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Non cognitive skills and personality traits: Labour market relevance and their development in education & training systems

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in Education & Training Systems**

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ABSTRACT

Non Cognitive Skills and Personality Traits: Labour Market Relevance and their Development in Education & Training Systems*

This paper reviews the empirical economic literature on the relative importance of non cognitive skills for school and labour market outcomes, with a focus on Europe. There is evidence that high cognitive test scores are likely to result not only from high cognitive skills but also from high motivation and adequate personality traits. This suggests that part of the contribution of cognitive skills to economic growth could be due to personality traits. Across large parts of the literature, there is consensus that non cognitive skills have important effects both on school attainment and on labour market outcomes. These effects might be as important as the effects of cognitive skills. Less consensus exists on the malleability of non cognitive skills, with some arguing that these skills can be altered until the end of teenage years and others claiming that emotional intelligence can be changed at any age. Most of what economists know about the technology of non cognitive skill formation concerns early educational levels, such as preschools and schools. While it is difficult to argue that all relevant skill formation ends before labour market entry, there is scant evidence on the role of the workplace in the maintenance and development of existing skills. Clearly, more research in this area is needed.

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Introduction

The Recommendation of the European Parliament and of the European Council of 18 December 2006 states that “...as globalization continues to confront the European Union with new challenges, each citizen will need a wide range of key competences to adapt flexibly to a rapidly changing and highly interconnected world. Education in its dual role, both social and economic, has a key role to play in ensuring that Europe’s citizens acquire the key competences needed to enable them to adapt flexibly to such changes...” (The European Parliament, 2006).

This view on the importance of competencies and skills is broadly shared by European economists. Partly because of this, applied research in the field of economics of education has expanded rapidly. Thanks to the increased availability of international data measuring cognitive skills either at school or in adult life, this research has been able to go beyond the classical measures of education (years of schooling) and to focus instead on the contribution of these skills to individual and aggregate economic performance (see for instance Hanushek and Kimko, 2000, and Hanushek and Woessmann, 2008).

However, by paying substantial attention to measures of literacy in the areas of reading, mathematics and science, empirical economic research has somewhat overlooked the fact that other abilities, which are weakly related to cognition, are potentially as important as cognitive skills for individual development and economic success. These abilities include social skills, motivation and leadership, are typically non cognitive and involve important personality traits. In a critical review of this research, Nobel Prize winner James Heckman has argued that “...the preoccupation with cognition and academic “smarts” as measured by test scores to the exclusion of social adaptability and motivation causes a serious bias in the evaluation of many human capital interventions...” (1999, p.1)

This bias in favour of more easily measurable cognitive skills has been partially amended by empirical research carried out mainly in the past ten years. In this report, we review this research and motivate its main conclusion so far: non cognitive skills are at least as important as cognitive skills for individual development and labour market success.

How do we define and measure non cognitive skills? Section 1 of this report addresses this question by reviewing the definitions available in the literature and by distinguishing the non cognitive from the cognitive dimension. The European Council has recently identified eight key competences within the “European Framework for Key Competences for Lifelong Learning”, which include both cognitive and “transversal skills”. We show that personality traits are important components of transversal skills, and may also be considered as factors that contribute to the development of these skills. After having discussed the definition of non cognitive skills, we focus on measurement issues. Compared to cognitive skills, which are measured by national or international tests taken by students or adults, non cognitive skills are often self reported. Since empirical research on the importance of non cognitive skills heavily depends on data availability, we briefly review the sources of data, which are typically national and involve either the sub-population of students or a random sample of the entire population.

Section 2 reviews the existing evidence on the effects of non cognitive skills on individual outcomes. First, we argue that results in national or international cognitive tests may reflect both cognitive competences and non cognitive skills. Next, we consider the effect of the latter on school attainment, earnings and employment.

After having ascertained the importance of non cognitive skills for several labour market outcomes, we discuss in Section 3 how these skills are developed. We look both at schools – school inputs and schooling institutions – and at the workplace. In spite of the fact that “...post school learning is an important source of skill formation that accounts for as much as one third to one half of all skill formation in a modern economy..” (Heckman, 1999, p.3), the contribution of the workplace is often neglected, mainly because of the scarcity of relevant data. We complete this section with an overview of the programs designed to improve the non cognitive skills of adolescents both in schools and outside schools. Conclusions follow.

1. Definition and measurement of non cognitive skills

In this Section we discuss the definition of non cognitive skills and relate them to the transversal skills described by the European Framework. Furthermore, we provide an overview of how non cognitive skills can be measured and which datasets and surveys can be used in empirical research.

1.1 Definition

Cognitive abilities (and skills) are usually identified with intelligence and the ability to solve abstract problems. Measures of these skills include the IQ test and the standardized tests on reading, science and maths carried out almost routinely at the international level since the early 1990 or even before¹. Since the different aspects of cognition are highly correlated, a general intelligence factor labelled “g” can be extracted from correlated test scores.

Non cognitive skills are personality traits that are weakly correlated with measures of intelligence, such as the IQ index. A broadly accepted taxonomy of personality traits in the empirical economics literature is the Five – Factor Model (FF). Following the definition by Nyhus and Pons, 2005, this model includes the following factors: agreeableness, conscientiousness, emotional stability, extraversion and autonomy.

Agreeableness is the willingness to help other people, act in accordance with other people interests and the degree to which an individual is co-operative, warm and agreeable versus cold, disagreeable and antagonistic. *Conscientiousness* is the preference for following rules and schedules, for keeping engagements and the attitude of being hardworking, organized and dependable, as opposed to lazy, disorganized and unreliable. *Emotional stability* encompasses dimensions such as nervous versus relaxed and dependent versus independent, and addresses the degree to which the individual is insecure, anxious, depressed and emotional rather than calm, self-confident and cool.

¹ For instance, the OECD Program for International Student Assessment (PISA) carries out on a regular basis (every three years) standardized tests focusing on maths, reading and science on a sample of 15 – years old students of member and associated countries. Other programs include The Trends in International Mathematics and Science Study (TIMSS) and The Progress in International Reading Literacy Study (PIRLS) by the International Association for the Evaluation of Educational Achievement. See Hanushek and Kimko, 2000, for an early influential study on the effect of measured cognitive skills on economic growth.

Autonomy indicates the individual propensity to decide and the degree of initiative and control. *Extraversion* is the preference for human contacts, empathy, gregariousness, assertiveness and the wish to inspire people.

Borghans et al, 2008, and Muller and Plug, 2006, present a slightly different characterization of FF, using “openness to experience” rather than “autonomy” as one of the five factors. Openness measures the degree to which a person needs intellectual stimulation, change, and variety. Table 1 is taken from Muller and Plug, 2006, and illustrates the different facets of each factor.

Are personality traits important for labour market success? Kuhn and Weinberger, 2005, report the findings of a recent nationwide survey carried out in the US by the National Association of Colleges and Employers. This survey found that employers’ five most highly-valued personal qualities, in order, were: communication skills, motivation/initiative, teamwork skills, leadership skills, and academic achievement/GPA. These were followed by interpersonal skills, flexibility/adaptability, technical skills, and honesty/integrity; with “work ethic” and analytical/problem-solving skills tied for tenth place. Only a minority of these qualities (academic achievement, technical and analytical skills) can be considered as cognitive. The majority reflects instead personality traits that are partially covered by the FF model.

Some personality traits matter for employers because they facilitate effort at work and affect labour productivity. They are called “incentive enhancing preferences” (see Bowles, Gintis and Osborne, 2001). Valuable traits that are non cognitive but do not appear explicitly in the FF setup are motivation and leadership. Borghans et al, (2008), argue that the omission of motivation is not complete, however, because “achievement striving” is a facet of conscientiousness.

Which measure of non cognitive skills is used in the empirical economic literature is often dictated by data availability. Several studies, for instance, use either the Rotter measure of internal (external) locus of control, defined as the degree to which an individual perceives success or failure as being dependant on one’s own action, or self – reported measures of self-esteem (see for instance Heckman, Stixrud and Urzua, 2006). In his relatively recent review of this literature, Heckman, 2008, lists as non cognitive skills motivation, socio-emotional regulation, time preference, personality factors and the ability to work with others.

