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Learning for a bonus: How financial incentives interact with preferences

Uschi Backes-Gellner and Yvonne Oswald

Universität Zürich
IBW – Institut für Betriebswirtschaftslehre

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Learning for a bonus: How financial incentives interact with preferences

Uschi Backes-Gellner [a], Yvonne Oswald [b*]

[a] Department of Business Administration, University of Zurich, Switzerland; E-mail address: backes-gellner@business.uzh.ch

[b] Department of Business Administration, University of Zurich, Switzerland; E-mail address: yvonne.oswald@business.uzh.ch

This paper investigates the effect of financial incentives on student performance and analyzes for the first time how the incentive effect in education is moderated by students' risk and time preferences. To examine this interaction we use a natural experiment that we combine with data from surveys and economic experiments on risk and time preferences. We not only find that students who are offered financial incentives for better grades have on average better first- and second-year grade point averages, but more importantly, we find that highly impatient students respond more strongly to financial incentives than less impatient students. This finding suggests that financial incentives are most effective if they solve educational problems of myopic students.

Keywords: Student performance; Financial incentive; Time preference; Risk preference

JEL classifications: I20, C91

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[*] Corresponding author.
Tel.: 0041 44 634 42 76; Fax: 0041 44 634 43 70

1. Introduction

The past decade has seen a major proliferation of school interventions to encourage students to increase their school achievement. As increased human capital accumulation contributes positively to the welfare of and the equality within societies, the underlying aim of these interventions is obvious. Not surprisingly, a growing empirical literature investigates the role of incentives in education in general (see, e.g., Gneezy et al., 2011 for an overview) and the role of financial incentives for student performance in particular (see, e.g., Fryer, 2012 for an overview). Quasi-experimental and experimental studies evaluate financial incentive programs designed to improve student performance. These studies typically find small average program effects, if any at all (for secondary and post-secondary education, see, among others, Angrist et al., 2009; Angrist and Lavy, 2009; Fryer, 2011; Leuven et al., 2010). Nonetheless, their findings suggest that while such programs can have positive effects for certain groups of students, they can have no or even negative effects for other groups of students. Thus far, relatively little is known about the reasons for these heterogeneous behavioral responses to financial incentive programs in education.

Whether students increase their school performance in response to a financial incentive program is clearly an intertemporal choice, in which the timing of costs and benefits (of an increased learning investment) are spread over time (Becker, 1962). To analyze how financial incentives in education affect this intertemporal choice, it is necessary to include measures of students' economic preferences (e.g., Frederick et al., 2002; Keren and Roelofsma, 1995; Prelec and Loewenstein, 1991). Preferences vary considerably among students (Castillo et al., 2011; Dave et al., 2010), and recent literature has pointed to non-cognitive abilities (including economic preferences) as being systematically related to school achievement (Cunha and Heckman, 2010; Duckworth and Seligman, 2005; Heckman et al., 2006). Therefore, that incentive effects in education interact with economic preferences—meaning that differences in preferences might affect students' responses to financial incentives in education—might not be surprising.

In this paper we analyze the effect of the existence of financial incentive programs on student performance by considering interactions of the incentive effect with two important economic preferences: students' time and risk preferences. We derive our hypotheses by applying standard human capital theory (Becker, 1962; Bishop, 2006). To empirically investigate the effect of the performance pay program (PPP) on student performance and to assess whether, and if so, how the program effect depends on economic preferences, we collected a unique and comprehensive dataset. It includes information on both student performance (measured by end-of-semester grade point averages) and student economic preference parameters (measured when students started their vocational education program). These data are available within a school environment where some of the students are part of school-independent PPPs and some are not. The PPPs take the form of a natural experiment. This unique combination of data allows us to contribute in two major ways to the existing body of evidence on financial incentives in education: Most importantly, we examine the link between the effect of financial incentives and students' economic preferences. We thus shed light on some of the fundamentals of students' response to financial incentives. Moreover, we analyze the program effect in a school environment, i.e., in vocational education, where it has not yet been analyzed.

Our paper provides two main findings. First, empirical results indicate that, on average, the existence of PPPs significantly increases the performance of students in upper secondary vocational education (by approximately 0.35 standard deviations). This average effect is the result of fundamental differences in findings among students in different occupational subgroups. For one of the two occupational subgroups, i.e., students in technical occupations, we find a statistically significant and highly positive program effect (0.55 – 0.65 standard deviations). For the other subgroup, i.e., students in commercial occupations, we find a zero program effect. In the latter case, the actual fraction of students in a PPP is insufficiently large, and data are thus not persuasive to reject the hypothesis of no program effect.

Second, for the interaction between financial incentives and economic preferences, our findings suggest that program effects differ across students with heterogeneous preferences. For students' time preferences our findings suggest that relatively impatient students increase their performance far more when financial incentives are offered. For students' risk preferences, our results are less convincing, leading us to suspect that risk loving students respond less to the PPP than relatively risk averse students. The remainder of the paper is structured as follows. Section 2 presents hypotheses. Section 3 describes details of the PPP, provides information on the elicitation of economic preferences, and presents descriptive statistics. Section 4 provides the empirical strategy and Section 5 presents results for both the pure program and the interaction effects. Section 6 concludes.

2. Hypotheses

According to human capital theory (Becker, 1962; Bishop, 2006), students decide about their time and effort devoted to learning activities by comparing the present discounted value of the benefits (i.e., expected advantageous labor market outcomes, such as higher future earnings or lower unemployment risk)[1] to the present discounted value of the costs (i.e., direct and indirect costs of exerting learning effort). Ceteris paribus, the theory predicts that students raise their school performance when their marginal net benefit increases, i.e., when monetary incentives for better student performance are provided. *We thus derive our first hypothesis:* The provision of financial incentives to students with good school performance increases their performance (everything else being constant).[2]

Nonetheless, given that the timing of the investment costs and benefits are spread over time, the relationship between financial incentives and student performance is not straightforward. Further applications or complements of theories on human capital investments have strengthened the argument that the decision to invest in human capital depends on individual economic preferences, i.e., on risk and time preferences in particular (for risk preferences, see Brunello, 2002; Levhari and Weiss, 1974; for time preferences, see Blinder and Weiss, 1976; Borghans and Golsteyn, 2006). Considering significant heterogeneity in preferences among individuals (e.g., Harrison et al., 2002; Rabin, 1998) and among students in particular (e.g., Dave et al., 2010) we expect that incentive effects in education interact with economic preferences.

Given heterogeneity in time preferences among students (as shown previously, for example by Bettinger and Slonim, 2007; Castillo et al., 2011), not only the expected size but also the timing of the return on investment is crucial for students' decision-making process. Students who overly discount the future, i.e., impatient students, choose to invest too little time and effort in

1 Same as Manski and Wise (1983), we assume that students form their expectation about returns to schooling as a function of the average test scores achieved in college. Empirical studies have shown that not only the schooling degree but also student performance (e.g., grade point averages) positively affect long-term labor market outcomes (e.g., Jones and Jackson, 1990; Roth and Clarke, 1998). In German-speaking countries, where applications always include academic records, school performance matters for labor market entrance in particular (see Schweri, 2004 for Switzerland).

