Non-Cognitive Skills and Labor Market Success

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Abstract

This literature review summarizes the current state of knowledge in economics with respect to non-cognitive skills and their impact in labor and other markets. Without going into theoretical modelling details, I aim to provide an overview of the influential and new papers in the field and to identify some of the primary challenges in obtaining precise estimates for the effects of personality traits. Lastly, I discuss some potential avenues for future research that can help develop this field further.

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1 Introduction

“It takes something more than intelligence to act intelligently”

- Fyodor Dostoyevsky

Economists have long been interested in identifying the factors that can explain labor market success. Ever since Becker’s (1964) work on human capital development, the vast majority of research aimed at explaining success has concentrated on the more obvious and easily measurable ability traits that are referred to as cognitive skills. The cognitive skill set is an umbrella term for our learning skills – the ability to process information, reason, remember and relate. It has often been defined singularly through the Intelligence Quotient (IQ) score obtained from achievement tests such as the Armed Forces Qualifying Test (AFQT) or the Wechsler Adult Intelligence Scale (WAIS) and Wechsler Intelligence Scale for Children (WISC) tests (Borghans et. al., 2008).

While these IQ measures are quite robust and have been used with reasonable success in both economics and psychology, they are able to explain only a small fraction (less than one fifth) of the variance of passing an exam, and even less so for wages earned in the labor market (Heckman and Kautz, 2012). Interestingly, the IQ measure has its roots in the psychometric tradition and was first used by Spearman (1904) to state that one latent ability measure, \( g \) (general ability), could explain a large degree of correlation in an individual’s scores in different achievement and ability tests (Heckman, 1995). While there has not been any general consensus on using a single factor loading such as \( g \) in the psychology field, economists have for long employed IQ as a standard measure for ability.
However, in the past two decades, the tide has been slowly turning towards more multi-dimensional measures of ability, beginning with the seminal work of Heckman and Rubenstein (2001) in which the authors identify the importance of non-cognitive or “soft” skills in determining the outcomes of the General Educational Development (GED) testing program in the United States. Heckman and Rubenstein (2001) find that after controlling for measured ability, GED recipients perform worse than other high school drop-outs. The authors claim that the GED recipients must be lacking in some important factor which they term non-cognitive skills.

Non-cognitive skills are defined as the personality traits, motivations and preferences that are valued in the labor market and other areas of life such as in school or in marriage markets. Measures of these skills are meant to capture characteristics like leadership ability, working well in teams, determination, openness and so on. In the psychology literature, Goldberg (1981) introduced the BIG FIVE (Conscientiousness, Openness, Emotional stability, Extraversion and Agreeableness) as a collection of the most universal traits. McAdams and Pals (2006) expand on this work and broadly define personality as an individual’s variation on the general evolutionary design which is expressed as a developing pattern of traits working to adapt to all of life experiences set in a cultural environment. The authors state that while lists such as a Big Five may not be perfect, they emphasize the need to understand how personality traits work alongside cognitive abilities and in relation to the environmental variables.

In the economics field, many researchers are worried about how traits are measured in psychological studies. Heckman and Kautz (2012) state that many such studies do not standardize for the incentives involved in performing a task or do not control for other traits that are simultaneously active. Despite
some concerns with exactly what these measures capture, there is growing evidence that personality traits have meaningful economic predictions.

Heckman et. al. (2010) use longitudinal data on cognitive and personality traits to show that the Perry Preschool program significantly enhanced outcomes for adults along multiple dimensions including education, earnings and marriage. The studies by Kuhn and Weinberger (2005) and Lundin, Skans and Zetterberg (2016) show how leadership ability translates into higher wage premiums. Mueller and Plug (2006) find that emotional stability increases male earnings, while conscientiousness and openness increase female earnings. Heineck (2011) finds wage penalties for neuroticism (the opposite of emotional stability) and agreeableness for workers in the United Kingdom. Nyhus and Pons (2005) find that emotional stability is positively related to the earnings of both men and women in Netherlands, while agreeableness is associated with lower wages for women. Lundberg (2012) shows that for cohorts born between 1960 and 1970 in Germany, two personality traits, openness to experience and conscientiousness, have significant effects on the propensity for individuals to marry. Lindqvist and Vestman (2011) use data on Swedish military enlistment to show that while cognitive ability is more important for success in the labor market, non-cognitive ability is significantly more important for avoiding failure.

