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How Do Students Allocate Their Time? An Application of Prospect Theory to Trade-offs between Time Spent to Improve GPA Versus Time Spent on Other Activities

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Abstract
We employ a choice experiment survey to elicit university students' preferences for grade point average (GPA) relative to time spent on various activities. Using expected utility and prospect theory approaches to analyze those preferences, we find statistically significant asymmetry between the desire to increase GPA and the desire to avoid a decrease in GPA. Surveyed students were loss averse regarding GPA: they would trade approximately 4.6 times as much free time to avoid losing a point in their semester GPA relative to time they are willing to give up to gain one additional point. This study contributes to the growing research regarding prospect theory by analyzing loss aversion in a novel context of students' time allocation.

1 Introduction

Most instructors view college success in terms of academic achievement, as measured by grade point average (GPA).[1] As a result, instructors use course grades and their impact on GPA as motivation to encourage students to perform well on assignments, prepare for exams, and meet course requirements. However, the university experience also involves social opportunities and pressures, extracurricular academic pursuits, employment, and recreational activities, all of which play a role in developing well-rounded students. Therefore, rational students will allocate their scarce time between efforts to improve GPA and other activities in a way that maximizes utility, given the constraints that they face (Kelley 1975; Ballard 2014). For each student, constraints and preferences will vary. For example, some students must work each week to pay for university expenses and housing. Other students might value the networking and social benefits offered by involvement in a fraternity or sorority. The economic approach to human behavior considers GPA to be just one of numerous rational ways to define university success.

Kelly (1975) postulated the reasons that students may have a disinterest in GPA level. He found some students are unmotivated by GPA changes because they view university as a "screening" output, the value of which is measured largely by the college degree earned. If so, a rational, utility-maximizing student might aim to achieve merely the minimum academic requirements for graduation. In this extreme case, minor increases in GPA do not increase utility because these increases do not affect the earning of a degree. If an institution requires a 2.0 GPA to grant a diploma, students who care only about earning a degree would achieve this goal with a 2.1 GPA just as they would with a 2.4 GPA.

[1] Throughout, we assume GPA to be measured on a 0 to 4 scale: A=4, B=3, C=2, D=1, F=0. Some U.S. universities calculate grades on the basis of plusses or minuses on letter grades, and some European universities use percentages instead of letter grades for courses. Because the research was conducted at Kansas State University, we assume students interpreted all questions in light of that university's policies.

To gauge the views of students surveyed in this research, we asked them to rank five university goals in order of importance: graduation, academic achievement, income after graduation, networking for the future, and social experiences. In general, survey results confirm that the findings of Kelley (1975) are a reasonable possibility. Figure 1 shows the relative importance of the goals. Academic achievement is third, and graduation is markedly more important than other goals. These results suggest that students' decisions are perhaps not as driven by GPA as one might think.

The complexity of students' decisions in broad behavioral economic research and the specific evidence that students in this study are perhaps more driven by graduating than by academic achievement motivate our research. Knowing how students value the trade-offs between time spent attempting to improve GPA versus time spent on other activities will provide instructors with a deeper understanding of students' choices and motivation. Furthermore, university leadership may use this knowledge to alter university offerings to better appeal to prospective students.

Important, existing literature has largely left students' time allocation decisions unaddressed. This study begins to fill this knowledge gap by using choice experiment analysis and a novel prospect theory (Tversky and Kahneman 1992), general application of which has been growing (Caputo, Lusk, and Nayga 2019). Furthermore, behavioral economics has spawned productive research to understand the complex educational decisions of students and policy makers (Koch, Nafziger, and Nielsen 2015). Students'

