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# IMPATIENCE AND ACADEMIC PERFORMANCE. LESS EFFORT AND LESS AMBITIOUS GOALS

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# Impatience and Academic Performance. Less effort and less ambitious goals

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***Abstract***

*In a simple theoretical model we show that impatience affects academic performance through two different channels: impatient students spend less effort in studying activities and set less ambitious objectives in terms of grades at exams. As a consequence, the relationship between impatience and academic success may vary according to how performance is measured. Using data from a sample of Italian undergraduate students, we find a strong negative relationship between impatience and both the average grade at exams and the probability of graduating with honours. Conversely, a negative but not statistically significant correlation emerges between time preferences and both the number of credits earned in the three years following enrolment and the probability of timely graduation. Our findings are robust to alternative measures of impatience and controlling for family background characteristics, for cognitive abilities and for risk preferences.*

*Keywords: Time preferences, impatience, human capital, academic success*
*JEL Classification: I20, D03, D91, J01*

## 1. INTRODUCTION

Individuals are often confronted with decisions involving tradeoffs between costs and benefits occurring at different points in time. Healthy eating habits, physical exercise, job search activities and saving are examples of such type of choices.

In this type of decisional processes a crucial role is played by inter-temporal preferences: impatient individuals weigh immediate costs more and delayed benefits less and then end up with economic and social outcomes that differ from those reached by more patient subjects. The relevance of inter-temporal preferences for individual decisions has long been recognized by the economic literature and an increasing number of empirical and experimental works confirms the influence of time preferences on individual choices in a very large number of domains. Among

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the most recent works, Della Vigna and Paserman (2005) show that impatience is negatively correlated to the exit rate from unemployment. Drago (2006) finds that impatience predicts workers' mobility into better paid jobs. Meier and Sprenger (2010) study the relevance of time preferences for credit card borrowing, while Chabris et al. (2008), Golsteyn et al. (2012) and Sutter et al. (2011) focus their attention on substance use and nutrition.

Inter-temporal preferences are also crucial for investments in human capital (Mincer, 1958; Becker, 1964). Individuals with high discount rates are expected both to invest less in education and training and to accumulate human capital of a lower quality: the cost of effort is immediate while the benefits deriving from human capital and from high quality human capital may be years away.

The relationship between human capital accumulation and inter-temporal preferences has been empirically scrutinized only by few very recent papers. Golsteyn et al. (2012), using a Swedish longitudinal dataset, highlight a substantial adverse relationship between impatience and educational performance. Castillo et al. (2011) show that children with higher discount rates are more likely to receive disciplinary referrals in school. Cadena and Keys (2011), using the National Longitudinal Survey of Youths (NLSY), find that impatient people do worse in terms of educational attainment and show dynamically inconsistent behaviours, for example, by starting an educational program but failing to accomplish it.

In this paper we offer new evidence on the relationship between time preferences and educational outcomes using a sample of Italian undergraduate students observed over a period of three years from their enrolment. This dataset allows us to measure time preferences, at the moment of students' enrolment at university, by referring to a survey question asking students about their willingness to give up part of a prize available in one year in order to have the win immediately. We also have detailed information on different measures of educational performance, such as the number of credits acquired in the three years following enrolment, the average grade at exams, the probability of timely acquiring the degree and the overall grade obtained on graduation.

Once enrolled at university, students have to decide the amount of effort to provide in studying activities and their objectives in terms of grades at exams. In educational systems, such as the Italian one, in which students are not forced to pass all the scheduled exams during an academic year in order to proceed to the subsequent year of study (allowing potentially uncapped completion period), these choices will affect both the time needed for degree completion and the final degree classification. The choice of a high level of effort will reduce the time to obtain the degree and increase the overall grade achieved. However, given a certain amount of effort, there exists a trade-off between grades obtained at exams and completion time: students aiming at obtaining high grades are more likely to focus their effort on few exams

thus obtaining higher grades but increasing the time to degree completion; on the contrary, students setting less ambitious objectives in terms of grades are more likely to take a large number of exams thus reducing the time to obtain the degree albeit scoring lower grades.

In a very simple theoretical model, we show that impatience affects students' academic performance by influencing both the level of effort they decide to exert in studying activities and the objectives they set in terms of grades at exams. Individual degree of impatience is negatively correlated with both decisions: more impatient students choose to exert lower effort, because it involves immediate costs and only delayed benefits, and to acquire a low-quality human capital because the benefits of high grades and deep knowledge will be obtained only when entering the labour market.

As students' academic performance is affected by time preferences through these two channels, the direction of the relationship between academic success and impatience may vary according to the measure of human capital considered. If we consider as a measure of success the average grade obtained at exams (or the probability of graduating with honours) the effect of impatience is clear-cut: more impatient individuals assign a lower value to the future benefits deriving from the accumulation of human capital and from its quality; therefore, they care less about good grades and exert less effort in studying activities ending up with a lower average grade at exams and a lower probability of graduating with honours. Instead, when we consider the effect of impatience on the number of credits earned in a certain period of time (or on the probability of timely graduation), the two channels described above operate with contrasting effects. On the one hand, since more impatient individuals assign a lower value to the future benefits of human capital and exert less effort, they acquire a small number of credits in a given period of time and delay the time of graduation. On the other hand, since more impatient students are less concerned about the quality of their human capital, they set less ambitious objectives in terms of grades and are more likely to acquire a larger number of credits and to timely obtain the degree. The global effect of impatience on these measures of academic success depends on the relative strength of these two factors.

