Ability and Self-Employment: Evidence from the NELS

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Abstract

Using the National Educational Longitudinal Study data, this paper examines the role of pre-market abilities, as well as other determinants, on young men's self-employment decision. Our results indicate that cognitive and noncognitive abilities are two important, in opposing directions, predictors of self-employment. We also find that cognitive and noncognitive abilities differ in their malleability with the latter being more malleable during adolescence. In addition, having a self-employed father, being black and family size exert large influences on self-employment probability.

JEL: C25, J0, J24
Keywords: Cognitive Ability, Endogeneity, Intergenerational Correlation, Noncognitive Ability, Reliability Ratios.

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1 Introduction

Many academics and policy makers view self-employment and other aspects of entrepreneurial dynamism as a spur to innovation and growth, a route out of poverty and labor market discrimination (see, e.g., Aghion and Howitt 1998 and Brown et al. 1990). Policies that would foster self-employment mainly depend on a thorough understanding of the factors that affect an individual's occupational choice. Two primary influences of self-employment over wage/salary work have been empirically put forth.

First, several studies emphasize the lack of financial assets, liquidity constraint, to start the enterprise as an important impediment. Blanchflower and Oswald (1998), Evans and Jovanovic (1989), Fairlie (1999, 2002) and Holtz-Eakin et al. (1994) all provide evidence that greater personal wealth relaxes capital market constraints and eases the self-employment decision.[1] Second, due to the transmission of nonfinancial assets such as work experience, informal business and other managerial human capital from parents, the offspring of self-employed display a greater propensity to become entrepreneur. Dunn and Holtz-Eakin (2000), Fairlie (1999), Hout and Rosen (2000) and Lentz and Laband (1990), using different data sets with various age groups, find strong positive effects of father's self-employment in son's self-employment decision. In addition, the intergenerational correlation may run through the financial channels if parents transfer their wealth to their offspring, which improves access to start-up capital. Furthermore, in exploring the influences, empirical studies generally find that being white, older, married and an immigrant increases self-employment (see, e.g., Fairlie and Meyer 1996).

Theoretical models, on the other hand, emphasize the importance of personal traits in the self-employment decision. Among many others, Lucas (1978) models self-employment decision as one in which the individual's managerial or entrepreneurial talent plays a prominent role, Kihlstrom and Laffont (1979) posit that less risk averse individuals are more likely to choose self-employment and Blanchflower and Oswald (1998) incorporates nonpecuniary gains from self-employment in their theoretical framework. Not

[1] In contrast to these studies, Hurst and Lusardi (2004) find that liquidity constraints are not a major deterrent to small business formation for most of the population. Specifically, the authors find a positive relation between wealth and business entry only for households at the very top of the wealth distribution.

surprisingly, due to lack of available data, there is not much evidence pertaining to the relation between personal traits and self-employment.[2]

The main goal of this article is to examine, among many other traits, the role of ability in self-employment decision, where ability is defined to be cognitive and noncognitive. The studies in self-employment literature usually treat educational attainment as a measure of ability. However, this variable is less than satisfactory for mainly three reasons. First, education after compulsory schooling is a choice variable and as any choice variable, it is endogenous to the self-employment equation. Second, since education itself is affected from ability, it does not necessarily represent the direct relation between ability and self-employment. Third, ability, as discussed below, is truly multidimensional and in this respect, we cannot disentangle the distinct effects of various types of abilities by using education as a proxy.

The importance of cognitive ability, as measured by aptitude and knowledge tests, in explaining outcomes such as wages, schooling and adolescence behavior is now firmly established (see, e.g., Cawley et al. 2001, Murnane et al. 1995 and Neal and Johnson 1996). Less attention, however, has been devoted to the relevant importance of noncognitive abilities, where much of the neglect stems from the lack of any available/reliable measures. In recent years, a body of empirical research documenting the importance of noncognitive ability on labor market and social outcomes has emerged. Bowles et al. (2001) with different data sets discuss the effects of personal traits such as self-esteem, optimism and aggression on earnings and schooling. Using the National Longitudinal Survey of Youth (NLSY) data, Kuhn and Weinberger (2005) find positive effects of leadership activities in high school, which they define as a measure of noncognitive ability, on earnings. Cunha et al. (2006) and Heckman et al. (2006) with the NLSY data demonstrate that noncognitive abilities (measured by locus of control and self-esteem scales) are important in explaining a various aspects of social and economic life. Carneiro et al. (2007), using

[2] A notable exception is Fairlie (2002), who uses drug dealing as a proxy for personal traits (i.e., risk aversion, entrepreneurial ability and preference for autonomy) and find significant positive effect of drug dealing on self-employment probability.

the British data, reach to similar conclusions. Mueller and Plug (2006) adopt the Five-Factor Model of personality structure to explore how personality affects the earnings of 1957 Wisconsin high school graduates.[3] The authors obtain statistically significant impact of personality on earnings. Finally, Segal (2006), using the National Educational Longitudinal Study (NELS) data, find a negative association between early adolescence misbehaving and schooling, as well as earnings.[4] Furthermore, some of these studies underscore the malleable nature of noncognitive ability and propose social policies that would be more active in attempting to alter them to combat perverse labor market and social outcomes.