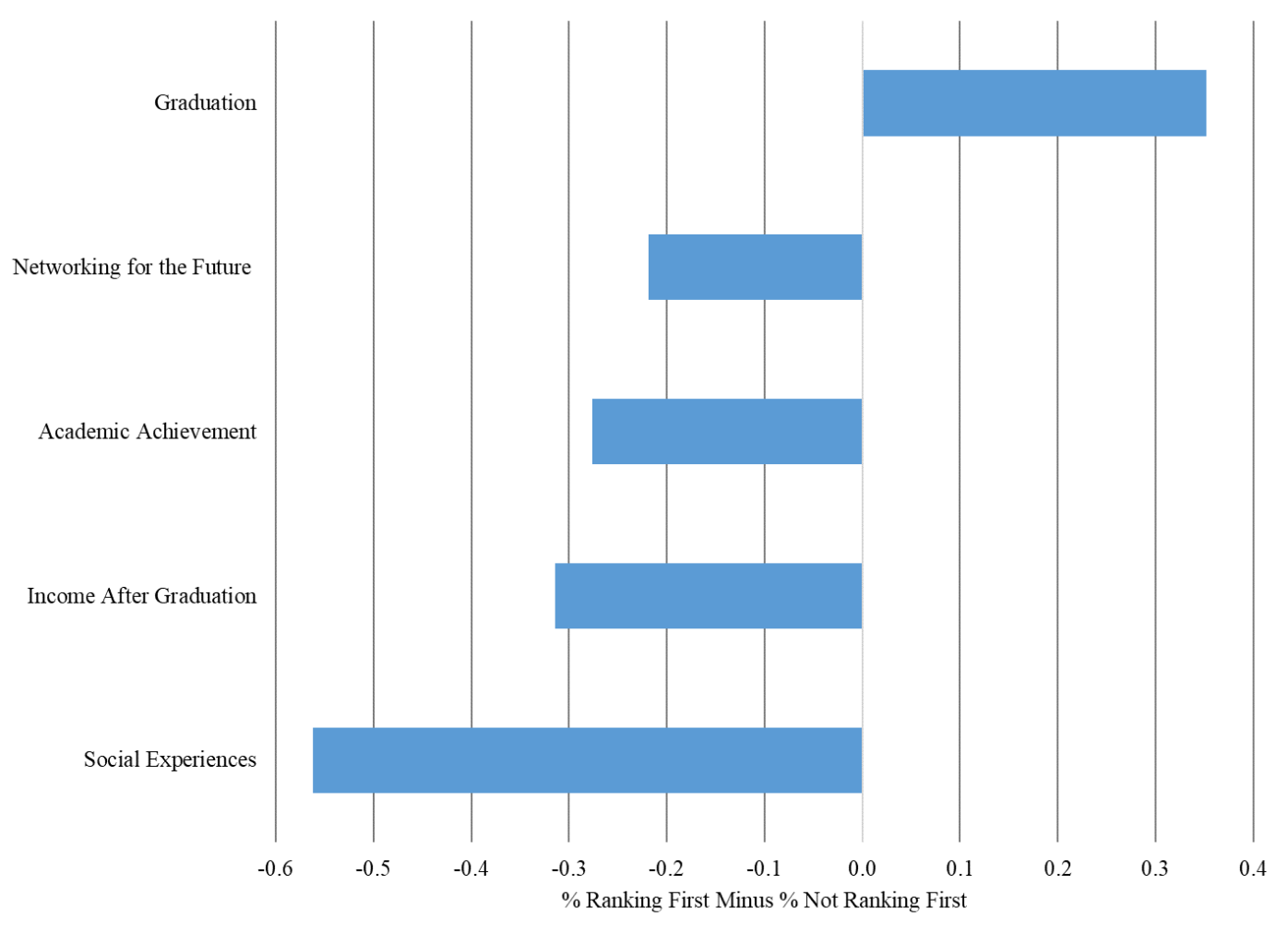

Figure 1. Relative Importance of University Goals

Note: Ranking is percent of times ranked first minus percent times ranked 2 to 5. Scale is bound -1 to 1. N=105.

decisions may be biased by seemingly small issues, such as the current weather during a campus visit (Simonsohn 2010). The increased use of behavioral economics to complement traditional economic analysis, in education and beyond, makes analysis of students' time allocation decisions timely. The choice experiment is novel in that we know of no other experiment that has measured trade-offs between GPA and time allocation. Allowing asymmetry between GPA gains and losses introduces prospect theory into the analysis.

The main objective of this research is to quantify the value that university students place on GPA relative to time spent on other activities. Specifically, we use choice experiments to elicit student trade-offs between time spent studying and time spent on other activities. We find that all students value an increase in GPA, but particularly students with a relatively high GPA. Time spent studying decreases utility, ceteris paribus, for students with relatively low GPAs. Among all offered activities, unstructured free time has the highest value. Finally, we find statistically significant asymmetry between the desire to increase GPA and the desire to avoid a decrease in GPA. Surveyed students would trade approximately 4.6 times as much free time to avoid losing a point in their semester GPA relative to time they are willing to give up to gain one additional point. This behavioral asymmetry is the major contribution of our research, and it has several implications for teaching and learning.

2 Student Time Allocation Background and Survey Design

The majority of empirical research on how university students allocate time is focused on class attendance, study time, or student effort (Schmidt 1983; Romer 1993; Devadoss and Foltz 1996; Bratti and Staffolani 2013; Krohn and O'Connor 2005). This body of research is enlightening in terms of conceptualizing and measuring the impact of attendance and study effort on student grades. A topic that has received less attention are the decisions of students concerning how to allocate their time. This study is the first to estimate and quantify students' perceived costs and benefits associated with time spent on a given activity. Some of the benefits might be related to improving GPA. However, some activities, such as networking or socializing, might offer long-term benefits but actually harm GPA in the short run. Likewise, some activities might be detrimental to GPA but offer short-term enjoyment to the student. In any case, an economically rational student would budget time accordingly and experience the resulting trade-offs.

When no market exists, economic research has increasingly relied on nonmarket valuation to estimate willingness to pay (Champ, Boyle, and Brown 2017). There have been many applications of such choice experiment frameworks in food and agriculture, including willingness of consumers to pay for specific traits of meat products (Lusk, Roosen, and Fox 2003), consumer preferences regarding meat labeling (Tonsor, Schroeder, and Lusk 2013), and livestock producer willingness to purchase feeder cattle and adopt feeding treatments in the face of uncertainty around pounds gained during feeding (Tonsor 2018). There are few applications of choice experiments to education, especially to elicit how students value academic achievement (i.e., GPA) relative to other attributes of the university experience. The application of choice experiment analysis provides a new perspective for the student choice literature and shows the ways that students think about increases and decreases in GPA.

In many choice experiments, participating subjects face a choice between goods with varying attributes and prices (Lusk et al. 2003; Tonsor , Schroeder, and Lusk 2013). By analyzing respondent choices over the various combinations of attributes and prices, a willingness to pay for those attributes can be estimated. In the case of student choice, there is no explicit cash price. Instead, students are asked to choose among alternatives with varying levels of GPA and weekly time commitments to various activities. Improved GPA is assumed to have some benefit for the student. This benefit could be a qualification for awards, signaling to potential employers, sense of personal accomplishment, or a proxy for attained education. Time may be spent in a way that directly influences GPA or not. In this way, the traditional trade-off between money and attribute levels becomes a trade-off between GPA level and time allocation.