Consistently with these predictions, in our empirical analysis we find that impatient individuals are less likely to be successful at university. The negative correlation between high discount rates and academic success is particularly strong when we consider as measures of academic performance the average grade at passed exams and the probability of obtaining a first class honours degree. On the other hand, we find a negative, but weakly statistically significant relationship, between impatience and the number of credits acquired in the three years after enrolment and between impatience and the probability of timely obtaining the degree.

Our findings are robust to alternative measures of impatience and controlling for family background characteristics, for different measures of cognitive abilities and for risk preferences.

Controlling for these variables is particularly important because previous research suggests that ability and time preferences are correlated (Dohmen et al 2010; De Paola, 2012, Shamosh and Gray, 2007) and that discount rates might reflect differences in risk preferences (Andersen et al., 2008; Andreoni and Sprenger, 2010).

The remainder of the paper is organized as follows. Section 2 presents the theoretical framework. Section 3 describes the data used in our analysis. In Section 4 we present our main findings. Section 5 considers an alternative measure of impatience. In Section 6 we investigate the relationship between impatience and both the probability of timely graduation and the probability of obtaining a honours degree. Section 7 concludes.

## 2. THEORETICAL FRAMEWORK

In order to obtain the degree, students have to accumulate an established number of credits by taking the corresponding exams. Exams are graded by instructors and students can earn credits with lower or higher grades.

Even if students are supposed to accomplish their degree program within its normal duration, extending university studies beyond the typical duration is becoming a common phenomenon in many countries. According to the US Department of Education, fewer than 40% of students, who enter college each year, graduate within four years, while almost 60% of students graduate in six years. As far as Europe is concerned, Brunello and Winter-Ebmer (2003) report that the percentage of students expecting to complete their degree at least one year later than the required time is quite high in many countries (31.2% in Sweden, 30.8% in Italy, 17.1% in France and 10% in Germany) with the exception of Anglo-Saxon countries where this percentage is close to zero.

In Italy, such tendency of late graduation might be, at least partially, due to the fact that in the Italian university system students are not forced to pass all the scheduled exams during an academic year in order to proceed to the subsequent year of study (they can retake an exam as many times as they want in case they are not satisfied with their performance).

Then, when planning their studies, students take important decisions that affect both the time they will take to accomplish the educational program (through the number of credits earned in a certain period of time) and the grades they will obtain at exams (and then the overall grade obtained on graduation). At one extreme, in a given academic year, students may decide to pass as many examinations as possible, albeit with low grades, or, at the other extreme, they might seek to obtain high grades by only concentrating their effort on few courses thus delaying the time of their degree. In this section we set up a simple model in which we analyse student's

choice regarding these two dimensions of his/her academic performance assuming that s/he has to decide the effort to exert in studying a given subject and the minimum grade s/he wants to score in that subject, with the possibility of freely determining the time s/he will take to accomplish the degree program. We have decided in favour of this theoretical framework because it reflects student's decisions in the Italian university system, but it is also sufficiently general to describe our idea in different contexts.

More precisely we propose a two-period[1] model in which a student chooses both the effort (*e*) to exert in studying activity and the standard (*s*) to accept an exam: in period 0 the student bears a cost, *c(e)*, depending on the level of effort exerted; in period 1 with probability *p(e,s)* s/he passes and accepts the exam obtaining a fixed level of utility ($\bar{u}$) plus an additional utility that depends on the standard chosen (*u(s)*) and represents the utility arising from higher chances on the labour market[2], whilst with probability *1-p(e,s)* s/he fails the exam (or s/he passes but rejects it) thus getting nothing. Inter-temporal preferences are caught by the term $\delta$ which represents the discount factor of the student and returns the value in period 0 of the utility available in period 1.

Formally, the student maximizes the following utility function:

$$U = -c(e) + \delta * p(e,s) * \left( \bar{u} + u(s) \right)$$

When choosing the level of effort to exert in studying activities and the grade s/he wants to reach, the student faces two trade-offs: on one hand, the higher the effort the higher the probability of passing the exam, $p_e'(e,s) > 0$, but the higher also the cost to bear in period 0, as we assume $c'(e) > 0$ and $c''(e) > 0$; on the other hand, the higher the standard the lower the probability of accepting the mark obtained at the exam, $p_s'(e,s) < 0$, but the higher the utility deriving from adding this exam to the academic career ($u'(s) > 0$; $u''(s) < 0$).

The optimal choice of effort and standard satisfies the following first order conditions (FOCs):

$$F_e = \frac{\partial U}{\partial e} = -c'(e) + \delta * p_e'(e,s) * \left( \bar{u} + u(s) \right) = 0$$

[1] The two-period horizon can be interpreted either in terms of choices related to a single exam (assuming that the student makes the choices at every period) or in terms of degree award (in this case in period 0 the students decides the time to spent studying in order to get the degree in period 1, with a grade depending on the standard chosen for the exams).

[2] A number of works find a high rate of return to university grades (see Schweri, 2004; Bratti, Naylor and Smith, 2007; Chia and Miller, 2008).

$$F_s = \frac{\partial U}{\partial s} = \delta * p_s'(e,s) * \left(\bar{u} + u(s)\right) + \delta * p(e,s) * u'(s) = 0$$

Second-order conditions for a maximum (which are satisfied given our assumptions[3]) require that $F_{ee} < 0$ and $F_{ss} < 0$, and that the determinant of the Hessian (composed by the second derivatives) is positive. Since $F_{ee}F_{ss} - F_{es}F_{se} > 0$, the Jacobian $J$ of this system with respect to the endogenous variables *e* and *s* does not vanish at the optimal values. Therefore, we can study the comparative static properties.

