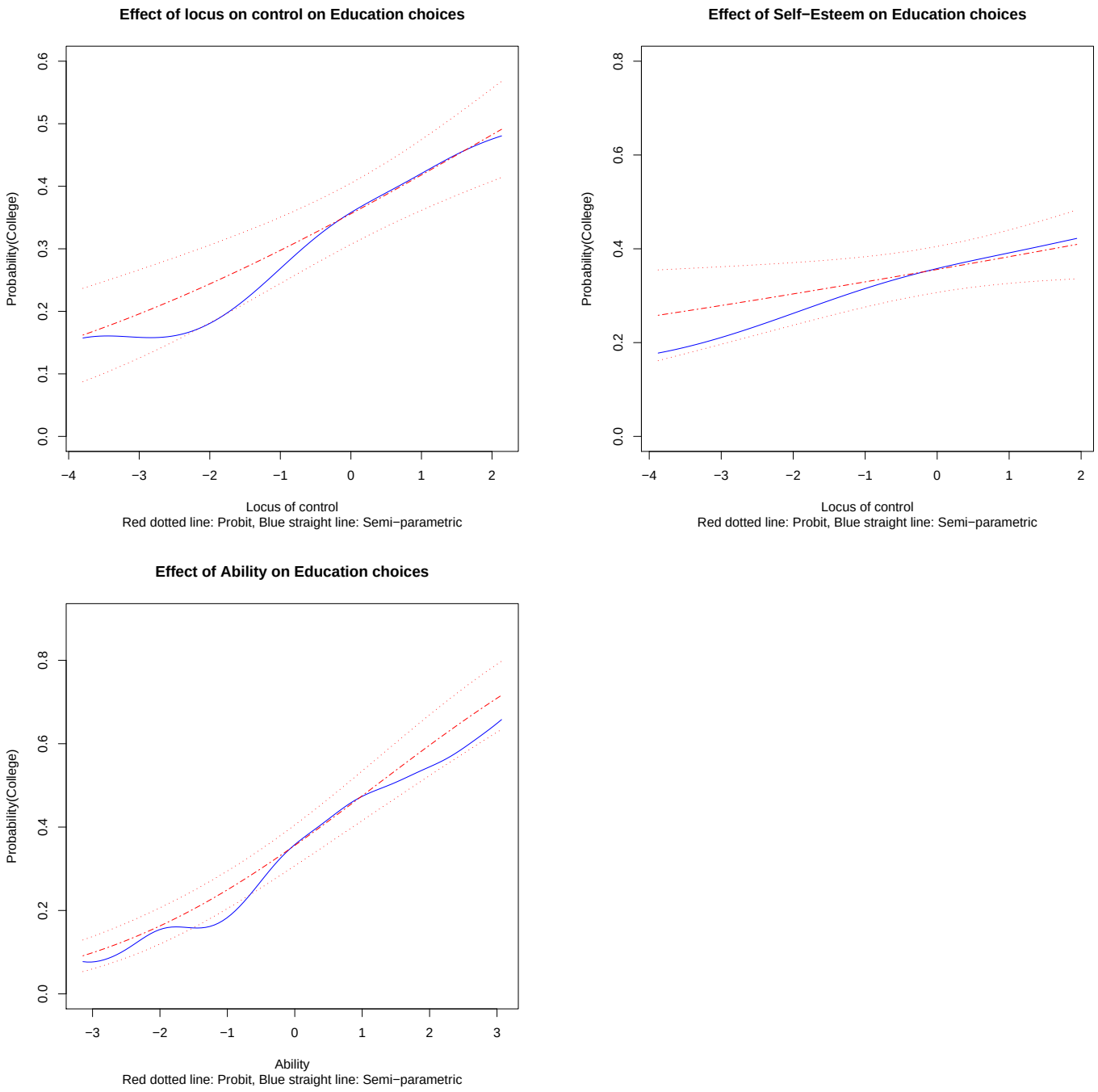
Table 4: Confusion matrices for parametric and semi-parametric models

In order to check whether the normality assumption here is too restrictive or whether we obtain similar results in terms of the partial effects of the variables of interest without imposing it, we will use a graphical comparison of the partial effects of the three main variables of interest. To illustrate the impact that the variation of the three variables of interest, locus of control, self-esteem and cognitive ability, has on the probability of completing a first year at college, we trace the three graphs of figure 2, with the probit specification shown as the red line, and the semi-parametric specification as the blue line. In each of the graphs, we hold all covariates constant at their mean values (setting *male*=1 and *non-white*=0), except for one: either locus of control, self-esteem or cognitive ability vary from their lowest observed value in the sample to the highest observed value, and we trace the graph of the corresponding probabilities.