In addition to the growing evidence in the literature, employers surveyed by the National Association of Colleges and Employers (NACE) in 2015 listed the ability to work in a team as the single most desirable attribute of new graduates, ahead of cognitive abilities such as problem solving and quantitative skills. It is now abundantly clear that while cognitive skills may have once been the single most important trait for labor market success, non-cognitive skills are now rapidly ascending to prominence as well.
The remainder of this paper is organized as follows. Section 2 highlights the difficulties in measuring personality traits and discusses their predictive validity. Section 3 outlines the recent research on complementarities between cognitive and non-cognitive skills. Section 4 presents two studies on the impact of leadership abilities on labor market outcomes. Section 5 looks at marriage markets and discusses the relationship between gender and non-cognitive skills. Section 6 concludes and discusses directions for future research.

2 Abilities: Personality traits and cognitive skills

2.1 Measurement issues

Measuring specific traits is inherently difficult because the traits are often intertwined with one another. Figure 1 below is a reproduced from Heckman and Kautz (2012). It shows that even when using broad measures of abilities, there is substantial overlap in the underlying traits that are able to explain the variation of outcomes. The broad measures used in this case are IQ and two measures of personality, the Big Five and Grit. Grit is a measure of persistence and passion for long term objectives and was first used in a study by Duckworth et. al. (2007) which shows that this measure of personality has stronger predictive validity than measures such as IQ and conscientiousness. Heckman and Kautz (2012) state that results such as those in Figure 1 highlight the problem in claims that standardized test scores are some absolute measure of cognitive ability. Clearly, the personality traits are bundled with cognitive ability making the measurement of traits very difficult.
Moreover, there is a large body of evidence which shows that there are significant identification problems when measuring a given trait. First of all, traits are usually measured as performance on tasks and this performance is affected by the incentives involved. For example, a study by Clingman and Fowler (1976) showed that rewarding candy as an incentive can increase the IQ scores of low scoring students.

Another potential issue is the stability of traits. Whereas IQ is thought to have become fairly stable by mid-childhood, personality measures like the Big Five may take far longer to stabilize. Even though there is a substantial body of evidence suggesting that stable traits exist, much less is known about how exactly they evolve over the life cycle. This causes significant difficulties in establishing causation using simple linear relationship because in many cases the effect of a trait on an outcome is not even monotonic and can change according to the circumstances and the existence of other traits that it is bundled with.
2.2 Predictive validity

The predictive validity of personality traits is now fairly well established as highlighted by the findings of the wide array of studies mentioned in the introduction. Moreover, to correct for measurement error, poor proxies and reverse causality, a study by Heckman, Stixrud, and Urzua (2006) employs an identification strategy that accounts for the simultaneity of cognitive and non-cognitive skills and shows that the selected personality traits can predict schooling, occupational choice, wages and health behavior. Their structural model builds on a methodological framework in which cognitive and non-cognitive skills are modeled as latent factors which are estimated as component mixtures of normals. In this paper, Heckman, Stixrud, Urzua (2006) assume independence between cognitive and non-cognitive skills, an assumption which is relaxed in Cunha and Heckman (2008). The non-cognitive skill factor they derive is a very strong predictor of wages. In this paper, the authors also highlight the importance of psychic costs, which is related to personality traits, in explaining why many students drop out despite the economic benefits of education.

A study by Borghans et al. (2008) also looks at the predictive validities of IQ as well as the Big Five dimensions of personality traits. Figure 2 below is reproduced from their paper. Conscientiousness is the best predictor of longevity and also performs better than IQ at predicting leadership. Despite this reasonable performance of the personality traits, there may be better news to come. Borghans et al. (2008) state that there are reasons to believe that the predictive power of personality traits is likely to have been underestimated.

First, as mentioned earlier, the benefits of personality traits are not always monotonically increasing in their outcomes and this non-linear relationship is not well captured by correlation coefficients. 