2 Referring to psychological and economic literature, one could as well hypothesize the opposite. According to psychological literature (e.g., Deci, 1971; Deci et al., 1999) or recent economic literature (e.g., Frey, 1994), the provision of incentives may also reduce individual performance due to the crowding out of intrinsic motivation. It remains mostly an empirical question whether financial incentives have a positive or negative effect on student performance. Existing studies on financial incentives in education have addressed the concern of crowding out effects; however, thus far they have found no evidence for lower intrinsic motivation of incentivized students (e.g., Fryer, 2011; Kremer et al., 2009). We add to the existing empirical literature on incentives in education and provide evidence on some of the fundamentals of students' response to financial incentives in education.

their own education when they highly discount time lagged investment benefits (Becker, 1975).[3] Generally, benefits from higher student performance are derived only in the long run. With the provision of financial incentives the waiting period for parts of the benefits becomes reduced. The incentives thus boost discounted marginal benefits from higher student performance, especially for impatient students. Conversely, for patient students, perceived marginal benefits change only slightly (if at all), as the size of the short-term incentive is smaller than the size of discounted long-term labor market benefits. Therefore, short-term incentives should particularly encourage the group of impatient students to increase their school performance (as already speculated by authors of related studies, such as Angrist and Lavy, 2009; Castillo et al., 2011; Fryer, 2011). *We thus derive our second hypothesis:* When students receive short-term rewards, relatively impatient students increase their school performance more than relatively patient students.

Just as investors in financial capital, investors in human capital are also concerned about the certainty and risk of the returns of an investment (Brunello, 2002; Krebs, 2003; Levhari and Weiss, 1974). Students who are relatively more risk averse choose to invest less in education when the benefits thereof are uncertain. Following Köszegi and Rabin (2006), we assume that students (will) value the new bundle of monetary benefits derived from the investment in higher school performance in comparison to their initial expectations about the value of benefits. The initial expectations refer to long-term labor market benefits, which, we argue, have at least two sources of uncertainty (similar arguments are made by Levhari and Weiss, 1974). First, benefits are determined by exogenous factors (such as changes in demand and supply for labor, new developments in technology or structural changes). Second, information about future benefits is limited, because students do not know today whether and, if so, how much a prospective employer will value increased school performance. With the provision of financial incentives, students have the possibility of reaping part of the investment benefits with a relatively higher certainty: First, benefits arise more immediately and are thus not as much exposed to exogenous future shocks. Second, the relationship between increased student performance and the additional monetary benefit is clear and provided by the rules of the incentive program. The provision of comparatively certain rewards thus increases perceived marginal benefits especially for the group of relatively risk averse students who value these certain benefits more than they value the long-

[3] Among others, Harrison et al. (2002) provide empirical evidence for this purely theoretical statement finding that individuals with longer investments in education have substantially lower discounting rates.

term, relatively uncertain benefits. Therefore, financial incentives should particularly encourage the group of risk averse students to improve their school performance. *We thus derive our third hypothesis:* When students receive short-term rewards, relatively risk loving students increase their student performance less than relatively risk averse students.

3. Data and descriptive statistics

To investigate whether financial incentives affect student performance, we collect data on 265 students who are both part-time students and part-time employees as part of their upper secondary vocational education (a "dual" education). In this educational environment we make use of school-independent PPP, in which some students participate and others do not. Our student sample started their dual education program in late summer 2009, with an average age of 16 years. At this point, we collected[4] both experimental and very detailed background survey data (such as date of birth, gender, parental schooling, language at home, and single grades achieved in their previous school, i.e., compulsory lower secondary education). In late summer 2010 and 2011, we conducted follow-up surveys collecting data on first- and second-year (end-of-semester) grade point averages (GPAs), among others, and details on the PPPs. To investigate heterogeneous program effects by student preferences, we combine these field data with experimentally elicited data on student preferences.

In the following three subsections, we first outline the PPP (in dual vocational education) that we use in our study. Second, we describe the measurements of economic preferences, and third, we provide key student characteristics of the program and comparison groups.

3.1 Performance pay programs under the Swiss dual education

Students in our sample take part in dual education programs in the vocational education and training (VET) system in Switzerland.[5] Students study part-time at school and at the same time work part-time as apprentices in a "host" company to train their practical skills. Some of these host companies have institutionalized a performance pay program (PPP), in which they pay

[4] We collected this data for a joint project with Michael Kosfeld, Holger Herz, and Donata Bessey. In this project we investigate the rationality of students' decision to drop out of vocational education. The project is work in progress.
[5] Attending a VET program is the most popular way of gaining a basic education in Switzerland (OPET, 2011). Graduates from a VET program hold qualifications that are highly valued by employers in the Swiss labor market and generally enjoy a low risk of unemployment (OPET, 2010).

students bonuses for good end-of-semester GPAs achieved in vocational schools.[6] Students who work in a host company offering a PPP thus have the opportunity to earn bonuses for good GPAs, whereas students who work in host companies with no PPP do not earn bonuses for good GPAs. Therefore, the first group can be seen as a treatment group and the second group as a comparison group.

In many companies, the maximum achievable yearly bonus equals almost an average monthly apprentice wage (which is around 1'100 Swiss Francs (CHF) in the second year of vocational education[7]). Companies pay their students different bonus sizes, according to the level of the individual GPA. In most cases, bonuses are paid twice a year. Compared to the incentives in existing studies (e.g., Angrist et al., 2009; Fryer, 2011; Leuven et al., 2010), incentives in this case are paid over a longer period, i.e., throughout the years that the students remain in the dual education program. As the structure of the PPPs differs by company, our estimation results will capture the incentive effect produced by the pure existence of PPPs in host companies, as opposed to the non-existence of PPPs.

Regardless of whether students work for a host company with an established PPP, students attend the same schools, sit in the same classrooms, and attend the same classes. Attendance is mandatory for all classes, with no option for class substitution. Given the nature of this experimental setting, we are able to compare students' academic performance (i.e., end-of-semester GPAs) for both the program and the comparison groups. To draw a causal comparison of student performance between the program and the comparison groups we make two key identifying assumptions: First, we assume that a student's host company choice is not determined by the offer of PPPs. Second, we assume that which companies offer PPPs and which do not is very idiosyncratic, approximating randomization from a student perspective. Descriptive statistics will show that our identifying assumptions yield balanced program and comparison groups of students. In the following two paragraphs, we further discuss the origin of our identifying assumptions by providing insights into the students' host company choice process and by explaining how school allocation is regimented.

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[6] Host companies have an interest in incentivizing students' school performance as the school curriculum covers theoretical knowledge that is complementary to the practical work that students carry out at work. Host companies that belong to trade associations determine the school curriculum ensuring that it is up to date and matches the host companies' latest requirements (OPET, 2011).

