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The effect of noncognitive ability on the earnings of young men: A distributional analysis with measurement error correction

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HIGHLIGHTS

- We examine the role of cognitive/noncognitive abilities on young men's earnings.
- We focus on the effects of ability at the mean and the distributional level.
- We correct for measurement error inherent in noncognitive ability.
- Effects of noncognitive ability exhibit significant heterogeneity.
- Noncognitive ability is at least as important as cognitive ability for earnings.

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ABSTRACT

Utilizing the National Educational Longitudinal Study data, this paper examines the role of pre-market cognitive and noncognitive ability, as measured in tenth grade, on the earnings of young men. In addition to the conditional mean, we estimate the impact over the earnings distribution using recently developed (instrumental) quantile regression method. Our results show that noncognitive ability is an important determinant of earnings, but the effects are not uniform across the distribution. We find noncognitive ability to be the most important at lower quantiles. The impact of cognitive ability, on the other hand, shows a more homogenous pattern. Several robustness checks support these results.

1. Introduction

Earnings dispersion among individuals for a given age, education level, gender and race has increased substantially in the United States over the past few decades (see, for example, Autor et al., 2008; Katz and Murphy, 1992). Many economists attribute the increase in within-group as well as across-group inequality to the growing importance of productive skills in the labor market (Juhn et al., 1993). Researchers have traditionally focused on cognitive ability, measured by knowledge and aptitude tests, as the primary example of productive skills. However, the view that treats cognitive ability as the sole or main aspect of productive skills may be misleading. For instance, Green et al. (1998) report the results from the British Employers' Manpower and Skills Practices Survey in which roughly one-third of the establishments respond positively to skill shortage inquiry. They identify poor motivation and attitude, rather than the lack of cognitive ability, as the main reason for their recruitment problems. Similarly, in a 1998 survey conducted by the U.S. Bureau of the Census, 1998, in collaboration with the Department of Education, employers rank noncognitive ability far more important than years of schooling or academic performance in the hiring process. Moreover, the sociology and psychology literatures have historically given noncognitive ability and cognitive ability equally predictive power for many labor market and social outcomes (see, for

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example, McClelland, 1965; Barrick and Mount, 1991; Hogan and Holland, 2003). Given this evidence, it is surprising to see that economists have turned their attention to the effects of noncognitive traits only in the last decade or so.

This long lasting neglect in economics is likely to stem from the lack of any available/reliable measures in the survey data sets up until recently, and from challenges in measuring noncognitive ability. Unlike cognitive ability, there is not a dominant "g" factor to summarize noncognitive ability reflecting its multidimensional nature. It is possible to lump several different personal traits into the category of noncognitive ability. That being said, since the pioneering paper by Goldsmith et al. (1997), there has been a growing economics literature examining the role of noncognitive ability and its importance relative to cognitive ability in predicting labor market outcomes (see for example, Bowles et al., 2001; Coleman and DeLeire, 2003; Mueller and Plug, 2006; Heckman et al., 2006; Fortin, 2008; Weiss, 2010; Segal, 2013, and Lindqvist and Vestman, 2011). In general, these studies find positive and significant effects of various measures of noncognitive ability on labor market outcomes.[2]

Recent studies analyzing the effects of ability on, say, earnings have primarily focused on a single measure of central tendency, the conditional mean.[3] While the mean impact is an interesting and important measure, it may not be informative about the inequality-decreasing (or increasing) effects of ability if the effects are heterogeneous along the earnings distribution. For instance, if the effects of noncognitive ability are more pronounced in the lower tail of the conditional earnings distribution than they are in the upper tail, an equal improvement in noncognitive ability over the entire distribution would lead to a decrease in inequality. Under this scenario, focusing on only the average impact masks some important policy relevant information. Moreover, understanding the relative effects of noncognitive and cognitive abilities over the earnings distribution is particularly essential for policy prescriptions.

Another shortcoming of the existing literature is that the majority of the studies analyzing the role of noncognitive ability overlook the self-rated (subjective) structure of these measures.[4] This structure, however, may lead to substantial measurement error and may contaminate the estimates of noncognitive ability and related variables on any outcome. As indicated in a survey by Borghans et al. (2008), accounting for measurement error in noncognitive ability is empirically important.

