The COVID-19 Pandemic and Fall 2020 Undergraduate Enrollment Intentions: Capturing Heterogeneity Across and Within Universities in the U.S.

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Abstract

The COVID-19 pandemic delivered an unprecedented shock to higher education, requiring a rapid transition to online instruction. Perhaps, more importantly, it likely had long-lasting effects on educational outcomes and university budgets, requiring students, faculty, and administrators alike to make decisions under experienced hardships and increased uncertainty. This study analyzes undergraduate student's enrollment and attendance intentions for the Fall 2020 term across six land-grant universities under different learning modalities and on-campus experience scenarios to test whether a continuation of remote and online learning modalities and a loss of on-campus experiences had a detrimental impact on student's enrollment intentions. Using a range of proposed scenarios, we further examine if a continuous disruption to in-person learning and campus live has caused students to become more price elastic or responsive to tuition changes. We built on existing literature by collecting data using a hypothetical choice experiment but are able to analyze a much larger and more diverse student sample to better identify differences amongst and within university campuses in the U.S. We detect significant differences in student's intention to enroll in the Fall 2020 term depending on location and learning modalities offered. Furthermore, willingness to pay for these modalities as well as on-campus and residential experiences vary significantly in both magnitude and sign. Our findings suggest that there is no one-size-fits all policy for tackling significant shocks like the COVID-19 pandemic, and that university administrators were justified in attempting to implement a variety of approaches from in-person instruction to asynchronous online delivery to better serve their students during the pandemic. However, our analysis further indicates that students are even more price sensitive than previous studies suggested and that reductions in tuition when offered might have not been significant enough to address students' safety concerns or increased uncertainty regarding learning outcomes and student experiences during these challenging times.

Keywords: COVID-19, Enrollment, Hybrid, Learning Modality, Online, Stated Choice, Uncertainty

JEL Codes: I21**,** I23, Q10, Q19

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1 Introduction

The COVID-19 pandemic was an unprecedented shock to learning, instructional delivery and administration at institutions of higher education in the United States. In the span of a few weeks, universities and colleges were forced to transition over 1.9 million students from in-person to remote learning at the beginning of the pandemic (Johnson et al., 2020). The impacts from early on in the pandemic on student educational experiences, as well as learning, social, health, economic, housing and other outcomes have been significant (Amendola et al., 2021; Lederer et al., 2021; Kiesel et al., 2021). Studies have found that the pandemic has reduced or impeded learning outcomes, impacted the ability of students to attend classes (and college in general), and has adversely affected student mental health and well-being (Jaggers et al., 2020; Lederer et al., 2021; Soria et al., 2020). The pandemic made the future much more uncertain for students, faculty and administrators alike.

A survey of university presidents conducted in April 2020, indicated that Fall enrollment and the long-term financial viability of their universities where the top two concerns during the COVID-19 pandemic. Other concerns included laying off faculty and staff, online-learning, student mental health, and emergency aid for students (Turk et al., 2020). Aucejo et al. (2020) surveyed undergraduate students at Arizona State University and found a significant and negative impact of the COVID-19 pandemic on students' academic performance and time to graduation (or degree completion), as well as a greater likelihood of withdrawing from classes. The authors also found that on average students indicated that they would potentially take a break from classes during the Fall 2020 term, which becomes more alarming when you consider that historically 28% of students that fail to register for the Fall term do not return to campus

(Aucejo et al., 2020). Thomas and Allen (2020) found that health concerns had a significant and negative indirect effect on student's enrollment intentions. Hawley et al. (2021) found that undergraduate students in several countries, including the U.S., at institutions of higher learning where uncertain about their educational future, including learning modalities, obtaining practical skills, residential experiences, campus safety, mental health, and employability.

Universities considered a number of learning modalities and reopening approaches for the Fall 2020 term including a continuation of remote and online learning, hybrid learning models, and continuing face-to-face learning. These decisions were likely shaped by a range of considerations including health and safety of students, faculty and staff, student retention, campus revenue, and student expectations (Blagg 2020; Yeo et al., 20201; Wrighton and Lawrence 2020). Such consideration are important, as impacts of declines in on-campus enrollment can have wide ranging implications, which extend beyond university budgets and include widening of educational gaps and inequalities, as well as longer term impacts on the future of institutions of higher education and local economies (Blagg, 2020).

The purpose of this study is to assess undergraduate students' enrollment and attendance intentions for the Fall 2020 term during the COVID-19 pandemic under different learning modalities and campus experience scenarios. We hypothesize that continuation of remote and online learning modalities and loss of on-campus experiences could have a detrimental impact on student's enrollment intentions. Furthermore, we hypothesize that the disruption to standard course delivery and campus life will cause students to become more responsive to changes in tuition (i.e. demand for higher education will become more price elastic).

To address this research purpose, we collect a unique survey data set of students in Colleges of Agriculture at six, medium to large, public, land-grant universities. Our survey

questionnaire included a stated choice experiment to examine student enrollment intentions with differing learning modality and tuition attributes. Six different learning modality and campus experience scenarios were examined that ranged from a return to normal, to a hybrid approach with online and face-to-face instruction, to a circumstance where all classes continue online and remotely. Survey data was analyzed using a conditional random parameter mixed logit model to test the hypotheses. The approach also allows for modeling of heterogeneity of student response and willingness-to-pay (WTP) for learning modality and campus experience scenarios across and within Colleges of Agriculture at the six participating universities. Students in Colleges of Agriculture provide a unique opportunity to view the impact of the COVID-19 pandemic from the perspective of students from rural communities who may have faced an especially challenging time when considering enrollment for the Fall 2020 term. Students may have felt pressures to help with family businesses (e.g. farming, ranching or other enterprises) that may heavily rely on family labor and have been impacted due to less reliable access to internet connectivity in rural areas (Lai and Widmar, 2021).

The findings from the paper contribute to the literature and our understanding of short-term impacts from significant disturbances (e.g. COVID-19 pandemic, natural disasters) to learning and life at institutions of higher learning. While focused specifically on undergraduate students in Colleges of Agriculture, important differences were found both across campuses and within each campus' student population, and for the different learning modality and campus experience scenarios considered. On average, students at surveyed universities in the central U.S. strongly preferred a return to normal or a hybrid type option with at least some face-to-face learning opportunities, while students at universities on the east and west coast preferred continuing online and remote learning modalities for the Fall 2020 term. Furthermore, there was

significant within-university heterogeneity in student preferences and WTP for different learning modalities and campus experience scenarios. For example, the WTP distributions across all campuses were bimodal, with groups of students WTP to return to campus, while other groups would require a reduction in tuition to be willing to return to campus for the Fall 2020 term. Findings confirm that students were much more responsive to tuition changes during the pandemic than in the past.