The analysis in this paper is based on the NELS data, which is an excellent and novel source of data for conducting research on self-employment. It provides detailed longitudinal information not only on demographic, family and schooling characteristics, but also on a variety of pre-market measures of ability. Specifically, the NELS data includes measures of test scores, self-esteem and locus of control. Apart from the main focus, the panel feature of the NELS data also allows us to investigate the malleability of cognitive and noncognitive abilities in the context of self-employment. A better understanding of the primary influences at the early stages of occupational choice, as well as the structure of ability may be useful for policy makers and for the target of the entrepreneurial programs.

Utilizing the NELS data, we reach to the following empirical conclusions. Cognitive and noncognitive abilities measured in twelfth grade are two important, in opposing directions, predictors of self-employment at the age of 27-28. Controlling for educational attainment does not affect the association between noncognitive ability and self-employment, while it accounts for only less than one-fifth of the overall correlation between cognitive ability and self-employment. The impact of adolescence cognitive ability on self-employment is invariant in the sense that the eighth grade test score estimates yield very similar conclusions to that of twelfth grade. In contrast, eighth grade noncognitive ability estimates do not yield any effect even after correcting for the measurement error. This suggests that these two do

[3] The Five-Factor Model is composed of the following personal traits: extroversion, agreeableness, conscientiousness, neuroticism and openness to experience.

[4] Even though it is not the primary focus of their paper, Persico et al. (2004) also find positive and significant effect of self-esteem on wages using the NLSY data.

differ in their malleability with noncognitive ability being more malleable during adolescence. Finally, we find that having a self-employed father, being black and family size exert large influences on young men's self-employment probability and father's self-employment indicator is not simply capturing the family business following rate, but instead underscores the importance of transmission of nonfinancial assets from fathers to sons.

The remainder of the paper proceeds as follows. Next section describes the data. Section 3 presents the results. Section 4 concludes and discusses the important policy implications for our analysis.

2 Data

The data are obtained from the National Educational Longitudinal Study (NELS) of 1988, a large longitudinal study of eighth grade students conducted by the National Center for Education Statistics (NCES). The NELS sample was chosen in two stages. In the first stage, 1032 schools were selected from a universe of approximately 40,000 schools. In the second stage, eighth grade students were selected based on race and gender from each of the sample schools. For subsample of respondents, follow-up surveys were administered in 1990 (first-follow up, tenth grade), 1992 (second-follow up, twelfth grade), 1994 (third-follow up) and 2000 (fourth-follow up).

Self-employed individuals are defined as those who identify themselves as "working for self" on the class-of-worker question for the current or most recent job in the year 2000, when most of the respondents were 27-28 years old.[5] We restrict our analysis solely to young men who were not enrolled in school at the time of the interview.

The respondents were administered cognitive tests in reading, social sciences, mathematics and science during the spring of the base year, first and second follow-ups to measure academic achievement. Each of the four grade specific tests contain material appropriate for each grade, but included sufficient overlap

[5] Using the National Longitudinal Surveys of Labor Market Experience data, Dunn and Holtz-Eakin (2000) report the mean age of first self-employment as 26.8 years old.

from previous grades to permit evaluation of academic growth. We use the NELS constructed twelfth grade composite item response theory mathematics and reading test scores, which is similar to the Armed Forces Qualifications Test (AFQT) score of the NLSY, as our primary measure of cognitive ability.

With respect to noncognitive ability, we mainly utilize the twelfth grade Rosenberg Self-Esteem and Rotter Locus of Control Scales. The Rosenberg Scale refers to the perceptions of self-esteem (Rosenberg 1965). The Rotter Scale, on the other hand, refers to the extent to which individuals believe that they can control outcomes that affect them (Rotter 1966). Individuals who believe that outcomes result primarily from their own behavior and actions have an "internal" locus of control, while those who believe that fate, chance or intervention of others determine their outcomes have an "external" locus of control. Similar to cognitive tests, respondents were asked to complete a series of questionnaire items pertaining to each trait in the base year, first and second follow-ups.[6] The items were measured on a four point Likert scale ranging from "strongly agree" (1) to "strongly disagree" (4). Each item was standardized to a mean of zero and standard deviation one and the NELS constructed composite measures, which constitute the

[6]Items that make up the self-esteem include responses to the following questions: How do you feel about the following statements?