On the basis of classroom pre-surveys, the authors' teaching experiences, and educational literature, we identified a group of broadly defined activities among which students allocate their weekly time. Table 1 shows the categories of time use and GPA. It includes the levels of each category (attribute) used in the choice experiment, as explained below. The included activities broadly cover how a student might spend time. "Studying" is included as a unique category to measure a student's effort to improve GPA. The other activities are not expected to increase GPA, but they could provide utility to the student. "Fraternity/Sorority/Club Activities" could offer memorable experiences and an opportunity to build social capital or social skills. "Fitness/Sports/Recreation Activities" offer a release of stress and an opportunity for personal accomplishment. However, it is also possible that fitness activities such as intramural sports, personal exercise, yoga, and related activities have a negative impact on utility for some students. "Unstructured Social Activity" offers the opportunity to be with others but has no long-term commitment, unlike "Fraternity/Sorority/Club Activities." Finally, on the basis of responses and comments we received in pre-testing for the survey, we included a completely unstructured time category: "Other Activities." An anonymous reviewer pointed out the conspicuous absence of work among the activities. Work is certainly a part of many students' university experience, but because students are paid for work, its inclusion might bias results. In other words, students who know they must work to pay the bills might always choose the option with higher work hours, regardless of other factors. Rather than include work as a potential activity, we instructed students to view the allocation of time in the survey as allocation of time left over after essential activities have been completed. The role of the need or desire to work in students' decision- making requires careful consideration in future research.

Table 1. GPA, Activities, and Levels Used in the Choice Experiment

Achievement or Activity	Levels
GPA for the Semester	2.25
	2.75
	3.25
	3.75
Hours per week spent Studying	4 hours
	8 hours
Hours per week spent in Fraternity/Sorority/Club Activities	4 hours
	8 hours
Hours per week spent in Fitness/Sports/Recreation Activities	4 hours
	8 hours
Hours per week spent in Unstructured Social Activities	4 hours
	8 hours
Hours spent in Other Activities (Staying Home, Relaxing, Watching Movies, etc.)	4 hours
	8 hours

Note: In this choice experiment, students evaluated two scenarios, each with a level of GPA and a time commitment to each of five categories of activities. Figure 2 is an example of a choice question.

As with any choice experiment survey design, there is a trade-off between the number of survey questions and the number of activities and time levels. That is, the more activities, time levels, or both, the more questions that must be included to achieve adequate statistical performance. In the interest of providing a reasonable array of potential activities and variation among GPA levels, we opted to offer four possible GPAs and two possible time levels for each activity (four hours and eight hours).

Using the six categories and attribute levels in Table 1, there are 16,384 unique choice alternatives. To create a manageable survey, we follow the common procedure of identifying a question set (as a fractional factorial design) that optimizes the D-efficiency score (Lusk et al. 2003; Tonsor 2018). The final survey design had 17 choice sets and a D-efficiency score of 96. To avoid participant fatigue, we presented the students with smaller blocks drawn from the 17 sets (Schulz and Tonsor 2010; Tonsor, Schroeder, and

Lusk 2013; Tonsor 2018). We formed blocks of five by dividing 16 sets into blocks of four and then including the seventeenth set in each of those four blocks. The result was four blocks of five questions. These blocks were randomly assigned to students. The five choice sets given to students contained two alternative scenarios with varying levels of GPA and time assigned to activities. GPA was always listed first, and the order of activities was varied randomly across questions. Figure 2 shows an example choice experiment question. It is likely that some alternatives may be dominant. For example, if one option has less study time *and* a higher GPA than another alternative, that option would be more attractive to many or most students. We also face the possibility that the neither-A-nor-B option would dominate other alternatives, particularly for students who consider lower GPAs unacceptable. Such issues are common in choice experiment design. We followed Lusk et al. (2003) and left all dominant alternatives in the experiment as well as allowed the equivalent of the neither-A-nor-B option in the interest of improving the statistical properties of the experimental design.

	Option A	**Option B**	**Option C**
GPA for the Semester	3.25	2.25	Neither A nor B is preferred
Hours spent Studying	8	4	
Hours spent in Fraternity/Sorority/Club Activities	8	8	
Hours spent in Fitness/Sports/Recreation Activities	8	4	
Hours spent in Unstructured Social Activities	4	8	
Hours spent in Other Activities (Staying Home, Relaxing, Watching Movies, etc.)	4	4	
I would choose…	◯	◯	◯

Figure 2. Sample Choice Experiment Question

3 Conceptual Model

The idea of household production whereby the decision maker is both producer and consumer is well established (Becker 1965). The concept has been adapted to the university student's situation, in which the student's endowments and effort are inputs into the university experience and the student also consumes (or benefits from) education and attained human capital (Kelley 1975; Devadoss and Foltz 1996; Ballard 2014). Utility-maximizing students will allocate scarce resources among activities to optimize their university experience.