These difference across and within campuses help to shed light on the valuation and preference for synchronous versus asynchronous learning modalities, as well as the value of on-campus experiences. At several of the participating universities, WTP estimates indicate that in-state students preferred synchronous learning modalities over asynchronous in blended learning models. Conversely, for online learning, students often preferred asynchronous options (which can include contact and content), though the WTP measures were not often statistically different from zero. Finally, when compared, the most preferred learning modality and on-campus experience scenarios were found to match up with the actual Fall 2020 learning modality and reopening decisions made by university administrators, even though some of these decisions where unknown at the time the survey was administered. This finding highlights that, on average, campus educational and operational responses to the pandemic were generally well-aligned with student preferences.

The remainder of this study proceeds as follows. The next section of this paper provides additional detailed background on enrollment conditions and expectations at universities, learning modality options that were considered at universities in Fall 2020, and a brief review of existing studies examining undergraduate student enrollment decisions during the COVID-19 pandemic. Section 3 of the paper presents the administered survey, discusses the choice

experiment presented to undergraduate students, and describes the student population in the six surveyed universities. Section 4 presents our empirical model based on random utility theory and estimated using a mixed logit regression framework. Section 5 presents descriptive, regression and willingness-to-pay results, as well as an examination of student preference heterogeneity with discussion of results and conclusions in Section 6.

2 Background

2.1 Enrollment Expectations and Policies

In the summer of 2020, many colleges and universities were struggling to determine if and how campuses would be reopened, and how they would offer instruction for the Fall 2020 term. In June of 2020, 67% of higher learning institutions in the U.S. were planning for in-person instruction, with the remaining institutions were considering hybrid options, staying on-line, or were undecided (Nurunnabi and Almusharraf, 2020; Steimle et al., 2020). By October 2020, over 40% of public, four-year institutions were offering instruction primarily online, while about 20% of institutions remained primarily in-person. Around 25% of public, four-year institutions decided to implement some type of hybrid learning modality (The Chronicle of Higher Education, 2020). Hybrid modalities include an array of options, including Hybrid Hyflex and Blenflex options (Miller et al., 2021), as well as a mix of online and in-person options based on class sizes. The differences in what schools intended to do in June 2020 and what they actually implemented in Fall 2020 exemplifies the uncertainty surrounding the impact of the COVID-19 pandemic on higher education learning and how to move forward.

A survey of college presidents indicated that 86% percent of them listed fall enrollment as a significant concern going into the 2020/2021 academic year (Turk et al., 2020). While many

issues impacted decisions on choice of learning modality and reopening, Felson and Adamcyzk (2021) found that the likelihood of using a predominantly in-person modality was heavily influenced by undergraduate enrollment, tuition revenue, dorm capacity, graduation rate, politics, and population density. Surprisingly, the state level COVID-19 incidence rate was not statistically significant when controlling for these other factors. Freeman et al. (2021) found that for the 100 largest public and private institutes of higher learning in the U.S., many instituted a number of campus safety policies, such as mask requirements (100%), social distancing (99%), reduced capacity classrooms (61%), dedensification of on-campus housing (58%), testing upon entry to campus (65%), and testing on a regular basis (32%). Undergraduate enrollment on-average fell by 4.9% in the Fall 2020 term across colleges and universities. For public, four-year institutions, first-time enrollments fell by 9%, student enrollment for continuing students increased by 1.2%, and enrollment by returning students (who had taken a semester or more off) fell by 15.2% (Causey et al., 2020).

2.2 Review of Existing Studies

To date, much of the literature examining the impact of COVID-19 in the U.S. higher educational system, particularly with respect to impact on academics and enrollment intentions, have been limited to examining the effects of the pandemic on students in particular courses and programs (e.g. Engelhardt et al., 2020; Ungel and Meiran, 2020) or at a particular university or college (e.g. Aucejo et al., 2020, Jaggars et al., 2020; Murphy et al., 2020). A small number of studies have considered students from multiple institutions (e.g. Blagg, 2020; Felson and Adamczyk, 2021; Mulholland, 2021). Among these, very few studies have examined students' intent to enroll and attend classes in Fall 2020, and how changes in learning modalities, the

residential experience, and the transition in Spring 2020 may impact enrollment and attendance decisions. Results of these studies anticipated a decline for many universities, with enrollment declining as much as 15 to 25 percent from the prior year (Dennis 2020; Friga, 2020).

Few studies have explicitly examined enrollment intentions by undergraduate students at U.S. colleges and universities. Blagg (2020) examines enrollment changes at Title IV colleges and universities among degree-seeking students and those enrolled in programs leading to a credential. Bragg considers several scenarios. If the change in enrollment was similar to the 2008 recession, then colleges on average would likely see an increase in enrollment (e.g. as high as 10 to 16% for full-time undergraduate students in some states), with the largest increases at community colleges, but there would exist heterogeneity in differences across the U.S. Blagg (2020) estimates potential decreases in international student enrollment, enrollment by residential students, and out-of-state students. Blagg (2020) does note the possibility of increased enrollment in distance education programs. The author indicates that there exists considerable uncertainty of what might happen in the Fall 2020 term given the unique shock from COVID-19, economic uncertainty, uncertainty about learning modalities, and uncertainty about how international and out-of-state students may react. All of this made prediction of enrollment impacts difficult for the Fall 2020 term.

Thomas and Allen (2021) examine how COVID-19 worries, attitudes, and other factors may impact enrollment intentions at a public university in the U.S. using the reasoned action model. They find that worries about others (e.g. family members) from the COVID-19 pandemic indirectly impact enrollment intentions as mediated by attitudes toward enrolling at the university, perceived normative pressure to enroll in courses and perceived behavioral control over their decision to enroll. Aucejo et al. (2021) use the COVID-19 pandemic to estimate

student's valuation of college experiences using a choice experiment at Arizona State University. The choice experiment examined different scenarios with attributes examining if COVID-19 was under control, if in-person instruction was provided, if normal campus social activities could take place, if a vaccine was required to attend, and a percent change in the cost of attending Arizona State University. For all choice scenarios examined the likelihood of returning was 75 percent or greater. Aucejo et al. (2021) estimate a willingness-to-pay for in-person instruction of 3.2% of the annual cost of attendance, and a willingness-to-pay to have regular social activities of 7% of the annual cost of attendance. Steimle et al. (2020) examine undergraduate student enrollment intentions at a medium-size public university in Georgia using a choice experiment. Their CE experiment examined mode of course delivery, campus safety, operating capacity of residence halls, tuition reduction, and limits on social activities. Steimle et al. (2020) find that course mode of delivery was the primary factor driving enrollment intentions, with students requiring a significant reduction in tuition to go entirely online. Students were willing to pay for increased safety on campus, which included mask requirements, social distancing and testing. Both Aucejo et al.(2021) and Steimle et al. (2020) find significant heterogeneity in student WTP estimates.

The current studies on enrollment intentions by students are university specific and demonstrate the differences across campuses and in geographic locations. Our study builds on this existing literature by collecting data using a choice experiment examining enrollment intentions by students at six medium to large universities with a much larger sample size than prior studies to be able to better identify differences amongst and within universities in the U.S. In addition, we are able to say something about the valuation of different learning modalities, particularly synchronous versus asynchronous approaches, as well as on-campus and residential experiences.

