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Behavioral economics of education☆

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ABSTRACT

During the last decade knowledge about human behavior from psychology and sociology has enhanced the field of economics of education. By now research recognizes cognitive skills (as measured by achievement tests) and soft skills (personality traits not adequately measured by achievement tests) as equally important drivers of later economic outcomes, and skills are seen as multi-dimensional rather than one-dimensional. Explicitly accounting for soft skills often implies departing from the standard economic model by integrating concepts studied in behavioral and experimental economics, such as self-control, willingness to compete, intrinsic motivation, and self-confidence. We review how approaches from behavioral economics help our understanding of the complexity of educational investments and outcomes, and we discuss what insights can be gained from such concepts in the context of education.

1. Introduction

Deciding how much to invest in their education is one of the most important economic decisions people make during the course of their lives. Education improves a range of important individual outcomes such as life-time earnings (Heckman et al., 2006), health, absence of delinquency or good citizenship (Lochner, 2011). Yet, many of the observed education investment decisions and outcomes seem puzzling when viewed through the lens of a standard economic model. For example, a sizeable proportion of students drop out of education just at the point in time where the returns appear to be at their maximum (Oreopoulos, 2007; Heckman et al., 2006), a tendency to shy away from competitive settings makes many girls underperform on math tests or avoid math courses altogether although the future returns are substantial (Niederle and Vesterlund, 2010; Joensen and Nielsen, 2014), and systems for grading and ranking students have a robust effect on educational achievement even if one controls for ability (Jalava et al., 2014; Murphy and Weinhardt, 2014).

In this paper, we review how a range of concepts and questions studied in behavioral and experimental economics can enhance our understanding of the complexity of educational investments and outcomes and thereby help explain the puzzling empirical evidence described above.

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Behavioral economics incorporates insights from psychology and sociology into standard economic theory to better understand human behavior.[1] It is often complemented by experimental evidence on actual behavior. Together these two fields suggest that people have non-standard preferences (such as preferences for fairness, time-inconsistent preferences and reference dependent preferences), they have non-standard beliefs (e.g., they are overly self-confident about their abilities or they hold self-serving beliefs) and they engage in non-standard decision making by responding to framing of choices or emotions (cf. DellaVigna, 2009).

As we argue, one needs reference to a range of these concepts to better understand educational outcomes. We need reference to self-control problems (time-inconsistent preferences) or self-confidence in order to better understand why many people invest too little in education. We need reference to experimental evidence on differences in how people respond to competitive pressure to better understand why women are less likely to excel in math or apply for elite education. We need reference to behavioral theories of motivation to better understand why relative rank in academic achievement within a class often influences academic outcomes independently from ability.

The concepts studied in behavioral and experimental economics are closely related to what is often referred to as "non-cognitive skills" or "soft skills" in the literature on economics of education.[2] Such soft skills encompass personality traits, goals, motivations, and preferences that are valued in the labor market, in school, and in many other domains (Heckman and Kautz, 2012). While the field of economics of education by now recognizes that cognitive skills (as measured by test scores) and soft skills have similar importance for educational achievements, soft skills are often treated as a black box summarized by a parameter in the utility or production function. As we outline in this review, applying models from behavioral economics and insights from laboratory and field experiments help us to better understand what is going on inside this black box, which in turn helps us to better understand investments into education.

The review provides a selected coverage of topics from behavioral and experimental economics. Compared to other review articles in behavioral economics, we do not structure this review along the most prominent "behavioral biases" such as reference dependent preferences, social preferences, time-inconsistent preferences, or non-standard beliefs. Rather we focus on those concepts from behavioral and experimental economics that seem particularly relevant for understanding investments into education. For example, there are several experimental studies that examine the development of social preferences in children.[3] Yet, (at least up to now) the impact of social preferences on educational investments outcomes has not been examined and thus we do not review this literature further here. Further, we focus on theoretical and experimental studies in combination with empirical evidence. In a complementary review, Lavecchia et al. (2014) survey intervention studies that are inspired by behavioral economics.

Combining the two lines of thinking embodied in the literatures on economics of education and behavioral economics offers many insights, as we argue. Yet there are some caveats: First, there is a caveat regarding the use of experiments to gain insights into the economics of education. While much of the empirical research in the educational literature is conducted using large panel data sets and well-defined population models, most lab and field experiments use convenience samples, low stakes and rely on the experimental random assignment method. In addition, the tasks in the lab are sometimes artificial compared to real world decision making. Although there is some replication of the main results with more representative samples, high stakes, and in field settings (see Falk and Heckman, 2009, for a discussion), additional research is needed. Further, the results from experimental economics mostly shed light on short run effects (e.g., how extrinsic incentives affect motivation) because long run effects cannot easily be observed in the laboratory or even field experiments. Second, there is a caveat about using behavioral economics, which relies on the same techniques and models as standard economic theory. Its aim is to enrich standard economic theory with more realistic assumptions about human behavior – based on insights from psychology or sociology. Thereby, it comes with its own set assumptions. And these assumptions also have to be validated empirically. As a consequence, many models in this field still are evolving (e.g., see the discussion of how models of reference dependent preferences progressed in Barberis, 2013). Thus, while we think that insights from behavioral and experimental economics can enhance our understanding of educational decision making, care should be taken when interpreting and applying the results.

The remainder of the paper unfolds as follows. Section 2 briefly describes how economics of education often models student achievement as outcomes of an education production function (Hanushek, 1979; Todd and Wolpin, 2003) that depends on individual skills and abilities, as well as the history of family inputs, school and pre-school inputs, and in some cases also peer inputs. We then review evidence on the importance of soft skills for educational achievement and we outline how researchers have applied soft skills in the field of economics of education. Noting that many of the factors of interest are closely related to the concepts studied in behavioral and experimental economics, we review in Section 3 relevant articles from these fields. Section 4 links back to the education production function by describing how concepts from behavioral and

[1] For an overview of the field of behavioral economics see Rabin (1998) and DellaVigna (2009).

[2] They are also sometimes described as socio-emotional skills or meta-cognitive skills.

[3] Children become fairer, and less spiteful as they become older (Fehr et al., 2008, 2013; Almås et al., 2010). Sutter et al. (2010) distinguish different social preferences and observe that inequality aversion becomes less prevalent with age, while efficiency concerns become more important for boys and maximin preferences more important for girls. Parochialism first becomes significant in the teenage years (Fehr et al., 2013). Further, trust increases from early childhood to early adulthood (Sutter and Kocher, 2007). Belot and van de Ven (2011) show the importance of friendship ties by establishing that children are biased in favor of their friends.

experimental economics relate to the three components in education production. Section 5 discusses policy implications and lessons for future research.