We are interested in showing how individual time preferences, represented by the discount factor $\delta$, influence student's choice of effort and standard. Taking the total differentials of the FOCs and allowing the endogenous variables *e* and *s* to vary, together with the relevant exogenous variable $\delta$, we obtain:

$$F_{ee}\partial e + F_{es}\partial s + F_{e\delta}\partial\delta = 0$$

$$F_{se}\partial e + F_{ss}\partial s + F_{s\delta}\partial\delta = 0$$

The above equation system can be written in matrix form as:

$$\begin{vmatrix} F_{ee} & F_{es} \\ F_{se} & F_{ss} \end{vmatrix} \begin{vmatrix} \partial e \\ \partial s \end{vmatrix} = \begin{vmatrix} -F_{e\delta}\partial\delta \\ -F_{s\delta}\partial\delta \end{vmatrix}$$

Then, using Cramer's rule we obtain $\partial e/\partial\delta$ and $\partial s/\partial\delta$ :[4]

[1] $$\frac{\partial e}{\partial \delta} = \frac{-\overset{+}{F}_{e\delta}\overset{-}{F}_{ss} + \overset{+}{F}_{s\delta}\overset{+}{F}_{es}}{\overset{+}{|J|}} > 0$$

[2] $$\frac{\partial s}{\partial \delta} = \frac{-\overset{-}{F}_{ee}\overset{+}{F}_{s\delta} + \overset{+}{F}_{se}\overset{+}{F}_{e\delta}}{\overset{+}{|J|}} > 0$$

The model highlights a negative relationship between student's impatience and the level of *e* and *s* that s/he chooses: more impatient students both exert lower effort in studying and select a lower standard to be accepted as final grade. In fact, expression [1] shows that an increase in the discount factor $\delta$ (that is, a higher level of patience) produces an increase in the level of effort

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[3] We also assume $p_s''(e,s) < 0$; $p_e''(e,s) < 0$; $p_{se}''(e,s) = 0$; $\dfrac{u'(s)}{\bar{u} + u(s)} > \dfrac{p_s'(e,s)}{p}$

[4] $F_{ss} = \delta * p_s''(e,s) * \left(\bar{u} + u(s)\right) + 2\delta * p_s'(e,s) * u'(s) + \delta * p(e,s) * u''(s)$; $\quad F_{e\delta} = p_e'(e,s) * \left(\bar{u} + u(s)\right)$

$F_{se} = F_{es} = \delta * p_{se}''(e,s) * \left(\bar{u} + u(s)\right) + \delta * p_e'(e,s) * u'(s)$; $\quad F_{s\delta} = p_s'(e,s) * \left(\bar{u} + u(s)\right) + p(e,s) * u'(s)$

$F_{ee} = -c''(e) + \delta * p_e''(e,s) * \left(\bar{u} + u(s)\right)$

exerted by the student; likewise, expression [2] shows that as the discount factor increases the student chooses a higher standard.

## 3. DATA AND DESCRIPTIVE STATISTICS

Our empirical analysis relies upon individual-level data using a sample of undergraduate students enrolled in the academic year 2008-2009 at the University of Calabria, a middle-sized public university located in the South of Italy.[5] The students in our sample are enrolled in First Level Degree (FLD) courses offered within different fields (Economics, Pharmacy, Engineering, Humanities, Mathematics and the Natural Sciences, and Political Sciences).[6]

At the moment of their enrolment, the about 6000 students who decided to enrol at the University of Calabria were asked to participate at an on-line survey asking a number of questions on individual characteristics, family background, previous studies, motivation, expectations etc. Participation in the survey was on a voluntary basis (only questionnaires that were totally completed were accepted) and about 80% of the freshmen answered the questionnaire. More precisely, 4,281 students have answered to the survey. However, 926 of these students have dropped out from university during their first year of academic studies, so we end up with a sample of 3,355 individuals.

Among the survey's questions, there was one aimed at obtaining information on students' time preferences. The question presented students with the following hypothetical situation: 'Imagine that you have won 1000 Euros in a lottery. The full amount of money you have won will be available to you in one year, but you can have your winnings immediately if you give up a part. What would be the largest amount of money you would be prepared to give up in order to have your money immediately?' Respondents could select an amount of 0, 20, 40, 60, 80, 100, 120, 140, 160 or 180 Euros.

Table 1 shows the distribution of individuals by reported levels of discount rate. About 29% of students refused to give up any amount of money. About 19% of students decided to give up €20, while 7.42%, 5.37% and 4.71% of them chose respectively to give up €40, €60 and €80. A quite large fraction of students, 24.32% decided to give up €100. Instead, only 1.97%,

[5] The University of Calabria currently has about 33,000 students, who are enrolled on different Degree Courses and are at different levels of the Italian University system.

[6] Since reform in 2001, the Italian university system has been organized around three main levels: First Level Degrees (3 years legal duration), Second Level Degrees (a further 2 years), and PhD Degrees. When starting their university career, students choose a field and within that field they enrol on a certain FLD course. In order to gain a FLD course, students have to obtain a total of 180 credits (each successfully accomplished exam gives a number of credits ranging from 1-10; dissertation carries also some credits).

1.46% and 0.77% of students decided to give up €120, €140 and €160 respectively. Finally, 5.96% of students have favoured the last option of giving up €180.