3 Choice Experiment and Survey

We designed a stated choice experiment embedded within an online survey to assess students' enrollment intentions for the Fall 2020 term under different learning modality and campus experience scenarios. The survey was administered to students in Colleges of Agriculture at six, medium to large, public, land grant universities across the United States.

3.1 Choice Experiment Design

To understand undergraduate student preferences for university policy and instructional style, we designed and implemented a simple choice experiment (CE). We elicited students' willingness to enroll and attend classes at their university during the Fall 2020 term. Our CE contained two attributes. The first attribute represents university policy towards class administration and campus life, representing different learning modality and campus experience scenarios that could be faced by students. Based on information from popular press, discussion with university administrators, and what was occurring at the authors' institutions, we identified five significant factors that could impact a student's enrollment and attendance intentions These factors are outlined in Table 1. The first factor, in-person status of classes looked at four options that had been talked about on university campuses and in the popular press from returning to in-person classes to remaining online (Felson and Adamczyk, 2021; McMurtrie, 2020). The second attribute, class content delivery, represents how learning may be provided in the classroom, asynchronously versus synchronously. Another important aspect to take into consideration is on-campus experiences. The third and fourth factors capture this aspect by indicating if students would have access to campus services, such as the library and recreational facilities, as well as

the ability to partake in on or near campus activities, such as sporting events and Greek life. The final factor considered was tuition and fees for the Fall 2020 term. This last factor plays a significant role given the revenue generation for universities and colleges from tuition revenue (Turk et al., 2020), as well as potential legal ramifications from lawsuits due to campus closures in Spring 2020 (Lederman, 2021).

Table 1: University Factors Impacting Class Administration and Campus Life for Fall 2020

Factor	Description
In-Person Status of Classes	There are four cases: (1) regular in-person classes will be held in-person; (2) all classes are online; (3) a hybrid approach with all classes being a mix of in-person and online delivery; (4) a mixed approach where small classes (< 30 people) are in-person and larger classes (> 30 people) are online.
Class Content Delivery	How classes are likely to be taught, which can include (1) real-time teaching (in-person or online) with recorded lectures (synchronous learning) OR (2) only using recorded lectures and videos (asynchronous learning).
Campus services	If campus services and associated buildings (e.g., student union, library, gyms) will be open for students.
Social events	If college sporting events and other social events (Greek and club events and meetings) will be allowed.
Tuition and Fees	Your expected cost of tuition and fees for the term based on Spring 2020 rates. Spring tuition for a full-time student (12-15 hours) was slightly more than $A for in-state students. Spring fees were approximately $B for a full time in-state student and $C for a full-time out-of-state student. This means that total semester cost would be about $D for an in-state student and up to $E for an out-of-state student.

It is likely that the first four factors will be highly correlated and dependent on health consideration, as well as the political environment and economic considerations (Felson and Adamczyk, 2021). For example, campus services and social events are extremely unlikely to be open if all classes are taught online. Taking these high degrees of correlation into account, we define the first attribute for CE as the learning modality and campus experience scenario, which has six levels, each with different combination of the factors in Table 1. The six levels for the first attribute are summarized in Table 2 and reflect escalating deviation from business-as-usual.

Each attribute level, representing a university policy scenario, describes the delivery of instruction, which is also conditional on the size of the class, the timing of delivery (e.g., synchronous versus asynchronous), social distancing requirements, and whether campus athletic and social activities would be allowed. It should be emphasized that the factors that make up each attribute level for the learning modality and on-campus experience attribute levels were fixed. That is, each respondent saw the same factors for each scenario for the first attribute. These policies broadly reflect tiers of policies under consideration by many universities throughout the US during Summer 2020 (Felson and Adamczyk, 2021; McMurtrie, 2020). The approach follows Aucejo et al. (2021) for defining different plausible scenarios for students.

Table 2: Six Scenario/Attribute Levels of Learning Modality and On-Campus Experience

Scenario (Attribute)	Description	
1	**Business-as-Usual**	
	In-Person Instruction:	Regular in-person classes
	Class Format:	Real time teaching with lectures being recorded
	Campus Services:	Open
	Social Events:	Allowed
2	**Hybrid Model**	
	In-Person Instruction:	All classes are hybrid with half of the time being in-person and half of the time online
	Class Format:	Real time teaching with lectures being recorded
	Campus Services:	Open with social distancing.
	Social Events:	Allowed with social distancing
3	**Synchronous Blended Model**	
	In-Person Instruction:	Small classes (< 30 people) are in-person and larger classes (> 30 people) are online
	Class Format:	Real time teaching with lectures being recorded
	Campus Services:	Open with social distancing
	Social Events:	Not allowed
4	**Asynchronous Blended Model**	
	In-Person Instruction:	Small classes (< 30 people) are in-person and larger classes (> 30 people) are online
	Class Format:	Small classes are real-time teaching and larger classes used recorded lectures and teaching videos
	Campus Services:	Open with social distancing
	Social Events:	Not allowed
5	**Synchronous Online Model**	
	In-Person Instruction:	All online
	Class Format:	Real time teaching with lectures being recorded
	Campus Services:	Closed
	Social Events:	Not allowed
6	**Asynchronous Online Model**	
	In-Person Instruction:	All online
	Class Format:	Recorded lectures and teaching videos
	Campus Services:	Closed
	Social Events:	Not allowed

The second attribute was based on the tuition and fees factor in Table 1 and represented the change in tuition and fees expected by the university for the Fall 2020 term. Attribute levels represented percent changes in tuition rates. The attribute had five levels, with a tuition and fees change of –15%, -10%, -5%, 0%, or +5%, representing real tuition changes under consideration by universities responding to COVID-19 (Douglas-Gabriel and Lumpkin, 2020).

Prior to participating in the CE, respondents were provided the information in Table 1 to highlight the potential policy considerations and factors that universities were considering. The CE instructions also included a consequentiality reminder, stressing the uncertainty caused by COVID-19 and how it may force universities to adjust, affecting the student, as well as a brief cheap talk reminder to answer truthfully and carefully to mitigate potential hypothetical bias. Finally, students were reminded of the cost of attendance at their university using tuition and fee rates as of Spring 2020.

Because of the simple design, we implemented a full-factorial design of the 30 possible combinations of the attribute levels for both attributes. Each participating student was provided six choice sets, corresponding to seeing each scenario/level presented in Table 2 exactly once. The change in tuition attribute level was randomized for each scenario, so that each respondent was randomly assigned one of the five tuition levels for each scenario. The scenario appearance order was also randomized. To adhere to incentive compatibility, a person faced two alternatives within each choice set, whether to enroll or not at their university. Their decision was presented as a Likert scale with seven levels of certainty: Definitely will not take classes (1), Not likely to take classes (2), Somewhat not likely to take classes (3), Undecided (4), Somewhat likely to take classes (5), Likely to take classes (6), and Definitely will take classes (7). Using this response format captures more information about the underlying strength of preference/certainty of the

respondent, while still being theoretically and construct valid (Wang, 1997; Whitehead et al., 1998).