1. I feel good about myself;
2. I feel I am a person of worth, the equal of other;
3. I am able to do things as well as most other people;
4. On the whole, I am satisfied with myself;
5. I feel useless at times;
6. At times I think I am no good at all;
7. I feel I do not have much to be proud of.

The first, second, third and fourth questionnaires are reverse scoring items and therefore, the values were reversed before the Rosenberg Self-Esteem Scale was created.

Items that make up the locus of control include responses to the following questions: How do you feel about the following statements?

1. I do not have enough control over the direction my life is taking;
2. In my life, good luck is more important than hard work for success;
3. Every time I try to go ahead, something or somebody stops me;
4. My plans hardly ever work out, so planning makes me unhappy;
5. When I make plans, I am almost certain I can make them work;
6. Chance and luck are very important for what happens in my life.

The fifth questionnaire is a reverse scoring item and therefore, the values were reversed before the Rotter Locus of Control Scale was created.

Rosenberg Self-Esteem and the Rotter Locus of Control scales. Higher values of the composite scales imply more self-esteem and an internal locus of control. These measures have been commonly used in previous studies analyzing the role of noncognitive skills on labor market outcomes (see, e.g., Coleman and DeLeire 2003 and Heckman et al. 2006). Hence our measure of noncognitive ability is the average of the respondents' scores on the Rosenberg and Rotter scales.

Since researchers interested in the impact of ability measures are typically (and correctly) concerned about the potential endogeneity of these variables, we utilize a relatively lengthy vector of demographic, family and school characteristics. This not only enables us to mitigate any potential endogeneity problem, but also provides further evidence on the determinants of self-employment with a novel data set. Specifically, our estimations control for the following variables:

Demographic: race, region, urban/rural status, educational attainment;

Family: indicator for father's self-employment, father's education, total family income from all sources, indicator for an intact family, family size and socioeconomic status of the family;[7]

School: percentage of students from single parent homes, percentage of students in Limited English Proficiency (LEP) classes, percentage of students receiving psychological counseling, average daily attendance rate, average dropout rate of twelfth graders prior to graduation, number of full-time teachers, an indicator for whether the school offers vocational educational program.

Information on family and schooling variables come from the second follow-up survey questionnaires and data pertaining to demographic characteristics are obtained from the fourth-follow up survey. We drop missing observations on the class-of-worker question, as well as on the twelfth grade cognitive/noncognitive ability measures. Dummy variables are used to control for missing values of the re-

[7] Socioeconomic status of the family ranges from -2.97 to 2.56 and was created by the administrators of the NELS using the following parental questionnaires: (i) father's education, (ii) mother's education, (iii) father's occupation, (iv) mother's occupation, and (v) family income.

maining variables. The final sample contains 2063 individuals; 159 (7.7%) self-employed and 1904 (92.3%) wage/salary workers. The detailed summary statistics are provided in the Appendix.

The story that will be told in more details below shows up in the simple means of Table 1. Self-employed individuals have substantially higher values of noncognitive ability while they score worse in cognitive tests. The kernel densities depicted in Figure 1 exhibit similar patterns; the distribution of noncognitive (cognitive) ability for self-employed lie to the right (left) of the distribution for the wage/salary workers. For ease of comparison with previous studies, we also provide the propensity for self-employment disaggregated by some key variables in Table 2. The figures show that 15.3% of those sons, whose fathers were self-employed while growing up, were themselves self-employed. In contrast, among sons whose fathers were not self-employed, the rate is only 5.9%. In addition, we observe a large racial disparity between whites and blacks. The self-employment rate for whites (7.7%) is more than twice as large as for blacks (3.2%). These differences in self-employment rates are consonant with the previous findings (see, e.g., Dunn and Holtz-Eakin 2000 and Fairlie 1999). In terms of total family income, however, there is no discernible pattern of young men's self-employment rates.

Prior to continuing, a few comments are warranted related to the endogeneity and measurement issues. First, our use of pre-labor market measures of cognitive and noncognitive abilities allow us to avoid the reverse causality problem (i.e., the possibility that self-employment develops self-esteem). Second, it is a well known fact that cohort effects contaminate the estimates of ability measures (see, e.g., Hansen et al. 2004, Neal and Johnson 1996). The problem mainly arises due to differences in years of schooling and age. For instance, the AFQT in the NLSY data were administered when the respondents were between 15 to 23 years old. That is, some respondents had already entered the labor force as full-time workers or completed their postsecondary education. Since job experience and education enhances human capital, the AFQT scores in the NLSY, particularly for older youths, do not solely reflect the cognitive ability and requires adjustment. These kinds of contaminations, however, are ruled out by the very nature of the NELS data. Finally, the self-rated structure of the questionnaire items that form the noncognitive

ability raises the question of reliability. As discussed below, we attempt to correct for such measurement error by imposing reliability ratios on these variables.