2. Soft skills in economics of education

2.1. Background: education production

Coleman (1966) was one of the first to study the relationship between the inputs into the educational process and student performance. Since then much research has been devoted to the statistical analysis of this relationship, which led to a formalization of the education production function by Hanushek (1979) and Todd and Wolpin (2003). This approach relates outcomes of the education production process – student achievement (A) as measured e.g., on standardized tests or attained education – to the student's individual skills and abilities (μ), as well as to family (F), school (S), and peer inputs (P). Let time period 0 be the period prior to school entry and let time periods 1 and 2 be the first and second years of school. Then the achievement production may be described as follows:

$$A_1 = g_0(F_0, \mu); \qquad A_2 = g_1(S_1, P_1, F_1, F_0, \mu) \tag{1}$$

The components F and S are thought of as investment responses defined by a family decision rule and a school decision rule, respectively. For instance family input in time period 0, F_0, is a function of family resources, W, and student ability, μ, while F_1 would also depend upon student achievement at school entry, A_1. In comparison to the model presented by Todd and Wolpin (2003), we have detached peer inputs, P, from the other inputs, although it is clearly decided upon by the family and/or the school and would often be considered a part of the family or school input in this model.[4]

The component related to a student's individual skills and abilities (μ) is often thought of as stemming from an initial endowment or learning capacity. Empirical studies typically assume that unobserved ability is a single, time invariant factor that can be differenced out in a panel, or they employ proxies such as parental cognitive ability.

The family inputs component of education production (F) is a function of the family's permanent economic and mental resources (W). It includes time and money investments by the family as well as child development activities from the time of conception onwards. Already Coleman (1966) noted that families play a strong role in shaping adult outcomes. Heckman (2008) states that "the accident of birth is a major source of inequality" and he reports descriptive evidence which suggests that growing up in an intact family with an educated mother is a strong predictor of positive adult outcomes. Investigating the causal impact of parental education on childrens' education Holmlund et al. (2011) find that almost half of the intergenerational correlation is causal. However, it remains an open question to what extent this effect is caused by higher income or by other influences related to parental education such as parenting style, patience or role model effects. The literature thus far suggests that one should judge the quality of the family environment not only on the amount of resources available but more broadly based on the quality of parenting, which may also encompass transmission of self-control, self-regulation, self-confidence, risk attitudes, patience, trust, altruism, or motivation (an issue to which we return in Section 4.1).

The school inputs component of education production (S) captures school and pre-school resources. Various studies consider the impact of school resources – the most studied and arguably the most important of which are class size and teacher quality – on educational achievement. According to Hanushek (2006) research provides little indication of a consistent relationship between resources available to schools (reflected among other things in class size) and student achievement. Others disagree, however. Krueger (2003) and Heinesen (2010) find substantial class size effects on educational achievement. Recently Fredriksson et al. (2013) documented persistent long-run effects of reduced class size in Sweden. Interestingly, these were driven by impacts on "non-cognitive skills". When it comes to teacher quality, there is a wide consensus that teachers are an important part of the school environment. Students seem to benefit from good teachers and to suffer from bad teachers. Jackson (2013) shows that some teachers are effective at improving students' cognitive skills while others are effective at improving their "non-cognitive skills", and that both types of skills are equally important for important adult outcomes (income, college attendance, and whether a student is arrested). However, it is largely unknown what constitutes a good teacher, since formal qualifications, certificates and experience of teachers do not have much explanatory power (Hanushek and Rivkin, 2006). Overall, both when it comes to the importance of class size and importance of teachers, research suggests that their effects on soft skills of students have to be accounted for in order to understand the impact on educational achievement.

The peer effects component of education production (P) is a function of the quality of a student's peer group. Hanushek (2006) and Sacerdote (2011), for example, argue that peer groups are as important for student outcomes as other inputs in the production function, although the validity of these results is sometimes questioned (Angrist, 2014). While linear-in-means models only find moderate effects of having high ability peers in the class, nonlinear models often reveal substantial effects (e.g., Lavy et al., 2012). Peer effects on behavioral outcomes – such as drinking, crime, drug use or teen pregnancy – are larger than those on academic outcomes – such as test scores (see Sacerdote, 2011), and recent studies suggest that disruptive peers are detrimental to both student behavior and academic achievement (Eriksen et al., 2014; Figlio, 2007).

[4] Recently, it has been shown that it may be difficult to manipulate peer groups to actually improve outcomes (Carrell et al., 2013).

To summarize, for all the components in the education production function, family inputs, school inputs and peer inputs, it is evident that research in economics of education increasingly refers to soft skills in order to make sense of observed behavior, and we now elaborate in more detail on such attempts.

2.2. Soft skills in economics of education

There are various channels through which education influences individual outcomes such as life-time earnings, but until recently the literature has focused mainly on the cognitive skill channel. For example, a higher level of education might improve earnings because it impacts cognitive skills directly (Cunha and Heckman, 2007), because it signals higher cognitive skills (Spence, 1973), or because it plays a direct role in revealing cognitive skills to the labor market through the vitae which typically includes information about grades, major and college attended (Arcidiacono et al., 2010).

In the last decade, however, researchers increasingly recognized the importance of soft skills for educational achievement and investments. For example, Eckstein and Wolpin (1999) discuss lacking motivation and Oreopoulos (2007) discusses self-control problems as reasons for high-school dropout. In the same vein, Heckman and Rubinstein (2001) report that a test certifying that the test taker has American or Canadian high-school-level academic skills (the General Educational Development Test) is a mixed signal. On the one hand, it signals that the individual possesses the cognitive skills to fulfill high school. But on the other hand, it signals that the individual lacks the soft skills needed to complete an ordinary high-school education for which the person would have earned an ordinary high-school diploma.[5]

A body of research provides specific evidence on the impact that soft skills have on educational achievement. A number of papers highlight the role of patience and self-control. Shoda et al. (1990) find that the ability to delay gratification at the age of 4 relates to academic competence in adolescents, and Duckworth and Seligman (2005) observe that self-discipline is a better predictor than IQ of academic performance[6] in adolescents. In a recent study, Lindahl et al. (2014) find a negative correlation between impatience and school performance (such as grades and the highest completed school level). Similarly, the predictive power of personality traits (such as the Big Five) for educational achievement is comparable to the one of IQ and achievement tests (Almlund et al., 2011). Personality traits even influence the level of education for individuals with a very high IQ as Gensowski (2013) shows.

Not only do soft skills influence educational achievement, but education and the educational environment also affect soft skills. Next to the family and peers, pre-school and school play an important role in shaping soft skills (see, e.g., Cunha et al., 2006; Cunha and Heckman, 2007; Datta Gupta and Simonsen, 2010). For example, the Perry Preschool Program, an intervention aimed at socially disadvantaged children, did not have a lasting effect on IQ. Nevertheless, the treatment group outperformed the control group on a range of individual outcome measures later in life – suggesting that the program affected soft skills that were relevant for life-time success (for the effects of the Perry Preschool Program, see e.g., Heckman et al., 2010).

To summarize, there is a large body of evidence suggesting that soft skills play an equally important role for education investments and outcomes as cognitive skills do. Education research in economics[7] has started to incorporate a broader set of skills by allowing for multidimensional endowments and skills in modeling the inputs to and outputs of education production and by parameterization of preferences (e.g., Almlund et al., 2011).[8] Yet these approaches most often treat soft skills as a black box. As we argue in the next section, behavioral and experimental economics can contribute to refine our understanding of what soft skills are and how they influence education investments and outcomes.

3. Soft skills and investments seen from the perspective of behavioral economics

Several of the soft skills are related to a range of concepts and questions studied in behavioral and experimental economics, such as willingness to compete, self-control problems (time-inconsistent preferences), intrinsic motivation, or self-confidence. In the following, we discuss the insights that behavioral and experimental economics provide on soft skills and how these influence investments into education. Thereby, we make an attempt to further open the black box of soft skills in education investments.