This paper attempts to fill these gaps first by estimating a traditional quantile regression and examining the relative effects of cognitive and noncognitive abilities along the earnings distribution.[5] We, then, take into account the (potential) measurement error in noncognitive ability by using the former measures of noncognitive ability as instruments for the latter and estimate a recently developed instrumental quantile regression, which was introduced in Chernozhukov and Hansen (2006, 2008). Recently, Montes-Rojas (2011) has shown that the instrumental quantile regression approach is applicable to measurement error correction over the distribution under certain set of assumptions.[6] To the best of our knowledge, this paper is the first to examine the relative effects of ability measures on earnings in a distributional setting using U.S. data.

As noted, it is also challenging to summarize noncognitive ability as there are several different personal traits that can be classified under the category of noncognitive ability. In this paper, we define a measure consisting of two different dimensions of noncognitive ability: self-esteem and locus of control (see, for example, Heckman et al., 2006 and Fortin, 2008 for similar descriptions of noncognitive ability).

Self-esteem is regarded as personal judgment of self-worth and capability, while locus of control describes the extent of which individuals believe that they can control the outcomes affecting them.

Utilizing the National Education Longitudinal Survey (NELS), which is an excellent source of data providing detailed longitudinal information not only on demographics, family and schooling characteristics, but also on a variety of pre-market measures of ability, we find that tenth grade noncognitive ability is an important determinant of earnings. The effect, however, is not homogeneous; those at the lower quantiles benefit the most from higher levels of noncognitive ability. Moreover, our results indicate substantial measurement error in noncognitive ability and correcting for it via instrumental variables more than doubles the mean and the distributional effects. The estimates of cognitive ability measured by tenth grade math test scores, on the other hand, exhibit a more homogeneous impact over the earnings distribution, and the attenuation bias does not seem to be a serious problem for test scores. Several robustness checks support our main findings. While there is some evidence of sample selection bias in the estimates of cognitive ability, this does not seem to alter our conclusions. Taken together, our results provide tentative evidence in support of implementing policies that focus on boosting noncognitive ability for economic success and to reduce earnings inequality.

2. Empirical methodology

2.1. Mean approach

To initially examine the data, we utilize a standard regression approach and thereby focus on the conditional mean. Specifically, we estimate a linear regression model of the form

$$w = \alpha N + \delta C + X'\beta + \varepsilon \tag{1}$$

where w is the (log) weekly earnings, N and C are the noncognitive (measured with error) and cognitive abilities, respectively, X is the vector of individual, family, and schooling characteristics, and ε is the error term. We estimate Eq. (1) by ordinary least squares (OLS) and instrumental variables (IV), where the latter is employed to take into account the potential attenuation bias in the effect of noncognitive ability.

2.2. Distributional approach

2.2.1. Standard quantile regression

Focusing on the mean may mask meaningful and policy relevant heterogeneity across the distribution. To examine such heterogeneity, we first utilize the standard quantile regression (QR) approach. The

[2] Some of these studies also examine the relationship between noncognitive ability and schooling (Bowles et al., 2001; Segal, 2013) or behavioral outcomes (Heckman et al., 2006; Segal, 2013). Furthermore, even though it is not the primary focus of their papers, Persico et al. (2004) and Kuhn and Weinberger (2005) find positive associations between personality traits and wages/earnings.

[3] A notable exception is Lindqvist and Vestman (2011) who examine the distributional impacts of cognitive and noncognitive abilities for Swedish men using a simple unconditional quantile regression.

[4] Notable exceptions are Heckman et al. (2006), Mueller and Plug (2006), Heineck (2011) and Lindqvist and Vestman (2011).

[5] Quantile regression method is introduced by Koenker and Bassett (1978) as a possibly efficient alternative to OLS in linear models. Among many others, Buchinsky (1994, 1998) and Powell (1986) extend the use of quantile regression to obtain information about the effects of exogenous explanatory variables on the dependent variable at different parts of the distribution.

[6] A few other approaches to endogeneity correction in a quantile setting are also available. For instance, Eren and Ozbeklik (2013) utilize the unconditional quantile treatment effect model developed in Frölich and Melly (2013). Specifically, the authors examine the effectiveness of a training program where the parameter of interest is a treatment variable (Job Corps participation) and the source of endogeneity is the existence of noncompliers. The unconditional treatment effect model is not appropriate in this current context as the parameter of interest is a mismeasured continuous variable.