Non cognitive skills are a crucial ingredient in the concept of emotional intelligence used by social psychologists and human resource management specialists such as Goleman and Boyatzis. In Goleman, 2000, emotional intelligence consists of four capabilities or competencies: self awareness, self management, social awareness and social skills. Table 2 presents the unadjusted correlations between cognitive and some non cognitive skills computed by Deke and Haimson, 2006, using the US National Education Longitudinal Survey. The correlation among measures of cognitive skills (reading, history and science) is above 0.75. Key personality traits, such as work habits, pro-social behaviour, leadership and locus of control, are instead rather poorly associated both with cognitive skills and among themselves. For instance, leadership correlated poorly both with math test scores (0.20) and with the locus of control (0.19). An implication of this poor correlation is that it is difficult to extract a single factor from measured non cognitive skills, in contrast with what happens for cognitive skills.

1.2 The Relationship with Transversal Skills and Key Competencies

The “European Framework for Key Competences for Lifelong Learning” identifies eight key competences considered as necessary for personal fulfilment, active citizenship, social inclusion and employability in a knowledge society: 1) communication in the mother tongue; 2) communication in foreign languages; 3) mathematical competence and basic competences in science and technology; 4) digital competence; 5) learning to learn; 6) social and civic competences; 7) sense of initiative and entrepreneurship; 8) cultural awareness and expression. According to the Commission, “...initial education and training should support the development of these key competences to a level that equips all young people – including the disadvantaged – for further learning and working life. Adult education and training should give real opportunities to all adults to develop and update their key competences throughout life” (The European Commission, 2009, p.3).

These competencies partially reflect demand shifts in the demand for skills, generated by the introduction of information technology and by the diffusion of new forms of organizing labour in modern workplaces, which feature flat and lean organizations, where emphasis is placed on the design and implementation of systems

focusing on processes and the customer (see Womack et al, 1990). New work practices include teamwork, job rotation, information sharing, and new skills are emerging, which emphasize problem solving and the ability to communicate effectively (see Green et al, 2001).

The eight key competencies include both typical cognitive skills, such as language, maths and digital skills, and more “transversal skills” such as learning to learn, social and civic competence, initiative taking and entrepreneurship. In order to understand whether and how these transversal skills relate to the non cognitive abilities defined in the previous section, it is useful to examine the keywords associated to each transversal skill. For instance, the keywords that characterize “learning to learn” include self – discipline, perseverance and motivation, which are also facets of conscientiousness in the FF model, and may also be related to the internal locus of control. Similarly, the keywords associated to “social and civic competencies” include ability to communicate, tolerance, empathy and coping with stress, which are clearly related to the facets of agreeableness and extraversion. Finally, “sense of initiative and leadership” includes creativity, leadership, innovation and risk taking, which are important features of openness to experience.

We conclude that personality traits are important components of the transversal skills considered by the European Framework, and may also be considered as factors that contribute to the development of these skills.

1.3 Measurement

In spite of recent developments, empirical studies which consider the labour market effects of non cognitive skills are still relatively scarce. One reason is that there are only a few surveys which collect individual information on cognitive, non – cognitive skills and outcomes. The Annex at the end of this paper reviews the available data, which cover only a limited number of countries, and especially the US and the UK.

To date, there is no available dataset that allows researchers to compare personality traits and non cognitive skills across countries. This is remarkable, given the relative abundance of international surveys that collect information on cognitive skills, both for the young still at schools (PISA, TIMSS and PIRLS are well known examples) and for

the adults (IALS, ALL and the new PIAAC survey), but understandable, because personality traits are more heterogeneous than cognitive skills, and more difficult to measure. The available data either rely on parents and teachers evaluating pupils, or are based on individual perceptions of personality facets. Therefore, the available measures of non cognitive skills are more exposed to measurement error problems, and more difficult to compare on an international scale.

2. Non cognitive skills and their effects on other outcomes

In this section, we ask whether non cognitive skills affect cognitive skills and review the evidence on the relationship between non cognitive skills and school performance, earnings and employment.

2.1 Effects of non cognitive skills on cognitive skills

International comparisons of standardized cognitive test scores draw a lot of attention, even outside the academic community. Recent research summarized by the EENEE report on the cost of low education achievement in The European Union (Hanushek and Woessmann, 2010) suggests that international cognitive test scores matter for economic growth and should be preferred to completed years of schooling as the synthetic measure of accumulated human capital.

Do these scores reflect only differences in cognitive abilities? To answer this question, it is important to realize that available scores are based on the tests administered to survey participants, who, as remarked by Segal, 2006, typically receive no incentive to elicit adequate effort and attention. Therefore, there is no a priori reason to believe that survey participants are doing their best when solving the tests. Effort and motivation may play a crucial part in interpreting cognitive test scores.

If individuals differ not only in their cognitive abilities but also in their test taking motivation, then in the absence of performance based incentives higher test scores do not necessarily imply higher cognitive ability. Instead, good performance may simply reflect higher test taking motivation, or differences in personality traits. The natural implication of this is well posed by Segal: it is possible that the correlation between

cognitive test scores and economic performance is to be attributed, at least in part, to differences in non cognitive skills rather than to differences in cognitive skills.

Experimental evidence suggests that non cognitive skills such as motivation and conscientiousness affect the outcomes of cognitive test scores. For example, students put more time in answering IQ questions when rewards are higher. This is the result of an experiment conducted by Borghans, Meijers and ter Weel, 2006, who measured psychological traits and economic preference parameters of 128 Dutch students, who participated in a cognitive test. Initially there were no rewards for right answers, but later on, when these rewards were introduced, results substantially improved because of higher student effort. Rewards matter, and matter the most when motivation, internal locus of control and curiosity are higher. Segal, 2006, also finds that explicit rewards improve test performance. Her results suggest that roughly a third of the participants to the experiment improved their performance significantly in response to explicit incentives, while the others did not.

An important implication of the fact that some personality traits – such as motivation – affect cognitive test scores is that the estimated effect of these scores on economic performance (such as economic growth) may reflect not only the contribution of cognition but also the role of personality traits.

2.2 Effects of non cognitive skills on school attainment

One of the targets set by the European Council in adopting “Europe 2020” is that “... the share of early school leavers should be under 10% and at least 40% of the younger generation should have a tertiary degree...”. (European Commission, 2010). In the economic approach to school attainment, a prominent role is played by the comparison of the expected benefits and costs of additional schooling. Better cognitive and non cognitive skills can affect school achievement by increasing the labour market benefits and by reducing the psychic costs associated to higher education.

The existing empirical literature suggests that the contribution of non cognitive skills to school attainment is an important one. This point is made very clearly by Heckman, Sixtrud and Urzua, 2006, who use data from the US national Longitudinal Survey of Youth and measure personality traits with indicators of loss of control and

self-esteem. Their simulations suggest that an increase in the non cognitive test score from the 25th to the 75th percentile of its distribution that keeps cognitive skills constant is associated to a close to 25 percentage points increase in the probability of being a four year college graduate at age 30. This increase is similar to the one obtained by keeping non cognitive skills constant and raising cognitive skills from the 25th to the 75th percentile of its distribution. They also find that both types of skills have strong effects on the dropout decision, but that increasing cognitive ability is more effective in reducing dropout behaviour.

Results based on US longitudinal data show that self-discipline measured in the falls account for more than twice as much variance as IQ in final grades (Duckworth and Seligman, 2005). A major reason for students falling short of their intellectual potential is their failure to exercise self – discipline. This is corroborated by Duncan and co-authors, 2006, who examine data from the UK, the US and Canada and report that maths and reading scores plus attention skills are the most important preconditions for educational achievement at school entry.

The importance of social skills for several schooling outcomes emerges also from a recent study, which uses the data drawn from the British National Child Development Survey to investigate the effects of cognitive skills and a measure of social maladjustment at age 11 on four indicators of educational attainment: whether the individual stays in school beyond age 16, whether she has a degree from a higher institution by age 42, and indicators of basic literacy and numeracy at age 37. The results show that children who exhibited greater social adjustment at age 11 were both more likely to stay at school beyond age 16 and to have a higher education degree. However, having high social skills early on is not particularly important for basic literacy and numeracy when adult. Perhaps more interestingly, the marginal effect of cognitive skills on the probability of staying at school beyond age 16 is quite low if social skills are fixed at a low value, but very high if social skills are fixed at a high value (Carneiro, Crawford and Goodman, 2006). These findings suggest that an individual with very high cognitive skills but very poor social skills is relatively unlikely to stay on at school beyond age 16.