**Table 1. Time preferences: amount given up to have money immediately**

| | *Frequencies* | *Percent* |
|---|---|---|
| 0 (discount rate 0) | 968 | 28.85 |
| 20 (discount rate 0.02) | 643 | 19.17 |
| 40 (discount rate 0.04) | 249 | 7.42 |
| 60 (discount rate 0.06) | 180 | 5.37 |
| 80 (discount rate 0.08) | 158 | 4.71 |
| 100 (discount rate 0.1) | 816 | 24.32 |
| 120 (discount rate 0.12) | 66 | 1.97 |
| 140 (discount rate 0.14) | 49 | 1.46 |
| 160 (discount rate 0.16) | 26 | 0.77 |
| 180 (discount rate 0.18) | 200 | 5.96 |
| | 3,355 | 100.00 |

We use the answers to this question in order to build two indicators of time preferences: *Discount Rate* with values from 0 (for students who would not give up any amount of money) to 0.18 (for students who would give up €180), and a dummy variable, *Impatient*, with a value of 1 for students who selected a positive amount of money they are willing to give up and 0 for those who would not give up anything. 71% of students show a certain degree of impatience as they will give up a positive amount of money in order to have the win immediately.

The measures of time preferences we have obtained seem quite reliable, since they behave in the same way as those emerging from a number of recent papers on the subject. A gender analysis shows that females are less impatient than males (the correlation between *Discount Rate* and the dummy *Female* is equal to -0.0434, statistically significant at the 1 percent level); while, looking at cognitive abilities, it emerges that more skilled individuals tend to be less impatient compared to students with a lower level of cognitive abilities (the correlation between *Discount Rate* and *High School final grade* is equal to -0.0279, statistically significant at the 10 percent level).

Still, our measures of time preferences present some advantages with respect to those used in the literature. First of all, we are able to obtain a direct measure of student's impatience while other authors (Cadena and Keys, 2012; Della Vigna and Paserman, 2005; Drago, 2006) use proxies relying on the assessment of the interviewer of whether or not the respondent was impatient or restless, which may also be related to impulsivity. Thus, our direct measures of impatience seem to better catch the general essence of time preferences compared to indicators that are likely to include elements that could be associated to hyperbolic discounting (i.e. National Longitudinal Survey of Youth assessment of impatience). Secondly, as time preferences in our study are measured at the moment in which students enrol at university, while educational outcomes are taken later in the student life, our analysis does not suffer of reverse causality. In fact, the ability to delay gratifications may be not entirely an inborn personality

trait (see Perez-Arce 2011) and educational investments may play a role in shaping individual time preferences.

Thanks to the administrative data provided by the University of Calabria we have detailed information on all the students enrolled at this university in the academic year 2008-2009. In Table 2 the descriptive statistics of the variables we use in our analysis are reported. We observe a number of individual characteristics such as gender, age, province of residence, type of high school attended, parents' education and type of occupation. About 62% of sample students are females. They are on average 20 years old and about 8% of them were employed at the moment of their enrolment at University. About 7% of students enrolled at University not in the same year in which they graduated from High School (*Late Enrolment*). Most of the students are enrolled in Economics and Humanities (about 26 and 23% respectively); about 17% are studying Engineering, 12.4% Pharmacy and only 12.1% are enrolled in Mathematics.

The richness of data, allows us to gather some information on students' family background. The average number of years of education for fathers ranges from 0 to 18, with a mean of 11.30. About 45% of students have a father employed in the public sector and about 6% of students have a father who is an entrepreneur.

As regards information on students' cognitive abilities, we refer to two different indicators. First, we observe the typology of the previous studies because students come from two different types of high school: Lyceums (about 54%) and Technical and Vocational Schools (about 46%).[7] In addition, we observe the final grade obtained at high school, *High School Grade*, which ranges from 60 to 100, with a mean of about 86.47. Since time preferences are correlated to abilities, it is important to control for measures of predetermined cognitive skills (Dohmen et al., 2010; Shamosh and Gray, 2007).

**Table 2. Descriptive statistics for the sample of students**

| Variables | Mean | Std. Dev | Min. | Max. | Obs. |
|---|---|---|---|---|---|
| *Discount Rate* | 0.054 | 0.053 | 0 | 0.18 | 3,355 |
| *Impatient* | 0.711 | 0.453 | 0 | 1 | 3,355 |
| *Average grade in exams taken* | 24.349 | 2.654 | 18 | 30 | 3,355 |
| *Number of credits earned* | 93.608 | 57.143 | 2 | 180 | 3,355 |
| *Timely Degree* | 0.133 | 0.340 | 0 | 1 | 3,355 |
| *First Class Honours Degree* | 0.093 | 0.290 | 0 | 1 | 2,492 |
| *Female* | 0.622 | 0.485 | 0 | 1 | 3,355 |
| *Age* | 20.019 | 3.444 | 17.717 | 62.327 | 3,355 |
| *Economics* | 0.261 | 0.439 | 0 | 1 | 3,355 |
| *Pharmacy* | 0.124 | 0.330 | 0 | 1 | 3,355 |
| *Engineering* | 0.171 | 0.376 | 0 | 1 | 3,355 |

[7] In Italy, after compulsory education (8 years of schooling), students can choose between a "generalist track" (Lyceum), or a more labour market oriented track (Vocational or Professional Track). There are no entry regulations and students can choose between the two tracks without restrictions. Students typically select between the two tracks according to family background (see Brunello and Checchi, 2006). Students from more educated families typically choose a Lyceum, while those with poorer socio-economic backgrounds enrol at vocational schools. Moreover, Lyceums are more academically oriented, while technical and professional schools educate for white collar and blue collar occupations.