7
Furthermore, interaction effects have not been captured either. A study by Judge and Hurst (2007) using the National Longitudinal Study of Youth (NLSY79) data finds that high socioeconomic status, academic performance and years of schooling in young adults predict higher earnings only for those with above-average core self-evaluations (a low dimensional personality factor). The authors speculate that high core self-evaluations may lead to several advantageous behaviors, including seeking out challenging jobs, persisting with difficult tasks, and maintaining motivation.
3 Complementarity of cognitive and non-cognitive skills

Weinberger (2014) investigates the complementarity between cognitive and social skills for two cohorts of high school seniors that are twenty years apart by using measures taken before their labor market entry. The author tackles three important questions: do wage premiums for math-related (cognitive) skills persist over the long-term (a twenty-year period), is there a growing wage premium for social skills and most importantly, how do these two skill sets interact? Weinberger (2014) finds that higher levels of each ability lead to higher earnings over the entire time period for which data is available. Moreover, these two abilities complement each other in such a way that the strongest earnings premium is observed for those who have higher levels of both cognitive and social skills. Figure 3 shows that this finding is corroborated by evidence from Census and Current Population Survey (CPS) data matched with Dictionary of Occupational Titles (DOT). Over the last three decades, not only have there been significantly more occupations requiring both cognitive and social skills but the wage premiums to such occupations (requiring both skill sets) have also grown.

Figure 3: Growth in Earnings Premium by Social and Cognitive Skill Levels
Building on the initial insights of Heckman (1995), Deming (2015) also attempts to understand the complementarities between cognitive and non-cognitive skills. His paper investigates why returns to cognitive skills appear to have declined in the last decade despite the presence of routine-biased technological change (RBTC). While technological change initially substituted low-skilled jobs through the automation of repetitive tasks, increasingly, computer technology is substituting for labor much higher up in the skill distribution. A closer look at the US economy however, reveals a very interesting pattern - the slow growth in high skilled jobs is almost exclusively concentrated in occupations which require little social interaction. Figure 4 is reproduced from their paper and shows this trend.

**Figure 4: Trend in Cognitive Tasks, 1980 - 2012 by Social Skill Intensity of Occupation**

In fact, all other cognitive high-skilled jobs have seen their shares grow in the US economy and the fastest growth is seen in those jobs that also require significant social interaction. Deming (2015) goes on show that this pattern has occurred throughout the wage distribution.
Employing the NLSY79 dataset, he finds a growing complementarity between cognitive skills and social skills which is consistent with the findings of Weinberger (2014). Additionally, Deming (2015) finds that employment has declined in occupations with high cognitive (math) but low social skill requirements. These two observations suggest that while cognitive skills remain necessary, increasingly they are not on their own sufficient to obtain high-paying jobs. Figure 5 shows this trend.

![Figure 5: Returns to Skill Complementarity Over Time - Wage Regression in the NLSY Controlling for Worker, Occupation and Industry Fixed Effects](image)

Deming (2015) also develops a model in which workers exploit their comparative advantage by trading tasks. In this model, he treats social skills as reducing worker-specific coordination costs. According to the author, this modelling technique enables skill complementarities to emerge naturally. Because the value of lowering the cost of trade increases in task productivity- labor market returns to social skills increase with increases in cognitive skill requirements.
So far, this literature review has focused on the latest research work with respect to the general category of social skills. The following section turns towards a more specific non-cognitive ability that is both highly valued by employers and has been identified cleanly (without acting as a proxy for some other personality characteristic) by economic researchers: leadership.

4 Leadership

4.1 Leadership skills and wages

Kuhn and Weinberger (2005) use three data sets that are representative of US high school students: Project TALENT (1960), the National Longitudinal Study of the Class of 1972 (NLS72), and the sophomore cohort of High School and Beyond (HSB 1982 seniors). The authors restrict their data to white males to avoid any confounding effects of race, gender and any changes in the labor market participation decisions of females. Kuhn and Weinberger (2005) find that after controlling for cognitive skills (mathematics test scores) and other covariates such as individual and high school fixed effects, men who occupied leadership positions in high school experience a pure leadership effect of between 4% to 33% higher earnings as adults, about 10 years after high school.

The richness of these data sets enables the authors to claim that the effects they find are not spurious. The leadership measure they define is orthogonal to cognitive skills and its effects are uniformly strong across the board. Furthermore, the results are robust to controls for physical attributes such as beauty and height as well as psychological characteristics such as vigor, maturity and self-confidence. This helps to strengthen the authors’ claim that leadership is not a proxy for some other personality trait.
To counter claims of measurement errors, the authors use tenth grade scores as an instrumental variable for the twelfth grade math scores that measure cognitive ability.

Despite the robust and significant effect of leadership on earnings, one question still remains unanswered – does Kuhn and Weinberger’s (2015) measure of leadership actually capture the ability to lead others? The authors show that their measure does accurately capture leadership because those men who were more likely to occupy positions of leadership in high school are also more likely to occupy managerial occupations as adults. While leadership ability is rewarded in all occupations, its marginal value is considerably greater in managerial occupations as compared to other jobs.