Personality traits are a crucial pre-requisite for access to and success in post-secondary schooling. The information contained in the US National Education

Longitudinal Survey has been used to inquire whether the personality traits measured in the 8th grade have had any impact on enrolment in or completion of post-secondary education. It turns out that these traits have significant effects on later schooling. For instance, 39.1 percent of students who spent one hour a week on homework completed some form of post-secondary education program, compared to 65.2 percent of those who spent seven or more hours a week of homework (Deke and Heimson, 2006).

Figure 1 – taken from Borghans et al, 2006 – shows the relative importance of cognitive and non cognitive skills for school attainment. Focusing our attention on two educational outcomes, college grades and years of education, the figure shows that conscientiousness proves to be, by far, the best personality predictor of grades and, after openness to experience, the second best personality predictor of years of education (Borghans et al, 2006). For both outcomes, however, IQ scores remain the single more important factor of success..

When comparing the contribution of cognitive and non cognitive skills, it is important to be aware that estimating the effects of non cognitive scores on school attainment and performance is complicated by the fact that personality in large sample studies is often measured by brief, self-report questionnaires. To the extent that IQ is more accurately measured than personality traits, estimates of the relative effects of personality on outcomes tend to be biased downwards by the larger measurement error. Therefore, the estimated correlations shown in Figure 1 need to be interpreted with care².

To summarize the existing evidence, the relationship between educational attainment and personality traits is complex: on the one hand, schools and educational programs contribute to instil the personality traits that are deemed to be useful in modern knowledge-based societies. On the other hand, individuals who are more self-disciplined and exhibit higher perseverance and motivation are likely to attain higher educational attainment and better grades at school. Although cognitive abilities seem to be the most important factor, personality traits play an important role in school attainment and performance.

² Heckman, Stixrud and Urzua, 2006, discuss this point at length and suggest an approach based on latent cognitive and non cognitive skills.

2.3 Effects of non cognitive skills on earnings and employment

Two key targets of “Europe 2020” are: a) 75% of the population aged 20-64 should be employed; b) 20 million less people should be at risk of poverty. Since labour market earnings are the main source of income for the vast majority of people, it is important to understand which abilities contribute to success in the labour market. In particular, we are interested in knowing whether non cognitive skills and personality traits contribute to employability and earnings.

Over the years, two main views have developed in the empirical economics literature. According to the first and older view, cognitive skills such as IQ and the intelligence factor g are considered as the most important determinants of success (see for instance Herrnstein and Murray, 1994). The second and more recent view holds instead that non cognitive abilities such as persistence, motivation, leadership and social skills are equally or even more important than cognition in determining earnings and success.

Early literature from the 1970s on the importance of non cognitive skills (see for example Jencks, 1979) had already shown that a composite measure of non cognitive traits is at least as important as cognitive test scores, parental background and years of schooling in predicting hourly earnings. More recent results based upon US and UK data that measure personality either with the Rotter score for the locus of control or with measures of aggression and withdrawal corroborate earlier findings: the external locus of control– or the belief that outcomes are the result of fate or luck –has a negative effect on earnings. Moreover, both aggression and withdrawal have a sizeable negative impact on later earnings (Bowles, Gintis and Osborne, 2001).

Movements from a low to a high position in the distribution of non cognitive skills appear to be much more relevant for earnings and employment prospects than similar movements in the cognitive skill distribution. This result emerges from an investigation of the role played by self-esteem and the locus of control measured at age 14 to 21 on employment status, work experience, occupational choice and earnings at age 30, using US data (The National Longitudinal Survey of Youth). The study shows that if one moves an individual from the 25 percent lowest to the 25 percent highest performer in terms of non cognitive skills, wages at age 30 improve by about 10 percent for males,

and by more than 30 percent for females. In comparison, a similar movement in the cognitive skill distribution leads to a 20 percent wage increase for males and to 30 percent increase for females. In terms of employment probabilities at age 30, moving a male up in the non cognitive skill distribution as described above increases the probability of employment by close to 15 percentage points for males and by close to 40 percentage points for females (Heckman, Stixrud and Urzua, 2006).

One of the most striking examples of the importance of non cognitive skills is provided by Heckman, Hsee and Rubinstein, 2001, who study the General Educational Development (GED) program in the US. High school dropouts in the US who did not complete high school can obtain high school certification by taking the GED exam. Heckman and co-authors show that, once one control for the impact of cognitive skills, job training and years of schooling, GED recipients have lower wages than high school dropouts without a GED degree. They find that the former group is much more likely to exhibit delinquent behaviour during adolescence – such as skipping school, getting into fights or engaging in crime – and less likely to hold a job when adults than either high school graduates or high school dropouts without GED. This indicates that GED recipients are relatively qualified and intelligent individuals, but that they lack skills such as discipline, patience or motivation, and as a result are penalized in the labour market.

Early signals of leadership qualities during school can be valid predictors of positive labour market outcomes during adulthood. Individuals with leadership positions in high school earn between 4 to 24 percent higher wages about 10 years later. Moreover, school leaders are more likely to occupy managerial jobs when adults. Interestingly, the impact of leadership on wages is reduced when one controls for “sociability” – a self reported measure of enjoyment of being around people. Thus, leadership probably captures in part social skills and emotional intelligence (Kuhn and Weinberger, 2005). These results are particularly convincing because leadership is measured before labour market entry, a fact that avoids the problem of reverse causality running from earnings or employment to personality traits.

Additional evidence on the importance of non cognitive skills comes from the Wisconsin Longitudinal Survey. These data suggest that the combined contribution of the non cognitive skills included in the Five Factors model is as large as the contribution

of IQ - both measured during high school - in explaining earnings later in life (Muller and Plug, 2006).

By and large, the reviewed evidence is based on US data. Turning to European evidence, Carneiro, Crawford and Goodman, 2007, use data from the British National Child Development Survey to investigate whether social skills at age 11 have had a significant effect on employment status and labour market earnings at age 42. They find that social adjustment at 11 has indeed a significant impact on labour market outcomes, and that individuals who possess a combination of good cognitive and social skills receive greater returns.

German evidence based on data from the Socio Economic Panel shows that individuals who score high on the external locus of control scale – and therefore tend to attribute success or failure to external circumstances rather than to individual effort – earn on average less than individuals with lower scores. The effect on earnings is large: everything else held constant, workers who score in the top quartile earn up to 20 percent less than workers who score in the bottom quartile (Heineck and Anger, 2010).

Dutch data can also be used to study how personality traits affect earnings, without controlling, however, for the effect of cognitive skills. On the one hand, there is evidence of a positive association between emotional stability and wages. This relationship is stronger for women. On the other hand, both extraversion and agreeableness are negatively related to earnings. Agreeable persons are either poor wage negotiators or self select into low pay occupations, such as services and nursing (Nyhus and Pons, 2005).

As already discussed above, one problem with estimating the effect of non cognitive skills is that the available measures of personality traits are mostly based on self reported questionnaires. Compared to IQ, such measures are less reliable and less precise. Lindquist and Westman, 2010, try to address this problem by using a unique dataset from the Swedish military enlistment. The enlistment is mandatory for all young Swedish men and spans two days with tests of health status, physical fitness and cognitive ability. In addition, each conscript is interviewed by a certified psychologist on a set of personal characteristics, which include persistence, social skills and emotional stability. The authors argue that these interviews generate more reliable measures than self-reported measures.

Using the ability measures from the military enlistment, Lindquist and Westman find that both cognitive and non cognitive skills are strong predictors of labour market earnings later in life. Importantly, non cognitive skills have a much stronger effect at the low end of the earnings distribution. At the tenth percentile, the effect of these skills is between 2.5 and 4 times the effect of cognitive skills. One reason for this result is that men with low non cognitive ability are significantly more likely to become unemployed than men with low cognitive ability. Among the unemployed, the former experience longer spells. In contrast, cognitive ability has no statistically significant effect on the duration of unemployment.

In sum, the recent empirical literature, both in the US and in Europe, supports the view that a certain level of non cognitive ability is a prerequisite for avoiding failure in the labour market. Moreover, labour market earnings tend to be higher among individuals with higher non cognitive skills.