For analyzing the responses to the CE in this paper, we convert the Likert scale to a binary response, with the dependent variable equal to 1 when a respondent chooses options 6 or 7 on the Likert scale and 0 otherwise. This coding ensures that there is greater certainty for the intent to enroll. In future research, we hope to explore how coding the dependent variable in different ways to account for uncertainty or explicitly modeling the Likert scale response to see how it impact regression and WTP estimates.

3.2 Survey Design and Administration

The CE was implemented within an online survey designed to understand several aspects of students' attitudes, preferences, and experiences during the initial phase of the COVID-19 pandemic. The survey had four sections. In the first section of the survey, students shared their academic experiences and challenges during the Spring 2020 term, including with remote-learning. For the second section of the survey, students described their current family situation, living conditions, health and safety concerns, as well as a Holt-Laury elicitation of health risk preferences. Students completed the CE eliciting intended enrollment for Fall 2020 in the third section along with questions about financial and personal obligations that may affect re-enrollment decisions. Lastly, participants provided additional background and demographic information, including political preferences and attitudes towards and experiences with implicit bias and discrimination. The survey was refined several times based on feedback from college administrators, instructors, and recently finished undergraduates before being administered in the field.

We surveyed students from Colleges of Agriculture at six land grant universities that have a combined enrollment of 17,000 students. The surveyed universities are diverse in their size, geographic locations, student population, and types of agricultural production predominant in each state where the universities are located. All survey materials and procedures were approved by all participating universities' Institutional Review Boards for human subjects' research. The survey was distributed online from June to August 2020 prior to the Fall semester via Qualtrics® either by the authors or by a College of Agriculture administrator.[1] Multiple reminder invitation emails were sent within each university. A total of 2,690 surveys were completed for a response rate of approximately 15%. Due to missing data, only 2,096 observations were usable for regression analysis of the CE.

3.3 Survey Sample Campus Populations and Characteristics

Information about the participating land grant universities is provided in Table 3. The universities are representative of a number of campuses and Colleges of Agriculture at other universities across the U.S. In addition, the universities are representative of different university student contexts, geographic conditions, political environments, and COVID-19 incidence. By conducting our survey across a number of campuses we are able to catch diversity in responses across student groups, geography, and situational contexts.

[1] Two universities provided incentives by entering participating students in a lottery for small cash prizes (e.g. five $50 and 20 $50 gift cards). If students opted out of participating in the survey, they were still able to enter the lottery after contacting the PI at their respective school.

Table 3. University Population Descriptive Statistics

	University A	University B	University C	University D	University E	University F
Geographic Location	West Coast	Great Plains	Western U.S.	Midwestern U.S.	Southern U.S.	East Coast
Approximate Population of City/Town	75,000	50,000	30,000	50,000	250,000	500,000
Undergraduate Enrollment[a]						
Campus	30,000+	15,000+	10,000	30,000+	20,000+	20,000+
College of Agriculture	750	2300	1000	2800	1400	3000
Fall 2020 Policies						
Learning Modalities	Online (Synchronous and Asynchronous)	In-person (small classes), Hybrid, Online (Synchronous and Asynchronous)	In-person (small classes), Hybrid, Online (Synchronous and Asynchronous)	In-person (small classes), Hybrid, Online (Synchronous and Asynchronous)	In-person (small classes), Hybrid, Online (Synchronous and Asynchronous)	Online (Synchronous and Asynchronous)
COVID-19 Information[c]						
State Level Data as of June 30, 2020						
Cases	228,732	14,443	1487	45,594	58,095	64,670
Deaths	5936	270	20	2640	3221	1343
Campus Level Data as of October 2020						
Campus Cases	88	888	678	1376	1146	1180

[a] Undergraduate enrollment numbers approximated based on Fall/Spring 2019/2020 academic year and to protect identity of the institution.

[b] Percentage are based entire university undergraduate enrollment. 5.

[c] Data for cases and deaths are reported at the state level for cumulative cases, hospitalizations and deaths as of June 30, 2020 from The COVID Tracking Project (2021). Campus cases are obtained from the New York Times (2020). "n.r." indicates that statistic was not reported.

4. Model

We adopt a random utility framework for development of our empirical model (Louviere et al., 2000). From the researcher's perspective, an undergraduate student's utility for enrolling is given by:

$$U_{ij} = V_{ij}\left(\Delta T_{i,j}; \boldsymbol{\theta}_{i,j}\right) + \varepsilon_{ij}, \quad (1)$$

where $i = 1,\ldots, N$ is an index representing undergraduate students and $j = 1,\ldots,J$ is an index for the levels of the first attribute, representing different learning modality and campus experience scenarios. The component $V_{ij}\left(\Delta T_{i,j}; \boldsymbol{\theta}_{i,j}\right)$ represents the observable or systematic component of utility, which is a function of $\Delta T_{i,j}$ the change in tuition and fees faced by student i and vector of individual specific parameters, $\boldsymbol{\theta}_{i,j}$, that allow for the modeling of unobserved preferences and factors on the enrollment decision across students surveyed. Finally, ε_{ij} is assumed to be a mean zero IID error term that is distributed extreme value Type 1 (Train, 2009).

To operationalize the random utility model given by equation (1), we assume that:

$$V_{ij}\left(\Delta T_{i,j}; \boldsymbol{\theta}_{i,j}\right) = \alpha_{i,j} + \beta_i \Delta T_{i,j} \text{ for } j = 1, \ldots, J \quad (2)$$

where $\alpha_{i,j}$ is an alternative specific attribute for the learning modality and campus experience scenario j and β_i is the change in marginal utility from a change in university tuition and fees, which is expected to be negative following demand theory and past literature (Carter and Curry, 2011). Furthermore, each $\alpha_{i,j}$ is assumed to randomly vary across the sample population due to unobserved preference heterogeneity and individual specific circumstances. We try to capture

part of this variation by modeling the conditional mean of $\alpha_{i,j}$ as $E(\alpha_{i,j}|\boldsymbol{X}_i) = \gamma_{0,j} + \boldsymbol{\gamma}_j{}'\boldsymbol{X}_i$, where $\boldsymbol{X}_i$ is a set of individual specific explanatory variables and $(\gamma_{0,j}, \boldsymbol{\gamma}_j)$ is a vector of parameters to be estimated. The set of individual specific explanatory variables includes binary variables for university attended (or applied to for incoming freshman), out-of-state students, and international students. The inclusion of these variables allows the location of the distributions of $\alpha_{i,j}$ to shift due to differences across universities and types of students. For example, demand for U.S. higher education by international students will likely be different under different scenarios given changes in COVID-19 travel restrictions, VISA/immigration requirements, and politics (Bound et al., 2021). Thus, the marginal distribution of $\alpha_{i,j} \sim N(\gamma_{0,j} + \boldsymbol{\gamma}_j{}'\boldsymbol{X}_i, \sigma_j^2)$. We further that $\beta_i \sim N(\tau_0 + \boldsymbol{\tau}'\boldsymbol{Z}_i, \varpi^2)$, where $\boldsymbol{Z}_i$ includes binary variables to differentiate effects of tuition and fee differences for out-of-state and international students.