While Kuhn and Weinberger (2015) do not establish causality, their research study does provide an important policy suggestion that other papers find more difficult to claim: leadership ability is a valuable non-cognitive labor market commodity that can be developed in educational institutions by increasing the exposure of students to leadership opportunities.

4.2 Leadership experiences, labor market entry, and early career trajectories

Lundin, Skans and Zetterberg (2016) also study the impact of leadership on labor market outcomes. By applying a regression discontinuity design to a Swedish data of student union elections at three major universities, the authors attempt to determine the effect of being elected into student union councils on labor market careers. The use of a regression discontinuity design enables Lundin et. al. (2016) to study labor market outcome differences between closely ranked winners and losers who are otherwise identical on observables. Students elected to become union members are able to gain important leadership experience during their university life. By matching their election data to
population wide register data on labor market outcomes, the authors are also able to assess the dynamic impact of leadership over time.

The authors find that marginally elected students have a significantly higher propensity (up to 20 percentage points) to make a quick transition into employment but this effect is temporary – other students catch up within a period of two years. Lundin et al. (2016) also find that the elected students are significantly more likely to have above-median paying jobs within three years after the election. Again, this effect disappears in the medium-run. While these results are transitory, there is no significant impact on being employed in jobs or industries where previous elected students have been employed. The authors use this lack of a significant impact to suggest that the benefits of being elected into a student union apply broadly to all segments of the Swedish labor market.

This section focused on the impact of leadership on labor market outcomes. In the next section, I discuss the role of non-cognitive skills in another important marketplace: the marriage market. I also look at the relationship between social skills and gender in the marketplace.

5 Marriage markets and gender concerns

5.1 Personality and marital surplus

In economic models of marriage and divorce, agents make their decisions by comparing the expected and realized surplus to married life with single life. The literature in this field has established that factors such as education and wages can be used to predict age at marriage and the probability of
divorce. However, economists have only recently begun to explore the role of personality traits on these decisions. A research paper by Lundberg (2012) uses data from the German Socio-economic Panel Study (SOEP) to investigate the impact of personality traits on the marriage market outcomes of two cohorts. The author shows how the sources of marital surplus changed substantially between older cohorts born in the years immediately after World War II and younger cohorts born in the 1960s. While the older cohort relied on production based gains in a marriage, the younger cohorts increasingly experience consumption complementarities in their marriages. These changes also effect the sorting of men and women into marriage over the two cohorts.

Lundberg (2012) finds that for younger cohort, two of the Big Five traits, openness to experience and conscientiousness, have significant effects on the probability of marriage. Higher levels of openness decrease the probability of marriage whereas higher levels of conscientiousness increase the probability of marriage for both men and women.

Personality traits also impact the probability of divorce, and not always in reverse to the way they impact marriage probabilities. While openness to experience increases the likelihood of first divorce for both genders in the full sample, conscientiousness is negatively related to the probability of divorce for men but not for women. Moreover, extraversion also increases the probability of divorce for males but has no impact on female divorce propensity in the full sample.

The author states that the findings for the young cohort are consistent with marital surplus model based on consumption complementarities- reflecting the fact that the effects of personality traits are more similar for younger men and women. Lundberg (2012) also finds that for older cohorts, born before 1960, these traits have gender-distinct effects on marriage. This observation is consistent with
a production based model of marital surplus, in which agreeable women, and conscientious and antagonistic men have a higher propensity to marry than others member of the cohort.

5.2 Social skills and gender

One of the most important debates in labor economics has to do with the gender wage gap. Recent decades have seen an increase in women’s education, their participation in the labor force has increased and the gap in wages has narrowed significantly, even reversing in some cases. Autor and Wasserman’s (2013) report on the changing US labor market states that the median male has been on a downward trajectory for over three decades in terms of skills acquisition, employment and real wage levels. Meanwhile, women have been progressing consistently upwards in the labor market. It is of little surprise that this trend overlaps with the routine-biased technological change (RBTC) that has been substituting computer automation for both low-skilled jobs as well as cognitive high-skilled occupations which require little social interaction. Deming (2015) investigates gender biased technological change by looking into gender advantages in non-cognitive social skills. Figure 6 which is reproduced from Deming’s (2015) paper shows that the routine task intensity for females has taken a sharp decline, from about the 57th percentile in 1980 to about the 34th percentile in 2010. In contrast, the task content for males has barely changed over this period. While there has been an increase in non-routine cognitive tasks for females, this change is overshadowed by a much larger increase in the social skills intensity for tasks.
Furthermore, Deming (2015) finds that occupations with higher social skill requirements tend to employ relatively more women today compared to 1980 and the reverse is also true, relatively less women are employed in routine occupations than in 1980.