Changing locus of control from the lowest observed value to the highest one while keeping all other variables constant at their mean level multiplies the expected probability of college attendance by three, from .15 to .48. Repeating the same exercise for self-esteem we obtain a rise in the probability of college attendance from .25 to .38 and for ability we obtain a rise from .10 to .70. Ability obviously is the most decisive factor, but we observe that variation in self-esteem and, in particular, in locus of control, equally play a large role.

The graph indicates that the parametric specifcation overpredicts probabilities of college enrolment for low values of locus of control and self-esteem, and for several levels of ability. However, the curve of predicted probabilities of the semi-parametric model remains almost always within the bounds of the 5% confidence interval around the curve of predicted probabilities of the probit specification, so that, again, the normality assumption may not be too restrictive.

Finally, we let ability and locus of control vary together and obtain figure 3. A striking feature here is that for ability levels around the mean (that is, around zero after normalisation: ability has a symmetric, approximately normal distribution in our sample) we find that having a low or a high locus of control changes the probability of college attendance by a large amount. This section confirmed previous research on different data in finding non-cognitive skills to be important predictors of the choice to enroll at college, and, in the case of locus of control, of obtaining a four-year college degree. When comparing the parametric and the semi-parametric specification we find that the ratios between the coefficients differ slightly, but that predicted probabilities are very similar, so that the distributional assumptions made by the probit model do not seem too restrictive in this case.



Dotted red lines are the bounds of the 95% confidence interval for the probit predictions.

Figure 2: Effect of cognitive and non cognitive skills on education choices

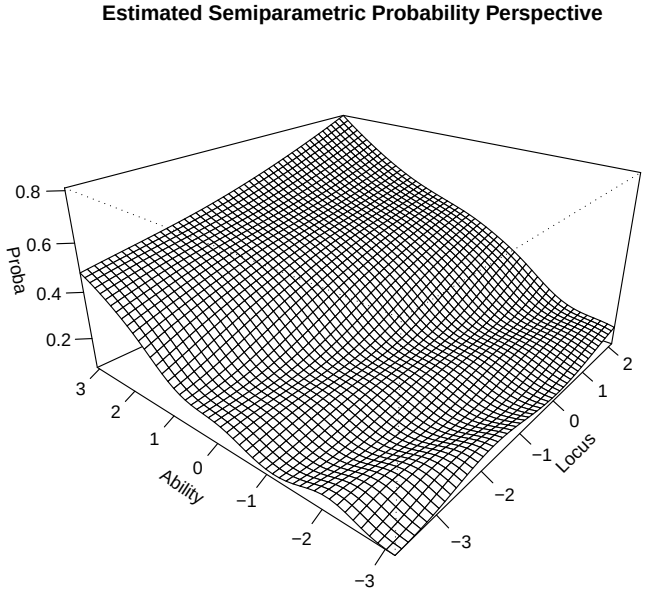


Figure 3: Semi-parametric estimate of the effect of cognitive and non cognitive skills on the probability of going to college

5.2 Labour market outcomes

Finally, we are interested in the effect of personality on labour market outcomes, and we want to see whether it is different for each educational group, ie, we allow the coefficient on the variables of interest to vary between college graduates and high-school graduates. Before estimating these wage equations, we would like to check whether selection into the labour market plays a role in our sample.

To this end, we use a switching regression model (or Roy model (Roy(1951), Maddala (1983)), rather than just a separate regression for each group. This allows to correct for possible selection effects related to education choices: unobservable individual characteristics may affect both education choices and outcomes on the labour market. If we are interested in a measure of returns to education, we would obtain biased results if we did not take account of this. For example, ability not captured by our cognitive test scores, or character traits not captured by our measures, may positively affect the probability of graduating from college, as well as leading to higher wages later. This is thus a form of treatment model with endogenous treatment, and we add a selection equation that explains selection into the treatment, ie the college choice.