It is likely there exists correlation between the scenarios (levels) of the learning modality and campus experience attribute, given the common factors (from Table 1) across levels. We further assume that this likely extends to the tuition attribute, as well. Given this, we assume the vector of random parameters $(\boldsymbol{\alpha_i}, \beta_i) \sim \boldsymbol{N}(\boldsymbol{\mu}, \boldsymbol{\Omega})$. That is the vector of random parameters $(\boldsymbol{\alpha_i}, \beta_i)$ is distributed multivariate normal with conditional mean vector $\boldsymbol{\mu}$ (where the conditional means are as specified earlier) and $\boldsymbol{\Omega}$ is a covariance matrix that is specified to capture unrestricted covariances (correlations) between the different random parameters (Hensher et al., 2015).

Given that only discrete choices are observed, given how the dependent variable is defined, and assuming ε_{ij} is assumed to be a mean zero IID error term that is distributed extreme value Type 1, applying a probabilistic framework following Train (2009):

$$P_{ij} = \int L_{ij}(\Delta T_{i,j}, \boldsymbol{\alpha_i}, \beta_i) f(\boldsymbol{\alpha_i}, \beta_i) d(\boldsymbol{\alpha_i}, \beta_i), \quad (3)$$

where $L_{ij}\left(\Delta T_{i,j}, \boldsymbol{\alpha_i}, \beta_i\right) = exp\left(\alpha_{i,j} + \beta_i \Delta T_{i,j}\right) / \left[\sum_s exp\left(\alpha_{i,s} + \beta_i \Delta T_{i,s}\right)\right]$ and $f(\boldsymbol{\alpha_i}, \beta_i) \sim \boldsymbol{N}(\boldsymbol{\mu}, \boldsymbol{\Omega})$. This results in a mixed logistic regression model of student enrollment. The model probabilities in equation (3) are estimated using simulated maximum likelihood following Train (2009) and Hensher et al. (2015). We estimate the model using NLOGIT 6 (Econometric Software, Inc. 2016) via simulated maximum likelihood using the David-Fletcher-Powell optimization algorithm with 500 Halton draws.

We utilize the model coefficient estimates to estimate mean willingness-to pay (WTP) for each learning modality and campus experience scenario (level) at the mean of the random parameter distributions and across respondents. WTP estimates at the mean of the random parameter distributions are estimated as:

$$WTP_j = \left(\gamma_{0,j} + \boldsymbol{\gamma}_j{}' \boldsymbol{X}_i\right) / (\tau_0 + \boldsymbol{\tau}' \boldsymbol{Z}_i) \quad (4)$$

with standard errors estimated using the delta method (Greene, 2012). Individual specific WTP estimates are obtained using the same formula as equation (4), with the estimates of $\gamma_{0,j}$ and τ_0 replaced with the individual specific estimates following Greene (2012). Smoothed histograms of these estimates are then produced to examine the distribution of WTP across students at different universities and across different learning modality and campus experience scenarios.

5. Results

This section of the paper presents descriptive statistics of responses to the differing enrollment scenarios presented to students, as well as results from the mixed logit model and willingness-to-pay estimates.

5.1 Descriptive Statistics of Student Enrollment Intentions

Response frequencies to each learning modality and campus experience scenario are summarized in Table 4 for each university and the entire sample of student responses. Again, student responses were collected using a 7-point Likert scale. Depending on the enrollment scenario and school, students were definite about their enrollment intentions 28 to 45% of the time. Twenty-four to 35% of the time students responded that they definitely would take classes under a given scenario, while 4 to 15% of the time students indicated they would definitely not be taking classes under a given scenario. For example, under Scenario 1 the likelihood of a student responding that they are at least somewhat likely to enroll in classes in the Fall 2020 term was as high as 84% for University B and C, which are located in the Great Plains and western U.S. In contrast, the same likelihood for Scenario 6 was 68% for University A (located on the west coast) and 40% for University D (located in the mid-west).

The summary statistics presented in this table also make it evident that students at land grant universities surveyed in the central U.S. tended to prefer returning to normal or having at least an in-person option for classes, while those on the coasts preferred options that provided for more social distancing.

Table 4. Responses for each enrollment scenario, by University

Response:	Definitely will not take classes (1)	Not likely to take classes (2)	Somewhat not likely to take classes (3)	Undecided (4)	Somewhat likely to take classes (5)	Likely to take classes (6)	Definitely will take classes (7)
			Scenario 1: Business-as-Usual				
Univ. A	17%	19%	10%	8%	11%	16%	18%
Univ. B	2%	5%	4%	4%	7%	24%	53%
Univ. C	3%	5%	4%	4%	6%	23%	55%
Univ. D	3%	3%	6%	5%	10%	27%	46%
Univ. E	7%	13%	10%	5%	8%	17%	42%
Univ. F	9%	15%	9%	9%	13%	18%	27%
Overall	10%	12%	7%	6%	9%	20%	35%
			Scenario 2: Hybrid Model				
Univ. A	7%	12%	11%	8%	17%	22%	22%
Univ. B	2%	3%	6%	6%	12%	33%	38%
Univ. C	4%	6%	4%	5%	13%	34%	33%
Univ. D	1%	2%	6%	6%	13%	30%	44%
Univ. E	2%	8%	5%	2%	14%	33%	36%
Univ. F	3%	5%	8%	3%	21%	28%	32%
Overall	5%	7%	8%	6%	15%	28%	30%
			Scenario 3: Synchronous Blended Model				
Univ. A	5%	8%	8%	8%	20%	28%	23%
Univ. B	4%	6%	8%	9%	16%	32%	26%
Univ. C	6%	7%	11%	7%	17%	28%	24%
Univ. D	1%	6%	11%	7%	16%	38%	21%
Univ. E	2%	6%	5%	8%	22%	30%	28%
Univ. F	1%	7%	10%	6%	17%	33%	27%
Overall	4%	7%	8%	8%	18%	30%	24%
			Scenario 4: Asynchronous Blended Model				
Univ. A	7%	7%	7%	9%	20%	25%	24%
Univ. B	6%	6%	9%	8%	18%	30%	22%
Univ. C	11%	7%	7%	7%	24%	20%	25%
Univ. D	2%	9%	10%	8%	16%	31%	24%
Univ. E	2%	5%	7%	8%	21%	25%	32%
Univ. F	1%	7%	8%	9%	16%	32%	28%
Overall	6%	7%	8%	8%	19%	27%	24%
			Scenario 5: Synchronous Online Model				
Univ. A	9%	7%	7%	8%	14%	21%	34%
Univ. B	18%	14%	11%	9%	14%	13%	21%
Univ. C	19%	11%	9%	11%	11%	16%	23%
Univ. D	21%	16%	12%	11%	18%	10%	12%
Univ. E	14%	11%	9%	6%	11%	23%	27%
Univ. F	14%	11%	10%	5%	10%	26%	24%
Overall	14%	10%	9%	9%	13%	18%	27%
			Scenario 6: Asynchronous Online Model				
Univ. A	9%	7%	7%	9%	16%	20%	32%
Univ. B	21%	14%	10%	9%	12%	14%	20%
Univ. C	19%	15%	10%	8%	14%	14%	21%
Univ. D	18%	15%	11%	12%	19%	14%	11%

Univ. E	15%	14%	11%	5%	18%	12%	25%
Univ. F	14%	15%	10%	4%	13%	21%	23%
Overall	15%	11%	9%	8%	15%	17%	25%

Note: *n* for University A, B, C, D, E and F were 977, 668, 238, 108, 132 and 196, respectively.