3 Empirical Results

In the previous section, we have shown some raw evidence pertaining to the relation between ability and self-employment. However, it is not possible to conclude any association without taking into account other observable characteristics. In the following sections, we investigate the correlations between ability and self-employment in more details. Below, in all probit models, the following equation is specified

$$S_i^* = \beta_C C_i + \beta_{NC} NC_i + X_i'\beta + \varepsilon_i$$

where S_i^* is a latent variable that is equal to one if $S_i^* \geq 0$ (denoting self-employment) and equals zero otherwise (denoting wage/salary work) for individual i. C_i and NC_i represents cognitive and noncognitive abilities, respectively. The vector X_i denotes other observable characteristics and ε_i is an error term.

For ease of comparison, ability measures were standardized to have a mean of zero and standard deviation of one and the NELS sampling weights are used throughout the analysis.

3.1 The Effects of Twelfth Grade Ability Measures on Self-Employment

Table 3 presents our baseline probit estimates. Standard errors are given in parentheses beneath each coefficient and the marginal effects, evaluated at the sample means, are reported in square brackets. Column 1 reports the result for the specification that only includes the noncognitive ability. In the absence of any controls, a one-standard deviation increase in noncognitive ability is associated with a significant 1.3 percent increase in young men's self-employment probability. Column 2 of Table 3 adds the twelfth grade test scores, which also yields a significant but negative coefficient. A one-standard deviation increase in test scores implies a 2.6 percentage decrease in the self-employment probability.

Comparing column 2 to column 1, we see that controlling for test scores does not diminish the coefficient on noncognitive ability. Therefore, at least in the context of self-employment, cognitive and noncognitive abilities seem to have distinct effects.

Given that the predicted probability of self-employment at the sample means is 7 percent (column 2), the impact of ability measures are non-negligible. However, this model is simplistic in that it does not take into account many observables that are known to be correlated with ability. Moreover, controlling for the observable characteristics may itself be interesting since they provide additional evidence on the determinants of self-employment. To this end, in the third column of Table 3, we include the demographic variables. The coefficients on ability variables are barely affected. We also find that being black has a large negative effect on the probability of self-employment, which is consonant with the previous findings in the self-employment literature (see, e.g., Fairlie 2002).

Column 4 of Table 3 augments the family characteristics to the probit model. Accounting for differences in family background does not greatly affect the coefficients of ability measures. In terms of the selected covariates, being black continues to be an important predictor of self-employment decision. Having a self-employed father while growing up has a large significant positive effect. The coefficient estimate of 0.536 implies that switching father's self-employment indicator from zero to one raises the young men's probability of self-employment by 8.5 percent. Once again, this is consistent with the previous findings. Actually, our coefficient estimate on father's self-employment indicator is virtually identical to Hout and Rosen's (2000) estimate. Furthermore, the size of the family contributes significantly to the self-employment probability. Even though not reported in Table 3, the family income coefficients are positive and increase monotonically across the income ranges, but they are not statistically significant. Hence, we cannot draw firm conclusion with respect to financial wealth of the family.

Another important concern regarding the impact of ability measures is that schooling environment affects the formation of ability and it is conceivable that schools have a role in the labor market decision or occupational choice. To investigate this, the fifth column of Table 3 adds a lengthy vector of school

characteristics to the probit specification. Doing so does not reduce the estimated effects of cognitive and noncognitive abilities.

In order to understand to what extent the association between ability and self-employment is attributable to educational attainment, we incorporate the educational controls in the last column of Table 3. Conditioning on educational attainment gives the ability coefficients a *direct* effect interpretation (excluding the effect that works through the educational attainment). The impact of noncognitive ability is essentially unchanged. The negative marginal effect of test scores, on the other hand, falls by around 18 percent (from -0.027 to -0.022) suggesting that only less than one-fifth of cognitive ability works through educational attainment.

Taken altogether, our probit estimates provide three main insights. First, twelfth grade cognitive and noncognitive abilities are two important determinants of self-employment. Considering the most extensive specification (column 6 of Table 3), a one-standard deviation increase in noncognitive ability (test scores) is associated with an increase (decrease) of 1.4 (2.2) percent in young men's self-employment probability. Moreover, controlling for educational attainment does not affect the relation between noncognitive ability and self-employment, while it accounts for less than one-fifth of the overall correlation between test scores and self-employment. Given that the predicted probability of self-employment at the sample means is 5.5 percent, the effects of ability measures are substantial. The interpretation of noncognitive ability is straightforward, i.e., those with higher esteem are more likely to be self-employed. Cognitive ability, on the other hand, requires some explanation. The general argument is that cognitive ability, as measured by test scores, represents the basic intelligence or skills ("g" theory of Herrnstein and Murray 1994). Individuals try to sell these skills to firms, which are then used by firms to produce output. Those who possess low levels of cognitive ability may experience limited opportunities (lower demand by the firms) in the wage/salary sector and thus, they may be compelled to self-employment. Second, the stability of noncognitive measure to the inclusion of cognitive ability suggests that these two, at least in the self-employment context, have distinct impacts. This finding provides additional evidence to a growing body

of research, which indicates that a unidimensional vision of ability is a faulty one (see, e.g., Carneiro and Heckman 2003 and Segal 2006). Third, we find that having a self-employed father, being black and family size significantly affects young men's self-employment probability.