3.1. Competition and gender differences

The picture that emerges from the large literature on gender differences in academic performance is that girls tend to get better grades and boys tend to do better on standardized tests (Duckworth and Seligman, 2006). In particular, more

[5] Bowles et al. (2001) demonstrate the importance of soft skills for employment decisions. They emphasize the results of a survey where employers were asked to rate the importance of a range of characteristics of applicants for non-supervisory or production jobs for their hiring decisions. “Attitudes” ranked much higher than “years of schooling”, “score on tests given by the employer” or “academic performance”.

[6] Measures of educational performance include final grades, school attendance, standardized achievement-test scores, and selection into a competitive high-school program.

[7] For a meta-analysis of studies in psychology that examine the factors that influence educational achievement see Hattie (2008).

[8] Thus A from Eq. (1) increasingly includes soft skills.

boys than girls obtain high test scores in mathematics (e.g., Pope and Sydnor, 2010).[9] Next to mechanisms that cause gaps in self-discipline and grading biases, gaps in individual responses to competitive pressure can possibly explain this observation. We start by outlining the experimental evidence on a gender gap in competitiveness, before we discuss the consequences of this gender gap for educational choices and performance.

Evidence. Gneezy et al. (2003) were the first to provide experimental evidence on the gender gap in responses to competitive pressure. They observe a gender gap in performance in a tournament, but not in a non-competitive situation. Not only does the performance of men and women differ in competitive situations, men and women also differ in their selection into competitive situations. Niederle and Vesterlund (2007) and Datta Gupta et al. (2013) examine this selection. They observe that women "shy away from competition". In contrast to Gneezy et al. (2003), Datta Gupta et al. (2013) however do not observe a clear gender gap in performance.

What drives this gender gap in competitiveness? When does it arise and when not? A range of studies suggest that gender stereotypes, the group composition and cultural differences matter for how individuals respond to competition.[10] Regarding gender stereotypes, Dreber et al. (2014), for instance, find that adolescent boys and girls are equally likely to self-select into competition for a verbal task but that a gender gap exists for a mathematical task. In the same vein, Pope and Sydnor (2010) find large variation across U.S. states in gender disparities in math and science tests, where boys stereotypically do better, and in tests of reading, where girls stereotypically do better. Interestingly, some states appear to be more gender-equal across *all* subjects, whereas gender disparities in other states conform more to the gender stereotypes. State differences in gender attitudes measured by a question[11] from the General Social Survey (GSS) explain to which extent test scores conform to gender stereotypes, with states with stronger gender attitudes also having larger gender gaps in test scores. Observing that the genetic and hormonal differences across genders should not depend on the state one is born in, the authors argue that their results point to differences across states in the social forces that reinforce stereotypes.

Next to the gender stereotypes, group composition matters. For example, girls from single sex schools are more eager to engage in competition than girls from co-educational schools (Booth and Nolen, 2012). Further, the gender gap in willingness to compete arises in some cultures, but not in others. Andersen et al. (2010) probe such cultural differences and find that in the patriarchal Indian villages there is no gender gap in the selection into competition at the age of 7, but a gap exists at the age of 15, while in the matrilineal villages no gender gap emerges at all. In contrast, Cárdenas et al. (2012) find a gender gap regarding the selection into competition in Sweden but not in Colombia – even though Sweden is usually viewed as more gender equal than Colombia.

Consequences. Some of the results discussed above indicate that females and males perform differently under competitive pressure. To the extent that educational activities and education programs are viewed as competitive, gender differences in competitiveness hence may be an important factor behind gender differences in educational choices. Niederle and Vesterlund (2010), for instance, argue that an individual's response to competitive pressure is a soft skill that influences test scores over and above influences of ability. They argue that gender differences in this soft skill in part explain why more boys than girls excel in math. Math may be seen as a competitive discipline because answers are either right or wrong and because math is highly predictive of future earnings. Further, math teaching and test-taking most often take place in a mixed-sex environment against the backdrop of the stereotype that boys excel in math but girls excel in language and reading. In line with the stereotype, girls at the top of the ability distribution tend to underestimate their own relative math skills. In such a context, a substantial fraction of girls may avoid competition against males. Altogether, there hence is a risk that test scores magnify or distort gender differences in skills and especially so for math skills.

There is ample evidence suggesting that the abovementioned mechanisms play a role in generating gender gaps in educational choices and academic performance.

The impact of single-sex education on academic performance is investigated by Eisenkopf et al. (2014). During the period 2001–2008, a group of 808 female students entering a Swiss high school were randomly assigned to a four year single-sex or co-educational high school program. The authors document that females taught in single-sex classrooms outperform those attending co-educational program by 7–10% in math while there was no performance difference in German. The effect is largest for females with high ex-ante math abilities. Based on a supplementary survey, the authors find that a plausible mechanism for the finding is improvement of self-assessed math ability and academic self-concept in math.

The relative performance of men and women in highly competitive exams is investigated in three studies using data from entrance exams for university programs (Ors et al., 2013; Jurajda and Münich, 2011; Pekkarinen, 2014). They all observe a gender gap. Ors et al. (2013) uses data from the entrance examinations for the MSc at a French elite university (HEC, Paris). They contrast performance on the entrance examinations with how the same cohort does in less competitive situations, using data from final high-school examinations and first-year exams at HEC. Comparing students with the same educational

[9] Specifically, the pattern appears to be one of rough gender equality in average test scores, but differences at the extremes. For example, in a meta-analysis of 100 studies Hyde et al. (1990) find only a small and insignificant average standardized difference in math test scores between boys and girls. But the math test scores of boys consistently have larger variance (e.g., Hedges and Nowell, 1995).

[10] An additional line of inquiry is to scrutinize how early the gender gap emerges. However, here the results are still not conclusive. Dreber et al. (2011) find no gender difference in the performance in reaction to competition for school children aged 7–10 for tasks such as running, skipping rope and dancing, while Sutter and Rützler (2010) find a gender gap in the willingness to compete already at the age of 3 for the task of running among Austrian children.

[11] "Is it much better for everyone involved if the man is the achiever outside the home and the woman takes care of the home and family?"

background they find that men outperform women on the competitive entrance examinations, even though women do better on the non-competitive high-school examinations and in the first year non-mathematical courses. As a consequence, men are more likely to enter the competitive programs even though they have inferior ex-ante abilities compared to women. Jurajda and Münich (2011) observe a cohort applying to Czech universities. Similar to Ors et al. (2013) they observe a gender gap in performance for the university entry examinations to the very competitive programs, although women do equally well in the entrance examinations for the less competitive programs. Pekkarinen (2014) studies gender differences in performance at university entry examinations for Business and Economics programs in Finland. When he controls for the fact that female applicants have higher ex-ante ability and that they apply to lower quality universities than males, he finds that females are less likely to gain entry than males. Further, he shows that females deviate more from an optimal answering strategy than males by answering too few items on the test.[12]

Two other studies examine the consequences of differences in the willingness to compete (elicited with experimental tasks) for the choice of high school and college major. Buser et al. (2014) observe that both gender and the willingness to compete relate to the choice of the high-school profile among Dutch school children. Women enroll in less prestigious profiles than men and competitiveness accounts for 18 percent of the gender gap (controlling for grades and mathematical ability). In contrast, Reuben et al. (2013) do not observe any relation between willingness to compete and the choice of college major among a sample of undergraduate students at NYU. Expected future earnings however do relate to competitiveness, as well as a measure of overconfidence. The different results of these two studies could possibly be explained by the different subject pools. While Buser et al. (2014) consider Dutch secondary school students on a pre-university track, Reuben et al. (2013) consider students who are already admitted to a private elite university and who hence are part of a selected sample with some tolerance for being in a competitive environment.