Empirically, utility is viewed from a random utility framework, whereby the random utility function is represented by a deterministic and stochastic component (Adamowicz et al. 1998; Lusk et al. 2003):

$$U_{ij} = V_{ij} + \varepsilon_{ij}. \quad (1)$$

In this formulation, U_{ij} is the utility the ith student receives from choosing option j, and ε_{ij} is the stochastic element.[2] V_{ij} is the systemic portion of the student's utility function determined by semester GPA and allocation of weekly time. The ith student faces the choice set C_i={A,B,C}, where A and B are random combinations of GPA level and time spent in each activity and C is opting to choose neither A nor B. The probability of choosing alternative j is:

$$\text{Prob}\left\{V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik}; \forall k \in C_i\right\}. \quad (2)$$

[2] Time subscripts, reflecting multiple choices being made by each respondent, are omitted for presentation convenience.

Following Lusk, Roosen, and Fox (2003), assuming independently and identically extreme value Type 1 distributed errors in (1), this probability is equal to (Ben-Akiva and Lerman 1985):

$$\text{Prob}\{j \text{ is chosen}\} = \frac{e^{\mu V_{ij}}}{\sum_{k \in C} e^{\mu V_{ik}}}, \quad (3)$$

where μ is a scale parameter inversely related to the variance of the error term. Assuming that the utility function is linear in the parameters, it is expressed as:

$$V_{ij} = \delta GPA_{ij} + \beta_1 x_{ij1} + \beta_2 x_{ij2} + \beta_3 x_{ij3} + \beta_4 x_{ij4} + \beta_5 x_{ij5}, \quad (4)$$

where GPA_{ij} is the level of semester GPA, and x_{ijn} is the number of hours allocated to the n^{th} activity in a week for n = 1, 2, 3, 4, or 5. The five activities corresponding to x_{ij1} to x_{ij5} are listed in Table 1. Equations 3 and 4 form a conditional logit model. The scale parameter is assumed to equal one.

In this choice experiment, GPA differs from the typical product attribute in experiments focused on new or hypothetical products. That is, it is not a label or product characteristic. In fact, students completing the survey have an existing frame of reference regarding GPA and how they might influence its level. Tonsor (2018) used the comparable situation of including varying levels of average daily gain of livestock in a choice experiment targeted at purchase of inputs.[3] He points out that the producer frame of reference for average daily gain sets the stage for the use of transformed probabilities (Tversky and Kahneman 1992) in the decision. We posit the same in the study. Student GPA is directly relevant to the surveyed students, unlike hypothetical products or situations removed from their current situation and not directly related to their well-being. Consequently, we use each student's current GPA to modify equation 4 so that GPA gains and GPA losses are considered separately to identify asymmetries in responses to potential GPA increases and decreases.

$$V_{ij} = \delta_1 GPAGain_{ij} + \delta_2 GPALoss_{ij} + \beta_1 x_{ij1} + \beta_2 x_{ij2} + \beta_3 x_{ij3} + \beta_4 x_{ij4} + \beta_5 x_{ij5}. \quad (5)$$

Here, $GPAGain_{ij}$ is the absolute value of the difference between GPA level offered in the choice experiment alternative and the self-reported, current GPA of the i^{th} student when the offered GPA level is greater than the current GPA and zero otherwise. That is, it is the absolute gain in GPA, relative to actual GPA, that a student would realize from choosing an alternative. $GPALoss_{ij}$ is similarly defined to reflect absolute decline in the GPA being offered. All other definitions from equation 4 remain the same. The appropriateness of a prospect theory approach can be tested using the estimates of δ_1 and δ_2. Whereas expected utility theory suggests the responses to gains and losses are symmetrical, prospect theory allows asymmetry. We hypothesize that the impact of *GPAGain* will be positive and that of *GPALoss* will be negative. However, it is the relative impact of *GPAGain* and *GPALoss* that is central to prospect theory. If the absolute values of δ_1 and δ_2 are not equal, prospect theory is appropriate to explain student behavior.

[3] Average daily gain (ADG) is the average weight gain per day of livestock. Because livestock are sold on the basis of weight, this measure directly impacts profitability. Furthermore, livestock producers may influence ADG through management practices. This situation is analogous to student GPA, which is valuable to the student and can, to some degree, be influenced by students.

4 Results

The choice experiment survey described above was administered in fall 2018 at Kansas State University to students enrolled in two intermediate microeconomic theory courses.[4] The two courses are required for agricultural economics and agribusiness majors and minors and, therefore, the survey participants were primarily majors or minors in these areas. The courses were chosen for several reasons. First, their enrollees were mostly juniors and seniors. Only a few were sophomores, and none were freshmen. Hence, all the enrollees had a cumulative GPA reflecting at least a few semesters of coursework. Moreover, because the enrollees were not all at the same point in their university careers, the survey could capture variation in behavior and incentives reflecting nearness of graduation. No student was enrolled in both courses. To elicit participation, the survey was announced in advance, and students in both classes were allowed to use completion of the survey as a homework assignment. There were a total of 105 usable, complete responses. Descriptive statistics of the student characteristics are reported in Table 2.

Table 2. Summary Statistics of Student Characteristics

Variable	Definition	Mean	Std. Dev.	Min	Max
GPA	Self-reported, cumulative, current Kansas State University grade point average (4-point scale)	3.318	0.484	2.3	4
Female	= 1 if student is female, 0 otherwise	0.410	-	0	1
Senior	= 1 if student is a senior, 0 otherwise	0.419	-	0	1
Greek	= 1 if student is in a fraternity or sorority, 0 otherwise	0.353	-	0	1
Working	= 1 if student is working full or part time, 0 otherwise	0.723	-	0	1

Note: *N*=105.