3. What accounts for the development of non cognitive skills?

In the previous two sections we have presented evidence supporting the importance of personality traits and non cognitive skills for school attainment, future earnings and employment opportunities. Although there are several empirical problems that hamper the identification of a causal relationship, it remains a well documented fact that skills that go beyond the cognitive dimension affect future outcomes.

How and when are these skills produced? Answering this question is crucial to highlight which interventions policymakers could design in order to promote the acquisition of non cognitive skills. Is early intervention preferable, as forcefully argued by Heckman and co-authors in the case of cognitive skills (see for instance Carneiro and Heckman, 2003, and Cunha and Heckman, 2007), and is there any scope for later intervention, which could improve the personality traits of adults?

In the literature that studies the determinants of cognitive skills - see for example Hanushek, 2002, for an overview - these skills are modelled as the output of several so-called *school inputs*, which include parental background, measured by household income, parental education and family size; socioeconomic and individual characteristics such as individual innate ability, which can hardly be manipulated by

policymakers; school resources/inputs such as teacher quality, class size or financial endowment; the institutional settings of the education system, including the presence of accountability systems, school autonomy or competition among schools. The focus on schools and the family is usually justified with the broadly accepted fact that cognitive ability is fairly well set early on in life (see Carneiro and Heckman, 2003) and that early interventions are more likely to have higher payoff than later interventions.

There is a sharp contrast between the abundant literature on the determinants of cognitive skills and the scarcity of studies that document the development of non cognitive skills. Yet, some evidence exists and we present it below by starting with the effects of typical school inputs. In the following sub-section, we focus instead on institutional school settings. Next, we ask whether the workplace also contributes to the formation of non cognitive skills. Here, the evidence is unfortunately very limited. Finally, we review some special programs available in European countries that were implemented in order to directly promote non cognitive skills.

3.1 Non cognitive skills and school inputs

The effect of class size on cognitive skills has been widely investigated. The large US Project Star launched in Tennessee in 1985, where students were randomly assigned to classes of different size, is one of the most famous projects that has been evaluated in this area. These data can also be used to study the effect of class size on non cognitive skills. The results show that students in smaller classes are both less afraid to ask questions and less disruptive (Dee and West, 2008).

The crucial role of teachers in enhancing different aspects of non cognitive skills is the topic of two studies focusing on Switzerland and the US. Evidence from Swiss tutorial classes held at the University of St. Gallen shows that the positive affirmation of teachers on students' success matters. Before taking a maths test, one half of the students in these tutorial lectures was randomly exposed to positive affirmation and motivation by teachers, while the other half was not. The treated group ended up with higher maths test scores after affirmation. Positive support probably reduced test anxiety and/or served as an additional motivator to achieve good results, as these were

perceived as realistic (see Behncke, p. 6). These findings suggest that teachers can affect student performance by affecting their attitudes and motivation.

Teachers' influence on the development of the non cognitive skills of students depends, in turn, on their own skill endowments. In a US study which looked at young teachers in the city of New York, it was found that teachers' quality improves if they are endowed with a well-balanced mix of competencies, including personality traits belonging to the FF model, such as conscientiousness and extraversion. Well endowed teachers appear also to be better suited at enhancing the non cognitive skills of students if they themselves are well grounded in such skills (Rockoff et al. 2008). Thus, as far as teachers are a crucial factor in the development of the non cognitive skills of students, policies aiming at the promotion of such skills should already be part of teacher education. Moreover, these findings speak in favour of considering personal traits when schools hire new teachers. The reviewed studies suggest that school inputs such as class size and teacher quality can help foster the non cognitive skills of students.

3.2 Non cognitive skills and systemic features of school systems

Differences in the institutional design of education systems matter for student performance. Woessmann et al., 2009, ask whether differences in school autonomy, degree of accountability and school choice among countries or among schools within the same country affect the performance of 15-year old students in the Progress of International Student Assessment (PISA). While the focus of this study is mainly on the effects of schooling institutions on cognitive skills, the authors also report results for non cognitive skills. They measure the latter using three school level indicators: an indicator of morale and commitment, one of non-disruptive behaviour (both obtained from the subjective assessment of school principals) and an indicator of disciplinary climate in maths lessons (reported by the students themselves). A fourth indicator is a self - reported measure of student tardiness. They show that students have a higher level of commitment and less disruptive behaviour if a school applies accountability in terms of monitoring teachers by the principals and/or external inspectors. Greater autonomy in hiring and staffing decisions in a school also leads to a higher level of morale and commitment and better behaviour. With respect to school choice indicators, the authors

find that attending a privately operated school is associated to less disruptive behaviour and tardiness. While it is difficult to interpret these results in a causal way, the findings suggest that the institutional features of education system may also be important in the formation of non cognitive skills.

In order to get a detailed overview of the assessment of non cognitive skills in the PISA project, Tables 3 and 4 present the different sub-indicators used to build the overall measure of morale and commitment (Table 3) and non-disruptive behaviour (Table 4). The tables report the percentage of students in schools where the principals agree or strongly agree with a number of statements about the students in schools located in the countries participating in PISA 2003 (ranked from the best to the worst performing in the respective indicator). These statements include: student absenteeism, disruption of classes by students, students skipping classes, students lacking respect for teachers, student use of alcohol or illegal drugs, students intimidating or bullying other students).

Table 5 provides data on the sub-indicators used to compute a measure of disciplinary climate in maths lessons. The numbers in the table indicate the percentage of students reporting that different disruptive events occur in every or in most of their maths lessons (students don't listen to what the teacher says, there is noise and disorder, the teacher has to wait a long time for the students to quieten down, students cannot work well, and students don't start working for a long time after the lesson begins)..

In the US, there is evidence that school atmosphere, religious denomination of a school and classroom behaviour are associated. Data from the National Educational Longitudinal Survey (NELS) include teacher reports on classroom behaviour with respect to absenteeism, disruptiveness, inattentiveness, tardiness, and homework completion and can be linked to school characteristics. One study using these data shows that children in Catholic schools behave significantly better in all categories including disruptiveness than children in all other schools. Furthermore, schools that emphasize discipline have better behaving students in all disciplines. Finally, more severe punishment for class disruptiveness is associated with less disruptiveness and inattentiveness. Although these results could be driven by selection of specific students into specific schools, they provide insights into the potential of school characteristics to affect the non cognitive skills that affect classroom behaviour (Segal 2008).

A transversal skill included in the Key Competencies Framework is sense of initiative and entrepreneurship, which we have argued is related to openness to experience and leadership. Sobel and King, 2008, show that US counties that increased school choice by introducing voucher programmes have experienced a significantly higher rate of youth entrepreneurship, as measured by the rate of self-employed individuals in the age range 16 to 25. This effect is probably due to the more competitive and innovative environment fostered by these programs among school administrators and teachers. The implicit message is that acting on school design by improving competitive pressure may enhance entrepreneurial skills, even when these skills are not directly taught in schools.

PISA data provide an even more concrete association between entrepreneurship and enrolment in private schools. Linking entrepreneurial intentions of 15-year old students to information on private school attendance (both assessed in PISA) shows that a ten percentage increase in the share of private schools in a country raises individual entrepreneurial intentions of students by 0.3-0.5 percentage points. This result is particularly reliable, because it uses the exogenous variation in the share of private schools that comes from historic variation in the share of Catholics in different countries. The mechanism underlying this effect could be the more business-like atmosphere associated to increased school competition induced by a higher share of private schools. Moreover, increased school choice might foster efficient and quality-enhancing behaviour in the educational system that leads not only to better cognitive outcomes, but also to better non cognitive results (Falck and Woessmann 2010).

3.3 Non cognitive skills developed in the workplace

The importance of personality traits for labour market success prompts the following questions. Are personality traits formed early in life as in the case of cognitive ability or is there room to change these traits significantly during adult life? Since employers value non cognitive skills, can they contribute to the development of these skills by organizing training and learning in the workplace?

There is no clear answer to the first question. On the one hand, Carneiro and Heckman, 2003, argue that, while cognitive intelligence is well set by age 8, social

skills are more malleable and can be modified until the late teenage years. On the other hand, social psychologists argue that the skills of emotional intelligence can be learned at any age (Cherniss and Goleman, 1998, Boyatzis, 2008, and Goleman, 2000). In the former case, there is little room for training and adult education policies. In the latter case, these policies can work. An important issue is whether it is more cost effective to intervene earlier than later. When learning begets learning, as forcefully argued by Heckman and associates, the case for early intervention even for non cognitive skills seems to be rather strong (see Heckman, 2008). Yet, devoting scarce resources to improving the cognitive and non cognitive skills of the (very) young does not address another important policy priority of an ageing European community, the maintenance in productive employment of a consistent share of the adult population aged between 50 and 65.