To sum up, there is evidence that some females shy away from competitive settings – in particular in environments where males most often dominate or excel. In an education context, this may explain why women tend to avoid elite education and educational paths that are heavy on math. These behavioral patterns may also explain some of the gender differences in education and labor market outcomes.

3.2. Self-control

Decisions about investments into one's education involve trading off costs right now (such as boredom and fatigue from studying, or foregone current earnings) against benefits that are often far into the future (such as higher future earnings). From behavioral economics we know people facing such intertemporal trade-offs often exhibit time-inconsistent preferences. They are more patient when thinking about decisions in the distant future than when they actually have to make such decisions right now. This phenomenon is often modeled by assuming a present bias, i.e., an additional discount factor applied to any payoff that lies in the future (Laibson, 1997).[13]

As a consequence of the present-bias, people face the problem of wanting one thing but later doing another thing unless they can exert self-control. In the context of education, for example, a non-negligible fraction of students provide insufficient study effort or procrastinate on important tasks like exam preparation even though they later regret it (see, e.g., Solomon and Rothblum, 1984; Steel, 2007). As a consequence grades, for instance, do not just depend on intellectual aptitude but also on being able to sustain effort and concentration over extended periods of time in spite of fatigue, boredom or other distractions.

Not only are there individual differences in such a present bias, but also there is heterogeneity in awareness of having such a bias. For example, O'Donoghue and Rabin (1999) distinguish between naïve individuals who erroneously think they have time-consistent preferences and sophisticated individuals who are aware of their present bias. (Types in between, who underestimate the extent of their present bias, are referred to as partially naïve.) This distinction has important consequences for behavior. For example, sophisticates make use of commitment devices to regulate their behavior to avoid the impulsive choices that naïves will make. And this distinction is also important for informing policy, because low study effort can result either because students are naïve about their present-bias, which for example could be addressed through better feedback by teachers, or because of a lack of possibilities for committing to study effort, which for example could be addressed by offering supervised homework sessions after school.

In the following, we first briefly discuss experiments that elicit time-(inconsistent)-preferences in settings relevant for education and then review how time-(inconsistent)-preferences are related to educational decisions and achievement, such as drop-out, grades and disciplinary referrals. Notice, however, that the concepts are not always defined as rigorously in some of the experiments as in the theoretical models described above.[14]

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[12] Related to these studies, Zhang (2013) examines how experimentally elicited measures of willingness to compete relate to taking a competitive entrance exam in China. She finds that more competitive adolescents are more likely to take the exam, but does not find any gender differences.

[13] Here the overall utility at date t, U_t, is given by: $U_t = u_t + \beta \sum_{s=t+1}^{T} \delta^{s-t} u_s$, where u_t refers to the per-period utility. While δ captures the standard exponential discount factor, β captures the individual's present bias. The present bias implies that the discounting between the present and the future is higher than between any future time periods.

[14] Some experiments do not aim at eliciting time-preferences, but rather confront subjects with some tempting task or use survey measures such as the (brief) self control scale by Tangney et al. (2004). Other experiments only elicit a broad measure of patience ("$\beta\delta$") and do not test for time-inconsistent

Evidence. The famous delay-of-gratification study by Mischel et al. (1972) documented that many children are not able to resist the temptation of a sweet for a few minutes, despite large returns to waiting. Such patterns of substantial impatience and heterogeneity in levels of patience emerge also from a range of lab or field experiments that elicit time-preferences in educational settings using behavioral measures or survey measures of patience and/or self-control (e.g., Ariely and Wertenbroch, 2002; Bettinger and Slonim, 2007; Wong, 2008; Castillo et al., 2011; Sutter et al., 2013; Lindahl et al., 2014; Bisin and Hyndman, 2014). There is also some evidence that boys are more impatient and exert less self-discipline than girls (Duckworth and Seligman, 2006).

Consequences. Patience is a predictor of academic success. Shoda et al. (1990) find that the ability to delay gratification at the age of 4 correlates with higher scores on the U.S. Standardized Aptitude Test (SAT). A number of other studies examine the relationship between grades and time-preferences. A recent example is Lindahl et al. (2014), who find a negative correlation between impatience and school performance (such as grades and the highest completed school level). Novarese and Di Giovinazzo (2013) observe that educational achievement can be predicted based on how prompt a student is at enrolling at university. They argue that one can interpret later enrollment as a measure of procrastination. Duckworth and Seligman (2006) argue that gender differences in patience and self-control, with boys being more impatient, may explain why girls tend to get better grades than boys despite similar performance on aptitude tests. By design aptitude tests should not be very sensitive to preparation, whereas school grades to a large extent reflect behaviors associated with patience, such as putting in consistent effort throughout a school term, timely home-work and exam preparation and the ability to resist distractions.

Time-preferences can also help explain major educational decisions, such as dropping-out as Oreopoulos (2007) argues. He investigates the effect of compulsory schooling laws in the US, Canada and the UK on school attainments, earnings, health, employment, poverty and happiness. The optimality of dropout decisions is evaluated from the perspective that the benefits from dropping out must equalize the costs from doing so. Oreopoulos (2007) finds that school attainment, health, employment and happiness are positively affected by laws imposing another year of compulsory schooling on "would-be-dropouts". Further, he finds that lifetime wealth increases by 15% with another year of compulsory schooling. These large returns to education imply that the financial costs from dropping out are generally higher than the benefits. Oreopoulos (2007) discusses that it is unlikely that "high-school aversion" is able to explain drop out decisions and he suggests that a major explanation of drop-out decisions are self-control problems faced by adolescents. In conjunction with the arguments of Duckworth and Seligman (2006), gender differences in patience and self-control could thus help explain why over the last few decades women have had higher average years of schooling than men (for the US see, e.g., Charles and Luoh, 2003) and why more women attend college than men (e.g., Goldin et al., 2006).

Patience also affects conduct at school. Castillo et al. (2011) investigate how time preferences relate to race and disciplinary referrals. The latter variables have previously been shown to predict outcomes such as dropping out of school and life income. They find that black children are more impatient than white children. Further, black children get more disciplinary referrals than white children on average and boys get more disciplinary referrals than girls on average. Their estimations reveal a positive relation between the discount rate and the number of disciplinary referrals, even when controlling for gender and race. Sutter et al. (2013) elicit time-preferences, as well as risk and ambiguity attitudes from 661 children aged 10–18 years. Higher ability students (measured by their math grade), and more risk-averse children are more patient. The authors relate these preferences to discipline at school, savings, as well as health-related risk-behavior and outcomes (smoking, drinking alcohol, body mass index). All of these are predominantly associated with impatience and not with risk preferences: More impatient children have worse disciplinary conduct at schools, lower savings, and worse health outcomes.