Survey responses were used to estimate a conditional logit model (based on equations 3 and 4); attributed being effects were coded.[5] Results are shown in Table 3. Estimates in the first column are for all students, using the base model. Opt Out is a binary variable equal to one when the available alternative is Neither A nor B and is added to equations 4 and 5 for the estimation. The Opt Out variable indicates that a given observation is option C (Opt Out). In the conditional logit model, each question for a given student results in three observations: one for choice A, one for choice B, and one for choice C (neither A nor B). The estimated coefficient on this binary variable can be used to estimate the probability of the opt out option being chosen, all else equal. This approach is typical in analysis of choice experiments (Schulz and Tonsor 2010; Tonsor 2018). A choice must be made about the value of the activities offered in the Neither A nor B option. In many cases, simply setting the value at zero is conceptually appropriate. That is, opting out of the other available choices means that you do not experience a given attribute. However, assuming that a student would associate opting for neither A nor B with a GPA equal to 0 is not reasonable. Therefore, we set the value of GPA to the student's self-reported GPA in these cases. The assumption is that, by opting out, a student is basically indicating they are happy with their current situation. The negative coefficient indicates that, all else equal, students were less likely to choose the Opt Out option or, in other words,

[4] The Institutional Review Board of Kansas State University determined this project to be exempt from further review under 45 CFR §46.101, paragraph b, category: 2, subsection: ii. The complete survey is available on request from the authors.
[5] Our final models are variants of traditional conditional logit models. Alternative logit models, including latent class specifications, revealed no significant preference heterogeneity.

Table 3. Expected Utility Theory: Conditional Logit Estimates

Variable	All Students	Students with GPA < Median	Students with GPA > Median
Opt Out	-2.366***	-1.676***	-3.408***
	(0.192)	(0.240)	(0.355)
GPA Level	1.951***	1.701***	2.741***
	(0.155)	(0.215)	(0.291)
Weekly Hours Devoted to Greek Activities	0.134	0.168	0.149
	(0.088)	(0.123)	(0.140)
Weekly Hours Devoted to Study	-0.069	-0.345***	0.128
	(0.087)	(0.129)	(0.141)
Weekly Hours Devoted to Unstructured Social Activity	0.081	0.095	0.037
	(0.103)	(0.144)	(0.172)
Weekly Hours Devoted to Sports/Rec/Fitness	0.121	0.089	0.165
	(0.086)	(0.110)	(0.161)
Weekly Hours Devoted to Other Activities (Staying Home, Relaxing, Watching Movies, etc.)	0.374***	0.576***	0.218*
	(0.078)	(0.117)	(0.126)
AIC	742.676	372.331	350.218
Percent of Correct In-sample Predictions	71.24%	71.3%	72.3%
N	1575	795	780

Notes: One hundred and five students completed the survey. Each student answered five questions and each question had three possible choices for 1575 (105 x 5 x 3) observations in the full sample MNL model. ***, **, and * note statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are listed in parentheses.

choose their current situation over other offered choices.[6] Student GPA is statistically significant and positively related to the probability that a student chooses a given alternative. This result is intuitive and indicates students are concerned about GPA when making time allocation choices. Interestingly, time devoted to Greek activities, Unstructured Social Activity, and Sports/Rec/Fitness does not statistically impact the probability of selecting an alternative. Even the coefficient on Hours Devoted to Study, which has a negative sign as hypothesized, is statistically insignificant. The only time category that is statistically related to student choice is Other Activities, which is unstructured recreational time. The more free time available, the greater the probability that a student will choose an alternative.

Existing research indicates that previous level of academic success is important in explaining student success or behavior. For example, previous GPA is found to be positively correlated with student attendance and course grade (Devadoss and Foltz 1996). A related finding is that the impact of introducing prepared lecture notes differed depending on a student's ACT or SAT score (Kelley 1975). To investigate the presence of such differences among student preferences in our survey, we divided the sample at the median self-reported GPA. The conditional logit model was re-estimated separately for (1) students with GPAs below the sample median and (2) students with GPAs above the sample median. The results are reported in the second and third columns of Table 3, respectively. There is a statistical difference between the choices of relatively higher-achieving and lower-achieving students. Higher-achieving students value GPA more. Specifically, GPA and the probability of choosing an alternative are positively related for both groups, but the impact is greater for the higher-achieving students. Hours Devoted to Study does not statistically impact the higher-achieving student choices, but it has a large, statistically significant negative

[6] We estimated two formulations: one in which the opt out GPA = 0 and one in which opt out GPA = self-reported GPA. Only the magnitude of the coefficient on Opt Out varied. The statistical significance of impacts across time categories was identical, and magnitudes of those coefficients did not change substantially.

impact for lower-achieving students. Finally, lower-achieving students valued free time (Other Activities) at much higher levels than higher-achieving students. Both groups treat it as a good, but the impact on likelihood of choosing an alternative is greater for the lower-achieving students. These results imply that the two groups of students may be motivated differently. Higher-achieving students are not put off by additional study time, and they value marginal improvements in GPA. Lower-achieving students view study time as a "bad." There are several possible explanations for this outcome. Higher-achieving students may be more efficient or effective at studying (Kelley 1975; Schmidt 1983) and, therefore, not as averse to it. Also, students with higher GPAs may enjoy learning or consider the additional effort worthwhile.