[7] The apprentice wage is higher for students in commercial occupations (average category ranges from 1'200 to 1'300 CHF) than for students in technical occupations (average category ranges from 900 to 1'000 CHF).

In Switzerland, the vocational education and training program is provided at the *upper*-secondary level, with different vocational education and training programs offered. The most popular training program is the dual-track program, which consists of part-time studies at a vocational school and a part-time apprenticeship at a host company. The apprenticeship positions are specifically created for the vocational education and training program, and voluntarily offered by host companies, which thereby ensure a consistent supply of qualified workers. Host companies post their apprenticeship openings in regional newspapers, on their own websites, or on online job websites, just as they do for any other job opening. To our best knowledge, those advertisements do not include information on whether the company offers a PPP or not. Students who wish to enter the apprenticeship market apply for these positions in their desired field, i.e., in the occupation they plan to study. While we do not observe host companies selection process, we have information on student characteristics for both program and comparison group students. Descriptive statistics will show that the characteristics of students who work in a host company offering a PPP do not differ from the characteristics of comparison group students.

Host companies offer the best-matching students an apprenticeship contract, which terminates with the completion of the training program. Once this contract is signed, host companies are required to register the contract at the cantonal (state) government office, which controls and approves apprenticeship contracts. Following strict governmental regulations, host companies enroll students in vocational schools. All vocational schools in Switzerland are public and offer the same quality of the educational content. School allocation depends on the location of the host company, with no option for choosing a different school. Both schools and host companies train students according to a uniform, clearly defined curriculum and national qualification procedures (OPET, 2011) that regulate not only the school but also the working hours. Therefore, our student population is assigned to their schools purely on the regional location of the host company.

3.2 Experimental elicitation of economic preference parameters

For the measurement of economic preference parameters, we use standard decision-making experiments, which we implemented in the classroom within a month of the starting date.[8] Our experiments consist of two main parts: In one part we elicit students' time preferences; in the other, we measure students' risk preferences.[9] The original tables and instructions are available from the authors upon request.

In the first part of the experiment, we elicited students' time preference by means of two payoff tables. Each table contained a series of 20 payoff alternatives at different times. For each alternative, students made their choices, starting from the first row at the top of the table: While the delayed payments were always 100 CHF, the earlier payments ranged from 5 to 100 CHF with increments of 5 CHF moving down the table. For the first table, students chose between payments today and payments in 3 months. The second table differs from the first only in the timing of the payments: The students chose between payments in 3 months and payments in 6 months. We identify students' degree of time preference by the point at which students switch from the delayed payment of 100 CHF to the earlier option. The lower the value of the switch point, the less patient a student is.

In the second part of the experiment, we measured students' risk preference by using choices between a paid lottery and safe payments in a sequence of 10 binary choices. The lottery was the same for all choices: Students won either 10 CHF or nothing, depending on the coin toss. The safe payments increased in value for each choice from 1 to 10 CHF.[10] We identify students' degree of risk preference by the point at which students switch from the lottery (10 CHF with p=0.5) to the save option. The lower the value of the save option at the switch point, the more risk averse the student is. As the expected value of the lottery is 5 CHF, only risk loving students should favor the lottery options when the safe options are greater than 5 CHF. In contrast, risk averse students should always favor safe options smaller or equal to 5 CHF.

Before we started the experiments, we informed students that after the experiments, their notional chosen payments would turn into real payments if their tables were drawn in a lottery. We thus incentivized students to express their true individual preferences. For the experiment in which we elicited time preferences, we selected two students in each school class for payment at

[8] Participation bias appears unlikely, given compulsory schooling attendance.
[9] Notable examples of studies that use a similar approach (i.e., multiple price lists) to measure time preferences, risk preferences, or both are Burks et al., 2009; Dohmen et al., 2010; Harrison et al., 2002; and Meier and Sprenger, 2010.
[10] The last row had no relevance for the measurement of risk aversion; we included it to test that students understood the task.

random. For those students who won the lottery, we randomly selected one row on the choice sheet as relevant for the payment. For the experiment in which we measured risk preferences, we randomly selected one row for payment for each student. After the experimental session ended, we either executed payments immediately or provided an official letter guaranteeing payments in the future.

According to recent evidence for temporal stability of preferences (see Meier and Sprenger, 2010 for time preferences; see Andersen et al., 2008 for risk preferences), we assume that student preferences remain static at least for the period of our analysis.

3.3 Descriptive statistics and covariate balance

Our baseline sample (collected in 2009) includes information on 265 students from 14 complete school classes in three public vocational schools.[11] Students in our sample are trained for three to four years in either commercial or technical occupations (i.e., commercial employees, electricians or polytechnicians).[12] Whereas students in technical occupations learn specific skills for technical production (e.g., how to set up complex electrical wiring systems or how to fabricate work pieces and tools required in the production industry), students in commercial occupations learn a broad knowledge of skills for carrying out administrative work in various fields and industries.

In 2010, 90% of the students in our baseline sample (245 of 265) completed the first follow-up survey. In this paper, we discuss data only for students who reported valid and complete information on both the first-year GPA variable and the control variables of interest.[13] This adjusted sample, which we call the "first-year sample", includes 200 students, one third (N = 65) of whom work for a host company with an established PPP. In 2011, 84% of the students in our first-year sample (167 of 200) completed the second follow-up survey, reporting valid and complete information on both the second-year GPA variable and the control variables of interest. Twenty-eight percent of the students in the second-year sample (N = 46) report receiving performance pay in both the first and second years of vocational education. One might expect that program group students are more likely to be part of the second-year sample. We deal with this concern at the bottom of Table 1: Figures indicate that the selection of students in the second-

[11] These schools are located in the greater region of Zurich, which is the largest Swiss city, located in the German-speaking part of Switzerland.

[12] These three occupations are among the top 10 of the 230 occupations where training programs in Switzerland are offered (OPET, 2011).

[13] Students that did not understand the task of the economic experiments (14/265) are also excluded in our sample.

year sample is independent of the treatment status. Additionally, we tested whether the participation in the second-year sample is determined by students' economic preferences. We find no connection between a student's second-year sample status and her or his economic preferences.

