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Learning for a bonus: How financial incentives interact with preferences

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ABSTRACT

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' time preferences. To examine this effect, we use real labor market incentive programs that we combine with data from experiments on time preferences. We find not only that students who are offered financial incentives for better grades have on average better first- and second-year grade point averages but also, more strikingly, that highly impatient students respond more strongly to financial incentives than relatively patient students. This finding suggests that financial incentives are most effective at the beginning of an educational program, when real labor market benefits are in the distant future.

1. Introduction

The past decade has seen a major proliferation of school interventions to encourage students to improve 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, 2011, for an overview). Quasi-experimental and experimental studies evaluate financial incentive programs designed to improve student performance. These studies typically find small, if any, average program effects (for secondary and post-secondary education, see, e.g., 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 student groups. 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 costs and benefits (of an increased learning investment) are spread over time (Becker, 1962). Therefore, any analysis of how financial incentives in education affect this intertemporal choice should include measures of students' time preferences (e.g., Frederick et al., 2002; Prelec and Loewenstein, 1991). Time preferences vary considerably among students (Castillo et al., 2011), and recent literature has pointed to non-cognitive abilities 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 time preferences – meaning that differences in preferences might affect students' responses to financial incentives in education – would not be surprising.

This paper analyzes the effect of the existence of financial incentive programs on student performance by considering interactions of the incentive effect with time preferences. We derive our hypotheses by applying the 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 time preferences, we collected a unique and comprehensive dataset. It provides information on students enrolled in vocational education and training programs. Given that in Switzerland 70% of the graduates of lower-secondary education enroll in such training programs (OPET, 2011), our student sample represents the largest part of Swiss young adults pursuing an upper secondary education. Students in our sample started their three- to four-year programs at an average age of 16 in 2009. The dataset includes information on both student performance (measured by end-of-semester grade point averages) and student time preference parameters (measured by economic experiments when students started their training program). These data are available within a school environment in which some of the students are part of school-independent PPPs and some are not. The allocation to these programs approximates randomization.

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' time preferences. We thus shed light on some of the fundamentals of student responses to financial incentives. Moreover, we analyze the incentive effect in a school

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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. This average effect is driven by the high responsiveness of students in technical occupations. Second, and novel to the literature, we find a significant interaction between financial incentives and time preferences; our findings suggest that, when financial incentives are offered, highly impatient students increase their performance far more than relatively patient students.

The next section briefly introduces the theoretical background. Section 3 describes details of the PPP, provides information on the elicitation of time preferences, and presents descriptive statistics. Section 4 provides the empirical strategy. Section 5 presents and discusses results for both the pure program and the interaction effect. Section 6 concludes.

2. Theoretical background

While attending school, students make decisions about the time and effort they devote to learning activities. According to the standard human capital theory (Becker, 1962; Bishop, 2006), they do so 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) to the present discounted value of the costs (i.e., direct and indirect costs of exerting learning effort).[1] The theory predicts, ceteris paribus, that students raise their school performance when their marginal net benefit increases, i.e., when financial incentives for better student performance are provided. Nonetheless, other streams of economic (e.g., Frey, 1994) and psychological literatures (e.g., Deci, 1971; Deci et al., 1999) could well predict the opposite: Due to the crowding out of intrinsic motivation, the provision of financial incentives may reduce individual performance. The prediction of the direction of the effect of financial incentives is thus not straightforward and remains mostly an empirical question. Although studies on financial incentives in education have measured the crowding out effects, thus far they find no evidence for lower intrinsic motivation of incentivized students (e.g., Fryer, 2011; Kremer et al., 2009). Thus, the first hypothesis we test is:

H.1. The provision of financial incentives to students with good school performance increases students' school performance (everything else being constant).

Given that the timing of the investment costs and benefits is spread over time, the decision to invest in human capital depends on individual time preferences (Blinder and Weiss, 1976; Borghans and Golsteyn, 2006). As these preferences vary significantly among individuals (e.g., Harrison et al., 2002) and among students in particular (as shown by, e.g., Bettinger and Slonim, 2007; Castillo et al., 2011), we expect that incentive effects in education interact with time preferences.

Generally, benefits from higher student performance (e.g., in the form of higher wages) are derived only in the long term. Students who overly discount the future, i.e., impatient students, choose to invest too little time and effort in their own education when they highly discount time lagged investment benefits.[2] The provision of financial incentives reduces the waiting period for parts of the benefits, thereby boosting discounted marginal benefits from higher student performance. As this benefit increase holds particularly for highly impatient students, short-term incentives most likely encourage this group of students to greatly increase their school performance. In contrast, for relatively patient students, perceived marginal benefits change slightly (if at all), as the size of the short-term incentive is very small relative to the size of discounted long-term labor market benefits.[3] This argument translates into the following hypothesis:

H.2. When students receive short-term rewards, highly impatient students increase their school performance more than relatively patient students.

3. Institutional background and data

To investigate the effects of financial incentives and their interaction with time preferences on student performance, we collect data on students who are part-time students and at the same time part-time employees as part of their upper secondary vocational education (a "dual" education). In this educational environment we make use of school-independent PPPs, in which some students participate and others do not. The allocation to these PPPs approximates randomization.

Our student sample started their dual education program in late summer 2009, at an average age of 16 years. At this point, we collected both experimental and very detailed background survey data.[4] 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 other things, and details on the PPPs. To investigate heterogeneous program effects by student preferences, we combine these field data with the experimental data on student preferences. In the following four subsections, we first outline the PPP (in dual vocational education) that we use in our study. Second, we describe the measurement of time preferences. Third, we provide information on our student sample. Fourth, to demonstrate that the allocation to PPP approximates randomization, we provide and compare key student characteristics of the program and comparison groups.

3.1. Provision of performance pay programs (PPPs) in our sample

Students in our sample take part in dual education programs in the vocational education and training (VET) system in Switzerland.[5] Students who attend such a training program study part-time at school for 1 to 1.5 weekdays. For most of the time (3.5 to 4 weekdays), students work part-time as apprentices in "host" companies with whom they have an employment contract for their entire three- to four-year training period. Some of these host companies have institutionalized a PPP, in which they pay 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 such bonuses. Therefore, the first group can be seen as a treatment group and the second group as a comparison group.

[1] Like 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 school. Empirical studies have shown that not only the schooling degree but also the 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 job applications always include academic records, school performance in particular matters for labor market entrance (see Schweri, 2004, for Switzerland).

[2] 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.

[3] Although Angrist and Lavy (2009), Castillo et al. (2011), and Fryer (2011) discuss this mechanism in their studies, none of them is actually able to test it.

[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 a work in progress.

[5] Graduates from a VET program hold qualifications highly valued by employers in the Swiss labor market and generally enjoy a low risk of unemployment (OPET, 2010).

[6] Host companies have an interest in incentivizing students' school performance, as the school curriculum covers theoretical knowledge that complements the practical knowledge 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).