Next, we specified a conditional logit model using equations 3 and 5. The purpose of this specification was to evaluate students' time-allocation decision using prospect theory, instead of expected utility theory. Specifically, this specification allows for asymmetry between responses to GPA gains and losses. The estimation results of the prospect theory model are reported in Table 4.[7] The statistical significance of Hours Devoted to Other Activities remains in this formulation. The magnitude of coefficients on hours devoted to each activity change very little compared to the base expected utility model (Table 3). However, the difference in the impact of GPA losses versus gains is striking. The signs are as expected. A GPA decrease (increase) lowers (raises) the probability of choosing a given alternative. However, the decrease in likelihood from a one-point GPA loss is 4.6 times as great as the increase from a one-point gain. The relative reactions are statistically different. We conducted a Wald test where H_0: $|\delta_1| = |\delta_2|$. The Chi-squared test statistic was 25.14, which means we rejected the null at a significance level of < 0.001. The

Table 4. Prospect Theory: GPA Gains and Losses Conditional Logit Estimates

Variable	Coefficient Estimate (Standard Error)
Opt Out	-2.926***
	(0.236)
GPA Gain (|GPA Offered – Reported GPA where GPA Offered > Reported GPA)	0.569**
	(0.288)
GPA Loss (|GPA Offered – Reported GPA where GPA Offered < Reported GPA)	-2.664***
	(0.228)
Weekly Hours Devoted to Greek Activities	0.157*
	(0.087)
Weekly Hours Devoted to Study	-0.082
	(0.085)
Weekly Hours Devoted to Unstructured Social Activity	0.039
	(0.101)
Weekly Hours Devoted to Sports/Rec/Fitness	0.101
	(0.085)
Weekly Hours Devoted to Other Activities (Staying Home, Relaxing, Watching Movies, etc.)	0.330***
	(0.078)
AIC	720.926
Percent of Correct In-sample Predictions	70.67%
N	1575

Notes: One hundred and five students completed the survey. Each student answered five questions and each question had three possible choices for 1575 (105 x 5 x 3) observations in the full sample MNL model. ***, **, and * note statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Standard errors are listed in parentheses.

[7] In this case, the value of GPA for both *GPAGain* and *GPALoss* was set to zero in the Opt Out scenario. This value is conceptually appropriate, assuming that the student uses current GPA as a reference. Opting out in this case would be to keep current GPA and experience no gain or loss.

statistical difference in the relative responses to gains and losses in GPA suggests prospect theory is more appropriate than expected utility theory in explaining student choices related to GPA and time trade-offs.

It is possible to derive willingness-to-pay (WTP) estimates from the conditional logit coefficient estimates. In typical choice studies, in which participants are presented with varying prices, WTP is calculated in units of currency (Lusk et al. 2003; Lusk and Hudson 2004; Tonsor, Schroeder, and Lusk 2013; Tonsor 2018). However, our relevant comparison is between GPA points and hours allocated to various activities. For example, we can estimate how many GPA points are required to induce a student to study another four hours. In this case, the concept is to calculate utility (equation 4 or 5) at four hours of study and at eight hours of study with GPA and all other variables at the same level. Then, in the case of the utility level associated with eight hours of study, GPA is increased until the two utilities are equal. The difference between GPA in the two cases is the willingness to trade GPA points for hours of study. Mathematically, this willingness to trade is equivalent to taking the ratio of the coefficient on Hours Devoted to Study to the coefficient on GPA and multiplying by two (Lusk, Roosen, and Fox 2003).[8] Table 5 contains WTP estimates and delta method 95% confidence intervals across all models. The interpretation of the WTP measures is points of semester GPA a student would trade for four more hours per week of a given activity, ceteris paribus.[9] Hours spent studying is statistically significant only in the expected utility model for lower-achieving students. Responses from these students indicate that they would forgo 0.406 semester GPA points to avoid four hours of weekly study.

Table 5. Willingness to Pay in Semester GPA Points per Weekly Time of Selected Activities with 95% Confidence Intervals

	Weekly Hours				
Points of:	**Greek**	**Study**	**Social**	**Rec/Sports /Fitness**	**Other Activities**
GPA (all students)	0.137**	-0.071	0.083	0.124	0.383**
	[0.268, 0.006]	[0.060, -0.202]	[0.213, -0.047]	[0.256, -0.008]	[0.516, 0.250]
GPA (students with GPA < Median)	0.197	-0.406**	0.112	0.105	0.678**
	[0.407, -0.013]	[-0.195, -0.617]	[0.317, -0.093]	[0.314, -0.104]	[0.891, 0.464]
GPA (students with GPA > Median)	0.109	0.093	0.027	0.121	0.159
	[0.283, -0.065]	[0.269, -0.082]	[0.201, -0.147]	[0.297, -0.056]	[0.336, -0.017]
GPA Gain (all students)	0.552	-0.289	0.137	0.355	1.160**
	[1.405, -0.300]	[0.547, -1.125]	[0.966, -0.692]	[1.192, -0.481]	[2.009, 0.311]
GPA Loss (all students)	-0.118	0.062	-0.029	-0.076	-0.248**
	[-0.258, 0.022]	[-0.079, 0.202]	[-0.170, 0.111]	[-0.216, 0.065]	[-0.390, -0.105]

Notes: WTP = (MNL coefficient for each activity/MNL coefficient for GPA) x 2. Confidence intervals were calculated using the delta method. Presented levels of activity hours were either four or eight. These effects are coded: 4 is the reference category (= -1). ** indicates statistical significance of at least 0.05. The WTP estimates in the first three rows are based on the three models in Table 2; the last two rows are based on those in Table 3. The category Other Activities is unstructured free time, as shown in Figure 2.