Table 1 presents student characteristics sorted by four subgroups. The first subgroup covers personal characteristics: age, gender, and native speaker dummy. The second subgroup covers ability measurements: a dummy for whether or not mothers hold a higher education degree, math grade at the end of lower secondary education, and a dummy for ever having repeated a grade.[14] The third subgroup covers the company characteristic. "Number of employees" is the only variable available in our data for describing company characteristics. The variable is a dummy indicating whether or not a student is working for a host company with 100 employees or more. The fourth subgroup covers students' economic preference parameters. The dummy "risk loving" (as opposed to being risk averse or risk neutral) indicates whether a student is willing to take risk or not. Risk loving students still prefer the lottery options when the expected value of the lottery option is smaller than the value of the safe option. In contrast to the unequivocal identification of risk loving students, there is no such clear-cut way of defining the group of relatively impatient (or patient) students. We create dummies of extreme characteristics of time preferences to increase statistical power when we include those dummies in our regression analysis. The dummy "super-impatient" refers to the 10th or 25th percentile of students who are always impatient, i.e., who are impatient either at the 10th or 25th percentile in both choice sets. Impatient students prefer a small amount of money today (in three months) than 100 CHF in three months (six months).[15]

One way of testing our identifying assumption is by comparing student characteristics of program and comparison groups. We thus report both means for the comparison group and differences in means for the program group for the variables within the four described subgroups (see columns 1 and 2 in table 1). Differences in means are reported as coefficients. Those coefficients are the results of regressions of each of the students' characteristics (e.g., age or gender) against the treatment status controlling for school and school classes. Displayed figures are in accordance with our identifying assumptions: The program and comparison groups appear balanced along observable dimensions. None of the reported differences in student

[14] Our dataset includes further ability measurements; however, either these measurements do not help explain the variance in GPA, or their inclusion would further reduce our sample size.

[15] Whereas the 10th percentile of super-impatient students prefers 45 CHF or less today (in three months) over 100 CHF in three months (and six months, respectively); the 25th percentile of super-impatient students prefers 50 CHF or less today (and 60 CHF or less in three months) over 100 CHF in three months (and six months, respectively).

characteristics—neither the variables themselves nor the variables as a subgroup—is statistically significant.

Program group differences for our first subgroup, personal characteristics, are not statistically significant. Descriptive statistics show that students entered the vocational program at an average age of 16, the traditional age for starting the program. A smaller fraction of students is female (40%), a percentage driven by the male-dominated technical occupations. A large proportion of students are native-German speaking (83%). Within the second subgroup, program group differences for each of the ability measurement are positive but also not statistically significant, indicating comparable ability levels among the program and comparison groups. Likewise for the third subgroup, the company size dummy, the difference between the program and comparison groups is not statistically significant. The same is true for the fourth subgroup, i.e., the economic preference dummies. Descriptive statistics show that, on average, 36% of the students have risk preferences consistent with being risk loving. The fraction of risk loving students is rather high, given that individuals are generally found to be risk averse (e.g., Dohmen et al., 2010). In our experiment, however, offered stakes were relatively low in size, possibly causing students to make risky decisions with a higher probability (Harrison et al., 2005; Holt and Laury, 2002). For time preferences, only 16% (9%) of the students match our description of being super-impatient defined as the 25th (10th) percentile of students who are impatient in both choice sets.

We further test the balance between the program and comparison groups by plotting students' math grades in lower secondary education, i.e., before students had the opportunity to participate in a performance pay program. Panel A in Fig. 1 shows the distribution of math grades for the program group, along with the distribution of math grades for the comparison group. For comparison, we normalized grades so that they are distributed with a mean of 0 and standard deviation of 1. The plot indicates that the distribution of math grades before the start of the program is similar for both groups. As our descriptive statistics already indicate, the two groups appear balanced in terms of their ability level.

Table 1
Covariate balance.

	Comparison Group Mean	PPP Group Difference
	(1)	(2)
Number of observations	135	65
Personal characteristics		
Age	16.333	-0.049
at entrance in vocational education	[0.961]	(0.174)
Female	0.519	-0.033
	[0.501]	(0.070)
Native speaker	0.874	-0.072
	[0.333]	(0.070)
F-test for joint significance		0.47
		{0.705}
Ability measurements		
Mother - higher education	0.163	0.023
	[0.370]	(0.074)
Math grade average (2009)	-0.073	0.050
standardized	[1.047]	(0.192)
Ever repeated grade (2009)	0.156	0.083
	[0.363]	(0.071)
F-test for joint significance		0.5
		{0.681}
Company characteristic		
Number of employees	0.467	0.131
(dummy equals 1 if the number of employees >= 100)	[0.500]	(0.093)
Economic preference parameters		
Risk-loving	0.326	0.127
(2009)	[0.470]	(0.094)
Super-impatient (25 percentile)	0.141	-0.001
(2009)	[0.349]	(0.068)
Super-impatient (10 percentile)	0.067	0.002
(2009)	[0.250]	(0.052)
F-test for joint significance		0.62
		{0.602}
Second-year sample		
Being in the second-year sample	0.822	-0.023
	[0.383]	(0.071)

Notes: "Comparison group mean" column reports averages and standard deviations in square-brackets. "PPP Group Difference" column reports coefficients and robust standard errors in parentheses. These coefficients are the results of regressions of each variable on the treatment dummy including school and class controls. Within the subgroup of variables we present F-tests for joint significance of all treatment differences. P-values for F-tests are in curly braces. Significance levels: *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

Panel B and C in Fig. 1 provide a preview of our results by plotting the distributions of standardized first- and second-year GPAs. The GPA variables are the averages of the grades achieved in each class attended during a school semester. Students in our sample attend classes according to a strictly defined school curriculum, in which class attendance is mandatory. Students reported their exact first- and second-year GPAs on a range from 1 to 6, with 4 to 6 as passing grades. In panel B we plot the distribution of standardized first-year GPAs for the program group, along with the distribution of first-year GPAs for the comparison group. The plot offers first evidence for different student achievement between those two groups within the first year: For the program group we observe a clear shift of first-year GPAs to the right. The shift indicates that students in the program group have higher first-year GPAs than students in the comparison group. The even right shift along the distribution (with the exception of the very right tail) suggests that program group students improve their first-year GPA fairly equally along the distribution. In contrast to the remarkably consistent shift of the program group's first-year GPA in Panel B, the shift of program group's second-year GPA in panel C is less steady. At the left and at the middle of the distribution we observe that program group students have higher grades than comparison group students. At the right tail of the distribution the effect reverses: Program group students appear to have lower grades than comparison group students. Nevertheless, the strong shift at the middle of the distribution suggests that, on average, program group students improve their GPA also in the second year of vocational education. By running multiple regressions, we test the robustness of this solely descriptive result.