3.2 The Effects of Eighth Grade Ability Measures on Self-Employment

Past research analyzing the role of ability variables, on say labor market outcomes, emphasizes the malleable nature of noncognitive abilities (see, e.g., Carneiro et al. 2006, Cunha et al. 2006 and Segal 2006). While cognitive ability is believed to be unchangeable after early childhood, noncognitive abilities are more open to changes and can be altered at a relatively late age. The panel structure of the NELS data allows us to test these hypotheses in the context of self-employment. To this purpose, we replace the twelfth grade cognitive and noncognitive measures with their eighth grade counterparts and reestimate columns 1-6 of Table 3. The results are reported in Table 4.[8]

Similar to Table 3, the first column of Table 4 presents the result for noncognitive ability. The coefficient is negative and not different from zero. The second column adds eighth grade composite test score, which yields a negative and statistically significant value. The remaining columns incorporate demographic variables, eighth grade family and school characteristics and educational attainment, respectively to the probit model.[9] In the most extensive specification (column 6), the noncognitive ability continues to be statistically insignificant and almost zero, whereas the coefficient on test score is precisely estimated and large in magnitude. Specifically, a one-standard deviation increase in eighth grade test score decreases the young men's probability of self-employment by 1.6 percentage. Note that this effect is similar to that of twelfth grade, which indicates evidence for the invariant and persistence structure of cognitive ability. In other words, cognitive ability is less likely to be malleable during adolescence. This

[8] From the full sample, around 2.6% of the respondents' have missing observations on eighth grade ability questionnaires. Dropping those lead to a sample of 2009 individuals for the eighth grade ability estimations.

[9] Some of the questionnaires that were asked to twelfth grade school administrators were not asked in the base year. Therefore, there are slight differences in the set of schooling controls. Specifically, we include the following eighth grade schooling variables to our specifications: percentage of students from single parent homes, percentage of students in Limited English Proficiency (LEP) classes, average daily attendance rate, number of full-time teachers and percentage of students in job training.

is consistent with the argument that cognitive ability is fairly well set after the first decade of life.

In contrast to test scores, comparing Table 3 and 4, we do not observe any persistent effect of noncognitive ability on self-employment probability. However, it would be premature to conclude that noncognitive ability is more malleable without taking into account the self-rated structure of these measures. It is plausible that attenuation bias due to measurement error is much more severe in eighth grade, which then consistently leads to lower values for noncognitive ability in Table 4. To check this, we quantify the size of the measurement error by calculating the reliability ratios (the average inter-item correlation), often known as Cronbach's alpha reliabilities, among the questionnaire items that constitute the noncognitive measures. The estimated reliability ratios are 0.74 and 0.80 for eighth and twelfth grade noncognitive abilities, respectively. Indeed, the internal consistency of the measure is lower for the eighth grade. To see the extent of attenuation bias, we utilize "error-in-variable" linear probability models and adjust for noncognitive ability by imposing the reliability ratios in estimations (assuming no serial correlation among the measurement errors of the questionnaire items).[10]

Specifications (1)-(6) of Table 5 presents the linear probability models under the assumption of no measurement error (i.e., reliability ratio is one), while specifications (7)-(12) adjust for the measurement error in noncognitive ability variable. Table 6 is defined analogously for the twelfth grade. Comparing

[10] The idea of the "error in variables" regression model is as follows. Let $NC_1.....NC_k$ be the observed scores on k questionnaire items, all designed to measure the same, but unobserved trait NC, where NC is noncognitive ability in this paper. Consider

$$NC_m = NC + \epsilon_m, \quad m = 1.....k$$

where $\epsilon_m \perp \epsilon_l$ for any $m, l \in \{1.....k\}$, $\epsilon_m \perp NC$ and $\sigma^2_{\epsilon_m} = \sigma^2_\epsilon$ for all m. The reliability ratio of NC is equal to

$$\frac{\sigma^2_{NC}}{\sigma^2_{NC_m}} = \frac{\sigma^2_{NC}}{\sigma^2_{NC} + \sigma^2_\epsilon}$$