As proposed by Heckman (1979) for the correction of selection into the labour market, the switching regression model therefore includes correction terms that account for selection into each education group, based on the conditional expectation of the error term in the selection equation. The basic model is the following:

$$
\begin{aligned}
I_i &= 1 \quad \text{if } \gamma Z_i + u_i > 0 \\
I_i &= 0 \quad \text{if } \gamma Z_i + u_i \leq 0 \\
\text{Regime 1} &: \quad y_{1i} = X_{1i}\beta_1 + \epsilon_{1i} \qquad \text{if } I_i = 1 \\
\text{Regime 2} &: \quad y_{2i} = X_{2i}\beta_2 + \epsilon_{2i} \qquad \text{if } I_i = 0
\end{aligned}
$$

where $(\epsilon_1, \epsilon_2, u_i)$ is assumed to be trivariate normally distributed. Taking expectations of the error term in the selection equation for each of the two outcomes, we obtain the correction terms for the equations of interest and the following conditional expectations:

Table 5: Roy Model With Selection Equation Explaining College Entry

VARIABLES	(1) Earnings HS	(2) Earnings College	(3) Selection
Male	0.086	0.214***	-0.330***
	(0.071)	(0.059)	(0.051)
Hispanic	0.021	0.010	
	(0.064)	(0.075)	
Black	-0.149**	-0.053	
	(0.058)	(0.067)	
Parental Income	0.642***	0.156***	0.370***
	(0.064)	(0.057)	(0.045)
Cognitive Ability	0.361***	0.194***	0.273***
	(0.039)	(0.037)	(0.028)
Age	0.044***	0.079***	
	(0.008)	(0.010)	
Locus	0.120***	0.0104	0.0851**
	(0.045)	(0.035)	(0.033)
Self-Esteem	0.172***	0.013	0.159***
	(0.045)	(0.036)	(0.032)
Parental Education			0.037***
			(0.008)
Constant	3.141***	6.083***	-4.025***
	(0.698)	(0.716)	(0.444)
Selection terms	2.016***	0.110	
	(0.0728)	(0.131)	
Observations	2,409	2,409	2,409

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

$$
\begin{aligned}
E(y_{1i}|I_i = 1, X_{1i}) &= X_{1i}\beta_1 + \sigma_1\rho_1\frac{\phi(\gamma Z_i)}{\Phi(\gamma Z_i)} \\
E(y_{2i}|I_i = 0, X_{2i}) &= X_{2i}\beta_2 - \sigma_2\rho_2\frac{\phi(\gamma Z_i)}{1-\Phi(\gamma Z_i)}
\end{aligned}
$$

Estimating the above model, with college choice as the selection equation, and an earnings equation for each education level, using parental education as the exclusion restriction, we obtain the results described in table 5 and table 6.

Table 6: Roy Model With Selection Explaining Obtention of College Degree

VARIABLES	(1) Earnings HS	(2) Earnings College	(3) Selection
Male	0.248***	0.160**	-0.132**
	(0.053)	(0.076)	(0.054)
Hispanic	0.041	0.025	
	(0.055)	(0.107)	
Black	-0.167***	0.051	
	(0.050)	(0.090)	
Parental Income	0.457***	0.181**	0.373***
	(0.049)	(0.081)	(0.047)
Cognitive Ability	0.303***	0.167***	0.292***
	(0.030)	(0.055)	(0.031)
Age	0.052***	0.096***	
	(0.007)	(0.014)	
Locus	0.094***	-0.044	0.080**
	(0.034)	(0.050)	(0.035)
Self-Esteem	0.106***	0.0566	0.122***
	(0.034)	(0.048)	(0.034)
Parental Education			0.028***
			(0.009)
Constant	4.103***	5.341***	-4.766***
	(0.551)	(1.059)	(0.470)
Selection terms	1.941***	0.195	
	(0.070)	(0.197)	
Observations	2,409	2,409	2,409

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

One interesting finding, mentioned above, is that non-cognitive skills seem to be rewarded to a different extent in the two different segments of the labour market: the effect on the salary of both locus of control and self-esteem is much higher for high-school graduates than for college graduates. This result is likely not due to a difference in the importance of character traits in the two markets. Rather, it may be due to a better revelation of ability for high-school graduates: obtaining the diploma requires not only cognitive skills, but also determination and effort, among other things.

Thus, for college graduates, remuneration initially depends on their diploma, their grades, and the college where they obtained it, which allows the employer to gather an important amount of information about their ability (defined in terms of both cognitive and non-cognitive skills) before offering them a job . Their non-cognitive skills are already well captured by their achievement at university, where perseverance and motivation for example play a large role.

For high-school graduates, though, employers dispose of less information about them, and may have a less favourable expectation about their ability at the outset. Thus, their motivation, assertiveness and initiative may account for a lot in convincing employers of their abilities. They are important both for obtaining employment, but also for the salary over time, once their capabilities are gradually revealed to the employer (see Arcidiacono (2008), for a similar result).