Panel A. —Math GPA
(before treatment)

Panel B. —First-year GPA
(after treatment)

Panel C. —Second-year GPA
(after treatment)

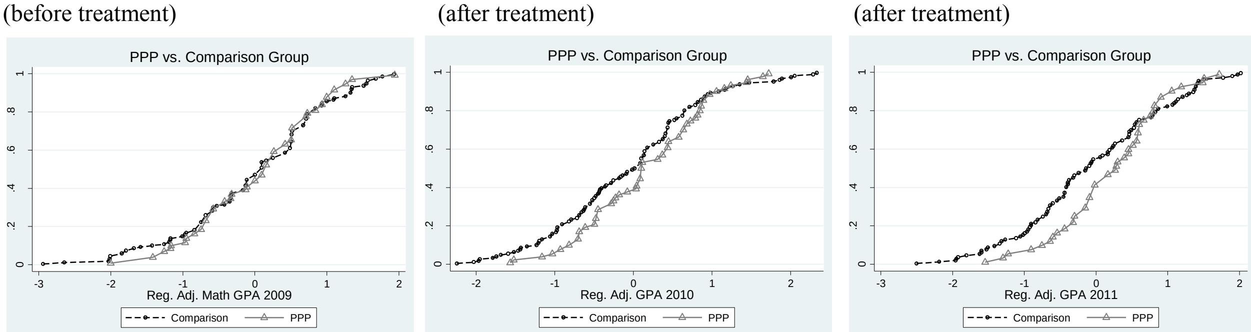

Fig. 1. Regression-adjusted cumulative distribution functions of GPA residuals. Notes: Residuals are computed using a regression including school and class controls. While Panel A plots Math GPAs achieved at the end of lower secondary education (before participation in PPP), Panels B and C plot average GPAs from the end of the first and second year of vocational education, respectively.

4. Empirical strategy

To empirically investigate whether students respond to the PPP and, if so, whether their response depends on their individual economic preferences, we use the following econometric model:

$$GPA_i = \beta_0 + \beta_1\, PPP_i + \beta_2\, ECONPREF_i + \beta_3\, (PPP * ECONPREF)_i + \beta_4\, X_i + u_i. \qquad (1)$$

GPA_i is the standardized, first-year (second-year) GPA for student i. The main explanatory variables in the model are dummies: PPP_i is the performance pay program indicator with the coefficient β_1, which captures the program effect. $ECONPREF_i$ indicates a student's economic preference (i.e., degree of risk aversion or time preference). $(PPP * ECONPREF)_i$ is the interaction term between those dummies with coefficient β_3, which captures the interaction effect. Significant interaction effects indicate heterogeneous program effects for students with different preferences. X_i comprises control variables that cover the three subgroups (personal characteristics, ability measurements and company characteristic) as described and displayed in section 3 (table 1). We gradually include these subgroup controls to investigate the sensitivity of our results and to redress any potential imbalance between the program and comparison groups. Our control variables are similar to those used in comparable studies on student achievement (e.g., Angrist and Lavy, 2009; Bettinger, 2010). Finally, we include u_i, an individual specific standard error. For our estimations, we use robust standard errors.

First, we run estimations to investigate the pure program effect, thus setting the coefficients β_2 and β_3 to zero. In a second step, to examine whether the program effect depends on student preferences, we include economic preferences and interaction effects. We examine interaction regressions for each economic preference separately.

5. Results

5.1 Baseline program effects on first- and second-year GPA

We start our analysis of program effects by looking at students' GPAs in the second and fourth semesters, i.e., at the end of the first and second year of vocational education. As only part of the students in the first-year sample submitted the survey in the following year, the second-year sample is lower (by 16%). However, descriptive statistics (at the bottom of table 1) indicate that participation in the second-year sample is not related to participation in the PPP. Focusing purely on the program effect on the first- and second-year GPAs, we conduct regressions of a short version of equation (1), i.e., we omit controls for economic preferences and their interactions with the PPP. We report four specifications. The first specification controls only for schools and school classes. We augment this specification by gradually including control variables that refer to the same set of subgroups as described in table 1—student characteristics (specification 2), ability measurements (specification 3) and company size (specification 4).

In sum, we find a statistically significant and positive effect of the existence of PPPs on students' first- and second-year GPAs. Carrying out separate analysis by the two occupational subgroups, we find that program effects differ between students in technical and commercial occupations. For students in technical occupations, our results indicate a statistically significant and highly positive program effect on student performance. In contrast, for students in commercial occupations, the program effect is non-significant and almost zero. As the actual participation in a PPP is low for students in the commercial subgroup (14 of 116 students), existing evidence is sufficiently inconclusive for rejecting the hypothesis that there is no program effect. The rest of this subsection examines these results in more detail.

Estimation results for the full first- (and second-) year sample (table 2; columns 1 to 4) indicate that students in the program and comparison groups differ in their school performance. Controlling for school and school classes only, we find that the treatment group's GPA is on average 0.349 (0.386) standard deviations higher than the comparison group's GPA (table 2, column 1). This difference is statistically significant ($p<0.05$). After we control for student characteristics and ability measurements, the program coefficient increases marginally in size. The significance of the coefficient remains robust across these specifications (table 2, columns 2 and 3). With the inclusion of the variable "company size" in column 4, the size of the coefficient decreases and its standard error increases. Nevertheless, the difference in student performance between the two groups remains significant ($p<0.05$ for the first-year sample; $p<0.10$ for the second-year sample). These results indicate that, on average, program group students have significantly higher GPAs than comparison group students.

Table 2
Program impact on standardized first- and second-year GPAs.

	Full Sample				Technical Occupations				Commercial Occupations			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: First-year GPA												
Performance Pay	0.349**	0.376**	0.380**	0.356**	0.642***	0.651***	0.630***	0.545***	-0.047	-0.013	0.035	-0.013
	[0.155]	[0.153]	[0.147]	[0.157]	[0.178]	[0.176]	[0.182]	[0.191]	[0.249]	[0.256]	[0.223]	[0.265]
School and class dummies	x	x	x	x	x	x	x	x	x	x	x	x
Student characteristics		x	x	x		x	x	x		x	x	x
Ability measurements			x	x			x	x			x	x
Company characteristic				x				x				x
R-squared	0.212	0.259	0.334	0.361	0.444	0.460	0.482	0.521	0.062	0.160	0.291	0.350
Number of observations	200				84				116			
% PPP	33%				61%				12%			
Panel B: Second-year GPA												
Performance Pay	0.386**	0.407**	0.414**	0.358*	0.614**	0.625**	0.648***	0.529**	-0.029	-0.012	-0.045	-0.088
	[0.184]	[0.187]	[0.187]	[0.197]	[0.237]	[0.240]	[0.242]	[0.262]	[0.276]	[0.283]	[0.238]	[0.288]
School and class dummies	x	x	x	x	x	x	x	x	x	x	x	x
Student characteristics		x	x	x		x	x	x		x	x	x
Ability measurements			x	x			x	x			x	x
Company characteristic				x				x				x
R-squared	0.141	0.159	0.191	0.215	0.162	0.172	0.176	0.260	0.116	0.155	0.256	0.289
Number of observations	167				72				95			
% PPP	28%				50%				11%			

Notes: The table reports regression estimates of the program effect on grade point averages (GPA) from the end of the first (2010) and second year (2011) of vocational education, respectively. GPAs are standardized to have a mean of 0 and a standard deviation of 1. Robust standard errors are reported in brackets. Significance levels are indicated as follows: *** p<0.01, ** p<0.05, * p<0.10.