The fact that learning both cognitive and non cognitive skills takes place even after school ends has long been recognized - see for instance Arrow's concept of learning by doing. However, the empirical evidence produced by economists on the importance of the workplace for the development of non cognitive skills is quite limited. In a recent study, Green, Ashton and Felstead, 2001, examine the source of competencies that are emerging from the new organization of labour: problem solving, teamwork and social skills. They quote extensive research – mainly by sociologists and management scholars – arguing the indispensability of work based learning for these types of skills. Economists somewhat lag behind both because of the emphasis they tend to place on the formal development of human capital – at school or in classrooms – and because of the lack of readily available data.

Green and co-authors use data from the British skills survey, which asks workers about the competencies used in the jobs they do. The questions asked are of the type: in your job, how important is skill A? Under the strong working assumption that the competencies used in the job correspond to the supply of skills, the authors are able to relate the portfolio of skills held by workers with the potential sources of these skills, which include formal education, on the job training and other work based learning indicators, and the organizational characteristics of the workplace. They find that formal education is by far the less important source of these transversal skills.

Additional preliminary evidence can be obtained using the micro data contained in the German Socio Economic Panel. In 2005, respondents are asked to reply to six questions that are meant to assess the degree of external locus of control. A high value of this degree implies a strong perception by respondents that events occur independently of individual action and effort. Answers are given in a 1 to 7 scale, with 1 equal to “disagree completely” and 7 equal to “agree completely”. We average out answers to the available questions and obtain an indicator of the external loss of control. Next, we relate this indicator to variables such as age, gender, quantity of education (years of schooling), type of schooling, a measure of training and information on current employment. We hasten to stress that such a multivariate study can only detect interesting associations, and does not pretend to uncover causal relationships.

Table 6 shows the results for our sample of individuals aged 25 to 59. We find that a 2 percent reduction in the external loss of control is associated both to one additional year of education and to 7 additional hours of workplace training. This is highly suggestive that workplace activities are potentially important in the formation of non cognitive skills³. The type of education also matters: conditional on years of school, having completed an apprenticeship or a vocational degree is associated to a reduction in the external loss of control by 1.6 and 2.6 percent respectively. Finally, and conditional on schooling, one additional year of potential labour market experience (age minus education) increases the external locus of control, suggesting that age could negatively affect this particular non cognitive skill. While these results should be interpreted with care, they do confirm the view that an important personality trait – measured by the external locus of control - is significantly correlated with learning after school. The type of formal education received also matters.

3.4 Programmes and campaigns to develop non cognitive skills at school

Some education specialists and psychologists believe that if schools teach youngsters to work well with others, regulate their emotions and be constructive in solving problems, students will be better equipped to deal with life’s challenges,

³ The estimated coefficients of schooling and training are both likely to be biased by reverse causality and omitted factors that are not considered in the empirical approach.. Most likely, these biases lead to overestimated results.

including academic ones (see DeAngelis, 2010). Following the lead of David Goleman, who in his best-selling “Emotional Intelligence” strongly argued in favour of schools teaching emotional intelligence, several programmes have been developed across both sides of the Atlantic. In the US, for instance, the Collaborative for Academic, Social, and Emotional learning (CASEL) has been actively promoting social and emotional learning (SEL), a programme which focuses on the development of the following five competencies: 1) self awareness; 2) social awareness; 3) responsible decision making; 4) self-management; 5) relationship skills. SEL consists of a set of lessons taught by trained teachers, who seek to induce pupils to recognize and manage their emotions, set and achieve positive goals, demonstrate caring and concern for others, establish and maintain positive relationships, make responsible decisions and handle interpersonal relationships effectively.

Does this programme work? According to a meta-analysis carried out by Payton and co-authors (2009), who reviewed 180 studies on the effects of SEL on individual behaviour and school performance, SEL programming yielded an average gain on achievement test scores of 11 to 17 percentage points. However, since only 45 percent of the reviewed studies are based on an explicit randomization mechanism, which allocates randomly students to the treatment and control groups, this positive result could be partly inflated by self-selection, if better schools with higher quality pupils are more likely to adopt SEL.

The promotion of social and emotional competencies among children aged 5 to 16 is the focus of The Children’s Plan, a UK government plan which aims at developing greater resilience and preparedness for change, both in learning and socially. One programme in this plan is SEAL (Social and Emotional Aspects of Learning), which has been used by approximately 80 percent of primary schools and 30 percent of secondary schools by July 2008 (see Duckworth et al, 2009). The key competencies taught by SEAL are self-awareness, managing feelings, motivation, empathy and social skills.

SEAL centres on whole-school development work designed to create the ethos and climate within which social and emotional skills can be most effectively promoted. It also involves small group interventions for children who are thought to require additional support to develop their social and emotional skills. The goals of these brief, early interventions include helping children by: facilitating their personal development;

exploring key issues with them in more depth; allowing them to practice new skills in an environment in which they feel safe, can take risks and learn more about themselves; developing their ways of relating to others; promoting reflection.

Case study evidence suggests that schools using SEAL resources report positive effects, but no broad quantitative evidence of impact on behaviour is available to date. Also in the UK, the programme “Values Schools” was started in an Oxfordshire schools and has been replicated in several other primary schools. According to Richard Layard, 2007, the aim of this programme is to help children control their emotions by familiarity with uplifting ideas and role models, and the practice of silent reflection. Children practice silent reflection during whole-school assembly and at the beginning of most classes. Informal evaluation suggests improved mood, conduct and academic performance.

3.5 Programmes targeted at the formation of non cognitive skills outside of schools

There are few examples of educational interventions outside the traditional classroom environment in the US that have reduced the disruptive and anti-social behaviours of students: the Perry Preschool program, for instance, targeted disadvantaged four and five year olds, providing weekly home visits with parents and intensive preschool services for two years. When in their late 20’s, participants exhibited substantially fewer arrests. Heckman et al, 2006, show that the Perry experiment did not raise IQ for boys and infer that its effect on crime must be due to improved personality traits.

The US Job Corps program targeted at adolescents provided seven months of education and vocational training for 16-21 year olds, and reduced criminal behaviour. How do schools and educational programs manage to alter individual behaviours and personality? A plausible hypothesis is that they do this by “... subjecting students to types of social interactions and systems of reward that replicate the social interactions and reward systems of the workplace, providing positive reinforcement for some behaviours and personalities and sanctions for others...” (see Bowle, Gintis and Osborne, p.38).

Another example is the US Junior Reserve Officers' Training Corps (JROTC), which supports at-risk students at high school level in order to improve their academic achievement. This is a multidimensional program, which does not only focus on the provision of non cognitive, extracurricular skills, but includes also 'standard' classroom teaching (see Pema and Mehay 2009).

Programs that are explicitly targeted at the improvement of non cognitive skills exist in Europe as well. The first example is the entrepreneurial classes implemented in Dutch Vocational Colleges, i.e. at the tertiary level. These courses are a component of the Junior Achievement Young Enterprise student mini-company (SMC) program, which exists in several European countries. The goal of this program is to teach students to put theory into practice and to understand what entrepreneurship is about. Students taking these classes are assumed to gain self-confidence and motivation, become proactive, creative and learn how to work in a team (see Oosterbeek et al. 2010, p. 443). Oosterbeek and co-authors (2010) evaluated whether such direct transfer of entrepreneurial knowledge increased the entrepreneurial intentions of the participants in the programme. They find no significant effect on students' self-assessed entrepreneurial skills. Moreover, the results on the intention to become an entrepreneur are even negative. While this does not speak in favour of the effectiveness of special programmes focusing on the provision of entrepreneurial knowledge, the results should be interpreted with caution, because the authors can only rely on the evaluation of the programme in one school. Therefore, it is not clear whether these findings can be generalized.