5.2 Student WTP for Learning Modality and On-Campus Experience Scenarios

Estimated coefficients and fit statistics for the mixed logit model are provided in Table 5. The estimated model coefficients are jointly significant, and the model had a McFadden Pseudo-R^2 of 0.73. With the exception of Scenario 6, the use of the mixed logit model was justified, given the significance of the standard deviations for all the random parameters indicating the presence of unobserved preference heterogeneity and individual specific effects. While not reported here, the covariances and correlations between the model parameters were all most all statistically significant ($p \leq 0.01$) indicating that the levels (scenarios) of the learning modality and campus experience attribute were correlated, as well as being correlated with the tuition attribute.[2] Correlations were higher between more similar scenarios. For example, the correlation between the coefficients for Scenarios 5 and 6 was 0.9. Individual school covariates in the parameter distributions had a statistically significant impact primarily for scenarios 1, 2, 5 and 6. Interestingly, for the mean marginal utility from each scenario, the average difference between in-state, out-of-state, and international students, is not statistically different. The only statistically significant effect of student type on the mean marginal utility was for out-of-state students in the synchronous online model (Scenario 5).

[2] Estimation results for the covariances and correlations between the parameters are available from the authors upon request.

Table 5. Student Enrollment Intention Mixed Logit Model Estimation Results

Coefficient	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Change in Tuition
Random Intercept	6.34**	2.70***	-0.169	-0.904	-6.49***	-6.83***	-0.261***
	(2.51)	(0.954)	(0.779)	(0.727)	(1.07)	(1.10)	(0.0213)
2 *University Binary Variables*[a]							
University A	-14.4***	-4.91***	-0.834	-0.358	5.75***	6.63***	---
	(3.86)	(1.07)	(0.828)	(0.763)	(1.08)	(1.14)	
University B	1.87	0.142	0.632	0.287	2.61**	2.92***	---
	(2.11)	(0.982)	(0.872)	(0.796)	(1.03)	(1.05)	
University C	3.40	-0.362	-0.363	-1.11	2.59**	3.76***	---
	(2.31)	(1.09)	(0.968)	(0.883)	(1.13)	(1.16)	
University E	-5.13*	-0.609	0.803	1.025	3.49***	6.25***	---
	(2.73)	(1.26)	(1.12)	(1.00)	(1.23)	(1.27)	
University F	-9.62***	-2.87**	0.477	0.942	4.76***	5.73***	---
	(2.96)	(1.14)	(1.01)	(0.909)	(1.24)	(1.23)	
Out-of-State	0.927	0.128	-0.0418	0.129	-0.955*	-0.747	0.0351
	(1.13)	(0.624)	(0.524)	(0.453)	(0.558)	(0.507)	(0.0275)
International	-0.831	-1.04	-0.864	-0.588	-1.09	-0.979	-0.0666
	(1.94)	(1.02)	(0.883)	(0.756)	(0.994)	(0.948)	(0.0478)
Standard Deviation of Random Intercept	14.7***	4.62***	4.28***	0.760***	2.53***	0.136	0.140***
	(3.37)	(0.661)	(0.531)	(0.241)	(0.563)	(0.525)	(0.0305)
Fit Statistics							
Log-Likelihood							-6422.5
χ^2 Test of Joint Significance of Coefficients (p-value)							35,421 (0.000)
McFadden Pseudo-R^2							0.73
N							12,402

Note: Scenario 1 is business-as-usual, Scenario 2 is the hybrid model, Scenario 3 is the synchronous blended model, Scenario 4 is the asynchronous blended model, Scenario 5 is the synchronous online model, and Scenario 6 is the asynchronous online model. Asymptotic standard errors are in parentheses. *,**,*** indicate statistical significance at the 10%, 5% and 1% levels of significance.

[a] University D served as the base or reference university and is captured by the random intercept term.

Another informative way to view the regression results and student preferences is to examine WTP for tuition during the Fall 2020 term. The mean of the WTP distributions across students by institution for each learning modality and campus experience scenario are reported in Table 6. These results demonstrate notable differences in the magnitudes of the mean WTP estimates across campuses for each scenario. Different circumstances warranted different approaches to campus reopening and course delivery format. In Scenario 1, business as usual, students at universities in the Midwest (B), Great Plains (D), and the western U.S.(C) indicated they were WTP a significant increase in tuition (24 to 37% for in-state students, 32 to 47% for out-of-state students, and 17 to 27%for international students) to be able to attend class in-person with no COVID-19 restrictions or precautions. In contrast, students at universities on the coasts (A and E), desired a reduction in tuition (13 to 31%for in-state, 10 to 31%for out-of-state, and 13 to 27% for international students) to return to campus under business-as-usual circumstances.

Students were often much more amenable to hybrid and blended model scenarios (2,3, and 4), with mean WTP estimates often 1/3 of the WTP estimates in Scenario 1, business-as-usual, or not being significantly different from zero. Again, there was a strong and different response across schools when examining the online model scenarios (5 and 6). Students at universities in the Midwest (B), Great Plains (D), and the western U.S. (C) required a decrease in tuition (12 to 27%for in-state students, 17 to 35 percent for out-of-state students, and 13 to 25% for international students) to intend to enroll, regardless if instruction was synchronous or asynchronous. Even students at the other universities (A, E and F) required a reduction in tuition to have a positive intention of enrolling for the Fall 2020 term. As mentioned earlier, many different factors may have impacted differences across universities, including COVID-19 incidence, politics, tuition revenue, budget constraints, amongst others (Felson and Adamcyzk,

2021; Mulholland, 2021). While the WTP estimates my seem high in some cases and not likely to be actually instituted (e.g. schools are highly unlikely to reduce tuition by as much as 30%), the WTP estimates do agree in magnitude with those found by Steimle et al. (2020). They found large WTP estimates (as a percent change in tuition as modeled here) for different modes of course delivery (e.g. -39 to 27% for a blended option).[3] For many of the WTP estimates though, they do fall into actual percent changes made by colleges and universities, which ranged from -15 to +5% (Douglas-Gabriel and Lumpkin, 2020).

[3] The WTP estimates in Steimle et al. (2020) are not directly comparable with ours, as their estimates are based on a latent class model and attributes are more separable than the approach utilized in this study.