We can also consider the implied corollary that, in order to be motivated to add four hours of study per week, a low-achieving student would have to expect a greater-than-0.406 increase in semester GPA. Such a WTP measure seems quite abstract, so it is helpful to give some context. Assume a student is enrolled in five courses, each of which counts for three credit hours. In this case, a 0.4 decrease in semester GPA corresponds to a one-letter grade decrease in two of the courses. This is a non-trivial change in GPA and is

[8] It is necessary to multiply by two because hours devoted to activities were effects coded. In model estimation, the reference category of four hours was set equal to -1, and eight hours was set equal to one.

[9] To put the four hours per week measure in context, adding 45 to 50 minutes per weekday would be one way to achieve this change. Adding 45 to 50 minutes per weekday would be a reasonable way to add study time. For example, a student might meet with a tutor or study group for a daily session each weekday.

consistent with Kelley (1975), who observed that, depending on the way GPA is calculated, only teaching innovations with major impacts on student achievement will be demanded by students. We see a similar finding here in that lower-achieving students require a substantial boost in GPA to offset the loss in utility derived from study time. The more common preference structure, as illustrated in Figure 1, could be that academic achievement matters, but mainly to the extent that it allows or disallows the binary achievement of a university degree. This structure holds true especially for students with a current GPA in the lower half of the sample.

WTP results also demonstrate that the statistical impact of hours devoted to Other Activities (i.e., free time) is generally significant. This result persists with different model specifications. The idea of completely free time with no express or implied commitments could be very attractive to university students. Results of the base model for all students indicate that students are willing to give up 0.383 semester GPA points for another 4 hours of free time each week. When the sample is split at the median GPA, the impact is not statistically significant for the higher-achieving students. But lower-achieving students would trade 0.678 semester GPA points for an additional 4 hours of free time per week. Note that these students assign a greater value, in absolute terms, to free time than to study time.

The final two rows of Table 5 report WTP estimated from the prospect theory model (Table 4). In terms of Other Activities, there is a stark difference between WTP for GPA Gain and WTP to avoid GPA Loss. Students will give up 4 hours of free time per week to avoid losing 0.248 semester GPA points. On the other hand, they must be rewarded with a gain of 1.160 GPA points to sacrifice this amount of free time. There are likely several reasons for this implied loss aversion ratio of 4.6. First, if university is indeed a screening output (Kelley 1975), as discussed earlier, a GPA loss puts a student at risk of dropping below minimum GPA requirements for academic probation or expulsion, both of which would prohibit graduation. Conversely, if a student is currently above such a minimum, a GPA gain contributes nothing to the binary achievement of graduation. This consideration would seem to especially apply to lower-achieving students with a GPA close to academic probation or expulsion. Second, higher-achieving students might also reasonably be loss averse. These students are likely receiving scholarships, fellowships, or other benefits with minimum GPA requirements. For them, a minor addition to GPA would offer little benefit, but a decrease that brought GPA below the threshold for a scholarship would be detrimental.[10]

Another notable finding is the relatively large loss aversion ratio. Many studies involving money and short-term choices find a loss aversion ratio of around 2 (Abdellaoui, Bleichrodt, and Paraschiv 2007). We find the noticeably higher ratio of 4.6. This higher ratio could be due to the stakes involved in the current scenario. In many choice experiment applications, participants face choices regarding a one-time purchase or monetary decision. In the case of this research, determining the GPA is basically a non-repeatable event that could impact quality of life and earnings for years to come. In this context, it is reasonable that GPA loss aversion would be high relative to monetary loss aversion in other choice experiment contexts.

5 Implications and Further Research

This study implemented a choice experiment survey targeted at 105 students enrolled in intermediate microeconomic theory courses in the Department of Agricultural Economics. Students were presented with alternatives that combined hypothetical GPA levels with time allocated to broad categories of activities. The experiment results were analyzed with conditional logit models. This approach is consistent with expected utility theory. Results show that lower-achieving students dislike allocating time to studying and that study time has no impact on the choices of higher-achieving students. All students seem to value Hours Spent on Other Activities (or free time) more than other ways of allocating time. Revising the model to separate GPA gains and losses allows a novel look at student time allocation from a prospect theory approach. Indeed, students are loss averse in terms of GPA points. They dislike losing GPA points about 4.6 times as much as they enjoy gaining GPA points.

[10] For students with a 4.0 GPA, a decrease could have a negative psychological impact and put awards out of reach.

The limitations of the findings should be carefully considered. The students were all enrolled in agricultural economics courses at Kansas State University, which is a major land grant university. Most, but not all of the students, were agricultural economics or agribusiness majors. Some of the particular findings may be specific to land grant schools, Kansas State University, or agricultural economics/agribusiness majors. Within our sample, we found no heterogeneity among groups as defined by class, gender, and so on. However, it may exist and be identifiable in a broader sample in future research. One specific area would be to consider the impact of working full time or part time on students' time trade-offs. Another concern is that student decisions have been found to be biased by current conditions (Simonsohn 2010). However, bearing the limitations in mind, there is evidence that the results are credible. First, the general findings confirm what other studies on the productivity of student time have suggested. Second, the trade-offs chosen by students are realistic (see footnote 4). Finally, student choice experiment responses are consistent with student university goal rankings. This internal consistency offers confidence that students were taking time to consider their choices and understood what was being asked. This confidence in the basic experimental design and research question offer a base on which to build future research that expands the study across multiple majors and institutions. We recommend conducting the experiment over different semesters as way to control for students being biased by their immediate situation (Simonsohn 2010).