Self-control problems affect adult students as well, although they to some extent may be more aware of the challenges and may be better able to compensate. Ariely and Wertenbroch (2002) conduct a field experiment within an executive-education course at MIT with 99 participants. Within this course participants have to write three papers. Participants are assigned to one of two treatments. In the first, participants are given fixed, evenly spread deadlines. In the second condition, participants could choose their deadlines freely (but once a deadline is set it is binding). Ariely and Wertenbroch (2002) observe that participants do impose deadlines on themselves[15] and that deadlines help to improve task performance. However, performance is worse compared with the treatment where students are given evenly spread deadlines, suggesting that students do not optimally set deadlines. These results indicate that students have self-control problems, but only have limited awareness of the extent of their self-control problems.[16] In contrast, Burger et al. (2011) do not find a positive effect of exogenously given, evenly spread deadlines on the completion rates of an academic task (studying a certain number of hours in exchange for a fixed payment). The latter results indicate that the reduced flexibility that a deadline brings along might counterbalance the positive effect it has on overcoming motivation problems. Bisin and Hyndman (2014) report a similar finding: self-set deadlines do not improve task completion rates, even though students show a demand for such

preferences and self-control problems ("$\beta < 1$"), while others elicit both preference parameters separately. Thus, some experimental work cannot distinguish whether impatient behavior is due to low δ and $\beta = 1$ (time-consistent preferences) or due to moderate δ and $\beta < 1$ (time-inconsistent preferences).

[15] Note that this is contrary to what the standard economic model would predict. A rational agent with time-consistent preferences would not without any compensation give up flexibility, because it may be needed, e.g., if illness causes an unforeseen delay.

[16] Wong (2008) also investigates how aware students are of possible self-control problems. Wong (2008) finds that most students suffer from time-inconsistency and divides them into three sub-groups: the naïves (who do not anticipate their delay in preparing for the exam), partial naïves (who anticipate some delay, but not as big a delay as the actual delay), and sophisticates (who fully anticipate their delay). Most students are classified as partially naïve. Further, his results indicate that both predicted and unpredicted delays are negatively associated with students' performance at the mid-term exam.

commitment devices. They discuss that next to present-bias other factors, such as students' overconfidence and lacking perseverance, are at play. Thus, overall, the effectiveness of (exogenously set) commitment devices in the educational context is mixed. While there seems to be a clear demand for such devices, they do not always improve performance. Further research is needed to better understand when such commitment devices are effective in an educational context and when not.

Often there is no need to impose external commitment devices, because internal commitment devices like goals, self-rewards, or mental accounts can help to overcome self-control problems. A large literature in psychology examines how and when exogenously set goals affect task performance (for a review see Locke and Latham, 1990). Recently, theoretical studies in behavioral economics have taken up these ideas to study how people endogenously set their goals and how such self-set goals help to overcome self-control problems (Koch and Nafziger, 2011; Hsiaw, 2013). The key idea is that goals induce reference standards. Loss aversion then makes substandard performance psychological painful and thereby motivates people to stick to their goals. Yet, for severe self-control problems people might rather give up. Koch and Nafziger (2014) extend these ideas to ask how people evaluate their goals when facing multiple tasks: in narrow mental accounts (e.g., by setting a daily study goal), or in broad mental accounts (e.g., a weekly study goal). They show that when facing routine tasks or when facing repeatedly the same task (such as studying on two subsequent days), students should set narrow (daily) goals, while for tasks where the outcomes are more uncertain people should adopt broad goals. Koch et al. (2014) study how self-rewards complement goal setting.

To summarize, there is ample evidence linking impatience and self-control problems to educational decisions (such as drop-out) and low educational achievement (such as worse grades and disciplinary referrals). But at least for some adult students, there seems to be some awareness of self-control problems that translates into a demand for external commitment devices such as deadlines for course work that can help to overcome the self-control problem, or the use of self-regulatory strategies such as goal setting that offer internal commitment. Understanding commitment is a major theme in behavioral economics (for a recent survey see Bryan et al., 2010). Understanding better the effectiveness of commitment devices in an educational context can provide further insights into how to improve educational outcomes by targeting self-control issues.

3.3. *Extrinsic and intrinsic motivation*

So far we have pointed out that self-control problems or reluctance to compete can lead to underinvestment in education and low educational achievement. We now turn to one possible solution to such underinvestment problems – namely the provision of incentives for educational attainment. We start reviewing evidence from lab and field experiments on the effectiveness of extrinsic rewards for educational achievement. There is a large literature in economics that considers the design of extrinsic rewards in an educational context. As our focus is on behavioral economics, we only briefly review this literature here and focus more on studies that discuss the effects and design of rewards from a behavioral angle. Then we discuss possible pitfalls of providing extrinsic incentives.

Extrinsic motivation. In the school context, extrinsic incentives can stem either from monetary or non-monetary rewards, or from grades and ranking. We first discuss the effects of rewards before we turn to the effects of grades and relative rank within a class on educational performance. Gneezy et al. (2011) survey field experiments that examine the role of extrinsic incentives in schools. Firstly, they conclude from the surveyed articles that incentives work well in increasing attendance and enrollment (e.g., Angrist et al., 2006; Behrman et al., 2005). Secondly, they summarize that incentives have mixed results on effort and achievement (e.g., Bettinger, 2012; Fryer, 2011; Rodriguez-Planas, 2014; Levitt et al., 2012). Thirdly, they conclude that incentives seem to work for some students but not for others and that gender and ability play a role here (e.g., Angrist and Lavy, 2009; Leuven et al., 2010).[17]

Levitt et al. (2012) conduct a field experiment which introduces rewards for performance on a low-stakes standardized test. A reward is triggered when a student improves compared to the previous test. Building on ideas from behavioral economics, they investigate whether different framings and timings of rewards have an impact on test scores. Further, they investigate whether there is a difference between the effect of financial and non-financial incentives. They find that immediate high financial incentives ($20) and non-financial rewards (a trophy) improve performance, while low financial rewards ($10) do not. However, if the former type of rewards is delivered with a delay, they also do not have any impact. Levitt et al. (2012) also find that, contrary to their initial hypothesis, it does not matter whether the reward is framed as a gain (you get $10) or a loss (you start with $10 that you need to repay if performance is substandard). Elementary school students turn out to be more responsive to incentives than secondary students, who are especially responsive to non-financial incentives.

Though not explicitly a reward, a desire to obtain good grades or high test scores is what motivates many students. One reason, of course, is that grades and test scores have a direct impact on later education and labor market opportunities. But grades also affect students' status – and status is a powerful motivator of human behavior (Frank, 1985). Status is obtained from achieving a high rank on some dimension that is considered important by one's peers or society as a whole. Dubey and Geanakoplos (2010) investigate in a theoretical model how grading systems motivate students who are sensitive to status ranking. They find that absolute grading (grades depend on passing a performance target) always motivates students better to provide effort than relative grading (rank-based or grading on a curve) if students are disparate in their abilities.