However, separate analysis by occupational subgroups show fundamental differences in program effects between students in technical occupations (table 2, columns 5 to 8) and students in commercial occupations (table 2, columns 9 to 12). Whereas we find a strong and significant program effect on student performance in technical occupations, the program effect on student performance in commercial occupations is non-significant and almost zero (in most cases, slightly negative). For students in commercial occupations we cannot reject the hypothesis that there is no program effect: Unfortunately, data are inconclusive in this case because only 14 of the 116 students participate in a PPP (in the first-year sample). Therefore, a larger sample size would be needed to provide conclusive evidence on program effects for students in commercial occupations. PPPs are more prevalent in technical occupations (51 of 84 students participate in a PPP in the first-year sample) for which we find a largely positive and significant program effect: When we control only for school and school classes (table 2, columns 5), the estimated first-year (second-year) GPA is 0.642 (0.614) standard deviations higher for students in the program than for students in the comparison group. The size of the coefficient remains fairly robust across specifications with the largest decrease in specification four to an effect size of 0.545 (0.529) standard deviations. The coefficient is statistically significant across specifications ($p<0.01$ for the first-year sample and $p<0.05$ for the second-year sample).

The highly positive program effect on student performance in technical occupations is both interesting and surprising. The positive sign of the coefficient meets the expectations drawn from standard human capital theory. With the provision of additional benefits, the investment in human capital increases (holding other factors fixed). But why do students in technical occupations respond extremely strongly to the PPP in comparison to low incentive effects found in the previous literature? Assuming that the differences between technical and commercial are real, we can think of three explanations.[16] First, our data indicate that students in technical occupations place generally a higher value on pecuniary rewards (as compared to students in commercial occupations, the only available reference group). Students in technical occupations not only attach greater importance to their potential wage after graduation but also appear less satisfied with their current apprentice wage (in both the first and second year of vocational education). Therefore, students in technical occupations might place a high value on gaining the offered reward. Second, our data suggest that students in technical occupations (as opposed to commercial occupations) are significantly less interested in continuing their career in the

[16] Differences reported in this section are statistically significant (at least at $p<0.10$).

occupation for which they are currently investing the training. As the human capital investment in the current occupation might not be directly linked with labor market benefits in a different occupation, students in technical occupations might place a low value on the long-term labor market benefits of better student performance but a relatively high value on the short-term reward offered by the PPP. Third, students in technical occupations have relatively high discounting rates as compared to those students in commercial occupations. The following subsection will show that students with a lower willingness or ability to postpone the acquisition of rewards respond more strongly to the PPP.

5.2 Heterogeneous program effects by time preferences

In this section, we assess the significance of students' time preferences by investigating whether the effect of the PPP on student performance interacts with students' time preferences. In table 3, we present estimates of equation (1), replacing *ECONPREF* by time preference dummies that take the value 1 if a student is highly impatient and 0 otherwise. Highly impatient students are less willing to tolerate delay. We report results for the two impatience dummies as defined and described in the descriptive section. The dummies differ by the percentile of students defined as being impatient: Whereas the first impatience dummy refers to students who are impatient on the 10^{th} percentile in both choice sets, the second impatience dummy is broader, referring to students who are impatient on the 25^{th} percentile in both choice sets (see descriptive statistics for more details). As in the previous result section, we report regression results for the first- and second-year sample, using specifications identical to those reported in Table 2.

We begin by describing results for the program and the interaction effect on the first-year GPA (table 3, panel A). Controlling for the 10^{th} percentile impatience dummy, we find that relatively patient students (as opposed to non-patient students) who work for a host company with a PPP increase their first-year GPA by about 0.244 standard deviations (table 3, column 1). This effect is marginally significant (p=.122). The coefficient remains marginally significant for specifications 2 and 3 (p=.111 and p=.102, respectively). If we instead include the 25^{th} percentile impatience dummy, the program effect increases marginally in size in each of the specification (table 3, columns 5 to 8). Significance levels remain the same as for the 10^{th} percentile impatience dummy. In sum, the program effect for relatively patient students is, if at all, only marginally significant.

A look at the program effect for highly impatient students shows that the coefficient of greatest interest—the interaction term between being part of the PPP and being impatient—is positive, indicating that highly impatient students respond more strongly to the program than relatively patient students (table 3, panel A, row 3). The coefficient is significant at the 1% level (table 3, columns 3 and 4), controlling for the 10th percentile impatience dummy and significant at the 10% level (table 3, columns 3 and 4), controlling for the 25th percentile impatience dummy. The effect size of the interaction is high and varies between 0.585 and 1.271 standard deviations (table 3, columns 1 to 8).

For the second-year sample the performance pay effect increases in both size and significance for patient students, especially when controlling for the broader 25th percentile impatience dummy (table 3, panel B, row 1). The interaction effect remains significant (although at lower significance levels than for the first year sample) for the 10th percentile impatience dummy but is no longer significant for the 25th percentile impatience dummy (table 3, row 3).

Overall, we find that relatively impatient students increase their GPA more than patient students, especially in their first year of education. This result supports our hypothesis. First, short-term financial incentives boost perceived marginal benefits from increased student performance, especially for relatively impatient students who highly discount long-term benefits from increased learning effort. Second, the relative value of the financial incentives shrinks when real, relatively high labor market benefits approach. The second argument might explain why the difference in response to the incentive between relatively impatient and patient student is less pronounced in the second year. We cannot, however, rule out the possibility that other mechanisms (such as positive spillover effects) might also play a role.

Our findings thus suggest that incentive programs constitute an effective tool, particularly for increasing the performance of students who are less willing to postpone the acquisition of a reward. If impatient students are more likely to respond to financial incentives, offering short-term rewards at the very beginning of an educational program, when long-term benefits of increased student performance are discounted over a higher amount of years, would be most appropriate.

Table 3

Heterogeneous program effect by time preferences.

	Impatient defined as 10% percentiles				Impatient defined as 25% percentiles			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: First-year GPA								
Performance Pay	0.244+	0.249+	0.245+	0.226	0.248+	0.269+	0.258+	0.247
	[0.157]	[0.156]	[0.149]	[0.162]	[0.167]	[0.165]	[0.160]	[0.175]
Impatient (dummy)	-0.169	-0.304	-0.416+	-0.427+	0.066	0.023	-0.060	-0.065
	[0.315]	[0.312]	[0.264]	[0.263]	[0.244]	[0.244]	[0.229]	[0.216]
PPP * impatient (interaction)	0.978**	1.163***	1.271***	1.202***	0.585+	0.608+	0.709*	0.646*
	[0.399]	[0.405]	[0.360]	[0.379]	[0.365]	[0.374]	[0.360]	[0.361]
School and class dummies	x	x	x	x	x	x	x	x
Student characteristics		x	x	x		x	x	x
Ability measurements			x	x			x	x
Company characteristic				x				x
R-squared	0.233	0.284	0.362	0.384	0.229	0.274	0.350	0.373
Number of observations		200				200		
Panel B: Second-year GPA								
Performance Pay	0.304+	0.313+	0.310+	0.256	0.398**	0.420**	0.418**	0.363*
	[0.192]	[0.194]	[0.194]	[0.209]	[0.197]	[0.201]	[0.201]	[0.212]
Impatient (dummy)	-0.224	-0.266	-0.287	-0.342	0.131	0.140	0.103	0.058
	[0.334]	[0.327]	[0.304]	[0.324]	[0.268]	[0.275]	[0.267]	[0.263]
PPP * impatient (interaction)	0.722+	0.813*	0.890**	0.865*	-0.047	-0.063	-0.008	-0.013
	[0.452]	[0.450]	[0.440]	[0.469]	[0.426]	[0.428]	[0.438]	[0.432]
School and class dummies	x	x	x	x	x	x	x	x
Student characteristics		x	x	x		x	x	x
Ability measurements			x	x			x	x
Company characteristic				x				x
R-squared	0.151	0.171	0.205	0.228	0.143	0.161	0.193	0.216
Number of observations		167				167		

