



# The effect of education on time preferences



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## ABSTRACT

I examine whether education increases patience by analyzing a case study of a public college in Mexico City where admission decisions are determined through a lottery. Applicants who were successful in the draw were more likely to be studying in the following years. I surveyed the applicants to this college almost two years after the admission decision was made and measured their time preferences with a series of hypothetical inter-temporal choice questions. I find that individuals who acquired more education due to the admission lottery were, on average, more patient, which suggests there may be a causal effect of education on time preferences.

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## 1. Introduction

Time preference is an important building block in economic models. Several studies have found an association between time preferences and long term outcomes in health, wealth and other domains. Since Fuchs (1982) first studied the correlation between patience and smoking, several studies have extended that literature to demonstrate its correlation with other health behaviors such as alcohol and drug use (Bickel, Odum, & Madden, 1999; Kirby, Petry, & Bickel, 1999). Golsteyn, Grönqvist, and Lindahl (2014) find a relationship of patience with a variety of negative adult outcomes in health, school performance and work. Courtemanche, Heutel, and McAlvanah (2015) establish its relationship with obesity. Outside of the health domain, Åkerlund, Golsteyn, Grönqvist, and Lindahl (2014) establishes an association with criminal behaviors; Meier and Sprenger (2013) and Ameriks, Caplin, and Leahy (2003) with financial decision-making, savings and wealth; Castillo, Ferraro, Jordan, and Petrie (2011) and Non and Tempelaar (2016) with education performance; and De Paola and Goia (2014) with marriage and divorce rates.

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Despite its importance in explaining a wide range of outcomes, little is known on the determinants of time preferences. It is particularly important for policy-making to understand whether they can be affected by life events such as taking on more education.

Economists have hypothesized that education can affect patience. For example, Becker and Mulligan (1997) state: "schooling focuses students' attention on the future. Schooling can communicate images of the situations and difficulties of adult life, which are the future of childhood and adolescence. In addition, through repeated practice at problem solving, schooling helps children learn the art of scenario simulation. Thus educated people should be more productive at reducing the remoteness of future pleasures".

Education may affect time preferences through at least two channels. The first channel is the one described above, where the effect arises through the practice of focusing student's mind on the future (Becker & Mulligan, 1997). This could be true of education at any level, as in all cases students may be encouraged to think about the future. The second channel is cognitive ability. Cognitive abilities have been shown to be strongly associated with the willingness to delay rewards (Benjamin, Brown, & Shapiro, 2013; Burks, Carpenter, Goette, & Rustichini, 2009; Dohmen, Falk, Huffman, & Sunde, 2010<sup>2</sup>), and education can improve cognitive

<sup>2</sup> Dohmen et al. (2010) shows correlations between cognitive ability and time preference (that are robust to controlling for demographic and other variables). Benjamin et al. (2013) aim to establish causality by increasing the cognitive load for a random subset of study participants, and then showing that those with the increased cognitive load (and thus reduced cognitive resources) are less likely to choose the delayed reward.

ability (Hansen, Heckman, & Mullen, 2004; Winship & Korenman, 1997; Banks and Mazzonna, 2012).

College may not be too late to improve patience. According to the psychology and neuroscience literatures, the pre-frontal cortex, the region of the brain that governs emotion and self-regulation, is malleable in individuals who are in their 20s (Dahl, 2004). In addition, there is evidence that adolescent interventions can affect non-cognitive skills (Cunha, Heckman, Lochner, & Masterov, 2006).

Though, there are reasons to think there may be a causal effect, it is difficult to establish empirically. A major difficulty is finding an estimation strategy that allows disentangling the causal effect from reverse causality and from third, unobserved, factors. In particular, the correlation between education and time preferences might occur because the most patient individuals decide to obtain more schooling. In fact, though the correlation between time preferences and schooling has long been established (Ghez and Becker, 1975; Fuchs, 1982; Oreopoulos & Salvanes, 2011) it is more often interpreted as evidence that those who are more patient are more likely to take on additional investments.<sup>3</sup> To my knowledge, with the exception of Bauer and Chytilová (2010), no study has attempted to establish empirically the causal impact of education on patience.<sup>4</sup>

I aim to establish causality through a natural experiment of a public university in Mexico City that uses a lottery to determine admission. The exogenous result of the lottery has an effect on education attainment (Perez-Arce, 2015), and can therefore be used to study the causal impacts of education. The university, which I call the Uni throughout the paper, randomizes all applicants into a group that can enter immediately (which I call the *immediate admission group*) and a group that has to wait one year before enrolling (the *delayed admission group*).