The second example is a remedial education programme for English secondary school students, who are at risk of school exclusion and with worsening educational pathways. The *xl*-programme was applied to students aged 14 in 500 English secondary schools over two years and for three hours per week. The most important element of the *xl* club programme was its explicit goal of improving crucial non cognitive skills of students, including confidence, self-esteem, motivation and locus of control which, in turn, are expected to affect school attendance and ultimately young people's achievements at the end of compulsory education at age 16 (see Holmlund and Silva, 2009). Participants in the programme did experience an increase in their non cognitive skills in terms of better motivation, better behaviour towards other students and more

self-esteem and confidence (see Browne and Evans 2007). In this regard, the programme was successful in the development of non cognitive skills. However, no significant positive effects on cognitive outcomes at the age of 16 could be found. One reason why the increase in non cognitive skills was not reflected in higher cognitive achievement could have been the dynamic process of skill formation described by Heckman and co-authors (see for example Cunha and Heckman 2007): increasing non cognitive skills during adolescence cannot compensate for cognitive deficits that have been accumulated since early childhood. As the programme explicitly focuses on at-risk children with low cognitive achievement at earlier ages this could be a reasonable explanation.

The third example is a program implemented in Portugal mostly for 13-15 year old pupils in 7th and 8th grade, who were at risk of failing or dropping out. The intervention called EPIS especially concentrated on the improvement of non cognitive skills and included motivational discussions, self-control, problem-solving techniques but also group techniques such as study methods, social competences training, management of criticism, anxiety self-control (see Martins 2010). The participants were treated in one-to-one interventions or small groups by psychologists or education scientists. Unlike in many other remedial programmes, the author finds significant positive effects of participation in EPIS on less grade retention, which is reduced by 10 percentage points.

In summary, the evidence from programs explicitly targeted at the provision of non cognitive skills is somewhat mixed and still scarce. While entrepreneurial classes do not seem to affect non cognitive skills in terms of more entrepreneurial knowledge and, thus, do not increase entrepreneurial intentions, other programmes in the UK and Portugal were both successful in enhancing the non cognitive skills of programme participants. The EPIS programme in Portugal even managed to translate the better non cognitive skills in better cognitive outcomes of students. Yet, a lot of research has to be done to get a clearer picture of the effects of such programmes, not least because programmes are mostly targeted to special groups of at-risk students and, thus, results can not be generalized.

4. How to assess non cognitive skills – some experience from EU Member States

The importance of non cognitive skills for later educational and labour market outcomes should also be reflected in assessments and exams throughout the educational process of individuals. While in the past assessments and exams have mainly focussed on the cognitive skill dimension, several Member States have introduced policies at different educational levels in order to integrate non cognitive skills in the evaluation process. The interventions differ with regard to the assessment method and designs that Member States use to examine non cognitive skills. Some assessments are more summative in the sense that they provide “summary statements of student achievements and capabilities” (see European Commission 2010, p. 9); others are rather formative as they take place simultaneously with teaching or provide ad-hoc feedback on test results. There is often a lot of overlap between these two forms of assessment and it is not clear which is more effective. In either case, the main challenge – particularly with regard to the examination of non cognitive skills - remains to find adequate designs that facilitate assessment.

In terms of summative assessments, Spain has incorporated the European Key Competencies Framework in its curriculum reforms instead of focussing on specific subjects. Social and civic competencies or learning to learn are now included in the national assessment regime and form part of paper and pencil tests, short answers or multiple choice tests. Austria, Denmark and Germany have included key competencies belonging to the non cognitive skill dimension in high-stakes assessments. For example, as a part of the upper secondary school leaving examination students in Austria have to present, a quasi-scientific, multi-disciplinary paper written during their final year, which reports on a research project they have worked on.

Germany applies role-plays in authentic situations in its EuroKom (European communication ability) test that forms part of the final grade in the first language. Furthermore, the Germany’s Realschulen have a cross-curricular competence examination which is part of the final examination after grade 10. It consists of a pre-prepared presentation by students, complemented by questions of the examiners.

Using ICT techniques, Denmark's assessment system can easily include a larger variety of tasks in its examinations. In a new pilot project students use the internet to answer specific questions and to complete tasks that are part of final exams in upper-secondary and commercial schools. The use of ICT facilitates the examination of such skills as searching and understanding information and creativity in the use of information for problem-solving.

The development of formative assessment at school level is adopted by some Member States in order to examine key competencies. The Assessment for Learning (AfL) strategy in England is used by all schools at the primary and secondary level. This approach enables teachers and students to make use of day-to-day informal "assessments" (sharing learning objectives with students, sensitizing students for self-assessment, giving immediate feedback) and to apply long-term benchmarking methods including the use of national standards as reference points in the classroom. Formative assessment methods are expected to improve the learning of key competencies and non cognitive skills. They require, however, an overall assessment culture in schools and capable teachers that are able to implement such strategies in the classroom. The programme in England, for example, aims at employing a trained assessment specialist in every school who serves as mediator in the development of assessment strategies and in the communication and dissemination to new staff.

5. Conclusions

This report has reviewed the empirical economic literature which examines the relevance of non cognitive skills for school and labour market outcomes. We have started with a definition of non cognitive skills, and argued that the selected definition in empirical studies is often determined by data availability. Non cognitive skills, or personality traits, are closely intertwined with at least three of the eight key competencies for lifelong learning discussed in the European Framework. They are also closely related to the transversal skills that are deemed to be increasingly necessary given the current developments of technology and the organization of labour: social and communication skills, learning to learn and problem solving.

We have learnt that failure to consider non cognitive skills may complicate inference on the importance of relatively well measured cognitive skills. We have discussed evidence showing that high cognitive test scores are likely to result not only from high cognitive skills but also from high motivation and adequate personality traits. Whenever we emphasize the importance of cognitive skills for economic growth, we need to recognize that part of this effect may be driven by cross country differences in personality traits.

We have shown that non cognitive skills have important effects both on school attainment and on labour market outcomes. These effects are often as important as the effects of cognitive skills. The importance of non cognitive skills suggests that well designed policy intervention should try to better understand the process of skill formation. There is growing consensus among economists that important steps in the formation of cognitive skills and ability end up fairly early. This suggests that policy interventions have a higher success when they occur early in individual life. No consensus seems to exist on the malleability of non cognitive skills, with some arguing that these skills can be altered by policy until the end of teenage years and others holding that emotional intelligence can be changed at any age. Even so, the common observation that learning begets learning does suggest that even in the field of non cognitive skills early interventions may have a higher payoff than later interventions.

Most of what economists know about the technology of non cognitive skill formation concerns schools. While it is difficult to argue that all relevant skill formation ends before labour market entry, there is scant evidence on the role of the workplace in the maintenance and development of existing skills. Some evidence – including the one produced in this report – does point out to the fact that learning after school can alter in important ways the stock of non cognitive skills. Clearly, more research in this area is needed.

We have reviewed a selected group of policy measures both in the US and in Europe that aim directly or indirectly at improving non cognitive skills. It turns out that the evidence from programs explicitly targeted at the development of non cognitive skills is somewhat mixed and still scarce. As it is often the case, some programs work and some don't. Clearly, additional research is required to better understand what are the features of these programmes that make them successful compared to others.

The overall importance of non cognitive skills both for educational and for labour market success should also be taken into account when designing accountability policies or admission rules for schools and colleges. To date, most of these rules are based on achievements that consider almost exclusively cognitive skills (see Heckman, 2008). Moreover, exams and assessments within schools and colleges should be adjusted to the special relevance of non cognitive skills. Several countries already provide interesting approaches that incorporate the assessment of different non cognitive skills in school curriculums at different educational levels (see European Commission 2010). When cognitive and non cognitive abilities are poorly correlated, as documented in the literature, standard admission tests, exams and assessments based only on academic abilities can be less efficient than balanced tests, which weight both types of abilities⁴.

We believe that economic analysis has much to offer in this field, both with its well developed theoretical framework, which emphasizes private and social costs and benefits and the key role played by incentives, and with an empirical methodology that takes seriously the issue of causality. The interest of applied economists on the role played by non cognitive skills in schools and the labour market is rising and is mainly limited by the availability of relevant data. Compared to the well covered – and easier to measure – field of cognitive skills, there is no international survey that tries to measure the key personality traits in a homogeneous way across different countries. Producing such statistical information is challenging, because of the substantial heterogeneity and measurement errors associated to self-reporting, which remains the key way of collecting information on non cognitive skills in large surveys.

While we know quite a bit on these skills in Anglo-Saxon countries, especially the US and the UK, little has been done to investigate the role of non cognitive skills in Southern Europe, mainly because of the lack of suitable data. Clearly, more and better data are required to increase the scope of our knowledge.