Notes: The table reports regression estimates of the program effect on grade point averages (GPA) from the end of first (2010) and second year (2011) of vocational education, respectively. GPAs are standardized to have a mean of 0 and a standard deviation of 1. The first (second) impatient dummy refers to students who are impatient at the 10th (25th) percentile in both choice sets. Robust standard errors are reported in brackets. *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

5.3 Heterogeneous program effects by risk preferences

In this section, we explore the importance of students' risk preferences by analyzing whether relatively risk loving students (as opposed to risk averse or risk neutral students) respond differently to the PPP. Table 4 presents estimation results of equation (1), in which we include the risk loving dummy representing a student's economic preference (*ECONPREF*). Risk loving equals 1 if a student prefers the lottery option even though its expected value is lower than the certainty equivalent and 0 otherwise. The interaction effect of receiving performance pay and being risk loving provides a measure of whether the program effect depends on students' risk preference.

For relatively risk averse students, we find a significant average program effect on first-year (second-year) GPA of 0.524 (0.535) standard deviation when we control only for school and school classes (table 4, columns 1 and 5). This effect remains statistically significant and high in size for all specifications, indicating that relatively risk averse students respond positively to the financial incentives.

Table 4
Heterogeneous program effect by risk preferences.

	Dep. Var.: First-year GPA				*Dep. Var.: Second-year GPA*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Performance Pay	0.524***	0.571***	0.543***	0.525***	0.535**	0.569**	0.560**	0.498**
	[0.192]	[0.186]	[0.180]	[0.193]	[0.230]	[0.227]	[0.222]	[0.235]
Risk-loving (dummy)	0.026	0.113	0.117	0.127	0.052	0.099	0.073	0.050
	[0.180]	[0.184]	[0.177]	[0.179]	[0.207]	[0.212]	[0.210]	[0.206]
PPP * risk-loving (interaction)	-0.389	-0.453+	-0.381+	-0.394+	-0.349	-0.391	-0.351	-0.329
	[0.271]	[0.277]	[0.258]	[0.262]	[0.325]	[0.332]	[0.326]	[0.338]
School and class dummies	x	x	x	x	x	x	x	x
Student characteristics		x	x	x		x	x	x
Ability measurements			x	x			x	x
Company characteristic				x				x
R-squared	0.222	0.269	0.341	0.368	0.147	0.166	0.197	0.220
Number of observations		200				167		

Notes: The table reports regression estimates of the program effect on grade point averages (GPA) from the end of first (2010) and second year (2011) of vocational education, respectively. GPAs are standardized to have a mean of 0 and a standard deviation of 1. Risk-loving is a dummy which equals 1 if a student prefers the lottery option although its expected value is lower than the certainty equivalent and 0 otherwise. Robust standard errors are reported in brackets. *** p<0.01, ** p<0.05, * p<0.10, + p<0.15

The interaction term between being part of the PPP and being risk loving is negative for both the first- and second-year samples (among all specifications, see table 4, row 3). The negative interaction term suggests that risk loving students respond less well to the PPP than relatively risk averse students. The size of the interaction term changes only marginally across the specifications from -0.394 standard deviations for the first-year sample to -0.329 for the second-year sample (table 4, columns 4 and 8). However, the statistical significance of the interaction term is either nonexistent or very weak. Although we find slightly significant results for the first-year sample ($.103 < p < .142$), the interaction term appears not to be significant for the second-year sample.

The large reduction of the program effect among risk loving program group students (as compared to their relatively more risk averse counterparts) is interesting. Although we do not find statistically significant interaction effects (with $p < 0.10$), the high reduction in response to the incentive might indicate lower program effects among risk loving students. This indication would be in line with our hypothesis: With the provision of financial incentives the relative certainty of monetary benefits increases and relatively risk averse students would have higher incentives to devote more time and energy to the learning investment. In sum, however, we can only speculate about whether students' difference in risk preferences causes heterogeneous program effects.

6. Conclusions

The purpose of this study has been twofold. First, we aimed at learning more about the potential effects of performance pay programs offered in upper secondary vocational education. Second, we investigated systematic differences in program effects among students with heterogeneous economic preferences, i.e., with heterogeneous time and risk preferences. To conduct the research empirically, we analyzed a unique dataset combining educational data, which includes real labor market incentive programs, with data from economic experiments. To test the robustness of our results and to redress any potential imbalance between program and comparison groups, we ran different model specifications.

We find that the existence of the PPPs has on average a positive and significant effect on students' first- and second-year GPAs. This positive program effect is driven by a statistically significant and high effect for the subgroup of students in technical occupations. Conversely, for students in commercial occupations, the program effect is almost zero. As only a very small fraction of students in the latter subgroup is actually part of a PPP, our data do not allow us to reject the hypothesis that there is no program effect for students in commercial occupations.

Most importantly, we find that the responsiveness to the program depends on differences in student preferences. For time preferences, we find that highly impatient students in particular respond strongly to the incentive program by increasing their GPA more than relatively patient students. For risk preferences, our results are less conclusive: We can only speculate that risk loving students might respond less well to the incentive than relatively risk averse students. These two results are in line with our theoretical predictions derived from human capital theory. Long run benefits from higher student performance, i.e., advantageous labor market outcomes, can be derived only with a considerable time lag and with a high uncertainty. With the provision of short-term financial incentives, part of the investment benefits can be reaped much closer to the investment and with a relatively higher certainty.

As to the best of our knowledge there exists no evidence on heterogeneous program effects by students' economic preferences in previous research on the effects of financial incentives in education, we are the first to show the importance of taking a closer look at the interaction of financial incentives and students' economic preferences. The finding that financial incentives in education particularly target highly impatient students—for whom the added benefit accounts for a difference in the perceived return to higher student performance—gives us a hint of when providing financial incentives might be most effective. As graduation approaches, the perceived value of real labor market benefits increases and the perceived added value of financial incentives decreases. Therefore, we suggest that the provision of financial incentives might be most effective at the beginning of an educational program.