which is identical to the correlation between any two scores

$$\rho_{ml} = \frac{\sigma^2_{NC}}{\sigma^2_{NC} + \sigma^2_\epsilon} = \rho$$

The reliability ratio of the average $\overline{NC} = (NC_1 + ... + NC_k)/k$ is defined by

$$\frac{\sigma^2_{NC}}{\sigma^2_{\overline{NC}_m}} = \frac{\sigma^2_{NC}}{\sigma^2_{NC} + \sigma^2_\epsilon/k} = \frac{k\rho}{1 + (k-1)\rho}$$

which is an increasing function of the number of questionnaire items k. Once we estimate ρ, we also obtain an estimate for the average reliability ratio. Since the estimate of NC is attenuated by an amount equal to the average reliability ratio, we can use OLS to obtain a measurement error corrected estimate of NC. See Mueller and Plug (2006) for a similar approach to correct the measurement error inherent in noncognitive ability.

specifications (1)-(6) to (7)-(12) in Table 5, the estimated effects of eighth grade noncognitive ability remains qualitatively and quantitatively identical even after correcting for the measurement error. The twelfth grade noncognitive ability coefficients in specifications (7)-(12) of Table 6, on the other hand, are precisely estimated and are all consistently larger than those in (1)-(6). Furthermore, test score is a significant predictor of self-employment in all linear probability specifications of Table 5 and 6.

As it is implied by the reliability ratios, there is evidence for measurement error in noncognitive ability variables. However, corollary evidence for economically meaningful attenuation bias exists for only twelfth grade estimates. Correcting for measurement error does not alter the small and insignificant coefficients of eighth grade measure, which supports the argument that noncognitive ability is more open to changes during adolescence and thus, is more malleable.

3.3 Additional Estimates

We estimate several additional probit regressions to examine the sensitivity of the main results. First, we test the potential interacting effects between cognitive and noncognitive ability. In none of the specifications, the interaction terms are statistically significant. Next, we drop all missing observations from the effective sample and reestimate all the specifications. The coefficient estimates are virtually identical to those presented in the Tables.

Finally, it may be the case that the estimate on father's self-employment is an artifact of sons simply entering (or taken into) the family business, rather than reflecting the transmission of nonfinancial assets. To check this, we use the NELS question pertaining to the source of acquiring the current job. The survey asked individual, "How did you find your most recent/current job?" The responses were divided into six categories as (i) Family, Relatives and Friends, (ii) Personal Initiative, (iii) Classified Ads, (iv) Employment Agency, (v) Company Transfer and (vi) Others. Dropping the first category from the effective sample largely isolates the intergenerational correlation. Doing so remains the father's self-employment coefficient practically unchanged in all the estimations. For instance, the estimate of father's

self-employment in column 6 of Table 3 is 0.620 (0.164) when we exclude the first category. This indicates the importance of intergenerational correlation.[11]

4 Conclusion

Utilizing a novel data set, this paper examines the role of pre-labor market cognitive and noncognitive abilities, as well as other determinants, on young men's self-employment probability. The results offer three main conclusions. First, we find that twelfth grade noncognitive and cognitive abilities are important predictors of self-employment. The effects of these two run in opposite directions and have distinct impacts on the self-employment probability. Second, the estimates of eighth and twelfth grade cognitive ability are very similar in magnitude. In contrast, eighth grade noncognitive ability estimates do not yield any effect even after correcting for the measurement error. This suggests that cognitive and noncognitive abilities do differ in their malleability with noncognitive ability being more malleable during adolescence. Furthermore, due to presence of attenuation bias, we can treat our noncognitive probit estimates of Table 3 as lower bounds. Third, we find that having a self-employed father, being black and family size affects young men's self-employment probability. In addition, father's self-employment indicator is not simply capturing the family business following rate, but instead underscores the importance of transmission of nonfinancial assets (i.e., work experience, informal business) from fathers to sons.

In recent years, a body of empirical research documenting the importance of noncognitive ability for wages, schooling and a variety of behavioral outcomes has emerged. These findings in conjunction with our results suggest important policy implications. The educational policy interventions during adolescence aiming at noncognitive rather than the cognitive ability may be more effective to combat many adverse labor market outcomes and behaviors given the malleable nature of the former. In addition, an expansion in the number and scope of services provided by entrepreneurial programs targeted toward individuals with higher noncognitive abilities may be more successful. The one caveat to the results presented in this

[11] All additional estimates are available upon request.

paper is that they may not be generalizable to older cohorts. Future work may shed light to this issue with different data sets.

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Table 1: Sample Statistics of Cognitive and Noncognitive Abilities by Self-Employment

	Self-Employed	Wage/Salary Worker
	Mean (Standard Deviation)	Mean (Standard Deviation)
12th Grade Noncognitive Ability	0.145 (0.663)	0.023 (0.586)
12th Grade Composite Test Score	49.001 (9.267)	52.039 (9.622)
Sample Size	159	1904

NOTES: NELS sampling weights used.