[17] Leuven et al. (2010) find that incentives had a positive effect on able students, but a negative impact on the less able students, and Angrist and Lavy (2009) find that incentives had an impact on girls, but not on boys.

The optimal grading system is not fine grained (such as providing percentage scores 100, 99, . . .) but turns out to contain some coarseness and a pyramidal structure. Specifically, grades should lump together larger bands of performance, and the best grade should occur less frequently than the second best grade and so on. Even if students are homogeneous in their abilities, absolute grading still motivates students better to provide effort than relative grading if a weak assumption about the density of the exam scores is satisfied. In this case, either fine or coarse grading can be optimal, depending on the detailed shape of the distribution of the exam scores.

Two papers build on the theoretical work by Dubey and Geanakoplos (2010) on grading schemes. Jalava et al. (2014) conduct a field experiment in Swedish primary schools to examine the effects of different grading schemes (such as rank based, or absolute grading) and of a non-monetary prize on students' test scores. They find that all these extrinsic rewards, except for absolute grading increase performance relative to the control group which did not receive any incentives. These results are in contrast to some of the theoretical predictions of Dubey and Geanakoplos (2010) – indicating that the incentive effects of grades might not only stem from status concerns. Using administrative data on the entire student population in England, Murphy and Weinhardt (2014) investigate the importance of a student's rank. Consistent with the theoretical assumption of Dubey and Geanakoplos (2010), they show that rank matters. Specifically, having a high rank in one's class at age 11 in primary school, has a large and robust effect on secondary school achievement at age 14, even after controlling for prior test scores and school and pupil effects. Specifically, their study exploits the fact that pupils with similar performance in a national test often have quite different relative rankings within their respective classes. As grades depend on both ability and effort, a high rank can influence subsequent performance by providing feedback to the student about her ability or by affecting the students' motivation to provide effort. The authors argue that the positive effect of being highly ranked is not driven by learning about ability but rather by pupils developing a more positive self-concept, which in turn influences their cost of effort for subsequent educational investments. We turn to such sources of intrinsic motivation next.

Self-confidence as a source of intrinsic motivation. Much of the analysis of educational investments focuses on extrinsic benefits from higher achievement, neglecting intrinsic motivation such as curiosity and a joy of learning. Self-confidence and self-esteem play a key role in building up such intrinsic motivation. Benabou and Tirole (2002) provide the first formal theoretical model in economics investigating the maintenance and enhancement of self-confidence. They suggest that an overly positive view of one's ability may be an important motivational factor, because ability and effort are complementary factors in (educational) production. Specifically, they show that it is optimal for individuals with self-control problems to selectively process information about their ability as a way to build up self-confidence.[18] Greater self-confidence makes students believe that their effort will be very productive, which in turn enhances their motivation to study. This positive motivation effect can compensate for negative motivation effects stemming, e.g., from self-control problems. An implication of this finding is that educators or parents may strategically give distorted feedback in order to boost students' self-confidence.

Wang and Yang (2003) and Filippin and Paccagnella (2012) further apply these ideas. Wang and Yang (2003) theoretically investigate the notion of self-confidence in an economic model of education where students care both about their grades and about their own perception of their ability. The grading system determines how much information a grade conveys about ability and thereby influences self-confidence, which in turn affects the choice of effort through the complementarity described above. If students care primarily about their perceived ability then strong competition induced by relative grading may actually lead to low effort, even from high ability students. Competition limits the number of good grades, making it less likely that a student gets favorable feedback about her ability if she works hard. To protect a prior positive self-image a student can put in low effort, which makes the grades relatively uninformative about ability and allows the student to maintain her self-image no matter what happens.

Filippin and Paccagnella (2012) explore in a theoretical model how a small initial difference in self-confidence can result in diverging patterns of human capital accumulation, even when students start off with the same level of initial ability. Among other things, their model can explain how "social heritage" can arise through self-confidence, consistent with empirical studies that show self-confidence to correlate with socio-economic background (see, e.g., Chowdry et al., 2011; Gregg and Washbrook, 2011; Chevalier et al., 2009). The theoretical results thus highlight how important early and accurate feedback on cognitive skills may be for disadvantaged children in particular.

Interaction of intrinsic and extrinsic motivation. One may be tempted to see extrinsic rewards as a substitute for lacking self-confidence, and thus view them as a tool for evening out diverging patterns of human capital accumulation when they arise. However, from psychology it is known that the positive effect of a short-term raise of extrinsic motivation by rewards (or punishments) might prove costly due to the possibility of a "crowding out" of self-confidence and intrinsic motivation in the long run.[19]

[18] Eil and Rao (2011) provide experimental evidence for selective information processing. In their study participants took an IQ test, were given objective feedback and then their beliefs about their ability were elicited. In response to favorable feedback, participants took into account the signal precision of the feedback and processed information quite closely to the Bayesian benchmark, with a small optimistic bias. In contrast, processing of unfavorable feedback was noisy and did not take into account the signal precision, which meant that unfavorable information was discounted on average.

[19] There are many experiments in psychology which confirm this. Deci (1971) was the first of them. Deci et al. (1999), for example, provide a meta-analysis of existing experiments confirming that external rewards crowd out intrinsic motivation, while Cameron et al. (2001) reach the opposite conclusion. Cameron and Pierce (2002) suggest that the pessimistic views on external rewards come from a historical context where all external influences were seen as harmful. They critically assess the evidence and conclude that positive reinforcement and rewards can be used to obtain desired behavior and to maintain interest, and that they are possibly very effective in contemporary Western cultures if designed wisely. The focus in the economics literature is different

Benabou and Tirole (2003) examine such motivational crowding out in a theoretical principal-agent model. We discuss here one of their interpretations, where the agent is a child and the principal a teacher or the parents. The child has imperfect knowledge about his ability. Self-confidence refers to the belief that the child has about the probability of succeeding in a task where effort and ability are complements. The principal, say the parents or a teacher, has knowledge about the ability of the child to succeed in the task and wants the child to pursue the task. But the child will pursue the task and resist distractions, say read a book or study for an exam rather than watch TV, only if it has high enough self-confidence that it will succeed in the task. Of course, in the short run the parents can motivate the child to do so by giving a reward for success. The reward influences the motivation of the child through two channels: First, the reward increases the direct payoff that the child has from succeeding in the task. Second, the reward affects the self-confidence of the child via an inference process, where the child takes the reward as a signal of the parents' knowledge of her ability. Here a large reward is bad news for the child, because it understands that the parents would offer a lower reward if the child were more able. That is, a higher reward reduces the self-confidence of the child and thereby its intrinsic motivation, which in turn lowers the effort once the reward is no longer given. In other words, short-term motivation through extrinsic rewards may crowd out long-term intrinsic motivation.

4. The influence of the environment on soft skills and investments into education

In the previous section, we discussed some of the insights that behavioral economics can offer on the nature of soft skills and the channels through which these skills influence investment decisions that individuals make about their own education. We now turn to the other investment components highlighted in the education investment function – namely those of the child's family, schools and peers – and examine how they influence soft skills.