Though caution is warranted in generalizing the findings, they are rich with implications for instructors, academic advisors, and other stakeholders concerned with university student experience. Choice experiment results, taken with the ranking of university goals, confirm that students likely see a university diploma as the most valuable product of the university experience. Marginal improvements in GPA are not highly valued, but losses in GPA are more severe in absolute terms, particularly for lower-achieving students. With this finding in mind, instructors should prioritize giving students big-picture course guidance and making clear what is generally required to achieve certain letter grades. This information helps students understand what is needed to actualize major grade changes and avoid GPA losses. By contrast, fine-tuned advice will likely appeal to higher-achieving students. Results highlight the difference between the decisions of higher- and lower-achieving students and the nuances of effectively teaching both groups. As instructors we must realize, painful as it might be, that many students will not value minor grade improvements or a marginal increase in knowledge. Their motivations and incentive structures often differ from our own. However, minor grade or GPA improvements will likely be valued by higher-achieving students (Table 3), possibly because these students are often in a position to benefit from a marginal GPA increase. For example, a student targeting graduate school might benefit from increasing GPA from 3.3 to 3.7. Our results imply that tailoring advice and direction on the basis of student goals and achievement will have a positive impact on their utility and university experience.

Academic advisors can similarly benefit from the study findings, specifically from realizing that many students value the diploma over all other aspects of the university experience. Accepting that this perspective is not necessarily a sign of laziness is helpful in developing empathy and rapport with students. It can reduce frustration when advice directed toward improving academic achievements seems to fall on deaf ears. Additionally, given the high value placed on free time, the study findings suggest that helping students to understand good time management practices and the possible future value of current activities will improve the student experience.

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References

Abdellaoui, M., H. Bleichrodt, and C. Paraschiv. 2007. "Loss Aversion Under Prospect Theory: A Parameter-Free Measurement." Management Science 53(10):1659–1674.

Adamowicz, W., P. Boxall, M. Williams, and J. Louviere. 1998. "Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation." American Journal of Agricultural Economics 80(1):64–75.

Ballard, J.S. 2014. "Working for the Weekend: A Time Allocation Model for Student Workers." Journal for Economic Educators 14(1):108–119.

Becker, G.S. 1965. "A Theory of the Allocation of Time." The Economic Journal 75(299):493–517.

Ben-Akiva, M.E., and S.R. Lerman. 1985. Discrete Choice Analysis: Theory and Application to Travel Demand. MIT Press.

Bratti, M., and S. Staffolani. 2013. "Student Time Allocation and Educational Production Functions." Annals of Economics and Statistics (111/112):103–140.

Caputo, V., J.L. Lusk, and R.M. Nayga Jr. 2019. "Am I Getting a Good Deal? Reference-Dependent Decision Making When the Reference Price Is Uncertain." American Journal of Agricultural Economics. https://doi.org/10.1093/ajae/aaz042.

Champ, P.A., K.J. Boyle, and T.C. Brown, eds. 2017. A Primer on Nonmarket Valuation. Dordrecht: Springer Netherlands. https://doi.org/10.1007/978-94-007-7104-8_1.

Devadoss, S., and J. Foltz. 1996. "Evaluation of Factors Influencing Student Class Attendance and Performance." American Journal of Agricultural Economics 78(3):499–507.

Kelley, A.C. 1975. "The Student as a Utility Maximizer." The Journal of Economic Education 6(2):82–92.

Koch, A., J. Nafziger, and H.S. Nielsen. 2015. "Behavioral Economics of Education." Journal of Economic Behavior & Organization 115:3–17.

Krohn, G.A., and C.M. O'Connor. 2005. "Student Effort and Performance over the Semester." The Journal of Economic Education 36(1):3–28.

Lusk, J.L., and D. Hudson. 2004. "Willingness-to-Pay Estimates and Their Relevance to Agribusiness Decision Making." Review of Agricultural Economics 26(2):152–169.

Lusk, J.L., J. Roosen, and J.A. Fox. 2003. "Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States." American Journal of Agricultural Economics 85(1):16–29.

Romer, D. 1993. "Do Students Go to Class? Should They?" The Journal of Economic Perspectives 7(3):167–174.

Schmidt, R.M. 1983. "Who Maximizes What? A Study in Student Time Allocation." The American Economic Review 73(2):23–28.

Schulz, L.L., and G.T. Tonsor. 2010. "Cow-Calf Producer Preferences for Voluntary Traceability Systems." Journal of Agricultural Economics 61(1):138–162.

Simonsohn, U. 2010. "Weather to Go to College." The Economic Journal 120(543):270–280.

Tonsor, G.T. 2018. "Producer Decision Making under Uncertainty: Role of Past Experiences and Question Framing." American Journal of Agricultural Economics 100(4):1120–1135.

Tonsor, G.T., T.C. Schroeder, and J.L. Lusk. 2013. "Consumer Valuation of Alternative Meat Origin Labels." Journal of Agricultural Economics 64(3):676–692.

Tversky, A., and D. Kahneman. 1992. "Advances in Prospect Theory: Cumulative Representation of Uncertainty." Journal of Risk and Uncertainty 5(4):297–323.

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