Table 2: Self-Employment Rates Based on Various Characteristics

	Self-Employment Rates (Standard Deviation)
Father's Employment	
Self-Employed	0.153 (0.361)
Not Self-Employed	0.059 (0.237)
Race	
White	0.077 (0.266)
Black	0.032 (0.178)
Others	0.069 (0.255)
Family Income	
0-$9,999	0.085 (0.280)
$10,000-$34,999	0.086 (0.281)
$35,000-$74,999	0.064 (0.245)
$75,000 or more	0.074 (0.262)

NOTES: NELS sampling weights used.

Table 3: The Effects of 12th Grade Cognitive and Noncognitive Abilities on Self-Employment Probability

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
12th Grade Noncognitive Ability	0.099**	0.146***	0.144***	0.124***	0.122***	0.128***
	(0.041)	(0.042)	(0.042)	(0.045)	(0.046)	(0.046)
	[0.013]	[0.019]	[0.018]	[0.015]	[0.013]	[0.014]
12th Grade Composite Test Score	…..	-0.194***	-0.213***	-0.250***	-0.244***	-0.204***
		(0.043)	(0.045)	(0.052)	(0.053)	(0.057)
		[-0.026]	[-0.027]	[-0.030]	[-0.027]	[-0.022]
Black	…..	…..	-0.496**	0.503**	-0.534**	-0.507*
			(0.243)	(0.259)	(0.272)	(0.271)
			[-0.046]	[-0.042]	[-0.041]	[-0.039]
Father Self-Employed	…..	…..	…..	0.536***	0.517***	0.515***
				(0.105)	(0.110)	(0.111)
				[0.085]	[0.077]	[0.076]
Family Size	…..	…..	…..	0.093***	0.097***	0.096***
				(0.034)	(0.035)	(0.120)
				[0.011]	[0.011]	[0.010]
Some College	…..	…..	…..	…..	…..	-0.096
						(0.120)
						[-0.010]
College/Advanced Degree	…..	…..	…..	…..	…..	-0.320**
						(0.158)
						[-0.033]
Predicted Prob. at the Sample Means	0.073	0.070	0.067	0.060	0.056	0.055
Other Controls:						
Demographic	No	No	Yes	Yes	Yes	Yes
Family	No	No	No	Yes	Yes	Yes
Schooling	No	No	No	No	Yes	Yes
Education	No	No	No	No	No	Yes

NOTES: NELS sampling weights used. Marginal effects, evaluated at the sample means, are shown in brackets. See text for definition of the variables.

* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4: The Effects of 8th Grade Cognitive and Noncognitive Abilities on Self-Employment Probability

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
8th Grade Noncognitive Ability	-0.057	-0.023	-0.023	-0.017	-0.022	-0.015
	(0.042)	(0.044)	(0.044)	(0.047)	(0.048)	(0.048)
	[-0.008]	[-0.003]	[-0.003]	[-0.002]	[-0.002]	[-0.001]
8th Grade Composite Test Score	…..	-0.134***	-0.157***	-0.196***	-0.184***	-0.148***
		(0.045)	(0.047)	(0.053)	(0.055)	(0.057)
		[-0.018]	[-0.021]	[-0.023]	[-0.020]	[-0.016]
Predicted Prob. at the Sample Means	0.075	0.073	0.070	0.059	0.054	0.053
Other Controls:						
Demographic	No	No	Yes	Yes	Yes	Yes
Family	No	No	No	Yes	Yes	Yes
Schooling	No	No	No	No	Yes	Yes
Education	No	No	No	No	No	Yes

NOTES: NELS sampling weights used. Marginal effects, evaluated at the sample means, are shown in brackets. Sample size is 2009; 157 self-employed and 1852. wage/salary workers.
See text for definition of the variables.
* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 5: The Effects of Cognitive and Measurement Error Corrected 8th Grade Noncognitive Abilities on Self-Employment

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
8th Grade Noncognitive Ability	-0.007	-0.002	-0.002	-0.000	-0.002	-0.000
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
8th Grade Composite Test Score	…..	-0.018***	-0.021***	-0.023***	-0.022***	-0.017**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
	(7)	(8)	(9)	(10)	(11)	(12)
8th Grade Noncognitive Ability	-0.010	-0.003	-0.002	-0.001	-0.003	-0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
8th Grade Composite Test Score	…..	-0.018***	-0.020***	-0.023***	-0.022***	-0.017**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Other Controls:						
Demographic	No	No	Yes	Yes	Yes	Yes
Family	No	No	No	Yes	Yes	Yes
Schooling	No	No	No	No	Yes	Yes
Education	No	No	No	No	No	Yes

NOTES: NELS sampling weights used. Linear probability model estimates are presented. Reliability ratios are assumed to be one for specifications (1)-(6), while reliability ratios imposed in specifications (7)-(12) is 0.737. Sample size is 2009; 157 self-employed and 1852. See text for definition of the variables.