4.1. Family inputs

A conclusion from recent research on family inputs is that the intergenerational correlation is strong and that it is likely related to the broader quality of family environment rather than just education and income. As Dohmen et al. (2012) put it: "Children may end up with similar outcomes to their parents partly because they inherit similar attitudes and thus make similar choices in life." In line with this, they observe a correlation between the risk and trust attitudes of children and their parents. In the same vein, Kosse and Pfeiffer (2012, 2013) report that impatience and self-control of children and their mothers are correlated. Bauer et al. (2014) find that children of parents with low education are less altruistic, more selfish, and more likely to be spiteful than those from high socio-economic status backgrounds, while Almås et al. (2014) find that children from low-income or low-education families are more reluctant to engage in competition than their counterparts from high socio-economic status families, even after controlling for confidence, risk- and time preferences, social preferences, and psychological traits. In contrast, Anger (2011) observes that personality traits (measured by the Big 5) and locus of control are to a lesser extent transmitted from parents to children than IQ, and they find no evidence that the socio-economic background plays a role in the transmission process of personality traits.

Which channels affect the transmission of soft skills and preferences from parents to children? Is it the parental environment or the genes that shape the preferences of children? Evidence for transmission through parental environment comes from Zumbuehl et al. (2013). They show that the risk and trust attitudes of kids and their parents are more similar for those parents who invested most in the upbringing of their children. Benjamin et al. (2012) review articles in genoeconomics which estimate the relative importance of genetic and environmental factors for preferences and conclude that genetic factors explain a non-negligible share of individual variation.

Taken together, the emerging evidence from behavioral economics on the intergenerational transmission of soft skills and preferences suggests that the family environment plays a big role in shaping the preferences and soft skills of children which, in turn, influence educational investments. The transmission of skills is strongly linked to the parents' education and socio-economic background as well as their investments in the children.

4.2. School inputs

A conclusion from the recent research on the role of school inputs in education production is that soft skills are crucial for understanding the influence of class size and teacher quality on individual outcomes (see Section 2). Research in behavioral economics provides a key to understanding these influences.

One of the puzzles in the literature is why better school resources are not robustly associated with better educational outcomes. Akerlof and Kranton (2002) point out that a pupil's motivation may depend on the social setting that the school creates and the extent to which the student accepts or rejects the ideals of the school. To integrate evidence from sociology with economic analysis they propose a model where a student mainly derives motivation from his or her identity. Next to choosing how much effort to exert in school, which determine the pecuniary benefits from later returns to skills, students

(for a survey see Gneezy et al., 2011). Rather than choosing side in this controversy, researchers study the conditions under which such trade-offs occur, see e.g. Gneezy and Rustichini (2000) or Benabou and Tirole (2003).

also make a choice to what "social category" they want to belong (this may include gender, racial or ethnic designations). When adopting a social category, students aim to conform as much as possible to the ideal characteristics and behavior of this chosen social category. Schools on the other hand create an image of what the ideal characteristics and behavior of a student are. For example, schools may choose to promote a single social category. For some of the students however the characteristics of the promoted social category may clash with their background. To preserve their self-image these students reject the school's ideal and put in low effort despite what on the surface looks like attractive returns to investing effort into acquiring skills.

Akerlof and Kranton (2002) argue that schools can help avoid such outcomes by being more inclusive and avoiding to push a narrow ideal. Offering a wide range of classes and curricula may be one way to achieve this aim. Such a strategy allows more students to identify with the school and become engaged. The drawback of such an inclusive approach is that the school is not as able to promote skills. The assumption the authors make in their analysis is that any attempt to promote a particular skill, such as proficiency in math or English, will make the school less inclusive by favoring a particular social group. That is, schools face a trade-off between investing into a more inclusive school identity (which is closer to the students' social backgrounds) and investing into teaching important skills (which narrows the range of students who can identify with the school). Akerlof and Kranton (2002) go on to theoretically derive the optimal ideal(s) the school ought to promote and the optimal fraction of resources that a school should devote to create a school identity as a function of how diverse the student population is. One of their key results shows that higher investments by schools into teaching skills need not always lead to higher educational achievement, because students may not identify with the school.

Akerlof and Kranton (2002) make an important first step by incorporating concepts from sociology into a school's investment decisions, but still treat as a black box how school investments affect skill teaching. Incentives for teachers are one important channel how school's investment decisions influence the quality of teaching. Incentives affect both teachers' effort, but also the selection of teachers. We will not attempt to summarize the large literature on the design and effects of incentives in the workplace, but just note that many of the incentive schemes that have been proven to be optimal in theory are seldom found in reality (for an overview of some puzzles see Prendergast, 1999).[20] To explain several of the puzzles that emerged, researchers have started to include ideas from behavioral economics into contract theory (Koszegi, 2014 provides an overview of this literature). Many of the insights gained from these models apply also for teachers. For example, non-standard preferences (such as reference-dependent preferences or social preferences) can explain why organizations pay voluntary bonuses, offer very simple wage schemes, or why we observe wage compression and wage stickiness. As teachers are often intrinsically motivated, the same trade-offs as mentioned in the student context apply. In the following, we review a number of studies that explicitly address teachers' incentives from a behavioral perspective.

Fryer et al. (2012) examine in a field experiment the impact of teachers' incentives on students' performance. They explicitly rely on insights from behavioral economics – namely framing and loss aversion – to design incentive schemes for teachers. They randomize teachers into two treatments. In the "gain" treatment, teachers receive an end-of-the-year bonus if their students' performance improves sufficiently. In the "loss" treatment, teachers receive a transfer in the beginning of the year and they have to return this payment at the end of the year if their students do not improve sufficiently. Fryer et al. (2012) observe that the loss treatment leads to a significant improvement in students' math test scores, while the gain treatment does not have any significant impact on test scores.

Besley and Ghatak (2006) address the issue that the introduction of rewards not only affects the motivation of current teachers, but also affects who selects to become a teacher. In a theoretical model, they ask how schools that are competing with each other can attract good teachers. Teachers are thought to be both intrinsically and extrinsically motivated, where intrinsic motivation depends on the match between the teacher and the school. For example, teachers may like to teach certain kinds of students or have preferences over the way in which students are taught. The quality of schooling experienced by the students can be high or low, with the probability of high quality increasing with the effort that a teacher puts in. There are two types of teachers, good or bad teachers, and two types of schools, good or bad. Everyone prefers to be matched with a good type. A teacher experiences a non-pecuniary payoff whenever delivered schooling turns out to be of high quality, which captures the teacher's intrinsic motivation. Good teachers are more motivated at good schools than bad teachers at good schools, who are as motivated as good teachers at bad schools, and both are more motivated than bad teachers at bad schools. There are not enough good teachers around so that every school can hire a good teacher. Bonus pay for high quality schooling not only influences teachers' incentives, but also the sorting of teachers across schools. Bad schools need to pay a bonus to attract good teachers, whereas good schools have the advantage that they match the "mission preferences" of good teachers. Besley and Ghatak (2006) show that it is not always optimal for these schools to implement incentive pay. Thus, competition for teachers leads to bonus pay for teachers in low-quality schools but not necessarily in high-quality schools.