⁴ Brunello and Giannini, 2004, show that the results of a balanced school admission test, which considers both cognitive and non cognitive skills, are not necessarily replicated by a sequential testing strategy, where schools admit students on the basis of their academic abilities and firms test the non cognitive skills of school graduates.

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Annex. Statistical sources of information on non cognitive skills.

It is useful to organize the available sources of information into two groups: 1) surveys that collect measures of cognitive and non cognitive skills for the sub-population of young individuals and/or students; 2) surveys that collect similar measures for the entire sample, independently of age.

The former group includes

- a) *The National Longitudinal Survey of Youth 1979*. This dataset is a panel which includes information on earnings, schooling and employment of a cohort of young Americans interviewed originally at age 14 to 21 in 1979. The survey includes information both on cognitive skills, measured by the AFQT (Armed Force Qualifications Test) score, and on personality traits, measured by the Rotter Locus of Control Scale – administered in 1979 – and the Rosenberg Self-Esteem Scale – administered in 1980. These measures are generated from individual answers to a number of items which refer to self - perceived internal control and self-esteem.
- b) *The National Child Development Survey*. This is a longitudinal dataset which contains rich information on the British cohort born between 3 and 9 March 1958. After a parental survey at birth, individuals have been surveyed in seven subsequent follow-ups – at age 7, 11, 16, 23, 33, 41 and 46. The survey includes measures of both cognitive and non cognitive skills taken at different ages (7, 11 and 16). The Bristol Social Adjustment Guide is used to measure social maladjustment at age 7 and 11. Teachers are given a series of phrases describing particular aspects of behaviour and are asked to underline those that apply to the child. The phrases are grouped into 12 domains, including anxiety for acceptance by children, hostility toward children, hostility towards adults, “writing off” adults and adult standards, withdrawal, unforthcomingness, depression, anxiety for acceptance by adults, restlessness and inconsequential behaviour (see Carneiro, Crawford and Goodman, 2007).
- c) *The British Cohort Survey*. This survey includes all individuals born in Great Britain between 4th and 11th April 1970. Information was obtained about the

sample members and their families at birth and at age 5, 10, 16 and 30. While measures of cognitive skills are available at age 5 and 10, non cognitive variables are collected from mothers at age 5, from teachers at age 10 and directly from individuals at age 16. The relevant variables are rather close to the FF model, and include: antisocial behaviour, neuroticism, application, clumsiness, extroversion, hyper-activity and anxiety (see Bladen, Gregg and MacMillan, 2006).

- d) *The Wisconsin Longitudinal Survey*, which surveys about 10 thousand graduates from Wisconsin high schools in 1957, and re-interviews respondents in 1975 and 1992. The available information on personality traits is based on the Big Five Inventory, which broadly corresponds to the FF. The data also contain information on cognitive skills and labour market outcomes (see Muller and Plug, 2006).
- e) *The National Education Longitudinal Survey*. This survey follows a cohort of US students who were in eight grade in 1988 with interviews in 1998, 1990, 1992, 1994 and 2000. The 1988, 1990 and 1992 rounds include detailed surveys of students still in high school, as well as surveys of their teachers and parents. The 2000 wave includes also details on postsecondary education and earnings. Cognitive skills are measured with math, reading, history and science tests that were administered in the 8th, 10th and 12th grades. Measures of non cognitive skills can be obtained by combining the information provided by students and teachers on a number of relevant items. Deke and Haimson, 2006, for instance, identify the following personality traits: work habits, leadership skills, pro-social behaviour, locus of control and attitudes toward determinants of success.
- f) *The Project Talent*. This is a study of 1960 US High School Students, who were surveyed during high school in 1960, and followed longitudinally for eleven years after high school. During the base year, over 400,000 students - approximately five percent of all U.S. high school students - responded to a 400-question survey, and were given cognitive and psychological assessments. Because the student testing and survey process lasted two full days, Project Talent also has a much more complete inventory of personality

measures than other US surveys (see Kuhn and Weinberger, 2002). This information includes for instance data on leadership roles and club/sports participation during high school.

By collecting information on cognitive and non cognitive skills at early age and adolescent years, the surveys in this group give to researchers the opportunity to investigate the impact of both types of skills on either school performance or early labour market outcomes after school completion. By definition they are not particularly useful to study the effect of skills on the adult population. The relevant information for this purpose is available in the second group of surveys, which includes

- a) *The German Socio Economic Panel*. The SOEP is a representative longitudinal micro-database that provides a wide range of socio-economic information on private households and their members in Germany. The annual data were first collected from about 12,200 randomly selected adult respondents in West Germany in 1984. After German reunification in 1990, the SOEP was extended by adding about 4500 persons from East Germany, and supplemented by expansion samples later on. Information on personality traits is provided mainly in 2005, whereas data on cognitive abilities is given in 2006. The 2006 wave of the SOEP includes two short tests of cognitive ability: a symbol correspondence test and a word fluency test. The 2005 wave of the SOEP has instead questions on three items for each factor of the Five Factor Model. It also asks respondents about 10 items which are the ingredients required to measure the locus of control (four for the internal and six for the external locus). The FF as well as the locus of control indicators are answered using a 7-point Likert type scale, ranging from 1: “disagree completely” to 7: “agree completely”.
- b) *The British Household Panel Survey*. The survey provides detailed information on British individuals and households on an annual basis. As in the case of SOEP, the 2005 questionnaire includes a set of questions that can be used to obtain a psychological profile of the respondent. The items are related to the Five Factor Model. The BHPS provides a set of fifteen

questions, three for each of the five factors of the FF model. These questions are answered by respondents using a 7-point Likert type scale.

- c) *The DNB Household Survey*. This survey includes, in addition to detailed information on the saving and borrowing behaviour of Dutch households, individual labour market details and items designed to tap psychological concepts. In 1996, the FF questions were included in the DHS. Twenty items represent each factor, half of which are positively phrased and half negatively. All items are comprehensible to respondents with lesser education because they lack conditionals, negatives, convoluted formulations and trait-descriptive adjectives and nouns (see Nyhus and Pons, 2005).

Table 1. The Big Five personality traits

Dimension	Facet (and correlated trait adjective)
Extraversion vs introversion	Gregariousness (sociable) Assertiveness (forceful) Activity (energetic) Excitement-seeking (adventurous) Positive emotions (enthusiastic) Warmth (outgoing)
Agreeableness vs antagonism	Trust (forgiving) Straightforwardness (not demanding) Altruism (warm) Compliance (not stubborn) Modesty (not-show-off) Tender-mindedness (sympathetic)
Conscientiousness vs lack of direction	Competence (efficient) Order (organized) Dutifulness (not careless) Achievement striving (thorough) Self-discipline (not lazy) Deliberation (not impulsive)
Neuroticism vs emotional stability	Anxiety (tense) Angry hostility (irritable) Depression (not contented) Self-consciousness (shy) Impulsiveness (moody) Vulnerability (not self-confident)
Openness vs closedness to experience	Ideas (curious) Fantasy (imaginative) Aesthetics (artistic) Actions (wide interest) Feelings (excitable) Values (unconventional)

Different facets of Big Five factors, from Muller and Plug (2006).

Table 2: Correlation between competencies

Reading	0.78				
History	0.77		0.83		
Science	0.83		0.80		0.84
	Maths	Work Habits	Sports Participation	Pro-social Behaviour	Leadership
Work Habits	0.38				
Sports Participation	0.12	0.08			
Pro-social Behaviour	0.26	0.59	-0.11		
Leadership	0.20	0.18	0.35	0.07	
Locus of Control	0.31	0.34	0.12	0.22	0.19

Note: see Deke and Haimson, 2006.