Table 6. Willingness-to-Pay as a Percentage Change in Tuition for each Learning Modality and On-Campus Experience Scenario for Different Student Types

University	A	B	C	D	E	F
Scenario 1: Business-as-Usual						
In-State Students	-30.8***	31.5***	37.3***	24.3***	4.7	-12.6***
Out-of-State Students	-31.4***	40.5***	47.3***	32.2***	9.5	-10.4
International Students	-27.0***	22.5**	27.2***	16.8*	1.2	-12.5*
Scenario 2: Hybrid Model						
In-State Students	-8.5***	10.9***	9.0***	10.3***	8.0**	-0.6
Out-of-State Students	-9.2***	13.2***	10.9***	12.5**	9.8*	-0.2
International Students	-10.0***	5.5	4.0	5.1	3.2	-3.7
Scenario 3: Synchronous Blended Model						
In-State Students	-3.8***	1.8	-2.0	-0.6	2.4	1.2
Out-of-State Students	-4.6**	1.9	-2.5	-0.9	2.6	1.2
International Students	-5.7**	-1.2	-4.3	-3.2	-0.7	-1.7
Scenario 4: Asynchronous Blended Model						
In-State Students	-4.8***	-2.4*	-7.7***	-3.5	0.5	0.1
Out-of-State Students	-5.0**	-2.2	-8.3***	-3.4	1.1	0.7
International Students	-5.7**	-3.7	-7.9***	-4.6	-1.4	-1.7
Scenario 5: Synchronous Online Model						
In-State Students	-2.8**	-14.9***	-14.9***	-24.9***	-11.5***	-6.6**
Out-of-State Students	-7.5***	-21.4***	-21.5***	-32.9***	-17.5***	-11.9***
International Students	-5.6*	-15.2***	-15.2***	-23.1***	-12.5***	-8.6***
Scenario 6: Asynchronous Online Model						
In-State Students	-1.1	-15.4***	-12.1***	-26.5***	-2.6	-4.6*
Out-of-State Students	-4.6**	-21.0***	-17.3***	-34.9***	-6.3*	-8.6***
International Students	-3.9	-15.2***	-12.6***	-24.5***	-5.0	-6.6**

Note: *,**,*** indicate statistical significance at the 10%, 5% and 1% levels of significance. Asymptotic standard errors for WTP estimates are available from the authors upon request.

Figure 1 presents the WTP distributions by learning modality and campus experience scenario (level) for each University in our sample, while Figure 2 presents the WTP distributions by scenario for each university in the sample. The figures present the WTP distributions for in-state students, which were very similar to the results for out-of-state and international students. In addition, out-of-state and international student individual specific effects were not statistically significant in Table 5. The patterns in Table 6 are evidenced in the Figures. For example, when comparing University A on the west coast and University B in the Great Plains, the mass for the distributions for scenarios 1 and 2, which are two significant in-person modalities, were centered on the range of negative WTP values for University A, while the opposite is seen for University B. Another interesting trend in Figure 1, is that for all the universities, the WTP distribution for scenario 1, business-as-usual, was heavily bimodal. That is, it seemed that this scenario had the greatest division amongst students in-support or not in-support of this enrollment option, which likely arises due to many reasons, including COVID-19 health concerns, campus safety, risk to family, mental health, spring experience, amongst other reasons (Steimle et al., 2020; Thomas and Allen, 2021; Wrighton and Lawrence, 2020). In Figure 2, another interesting finding, is that the distance between the means of the WTP distributions between scenarios is the greatest for scenario 1, which illustrates the heterogeneity between the different schools seen in Table 5. The WTP distributions in Figure 2 also indicate that for some scenarios, particularly scenarios 3 and 4, differences across universities were not that great. The wide range of values for the WTP distributions is similar to WTP distributions for social/residential experiences and in-person modalities found by Aucejo et al. (2021). While other studies on enrollment intention at specific colleges or schools do find significant variation among student populations at the school, they do not capture the heterogeneity or differences across campuses, as illustrated in this study. The

findings here suggest that there is no one-size-fits all policy for tackling a significant shock like the COVID-19 pandemic.

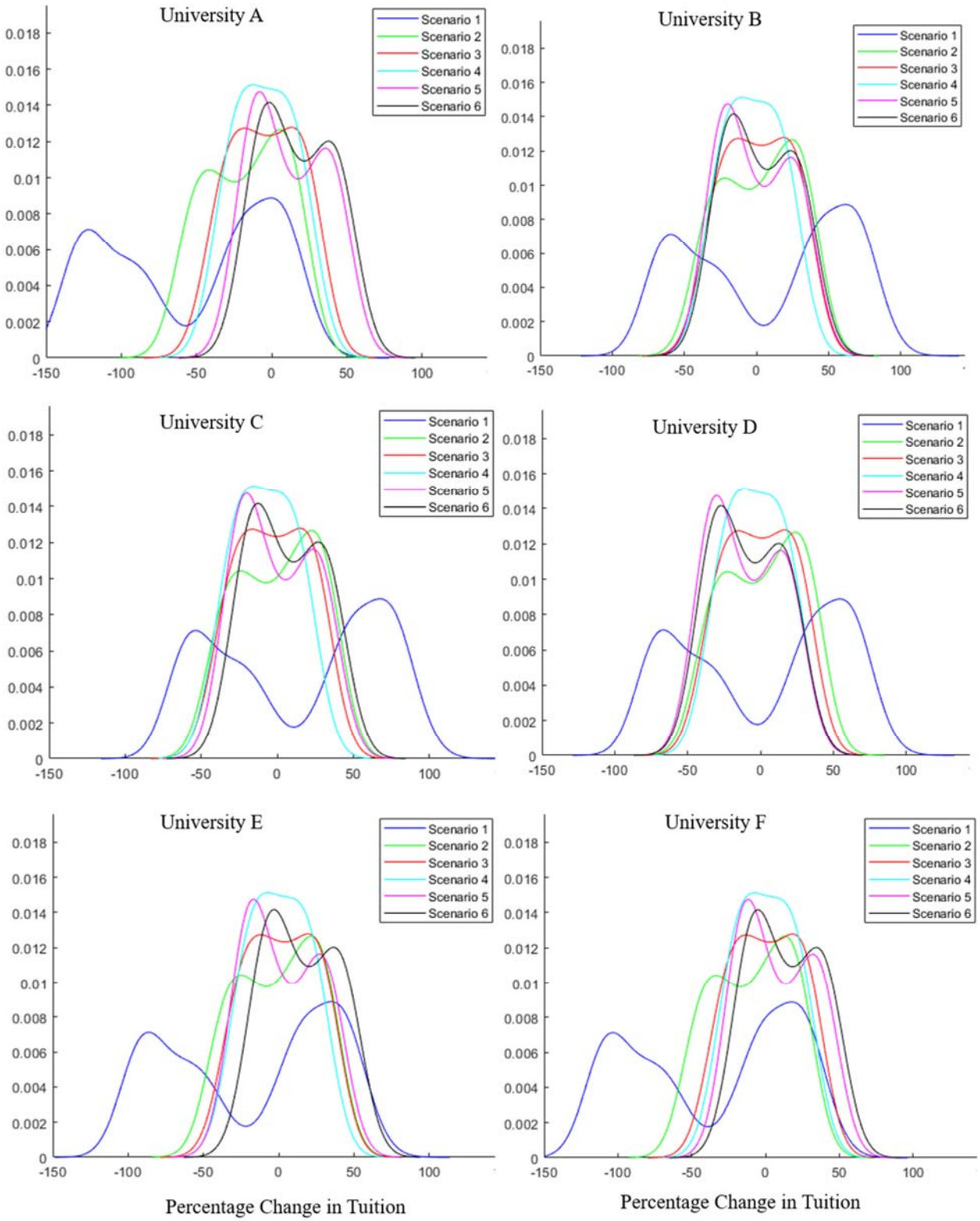

Figure 1. Willingness to Pay Distributions (as a percentage change in tuition) by Scenario for In-State Students in the College of Agriculture for Each University