Another observation is that there is a selection effect only for the market for high-school graduates: the correlation coefficient between the error term of the selection equation and the error in the earnings equation for high-school graduates is significantly different from zero at five percent, whereas the correlation coefficient for the earnings of college graduates is not. Unobservables related to the choice not to attend college are affecting the earnings of the group of high-school graduates, but not those of college graduates.

As for the schooling choice, we seek to relax the assumption of jointly normally distributed errors using a semi-parametric estimator. Newey's 2-Step Series estimator consists in rendering all variables orthogonal to the correction term, where the latter is approximated by a polynomial in the inverse Mills ratio. To form the inverse Mills ratio we use the index of both the first step probit estimation and the semi-parametric estimation by Klein and Spady's estimator. Table 7 compares the coefficients of the wage regressions obtained by simple OLS to those obtained using

Variable	OLS College	Newey College	OLS High School	Newey High School
(Intercept)	6.4	7.62	5.39	5.33
	(0.612)	(1.304)	(0.684)	(1.280)
Male	0.232	0.322	0.518	0.519
	(0.0556)	(0.120)	(0.061)	(0.146)
Hispanic	0.012	0.003	0.056	0.061
	(0.075)	(0.105)	(0.082)	(0.890)
Black	-0.055	-0.053	-0.288	-0.284
	(0.0679)	(0.104)	(0.076)	(0.907)
Parental Income	0.131	0.035	0.248	0.253
	(0.05)	(0.073)	(0.058)	(0.103)
Age	0.0797	0.082	0.060	0.061
	(0.0105)	(0.062)	(0.0113)	(0.047)
Cognitive Ability	0.177	0.112	0.147	0.138
	(0.032)	(0.410)	(0.033)	(0.060)
Locus of Control	0.005	-0.012	0.041	0.044
	(0.035)	(0.093)	(0.019)	(0.025)
Self Esteem	0.004	0.030	0.077	0.076
	(0.034)	(0.087)	(0.039)	(0.054)

Table 7: Wage Regressions for College and High School Graduates, Comparing Estimates by OLS and by Newey's (2009) 2 Step Series Estimator

Newey's method, for each education level. The coefficients obtained by both methods are similar, indicating that selection does not seem to have a large impact. The effects of our measures of non-cognitive skills are very similar to those obtained by the switching regression model: the traits are not significant for College graduates, but significant for high school graduates. The normality assumption again does not seem to be too restrictive..

6 Conclusion

This study found non-cognitive skills, proxied by measures of locus of control and self-esteem, to affect both the decision to enroll at college, and the outcome on the labour market for high-school graduates. It points to the importance of distinguishing between workers of different education levels when assessing the effect of character traits on wages, and thus suggests a possible answer to the disagreement in the previous literature about the effect that non-cognitive skills may have on wages: beyond the indirect one going through education choices there is a direct one, but only for certain groups of workers.

Without further research it is not possible to be certain about a causal interpretation of these effects. Nonetheless, our results clearly indicate that when controlling for both family income and education, and an individual's cognitive ability, there is an important other dimension, linked to her character and outlook on life, and proxied by our two measures of personality, which has an impact both on education decisions and on success in the labour market, particularly for low-skilled individuals. This confirms results obtained by Heckman and coauthors on different data. If in further research a causal link can be established, and more information obtained about the formation of non-cognitive skills, for example by analysing the early family environment, this may lead to policy recommendations concerning the interventions targeted at disadvantaged groups and aimed at facilitating their access to higher education and their outcomes on the labour market.

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8 Appendix A

8.1 Examples of Questions from Rotter's Locus of Control Questionnaire

1. What happens to me is my own doing.

2. Sometimes I feel that I don't have enough control over the direction my life is taking.

3. Many of the unhappy things in people's lives are partly due to bad luck.

4. People's misfortunes result from the mistakes they make.

5. In the long run people get the respect they deserve in this world.

6. Unfortunately, an individual's worth often passes unrecognized no matter how hard he tries.

7. I have often found that what is going to happen will happen.

8. Trusting to fate has never turned out as well for me as making a decision to take a definite course of action.

9. When I make plans, I am almost certain that I can make them work.

10. It is not always wise to plan too far ahead because many things turn out to be a matter of good or bad fortune anyhow.