Our evidence is based on a small sample of students and results might be specific to the underlying performance pay programs. Therefore, drawing a more general conclusion from our findings calls for further research in both the same and different educational environments. Identifying students who most likely respond to financial incentives will not only help target incentives to a tighter range of students but also provide them at the right time—both of which would increase the cost effectiveness of performance pay programs in education.

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References

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E.E., 2008. Lost in State Space: Are Preferences Stable? International Economic Review 49 (3), 1091–1112.

Angrist, J., Lang, D., Oreopoulos, P.. 2009. Incentives and Services for College Achievement: Evidence from a Randomized Trial. American Economic Journal: Applied Economics 1 (1), 136–163.

Angrist, J., Lavy, V., 2009. The Effects of High Stakes High School Achievement Awards: Evidence from a Randomized Trial. American Economic Review 99 (4), 1384–1414.

Becker, G.S.. 1962. Investment in Human Capital: A Theoretical Analysis. Journal of Political Economy 70 (5), 9–49.

Becker, G.S., 1975. Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education. Columbia University Press, New York.

Bettinger, E., 2010. Paying to Learn: The Effect of Financial Incentives on Elementary School Test Scores. NBER Working Paper No. 16333.

Bettinger, E., Slonim, R., 2007. Patience among Children. Journal of Public Economics 91 (1–2), 343–363.

Bishop, J., 2006. Drinking from the fountain of knowledge: Student incentive to study and learn. In: Hanushek, E.A., Welch, F. (Eds.), Handbook of the Economics of Education, Vol. 2. North-Holland/Elsevier, Amsterdam, pp. 909–944.

Blinder, A.S., Weiss, Y., 1976. Human Capital and Labor Supply: A Synthesis. Journal of Political Economy 84 (3), 449–472.

Borghans, L., Golsteyn, B.H.H., 2006. Imagination, Time Discounting and Human Capital Investments. Mimeo, University of Maastricht.

Brunello, G., 2002. Absolute Risk Aversion and the Returns to Education. Economics of Education Review 21 (6), 635–640.

Burks, S., Carpenter, J., Goette, L., Rustichini, A., 2009. Cognitive skills affect economic preferences, strategic behavior, and job attachment. Proceedings of the National Academy of Science 106 (19), 7745–7750.

Castillo, M., Ferraro, P.J., Jordan, J.L., Petri.e., R., 2011. The Today and Tomorrow of Kids: Time Preferences and Educational Outcomes of Children. Journal of Public Economics 95, 1377-1385.

Cunha, F., Heckman, J.J., 2010. Investing in Our Young People. NBER Working Paper No. 16201.

Dave, C., Eckel, C.C., Johnson, C.A., Rojas, C., 2010. Eliciting Risk Preferences: When Is Simple Better? Journal of Risk and Uncertainty 41 (3), 219-243.

Deci, E.L., 1971. Effects of Externally Mediated Rewards on Intrinsic Motivation. Journal of Personality and Social Psychology 18 (1), 105–115.

Deci, E.L., Koestner, R.M., Ryan, R., 1999. A meta-analytic review of experiments examining the effect of extrinsic rewards on intrinsic motivation. Psychological Bulletin 125 (6), 627–668.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., 2010. Are Risk Aversion and Impatience Related to Cognitive Ability? American Economic Review 100 (3), 1238–1260.

Duckworth, A.L., Seligman, M.E.P., 2005. Self-Discipline Outdoes IQ in Predicting Academic Performance of Adolescents. Psychological Science 16 (12), 939–944.

Frey, B.S., 1994. How Intrinsic Motivation is Crowded Out and In. Rationality and Society 6 (3), 334–352.

Frederick, S., Loewenstein, G., O'Donoghue, T., 2002. Time Discounting and Time Preference: A Critical Review. Journal of Economic Literature 40 (2), 351–401.

Fryer, R.G., 2011. Financial Incentives and Student Achievement: Evidence from Randomized Trials. The Quarterly Journal of Economics 126 (4), 1755-1798.

Fryer, R.G., 2012. Aligning Student, Parent and Teacher Incentives: Evidence from Houston Public Schools. NBER Working Paper No. 17752.

Gneezy, U., Meier, S., Rey-Biel P., 2011. When and Why Incentives (Don't) Work to Modify Behavior. Journal of Economic Perspectives 25 (4), 1–21.

Harrison, G.W., Lau, M.I., Williams M.B., 2002. Estimating Individual Discount Rates in Denmark: A Field Experiment. American Economic Review 92 (5), 1606–1617.

Harrison, G.W., Johnson, E., McInnes, M.M., Rutström, E.E., 2005. Risk Aversion and Incentive Effects: Comment. The American Economic Review 95 (3), 897–901.

Heckman, J.J., Stixrud, J., Urzua, S., 2006. The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior. Journal of Labor Economics 24 (3), 411–482.

Holt, C.A., Laury, S.K., 2002. Risk Aversion and Incentive Effects. The American Economic Review 92 (5), 1644–1655.

Jones, E.B., Jackson, J.D., 1990. College grades and labor market rewards. Journal of Human Resources 25 (2), 253–266.

Keren, G., Roelofsma, P., 1995. Immediacy and certainty in intertemporal choice. Organizational Behavior and Human Decision Processes 63 (3), 287-297.

Köszegi, B., Rabin, M., 2006. A Model of Reference-Dependent Preferences. Quarterly Journal of Economics 121 (4), 1133–65.

Krebs, T., 2003. Human Capital Risk and Economic Growth. The Quarterly Journal of Economics 118 (2), 709–744.

Kremer, M., Miguel, E., Thornton, R., 2009. Incentives to Learn. The Review of Economics and Statistics 91 (3), 437-456.

Levhari, D., Weiss, Y., 1974. The Effect of Risk on the Investment in Human Capital. The American Economic Review 64 (6), 950–963.

Leuven, E., Oosterbeek, H., Van der Klaauw, B., 2010. The Effect of Financial Rewards on Students' Achievement: Evidence from a Randomized Experiment. Journal of the European Economic Association 8 (6), 1243–1265.

Manski, C., Wise, D., 1983. College choice in America. Cambridge, Mass.: Harvard University Press.

Meier, S., Sprenger, C., 2010. Stability of time preferences. IZA Discussion Paper No. 4756.

OPET, 2010. Berufseinsteiger-Barometer 2010. Bern: Federal Office for Professional Education and Technology.

OPET, 2011. Vocational and Professional Education and Training in Switzerland 2011. Bern: Federal Office for Professional Education and Technology.

Prelec, D., Loewenstein, G., 1991. Decision making over time and under uncertainty: A common approach. Management Science 37 (7), 770-786.

Rabin, M., 1998. Psychology and Economics. Journal of Economic Literature 36 (1), 11–46.

Roth, P.L., Clarke, R.L., 1998. Meta-analyzing the relation between grades and salary. Journal of Vocational Behavior 53 (3), 386–400.

Schweri, J., 2004. Does it pay to be a good student? Results from the Swiss gruaduate labour market. University of Berne Discussion Paper No. 0405.