| | | | | | |
|---|---|---|---|---|---|
| *Humanities* | 0.232 | 0.422 | 0 | 1 | 3,355 |
| *Mathematics* | 0.121 | 0.326 | 0 | 1 | 3,355 |
| *Father's Education* | 11.305 | 4.042 | 0 | 18 | 3,355 |
| *Father in Public Sector* | 0.455 | 0.498 | 0 | 1 | 3,355 |
| *Father Entrepreneur* | 0.063 | 0.243 | 0 | 1 | 3,355 |
| *High School Type: Lyceum* | 0.540 | 0.498 | 0 | 1 | 3,355 |
| *High school final grade* | 86.474 | 11.725 | 60 | 100 | 3,355 |
| *Risk Aversion* | 3.877 | 1.053 | 1 | 5 | 3,355 |
| *Employed* | 0.077 | 0.267 | 0 | 1 | 3,355 |
| *Late Enrolment* | 0.072 | 0.259 | 0 | 1 | 3,355 |

As shown in Castillo et al. (2011), when analysing the effect of time preferences, it might be important to control for individual risk preferences since discount rates might reflect differences in risk preferences. At this aim we use information on the risk attitudes of students that has been gathered from a question of the on-line survey asking them to choose the amount of money they would like to invest in a hypothetical lottery. More in detail, students were required to answer a question on the following hypothetical situation: 'Imagine that you have won 100,000 Euros in a lottery. Almost immediately after you collect the winnings, a reputable bank offers you an investment opportunity with the following conditions: You can invest money. There is the chance to double the invested money. However, it is equally possible that you could lose half of the amount invested. You have the opportunity to invest the full amount, part of the amount, or reject the offer. What share of your winnings would you be prepared to invest in this financially risky, yet potentially lucrative investment?' Respondents could select an investment amount of 0, 20,000, 40,000, 80,000, or 100,000 Euros. Using answers to this question, we built the variable *Risk Aversion* with values from 1 (for students who would invest the whole amount of the win) to 5 (for students who would refuse to invest any money). The average value of this measure in our sample is 3.88.

Student's performance can be measured considering different indicators, such as grades obtained at exams or the number of credits earned in a certain period of time. By the end of the three years following their enrolment (the regular duration of their degree course) students have acquired on average about 93.61 credits (out of 180 that they were expected to earn) while the average grade at passed exams is 24.35 (exams are evaluated on a scale ranging from 18 - the minimum passing line - to 30).

We also consider as measures of student's performance whether the student in the period of time we consider has accomplished the degree program[8] and the degree class s/he obtained. As shown in Table 2, only about 13% of students have acquired the degree in the three years following their enrolment and only 9.27% has obtained the highest degree class.

[8] We measure the probability that the student has accomplished the degree program by considering whether the student has reached the number of credit necessary to gain a FLD (180).

## 4. TIME PREFERENCES AND ACADEMIC SUCCESS

As shown in the theoretical model, student's impatience is negatively correlated with the level of effort exerted in studying activities and with the educational standards in terms of grades obtained at exams. When the degree of impatience varies, the change in these two factors affects academic performance.

In order to study the relationship between time preferences and academic success, we consider both the average grade at passed exams and the number of credits earned by each student in the three years following enrolment (that is the legal duration of their degree program).[9] The first measure of academic performance is more focused on the quality of the human capital accumulated and we expect a negative correlation between this measure of success and impatience: impatient students spend lower effort in studying activities and set lower standards compared to patient individuals and, as a consequence, obtain lower grades. The second indicator of academic performance allows us to measure the impact of impatience on the time to obtain the degree. Such a relationship is less clear cut. On the one hand, impatient students are less likely to spent effort in studying activities with negative consequences on their probability of reaching the minimum passing grade. This would imply that they are less likely than patient students to earn a high number of credits in the three years following enrollment. Yet, impatient students set a lower grade standard, implying that, in a certain period of time, they are more likely than patient students to earn a high number of credits. Recall that in Italy students can refuse the grade obtained at an exam and retake the exam as many times as they wish. Students who are satisfied with low grades are less likely to retake an exam, thus earning a higher number of credits in a given period of time.

Table 3 reports the estimation results of an OLS model in which we consider as dependent variable alternatively our two measures of academic performance (the average grade at exams and the number of credits earned in the three years following enrolment). In the first specification (columns 1 and 3) we only control for student's predetermined characteristics (gender, *Age*, *Employed* and *Late Enrolment*) and family background (father education and father type of employment). In the second specification (columns 2 and 4) we add among controls two indicators of student's cognitive ability (*Lyceum* and *High School Final Grade*) [10]

[9] About 20% of students enrolled at the University of Calabria in 2008-09 have dropped out from their university career within three years after enrolment. Therefore, even if it is not the focus of our analysis, we have also investigated the relationship between impatience and drop-out behaviour. Whilst, controlling for individual ability, we find a positive but statistically not significant relationship between students' discount rate and their dropping out probability, it emerges that patient students (those who refused to give up any amount of money) are significantly less likely to abandon their university studies.

[10] Our results do not qualitatively change when we include among our controls an additional measure of cognitive ability represented by scores on a cognitive test taken by students at the same time as the survey (results available upon request to the authors). We have decided to not control for this variable in estimates reported in the paper as, due to missing values, the number of observations reduces to 2,492.

and our measure of student's risk aversion. In both specifications we also control for field of study dummies and for province of residence dummies (not reported).