* significant at 10%, ** significant at 5%, *** significant at 1%.

Table 6: The Effects of Cognitive and Measurement Error Corrected 12th Grade Noncognitive Abilities on Self-Employment

	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
12th Grade Self-Esteem	0.014**	0.020***	0.020***	0.017***	0.017***	0.018***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
12th Grade Composite Test Score	…..	-0.026***	-0.028***	-0.032***	-0.030***	-0.024***
		(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
	(7)	(8)	(9)	(10)	(11)	(12)
12th Grade Self-Esteem	0.018**	0.026***	0.025***	0.022***	0.022***	0.024***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
12th Grade Composite Test Score	…..	-0.028***	-0.030***	-0.033***	-0.031***	-0.025***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Other Controls:						
Demographic	No	No	Yes	Yes	Yes	Yes
Family	No	No	No	Yes	Yes	Yes
Schooling	No	No	No	No	Yes	Yes
Education	No	No	No	No	No	Yes

NOTES: NELS sampling weights used. Linear probability model estimates are presented. Reliability ratios are assumed to be one for specifications (1)-(6), while reliability ratios imposed in specifications (7)-(12) is 0.804. See text for definition of the variables.

* significant at 10%, ** significant at 5%, *** significant at 1%.

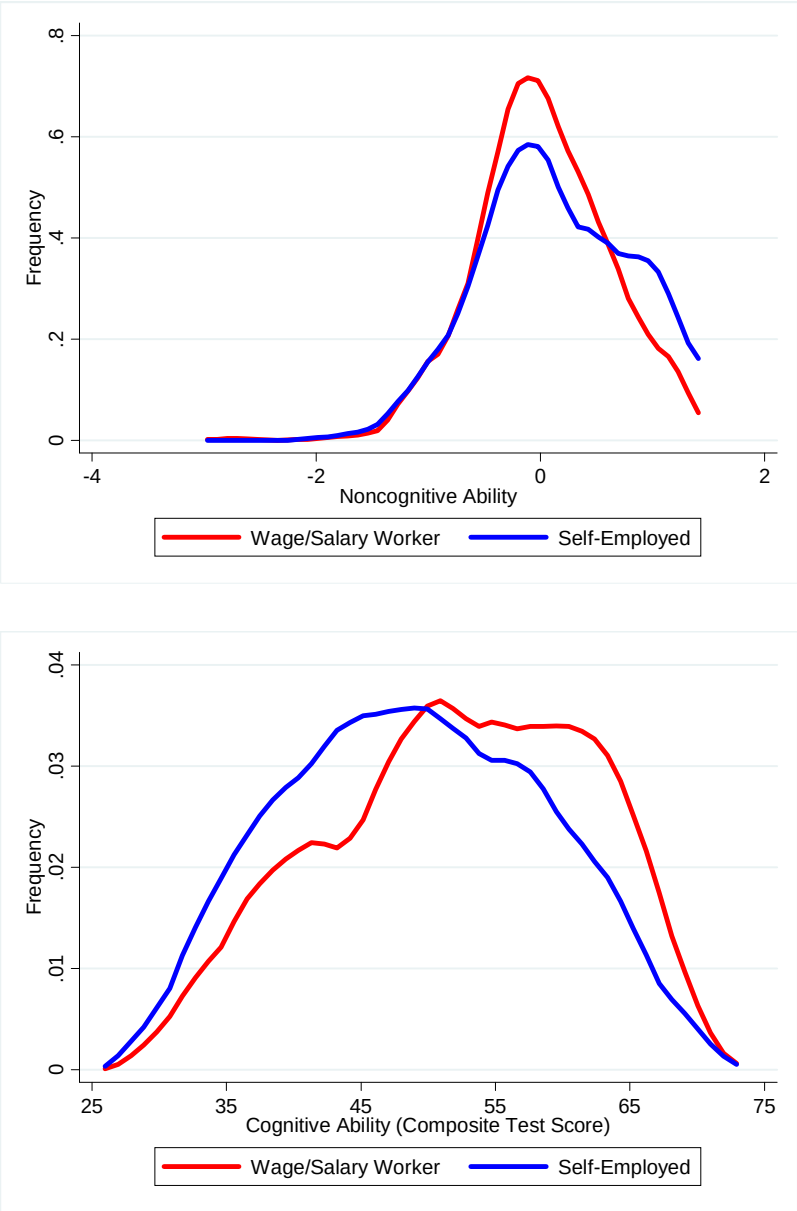

Figure 1: Kernel Densities of Noncognitive and Cognitive Abilities by Self-Employment