Table 3: Sub-indicators of the PISA measure of morale and commitment

School Principal's assessment of student morale and commitment							
	Percentage of students in schools where the principals agree or strongly agree with the following statements about the students in schools						
	Students enjoy being in school	Students work with enthusiasm	Students take pride in this school	Students value academic achievement	Students are cooperative and respectful	Students value the education they can receive in that school	Students do their best to learn as much as possible
Indonesia	98	96	99	99	99	99	94
Thailand	99	88	98	99	100	99	95
Australia	99	90	94	90	98	96	85
Canada	99	94	94	94	97	95	90
New Zealand	100	92	96	90	97	96	84
United States	99	89	95	92	96	94	84
Mexico	95	89	96	90	88	88	83
Ireland	99	83	94	93	98	93	84
Tunisia	98	76	94	84	85	82	78
Japan	99	76	81	78	90	82	67
Sweden	98	88	85	93	97	90	85
Iceland	100	93	95	89	95	86	73
Denmark	99	93	95	87	93	95	84
Austria	97	85	90	82	93	91	72
Brazil	94	84	92	77	87	88	66
Finland	99	90	87	94	97	90	64
Greece	78	65	89	90	93	86	60
Macao-China	97	75	94	97	97	96	55
Poland	97	65	96	95	89	87	71
Switzerland	98	80	79	92	96	90	77
Italy	79	64	88	96	86	95	67
Portugal	100	76	95	88	91	86	60
Russian Fed.	98	57	97	89	88	98	81
Korea	86	65	81	73	93	81	70
Turkey	88	57	89	75	89	87	64
Norway	100	77	82	91	94	87	69
Netherlands	95	87	86	90	89	91	67
Hong Kong-China	99	71	86	75	94	95	57
Latvia	100	72	99	95	91	96	39
Uruguay	91	71	90	78	93	86	53
Belgium	99	76	87	77	92	89	68
Slovak Republic	89	59	89	93	88	91	35
Czech Republic	91	49	92	94	93	86	51
Hungary	93	53	93	59	84	90	32
Spain	97	54	92	77	81	89	35
Germany	99	63	71	63	88	88	40
Luxembourg	100	40	88	81	93	94	45
Serbia	45	40	74	69	69	87	39
OECD average	92	73	86	83	89	87	65
United Kingdom	m	m	m	m	m	m	m

Source: Organisation for Economic Co-operation and Development (OECD) (2004): Learning for Tomorrow's World. First Results from PISA 2003, p. 224.

Table 4: Sub-indicators of the PISA measure of disruptive behaviour

Student-related factors affecting the school climate						
Percentage of students in schools where the principals agree or strongly agree with the following statements about the students in schools						
	Student absenteeism	Disruption of classes by students	Students skipping classes	Students lacking respect for teachers	Student use of alcohol or illegal drugs	Students intimidating or bullying other students
Korea	17	18	13	23	13	13
Uruguay	58	12	42	17	7	11
Japan	39	13	23	32	1	7
Belgium	34	26	21	18	7	14
Hong Kong-China	27	31	21	28	18	25
Hungary	56	42	26	14	6	8
Slovak Republic	61	40	a	12	4	5
Thailand	45	19	19	8	2	4
Denmark	39	42	14	13	1	7
Mexico	44	27	32	13	8	24
Czech Republic	65	36	24	16	2	2
Iceland	38	62	28	22	5	25
Italy	68	41	63	17	1	8
Switzerland	27	52	11	17	19	24
Spain	44	59	38	34	5	13
Australia	52	37	20	22	6	24
Austria	53	38	43	17	9	15
Poland	47	40	45	21	10	8
Germany	35	51	25	22	9	24
Sweden	48	50	28	25	5	17
Finland	56	39	34	12	4	7
Latvia	79	24	57	14	11	8
Portugal	61	35	50	16	3	9
Luxembourg	39	45	25	16	9	15
Norway	37	74	20	35	3	12
Brazil	51	44	45	30	21	26
Netherlands	43	43	30	28	7	22
United States	69	27	36	22	21	14
Ireland	63	47	21	23	24	21
Turkey	70	46	45	37	22	32
Greece	66	52	46	47	31	23
New Zealand	63	41	38	24	20	15
Canada	65	34	58	25	32	18
Macao-China	62	54	51	56	39	32
Serbia	90	45	82	34	24	12
Russian Fed.	90	41	86	49	41	41
Tunisia	84	78	67	58	45	43
Indonesia	80	79	72	69	67	64
OECD average	48	40	30	22	10	15
United Kingdom	m	m	m	m	m	m

Source: Organisation for Economic Co-operation and Development (OECD) (2004): Learning for Tomorrow's World. First Results from PISA 2003, p. 216.

Table 5: Sub-indicators of the PISA measure of disciplinary climate in math lessons

	Students' views on the disciplinary climate in their mathematics lessons				
	Percentage of students reporting that the following happens in every or in most of their mathematics lessons				
	Students don't listen to what the teacher says	There is noise and disorder	The teacher has to wait a long time for the students to quieten down	Students cannot work well	Students don't start working for a long time after the lesson begins
Russian Fed.	22	16	18	19	15
Japan	19	17	14	25	15
Latvia	27	20	20	18	21
Germany	22	25	32	26	26
Ireland	32	32	25	19	21
Liechtenstein	26	28	33	28	25
Austria	31	27	33	27	30
Hungary	28	28	30	22	19
Hong Kong-China	21	17	19	19	20
United States	32	34	26	19	27
Korea	27	a	19	18	21
Poland	33	27	30	21	22
Switzerland	28	33	32	26	31
Macao-China	18	15	17	21	20
Indonesia	25	32	37	22	30
Belgium	28	37	34	19	33
Canada	29	39	28	18	31
Portugal	28	35	30	22	27
Mexico	29	27	26	24	34
Thailand	22	27	32	23	28
Australia	34	42	32	20	27
Czech Republic	36	34	34	25	25
Uruguay	32	37	32	24	31
Spain	30	35	36	24	35
Sweden	26	36	33	20	28
Denmark	32	43	28	20	27
Tunisia	26	37	36	33	52
Serbia	33	32	28	27	28
Slovak Republic	39	34	34	25	28
Italy	37	42	39	25	33
Turkey	24	33	35	31	31
Netherlands	27	42	36	19	39
France	33	46	38	25	42
Finland	36	48	35	19	32
Iceland	31	41	36	25	26
New Zealand	38	47	37	23	31
Luxembourg	35	48	43	39	35
Greece	35	43	35	29	39
Norway	34	41	36	28	36
Brazil	35	38	38	30	63
OECD average	31	36	32	23	29
United Kingdom	m	m	m	m	m

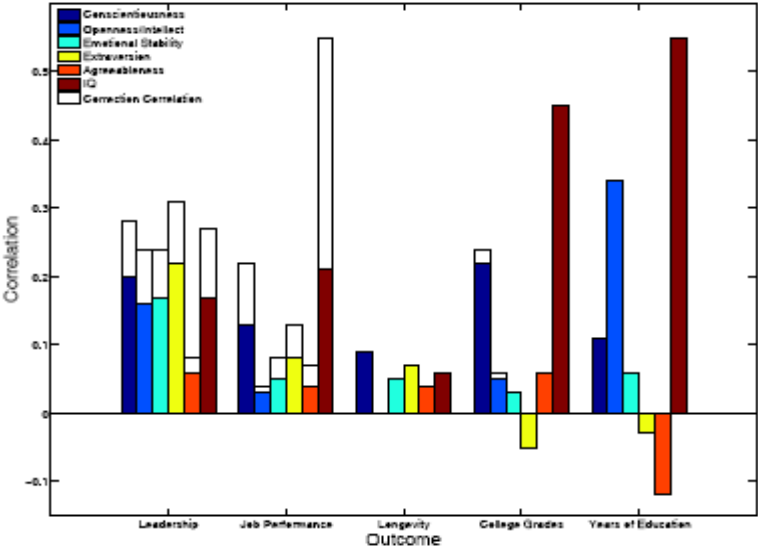
Source: Organisation for Economic Co-operation and Development (OECD) (2004): Learning for Tomorrow's World. First Results from PISA 2003, p. 217.

Table 6: Partial correlations between the external locus of control and Education & Training. Germany 2005.

	<i>Coefficient</i>	<i>Standard error</i>
Potential experience	0.001***	0.0002
Gender	0.005	0.005
Year of schooling	-0.021***	0.0016
Apprenticeship	-0.016***	0.006
Vocational education	-0.026***	0.006
Hours of training	-0.003***	0.0003
Number observations	11354	

Results from the German Socio Economic Panel. Dependent variable: log external locus of control. One, two and three stars when the coefficient is statistically significant at the 10, 5 and 1 percent level of confidence. Robust standard errors.

Figure 1: Predictive validities of IQ and Big Five dimensions



Predictive Validities of IQ and Big Five Dimensions. from Borghans et al. (2006, p. 1007).