In columns (1) and (2) we study the relationship between impatience and the average grade obtained at the exams taken during the three years following enrolment.[11] We find that more impatient students obtain lower grades (the relationship is statistically significant at the 1 percent level): an increase in the level of impatience from 0 (patient student) to 0.18 (highest level of impatience) reduces by almost 0.45 points (-2.519*0.18) the average grade obtained at exams. Column (2) shows that patience is an important trait for achieving high grades also when we control for individual ability: the negative relationship between the discount rate and the average grade in exams remains statistically significant at the 1% level although the magnitude of the effects becomes smaller.

**Table 3. Time Preferences and Academic Performance: OLS estimates**

| Variables | Average Grade (1) | Average Grade (2) | Number of Credits (3) | Number of Credits (4) |
|---|---|---|---|---|
| *Discount Rate* | -2.519*** | -1.859*** | -34.970** | -23.050 |
| | (0.756) | (0.654) | (17.000) | (15.420) |
| *Female* | 0.920*** | 0.306*** | 15.480*** | 3.695* |
| | (0.096) | (0.085) | (2.072) | (1.969) |
| *Age* | 0.018 | 0.063*** | -0.766** | 0.066 |
| | (0.016) | (0.016) | (0.350) | (0.355) |
| *Father's Education* | 0.056*** | 0.008 | 0.938*** | 0.207 |
| | (0.011) | (0.009) | (0.240) | (0.233) |
| *Father in Public Sector* | 0.099 | 0.063 | 0.026 | -0.561 |
| | (0.084) | (0.073) | (1.935) | (1.769) |
| *Father Entrepreneur* | 0.013 | 0.188 | -4.070 | -1.250 |
| | (0.183) | (0.155) | (3.944) | (3.624) |
| *Employed* | -0.181 | 0.061 | -6.317 | -2.503 |
| | (0.168) | (0.158) | (4.013) | (3.896) |
| *Late Enrolment* | -0.270* | -0.158 | -16.730*** | -15.020*** |
| | (0.162) | (0.151) | (3.913) | (3.807) |
| *Lyceum* | | 1.046*** | | 14.120*** |
| | | (0.076) | | (1.811) |
| *High School Final Grade* | | 0.099*** | | 1.960*** |
| | | (0.003) | | (0.075) |
| *Risk Aversion* | | -0.013 | | -0.055 |
| | | (0.033) | | (0.793) |
| *Constant* | 21.670*** | 13.990*** | 61.230*** | -90.250*** |
| | (0.552) | (0.579) | (10.990) | (12.240) |
| *R-squared* | 0.223 | 0.414 | 0.141 | 0.289 |
| *Observations* | 3,355 | 3,355 | 3,355 | 3,355 |

Notes: In all specifications we control for field of study dummies and for province of residence dummies. Standard errors (corrected for heteroskedasticity) are reported in parentheses. The symbols ***, **, * indicate that the coefficients are statistically significant at the 1, 5 and 10 percent level, respectively.

[11] The variable *Average Grade* is a censored indicator of students' academic performance because it is possible to observe only the grade the students scored at passed exams (from 18 to 31 where 31 is 30 cum laude). For this reason we also study the relationship between impatience and the average grade obtained at exams using a Tobit model. Results do not change qualitatively.

As expected, when we analyse the relationship between impatience and time to degree completion by considering the number of credits earned within the normal degree completion time, results are less clear cut. Without controlling for individual cognitive ability (column 3), it emerges a negative relationship, with a coefficient statistically significant at the 5 percent level. That is, more impatient students earn a lower number of credits: when impatience increases from 0 (patient student) to 0.18 (highest level of impatience) the number of credits acquired by the student decreases on average by 6.295. However, once we control for individual ability (column 4), the negative correlation between the discount rate and the number of credits acquired becomes smaller and the coefficient is no longer statistically significant.

As far as control variables are concerned, cognitive ability is an important determinant of academic performance. Both when we consider as dependent variable *Average Grade* and *Number of Credits* it emerges a positive and statistically significant correlation. Students with a higher High School final grade and whose high school was a lyceum have on average a higher grade at the exams they take during the three years after enrolment and are more likely to graduate on time because they accumulate a higher number of credits during the legal duration of the degree program. Females have better performance than males; age and family background have only a marginal effect on student's achievements, whilst risk aversion does not produce statistically significant effects[12]. Enrolling at university late exerts a statistically significant negative impact on academic success, especially on the number of credits earned in the considered period, whilst working when studying has no statistically significant effect on performance.

All in all, our estimation results are consistent with the idea that impatience negatively affects grades obtained by students at examinations but has an unclear impact on the number of credits acquired. The two contrasting effects that impatience may produce on the number of credits in our estimates lead to a weakly statistically significant relationship.[13]

The relationship between time preferences and academic performance may change as time advances, for example because impatient students, when approaching the end of their educational program, may become anxious to enter the labour market and set even lower standards.[14] Therefore, we have also investigated whether the relationship between impatience

[12] Risk aversion is, instead, relevant to explain the field choice of our sample students (see De Paola and Gioia, 2012).

[13] We obtain very similar results also when considering the academic performance, both in terms of average grade at exams and number of credits earned, in the four years after enrolment (results not reported and available upon request).

[14] It could also be that impatience negatively affects student's effort especially at the beginning of his/her academic career, as the advantages deriving from obtaining the degree are many years away. In addition, the relationship between time preferences and academic performance may change over time due to the fact that individuals accumulate experience and become more capable in evaluating the costs and the benefits of their choices.

and performance is stable during students' academic career. At this aim we have stacked data at student-year-level observations, ending up with three observations for each student (one for each year), and we have computed the average grade at exams passed each year by the student and the number of credits earned each year. Using these data, we have estimated an OLS model taking as dependent variable respectively the per year average grade and the per year number of credits and including among regressors yearly dummy variables and interaction terms between these dummies and our measure of impatience. We find that the relationship between impatience and performance (measured considering both the average grade at exams and the number of credits earned each year) does not vary over time (see Table A1 in the Appendix).