The available evidence shows that the shift toward social skill-intensive jobs that has taken place in the US economy in the last three decades has been concentrated among females. This is consistent with the existing literature on gender differences in social perceptiveness and the ability to collaborate. Woolley et al. (2010) find evidence of a general collective intelligence “c” factor that explains group performance. While this “c” factor is not highly correlated with an individual’s IQ, it is correlated with the group’s average social sensitivity, the equality in turn-taking, and the proportion of females. Woolley et al. (2010) go on to show that teams with a higher share of females perform better on group tasks, even after controlling for cognitive skills.
6 Conclusion and Future Research Directions

This literature review summarizes the current state of knowledge around non-cognitive skills in economics. While psychologists have been working with personality traits for a long time, economists have only recently begun using these measures in research work. This practice coincides with the increasing availability of personality characteristics along multiple dimensions in large scale surveys. Beginning with the seminal work by Heckman (1995), the literature in this field continues to grow and the evidence that it is producing is helping to generate wide acceptance of the importance of non-cognitive skills in explaining success in the labor market as well as in other parts of life.

Still, many important issues concerning non-cognitive skills remain unsolved. Not least is the difficulty in measuring these personality traits. While some studies such as Heckman, Stixrud, and Urzua (2006) try to develop low dimensional vectors to try and overcome measurement errors and reverse causality issues, others such as Becker et. al. (2012) attempt to determine how key economic preferences towards risk and time are linked to conventional measures of personality used in psychology such as the Big Five by studying their correlation structures. While much work remains to be done in synthesizing the body of empirical knowledge on personality in psychology into economics, significant progress is being made. Kuhn and Weinberger (2014) incorporate a clean measure of leadership skill into wage equations, Heineck and Anger (2010) use a set of personality measures in Mincer-type earnings regressions and to control for interdependence of personality and earnings, they use personality residuals that are free from age effects following the approach of Nyhus and Pons (2005).

Along with measurement difficulties, another key unknown in the area of non-cognitive skills is the mechanism through which personality traits can be taught and transmitted. Little is known as yet about
how much of personality is inherited from one’s parents and how much is learned from our childhood environments and through training. Lundberg (2013) explores how the returns to cognitive ability and personality traits vary by family background in a recent cohort of young college graduates. She finds that for cohorts that are otherwise identical, there are substantial returns to conscientiousness for children from advantaged socioeconomic backgrounds but no gains to be had from openness. However, conscientiousness has no significant impact on the education of disadvantaged men, while openness to experience is important for both men and women from disadvantaged backgrounds. Lundberg (2013) states that her findings have two important implications: firstly, returns to non-cognitive traits may be highly context-dependent and secondly, educational policies should address the need to change the environments that limit opportunities of disadvantaged children.

Future work in this area could focus on the long-run returns to early childhood interventions and the technology of early skill formation to justify investing in the education of disadvantaged children along the lines of Heckman, Pinto and Savelyev (2012). Another important area of discovery could involve working in conjunction with neuroscience to allow for brain-activity mapping studies of diseases that specifically impact either cognitive or non-cognitive ability. Brain activity mapping studies could provide improved measures of personality traits rather than relying solely on self-administered questionnaires. As yet, there is a lack of economic research on the impact of personality traits on migration. Jokela’s (2009) paper in the field of psychology finds that high levels of openness and low levels of agreeableness increase both within and between states migration, while high extraversion only increases within states migration. With these results in mind, finding a natural experiment to study how an exogenous shift in the aggregate levels of personality traits in the labor market due to migration impacts wages could yield important insights. If traits are valuable in the labor market, then an inflow of refugees for example, could change the aggregate levels of traits and it would be useful to learn how
wages respond to the relative aggregate levels of different personality traits. An individual’s wage is arguably determined by not just the personality traits the individual possesses but also by the average level of each of the traits in the population. Lastly, I have also found a general lack of evidence in the economics literature regarding the impact of personality traits on crime and suicide rates and this could be a fruitful direction of future work.

References