For the 2007/2008 academic year, the lottery took place in June of 2007. Individuals who were successful in the lottery were enrolled to start classes in September 2007, whereas *delayed admission* individuals had to wait until September of 2008 to do so. Instead of waiting, some *delayed admission* applicants started college in some other institution. However, a large proportion of them did not study in any college during the academic year. Furthermore, some did not study in 2008/2009 either. In the 2007/2008 academic year, about 80% of *immediate admission* applicants and 42% of *delayed admission* were studying in some college (i.e. at the Uni or elsewhere). By the fall of 2008, the average number of education years within the *immediate admission group* was larger than within the *delayed admission group*. By then, the random outcome of the lottery had affected the education attainment of applicants. I use this setting to determine whether education affects measures of time preference

At least three broad types of time preference measures have been used in the literature, each of which has its advantages and

disadvantages. Real-stakes inter-temporal choice experiments are used in laboratory and field experiment settings. This type of measure is often preferred because they involve real choices. A disadvantage is that they involve small (most likely monetary) rewards. Since most people have the ability to borrow or save at least small amounts of money, they are less likely to reveal actual time preferences. Two other challenges made this type of measure less pertinent for this particular study: first, it is necessary to ensure participants will believe the researcher will come back to pay the reward (otherwise, impatience may be confused with lack of trust on the experimenter) which would have been difficult to ensure in this case. Second, these choice experiments are hard to implement in some field setting such as this one where using real rewards would have added in complication and cost.

A second approach consists of observing behavior that should be affected by time preferences. For instance, it is thought that less patient individuals are going to be more likely to smoke and drink and less likely to exercise and eat well. Though I look at some of these measures as well, I cannot use the effect of education on these outcomes as evidence of a change in time-preferences as they can be affected by education through other channels as well (for instance, more educated people may become more aware of the harm from smoking).

The third possible approach, which I follow in this paper, consists of using questions where the interviewee is asked to choose between hypothetical current and future rewards. Some researchers shun these measures because a concern that, due to the lack of a real reward, respondents may not reveal their real preferences. Though this is a valid concern, as Frederick, Lowenstein, and O'Donoghue (2002) argue, there are also advantages including the ability of asking about large rewards (which is prohibitively costly under real stakes elicitation).

Measures of hypothetical measures of time preferences have been shown to correlate with behaviors in the way we would expect them to do (i.e. the most patient individuals save more, take better care of their health, study more, etc.).<sup>5</sup>

In the fall of 2008, I surveyed the cohort of applicants for the 2007/2008 academic year. The survey instrument included a series of questions intending to measure time preferences through hypothetical inter-temporal choice questions. In a first set of questions the options were either immediately receiving a certain amount of money or receiving a larger sum one year later. A second set of questions used, instead, rewards consisting of trips of different durations.

I find that individuals in the *immediate admission group* tended to give “more patient” answers to the time preference questions that used trips as a reward (that is, they were more likely to choose the longer trip in the future over a shorter trip in the present). I do not find a statistically significant difference between the groups when using monetary rewards.

I interpret these results as showing that there is a causal effect of schooling on time preferences, but that the questions with monetary rewards do not provide a good measure of patience. Consistent with this interpretation, I find that the responses to the

<sup>3</sup> Psychologists had established a relationship between time preferences and life outcomes, including education. Early on, psychologists established a link between the ability to delay gratification and lifetime outcomes by showing that 4-year old children who were able to delay gratification, over a decade later did better at school and were better at coping with frustration and stress. This early strand of research is reviewed at Mischel, Shoda and Rodriguez (1989). More recent work has added by showing that these children grow into adults who are better at establishing social relationships (Carducci, 2009). Recent research has focused on establishing the conditions under which the ability to delay gratification can be developed (Mischel, Ayduk, & Mendoza-Denton, 2003; Carducci, 2009).

<sup>4</sup> Bauer and Chytilová (2010) use geographic variation in access to schools across Uganda's villages to instrument for education. That study acknowledges that other village characteristics may be correlated with school access and be correlated with time discount rates, in which case the identifying assumptions would not be met. In alternative specifications, they use time-varying changes in educational access caused by disorder generated by the dictatorship of Idi Amin. As the authors acknowledge, the effect of education in this case could be confounded with other effects related to living through that dictatorship.

<sup>5</sup> Bickel, Odum and Madden (1999) established an association of these measures with smoking; Kirby, Petry, and Bickel (1999) with heroin use; Fuchs (1982) with education; Donkers and van Soest (1999) shows more patient individuals –as revealed by inter-temporal choice questions– are more likely to decide to own a home; Stephens and Krupka (2006) shows a correlation with asset ownership and number of hours worked; Khwaja, Silverman, and Sloan (2007) find a correlation between patience and smoking with a subset of the measures used (they do not find it when the reward used is monetary). Furthermore, among the studies described above, Golsteyn, Gronqvist and Lindahl (2014); Courtemanche, Heutel and McAlvanah (2015); Non and Tempelaar (2016), Akerlund et al. (2014); and De Paola and Goia (2014) also successfully use hypothetical choice questions to establish the relationship of interest.

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