Finally, we have investigated whether the relationship between time preferences and educational outcomes differs between men and women, between students with high and low ability and between students with rich and poor parental background. When looking at students' gender we find that the relationship between impatience and performance does not significantly differ between men and women. Similarly, the effect of impatience does not seem to be heterogeneous neither according to student's ability (measured considering the High School Final Grade) nor according to student's family background (we have considered as an indicator of family background whether student's father has at least completed college). Results are not reported and available upon request.

## 5. AN ALTERNATIVE MEASURE OF IMPATIENCE

In this section we check the robustness of our results using as an alternative indicator of time preferences the dummy variable *Impatient*. We take as dependent variable the average grade at exams (columns 1 and 2) and the number of credits earned (columns 3 and 4) and show results from OLS estimates.

Our results remain essentially the same as those discussed in section 4. In fact the coefficient on *Impatient* shows a negative and statistically significant sign when we measure student's performance considering the average grade at exams. Also when controlling for cognitive ability (column 2), on average, an impatient student has an average grade at exams that is 0.194 points lower with respect to a patient student.

On the other hand, a negative but statistically insignificant relationship emerges when we focus on the number of credits earned during the three years after enrolment.

**Table 4. Time Preferences (Dummy Variable Indicator of Impatience) and Academic Performance**

| Variables | Average Grade (1) | Average Grade (2) | Number of Credits (3) | Number of Credits (4) |
|---|---|---|---|---|
| *Impatient* | -0.228** | -0.194** | -0.692 | -0.143 |

| | | | | |
|---|---|---|---|---|
| | (0.090) | (0.078) | (2.031) | (1.853) |
| Pred. Charact. | YES | YES | YES | YES |
| Family Background | YES | YES | YES | YES |
| Cognitive Abilities | NO | YES | NO | YES |
| Risk Aversion | NO | YES | NO | YES |
| *R-squared* | 0.222 | 0.414 | 0.140 | 0.289 |
| *Observations* | 3,355 | 3,355 | 3,355 | 3,355 |

Notes: In all specifications we control for field of study dummies and for province of residence dummies. Standard errors (corrected for heteroskedasticity) are reported in parentheses. The symbols ***, **, * indicate that the coefficients are statistically significant at the 1, 5 and 10 percent level, respectively.

## 6. TIMELY GRADUATION AND FIRST CLASS HONOURS DEGREE

Measuring academic performance by considering the number of credits earned in the three years following enrolment (i.e. during the normal degree completion time) has allowed us to check whether time preferences affects the time students need to complete their studies.

As argued by Garibaldi et al. (2012), throughout the world obtaining a degree within the normal completion time is becoming the exception rather than the rule. Late graduation depends on different reasons. In some countries it is related to the high cost of education forcing not well-off students to do paid work to support their studies (i.e. US), in Nord-European countries it is related to the fact that students can leave educational programs relatively easily and re-enter at a later date (OECD, 2010). Finally, in other countries, such as Italy, the institutional system allows for an uncapped completion period.

In this section we look deeper at this aspect by analysing the relationship between student's time preferences and his/her probability of timely acquiring the degree. Besides, for the sub-sample of graduated students, we analyse the relationship between impatience and the probability of obtaining a first class honours degree.

In Italy the normal completion time for a FLD is three years, but students on average take 4.6 years (Almalaurea, 2011). Even a worst picture emerges for our sample students: only 13% of them has accomplished the degree program within the normal time; the fraction of students who have obtained their FLD degree within four years slightly increases at 17%.

On the basis of the same arguments discussed in relation to the number of credits earned by students, the relationship between time preferences and the probability of accomplishing the degree program within the normal completion time may be either negative or positive.

Table 5 presents estimation results of the specification including among regressors the full set of controls and considering as measure of impatience *Discount Rate*; similar results are obtained when using the dummy variable *Impatient*.[15] Column (1) reports the marginal effects

[15] The estimates of the relationship between impatience and both the probability of timely obtaining the

(computed at the mean values of the explanatory variables) of probit estimates for the probability of timely acquiring the degree. Similarly to results obtained for the number of credits, we find a negative but not statistically significant correlation between the probability of timely acquiring the degree and our measure of time preferences.

In columns (2) we only consider the sample of graduated students who obtained the degree within three years and present probit estimates for the probability of obtaining a first class honours degree. We find a negative and statistically significant (at the 5 percent level) correlation between impatience and the probability of graduating with the highest grade.

**Table 5. Time Preferences and Graduation: Probit estimates**

| Variables | Graduation within 3 years (1) | Honours Degree within 3 years (2) | Graduation within 4 years (3) | Honours Degree within 4 years (4) |
|---|---|---|---|---|
| Discount Rate | -0.896 | -1.024** | -0.631 | -0.997** |
| | (-1.630) | (.0.526) | (0.520) | (0.441) |
| Pred. Charact. | YES | YES | YES | YES |
| Family Background | YES | YES | YES | YES |
| Cognitive Abilities | YES | YES | YES | YES |
| Risk Aversion | YES | YES | YES | YES |
| *Pseudo R-squared* | 0.128 | 0.208 | 0.128 | 0.194 |
| *Log pseudolikelihood* | -1149.323 | -245.014 | -1347.879 | -324.361 |
| *Observations* | 3355 | 448 | 3355 | 581 |

Notes: The Table reports marginal average effects of Probit estimates. In all specifications we control for field of study dummies and for province of residence dummies. Standard errors (corrected for heteroskedasticity) are reported in parentheses. The symbols ***, **, * indicate that the coefficients are statistically significant at the 1, 5 and 10 percent level, respectively.