11. In my case getting what I want has little or nothing to do with luck.

12. Many times we might just as well decide what to do by flipping a coin.

13. Who gets to be the boss often depends on who was lucky enough to be in the right place first.

14. Getting people to do the right thing depends upon ability, luck has little or nothing to do with it.

15.Most people don't realize the extent to which their lives are controlled by accidental happenings.

16. There really is no such thing as "luck."

8.2 Examples of Questions on the Rosenberg Test of Self-Esteem

1. On the whole, I am satisfied with myself.
2. At times, I think I am no good at all.
3. I feel that I have a number of good qualities.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I certainly feel useless at times.
7. I feel that I'm a person of worth, at least on an equal plane with others.
8. I wish I could have more respect for myself.
9. All in all, I am inclined to feel that I am a failure.
10. I take a positive attitude toward myself.

9 Appendix B: Distribution Of Skills

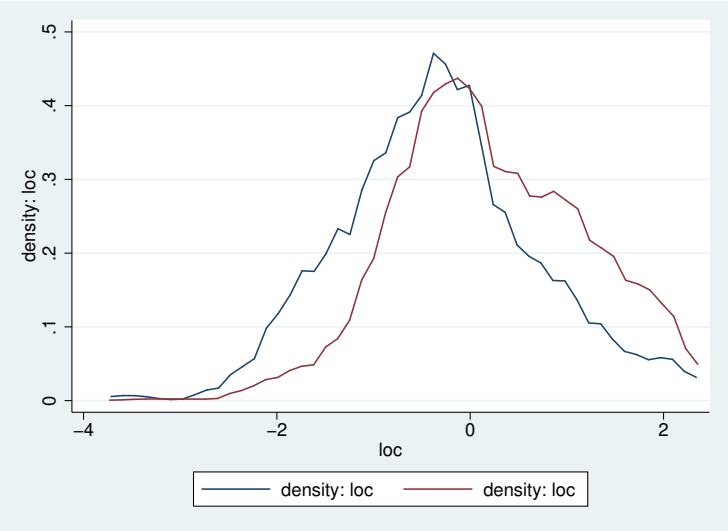

Figure 4: Distribution of Locus for HS Graduates (blue) and 1st-Year College Students (red)

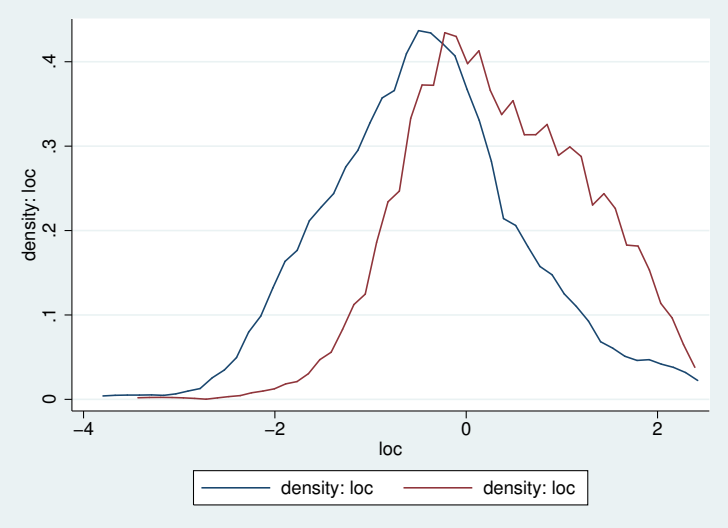

Figure 5: Distribution of Locus for HS Dropouts (blue) and 4-Year College Graduates (red)

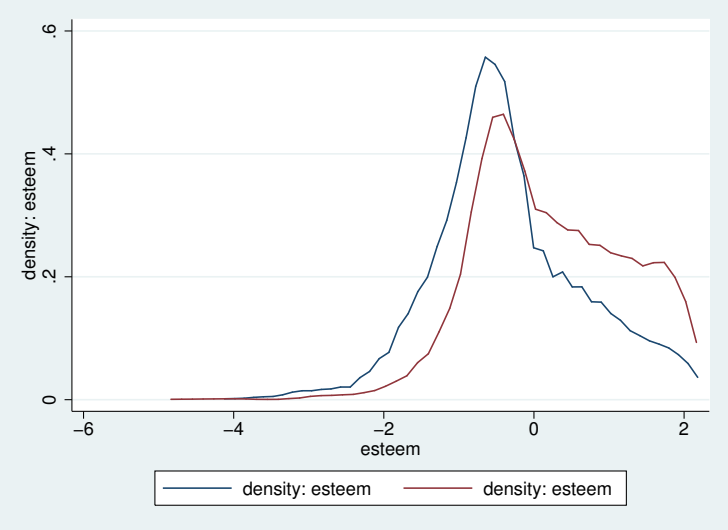

Figure 6: Distribution of Esteem for HS Graduates (blue) and 1st-Year College Students (red)