Dohmen and Falk (2010) provide some evidence on sorting into the teacher profession. They use data from the German Socioeconomic Panel to examine the characteristics of teachers. Teachers in Germany, like other public sector employees, have a secure job with a fixed performance unrelated pay. In this sense, the environment studied by Dohmen and Falk (2010) is orthogonal to the competitive environment outlined by Besley and Ghatak (2006). Dohmen and Falk (2010) find

[20] Neal (2011) examines the design of incentive schemes in educational contexts.

that those who select into the teacher job are, relative to the comparison group, more risk-averse, more trusting, less negatively reciprocal and less conscientious, the latter of which the authors interpret as a relatively low work attitude.[21]

In sum, behavioral economics provides insights into how schools can affect the work norms of students and teachers and how school characteristics and compensation schemes affect sorting of teachers and teaching quality.

4.3. Peers

In Section 2, we saw that peer influences were particularly strong when considering behavioral outcomes such as drinking, crime, drug use, teen pregnancy and disruptive behavior. In the following, these observations are connected to the insights from behavioral economics about the importance of peers when it comes to soft skills.

How does a peer affect a person struggling with a self-control problem according to the literature in behavioral economics? In a model where agents have imperfect knowledge about their willpower, Battaglini et al. (2005) study how observing peers struggling with similar self-control problems influences a person's own ability to cope with a self-control problem. Observing how a peer does provides clues to the individual about how difficult it will be for himself to resist a similar temptation. It is good news if the peer manages to regulate his behavior and bad news if he gives in to temptation. Depending on the initial level of self-confidence an agent has about his willpower and confidence in others, as well as how correlated willpower is across individuals, two types of equilibria may arise: Either a good news equilibrium in which social interactions help individuals to overcome their self-control problems, or a bad news equilibrium in which social interactions make self-control problems worse, or both types of equilibria may be possible. Further, Battaglini et al. (2005) ask when interactions with peers are actually beneficial and they investigate what characteristics the optimal peer has. They find that if all group members have a minimum level of self-confidence, peer interactions can be beneficial for all types of individuals. The optimal peer has a slightly worse self-control problem than oneself so that his successes are encouraging ("If he can do it, I can do it, too.") and his failures not so discouraging ("He had a tougher battle to fight than me."). However, among groups of individuals with really poor self-confidence, social interactions exacerbate self-control problems.

The literature on self-set goals shows how these can help to overcome self-control problems by setting a reference standard that is painful not to achieve (Hsiaw, 2013; Koch and Nafziger, 2011). Extending these ideas to study the influence of social comparisons, Hsiaw (2010) models how a peer's expected outcome influences the goal of an individual. She shows that comparisons to more patient peers can help to attenuate an individual's self-control problem by motivating him to adopt more ambitious goals.

In sum, behavioral economics suggests that interactions with peers who have slightly better or worse self-control problems than oneself, may improve outcomes. However, it may also be informative as to why peer influences are stronger for some particular poor outcomes such as drug use or teenage pregnancy than for test scores, since social interactions aggravate self-control problems among individuals with really poor self-confidence.

5. Discussion, implications and concluding remarks

With our review of selected theoretical and experimental studies combined with empirical evidence we attempt to illustrate how integrating behavioral economics with educational economics holds great promise for academics and practice. We need behavioral education economics to further our understanding of the complexity of educational decision making and to gain ground on some of the fundamental puzzles mentioned at the beginning of this article. But we also need it to formulate educational policy and to expand our knowledge of which educational interventions might possibly work and which not. Consider, for example, the question how one should design reward schemes for students or teachers. Do incentive schemes work at all and are they cost effective? If rewards work, then which ones are most effective (grading, financial, non-financial) and how should incentives be designed? Do explicit incentives lead to crowding out of intrinsic motivation and do they affect how teachers and students sort into schools? We discussed how behavioral economics can help address some of these questions. For example, analyzing how students respond to competition and what concerns for status they have can help to design better grading schemes (cf. Jalava et al., 2014). Understanding non-standard preferences, such as loss aversion, time-inconsistent preferences, or social preferences can help to think about how to design effective incentive schemes (cf. the field experiments by Fryer et al., 2012; Levitt et al., 2012).

Another example where behavioral economics can inform policy makers is the understanding of how self-control problems affect educational outcomes and how to design programs to cope with these problems. Here it is imperative to draw on existing experience with methods that address self-control problems. For instance, mental contrasting and implementation intentions can help to improve student performance (cf. the intervention study by Duckworth et al., 2011). The intervention study "KIDS-WIN" by a research team around Daniel Schunk and Ernst Fehr at the Universities of Mainz and Zurich takes

[21] A recent field experiment by Ashraf et al. (2014) offers interesting insights into how workers with intrinsic motivation select into the health care profession. They find that making career incentives salient leads to an increase in qualified applicants with stronger career ambitions but that this does not displace applicants with pro-social preferences. Though not about teachers, some of the conclusions from the study may be portable to the education context.

up these ideas to investigate how successful these tools are over a longer time horizon.[22] Experiments can also reveal how environmental factors affect self-control. For example, Bucciol et al. (2011) conduct an experiment with children aged 6–13 in Italy to investigate the effect of temptation (working in view of one's favorite snack) on children's productivity (folding papers and marking items with a pen). When pooling all age groups together Bucciol et al. (2011) find no significant effect from temptation on productivity. However, they find that the productivity of young children is negatively affected by temptation, even though the subjects did not give in to the temptation. Another example is an experiment by Houser et al. (2012), who find that older children are better able to resist a temptation[23] when their decision to resist is publicly observed by their classmates rather than privately made. However, for younger children there is no such effect.

Furthermore, issues such as framing effects (Kahneman and Tversky, 1984), default effects (Thaler and Benartzi, 2004), nudges (Thaler and Sunstein, 2008), or cognitive limitations (such as choice and information overload) can play a role when designing educational policies. For example, Bettinger et al. (2012) report the results from a field experiment in which students from low-income families received a special nudge – namely personal assistance with filling out the very complicated "Free Application for Federal Student Aid" form. They observe that such assistance increased submissions for aid and then also college attendance. In contrast, providing information only had no effect. The review article by Lavecchia et al. (2014) discusses in more detail intervention studies that have been inspired by behavioral economics, including interventions that affect self-control, reduce inertia, change defaults, strengthen positive identities, or simplify choice options.

Finally, it is important for the designer of an intervention to know to which extent certain preferences, or cognitive and soft skills, are transmitted from parents to the child and to which extent these traits and skills are malleable. Both genetic factors (Benjamin et al., 2012), as well as the social environment (Bettinger and Slonim, 2006[24]; Almås et al., 2014; Booth and Nolen, 2012; Eckel et al., 2012[25]; Zumbuehl et al., 2013; Holmlund et al., 2011) appear to play important roles here.

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[22] See http://www.public.economics.uni-mainz.de/251_DEU_HTML.php.

[23] The children had the option of resisting versus not resisting a temptation for several minutes. If they did not manage to resist, this had no negative consequences for themselves, but for their classmates.

[24] They report the results from an educational intervention on the introduction of a voucher program which influences the altruism of participants.

[25] Eckel et al. (2012) elicit the risk preferences of 9th–11th graders. One of their aims is to examine the impact of the school environment on these preferences. They find that students who attend a school with a higher percentage of low-income families are more risk-averse, while students attending schools with smaller classes and more, and higher educated teachers are less risk averse.

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