In columns (3) and (4) we replicate the same estimates by extending the analysis to four years. Results do not change: impatience does not significantly affect the probability of graduating within four years, while it exerts a negative and statistically significant effect on the probability of obtaining a first class honours degree for the students graduated within four years after enrolment.

## 7. CONCLUDING REMARKS

When deciding their investment in education, students face a trade-off between costs and benefits occurring in different periods of time: the cost of effort is immediate while the benefits deriving from the human capital accumulated and from its quality may be years away. Students' degree of impatience strongly influences their response to this inter-temporal trade-off and negatively affects their academic performance: more impatient students choose to exert lower

degree and the probability of scoring the highest grade are not reported and available upon request.

effort, because it involves immediate costs and only delayed benefits, and to acquire a low-quality human capital because the benefits of high grades and deep knowledge will be obtained only when entering the labour market.

In this paper we have investigated the relationship between impatience and academic performance using a rich dataset on a sample of 3,355 Italian undergraduate students observed over a period of three years after their enrolment. This dataset allows us to collect information on a number of students' predetermined characteristics, such as family background, cognitive abilities and personality traits, and to measure students' time preferences. We also have detailed information on students' academic performance such as their average grade at exams, the number of credits acquired each year, the probability of timely obtaining the degree and the degree class.

With a simple theoretical model we show that impatience affects academic performance through two different channels: impatient students spend less effort in studying activities and set less ambitious objectives in terms of grades at exams. As a consequence, the relationship between academic success and impatience may vary according to how we measure student performance.

In our empirical analysis, we find that, when we consider as measures of academic success the average grade obtained at exams or the probability of graduating with honours, it emerges a strong statistically significant negative relationship between impatience and academic performance. More impatient individuals assign a lower value to the future benefits of their investment and to its quality and choose to exert less effort in studying activities ending up with a lower average grade at exams and a lower probability of graduating with honours. Instead, when we measure performance with the number of credits earned during the three years after enrolment or with the probability of timely graduation, the relationship is negative but weakly statistically significant. In this case impatience operates with two contrasting effects. On the one hand, the choice to exert less effort leads more impatient students to acquire a small number of credits and delay the time of graduation. On the other hand, the lower concern about the quality of their human capital, makes them set less ambitious objectives in terms of grades thus becoming more likely to acquire a larger number of credits in the considered period of time and to timely obtain the degree.

Our findings are robust both when we control for cognitive abilities and personality traits and when we use an alternative indicator of impatience. The relationship between impatience and performance is stable during the student's academic career. Moreover, the effects of impatience on academic success is not heterogeneous according to gender, cognitive abilities and family background.

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## APPENDIX

Does the relationship between impatience and performance vary over time?

We have reshaped our data-set to get student-year-level observations, so for each student we have three observations, one for each year. This allowed us to compute the average grade at exams passed each year by the student and the number of credits earned each year. Using these data, we have estimated an OLS model taking as dependent variable respectively the per year average grade, *Grade*, and the per year number of credits, *Credits*. We have included among our regressors yearly dummy variables (the first academic year is left as reference category) and interaction terms between these dummies and our measure of impatience. Results are reported in Table A1.

In the first two columns the dependent variable is the per year average grade at exams. In both the specifications we find a negative and highly significant correlation between impatience and per year average grade. The effect becomes weaker as the student advances in his/her academic career, nevertheless, differences are never statistically significant.

When considering as measure of academic performance the number of credits earned each year, we find that the negative relationship between impatience and performance is never statistically significant when controlling for cognitive abilities. Also in this case, there are no statistically significant differences overtime. All in all, these results suggest that, as time advances, the impact of impatience on student's academic performance remains stable.

**Table A1. Heterogeneous effects over time**

| **Variables** | **Grade** | **Grade** | **Credits** | **Credits** |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| *Discount Rate* | -2.565*** | -1.848** | -9.961* | -5.989 |
| | (0.850) | (0.753) | (5.259) | (4.719) |
| *Second Year* | 0.274*** | 0.190*** | -2.017*** | -2.017*** |
| | (0.070) | (0.068) | (0.458) | (0.458) |
| *Third Year* | 0.818*** | 0.681*** | -0.628 | -0.628 |
| | (0.073) | (0.070) | (0.526) | (0.526) |
| *Discount Rate*SecondYear* | 0.129 | 0.052 | -1.343 | -1.343 |
| | (0.920) | (0.895) | (5.888) | (5.889) |
| *Discount Rate*ThirdYear* | 0.048 | 0.050 | -3.744 | -3.744 |
| | (0.978) | (0.947) | (6.725) | (6.726) |
| Pred. Charact. | YES | YES | YES | YES |
| Family Background | YES | YES | YES | YES |
| Cognitive Abilities | NO | YES | NO | YES |
| Risk Aversion | NO | YES | NO | YES |
| *R-squared* | 0.201 | 0.346 | 0.107 | 0.217 |
| *Observations* | 8,446 | 8,446 | 10,065 | 10,065 |

Notes: In all specifications we control for field of study dummies and for province of residence dummies. Standard errors (corrected for heteroskedasticity) are reported in parentheses. The symbols ***, **, * indicate that the coefficients are statistically significant at the 1, 5 and 10 percent level, respectively.