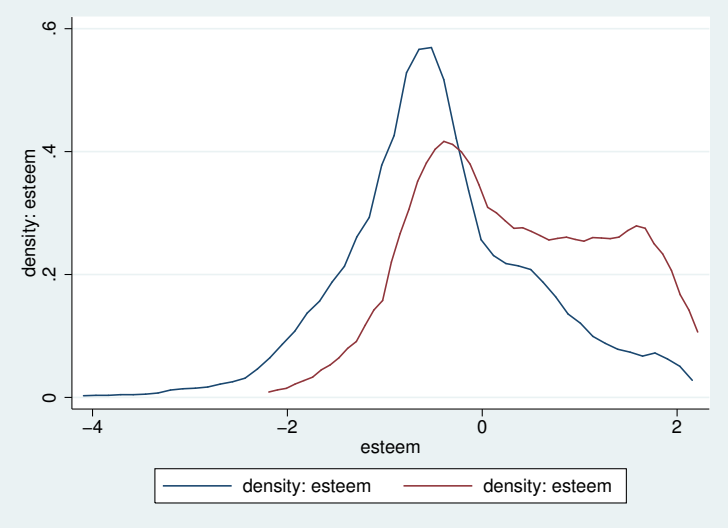

Figure 7: Distribution of Esteem for HS Dropouts (blue) and 4-Year College Graduates (red)

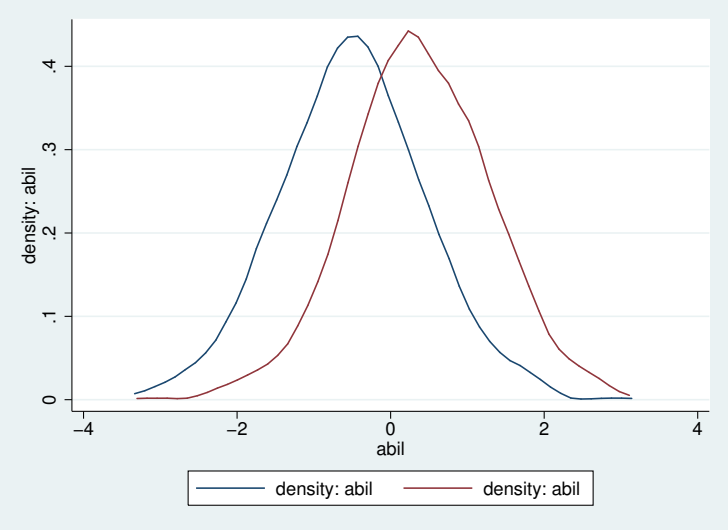

Figure 8: Distribution of Ability for HS Graduates (blue) and 1st-Year College Students (red)

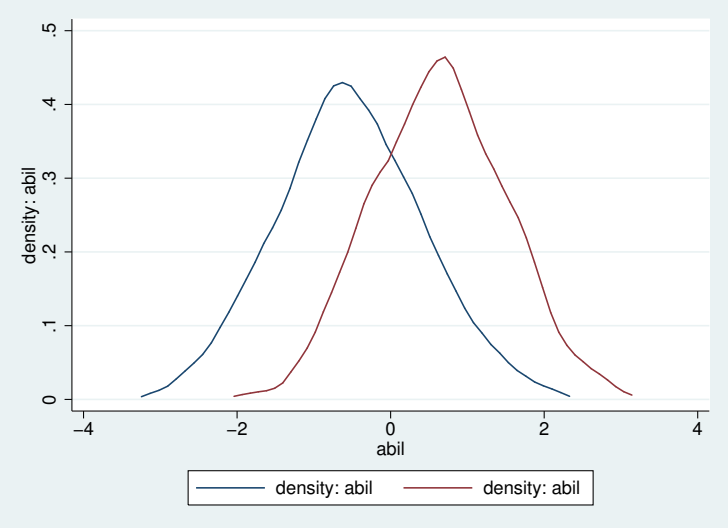

Figure 9: Distribution of Ability for HS Dropouts (blue) and 4-Year College Graduates (red)