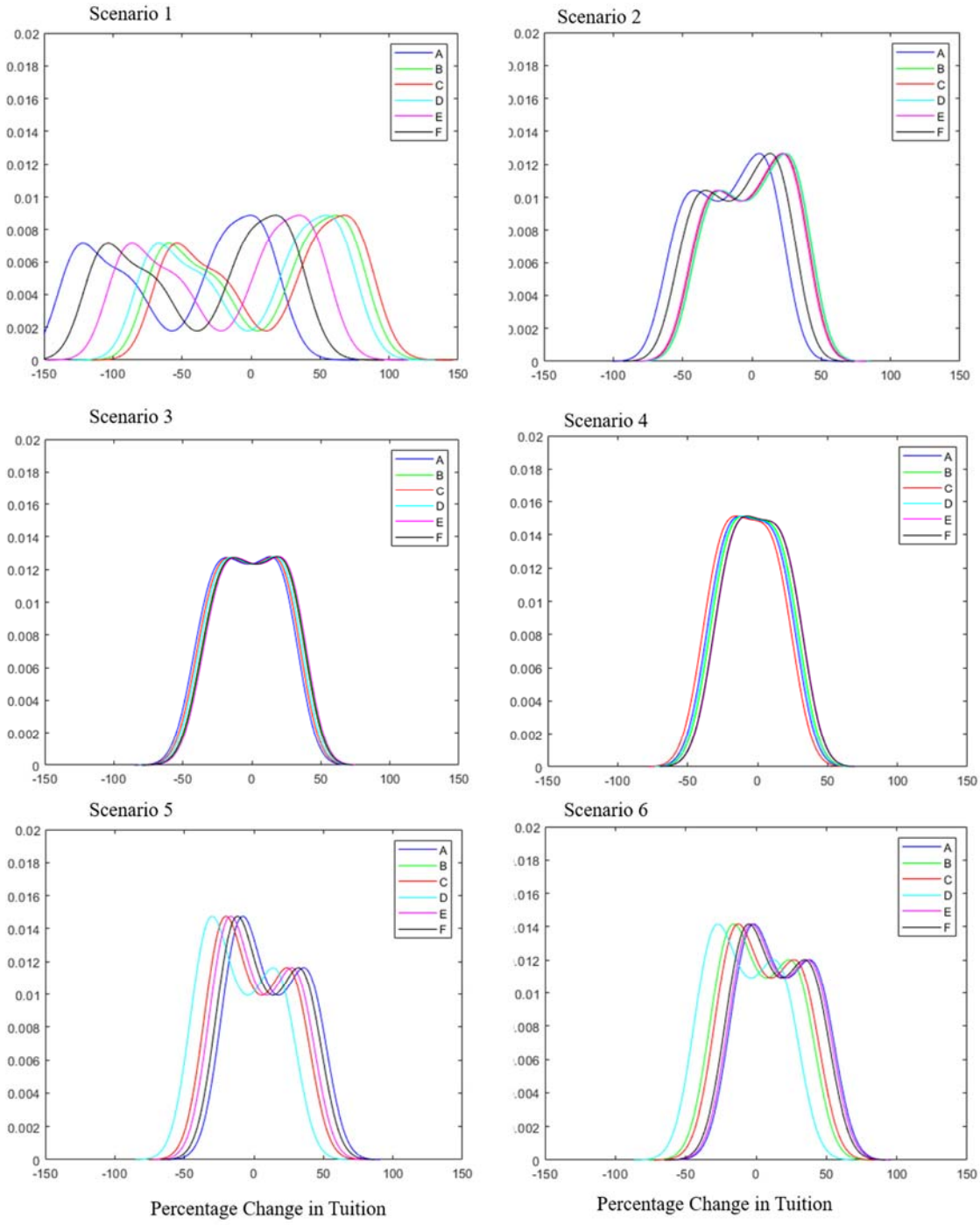

Figure 2. Willingness to Pay Distributions (as a percentage change in tuition) by University for In-State Students in the College of Agriculture for Each Enrollment Scenario

5.3 WTP for Synchronous versus Asynchronous Modalities.

Synchronous versus asynchronous learning modalities have resulted in mixed impacts on learning outcomes during the pandemic (Zeng and Wang, 2021). For the many students who prefer face-to-face interaction, the sudden switch to a remote, asynchronous learning was perceived to lower their learning outcomes and satisfaction (e.g. Khanal, 2021). Asynchronous learning modalities can provide more flexibility for students, while student interaction is greatly facilitated through synchronous learning modalities (Peterson et al., 2018; Petronzi and Petronzi, 2020). To examine students' preference for synchronous versus asynchronous learning modalities, we follow methods proposed by Aucejo et al. (2021). Given all students saw these scenarios, and WTP was randomly varied across student respondents, we are able to identify the WTP for a synchronous option by estimating the difference in mean WTP between the synchronous and asynchronous modalities. We have two cases in our study to examine: (1) preference for synchronous learning modality in a blended learning model (Scenario 3 – Scenario 4); and (2) preference for synchronous learning in an online learning model (Scenario 5 – Scenario 6). We estimated the differences in WTP to obtain estimates of the WTP for a synchronous learning modality for both cases using model estimates in NLOGIT 6. Results of this analysis are reported in Table 7.

From the WTP estimates for a synchronous learning modality option in Table 7, overall, it seems that students did not have a particular preference. There are some exceptions. In-state students at Universities A, B and C (on the west coast, Great Plains, and western U.S., respectively) were willing to pay for a synchronous learning modality option by as much as a 6% increase in tuition and fees if a blended learning model was adopted. This estimate is in line with the WTP for in-person instruction estimated by Aucejo et al. (2021) of 4.2%. In contrast, for

online learning, only in-state students at University E (in the southern U.S.) had a mean WTP significantly different from zero if an online learning model was adopted. Students at this university wanted a reduction in tuition by 10% to require synchronous learning modalities. While, not statistically significant, mean WTP estimates at Universities A, C and F were also more negative. It may be the case that, during the COVID-19 pandemic, students required and preferred the additional flexibility provided by asynchronous learning modalities with online education to be able to provide needed caregiving for family, work jobs, help on the farm, and other reasons (Lederer et al., 20201). A large survey of students around the world (5.8% from the U.S.), solicited through social media, by Nguyen et al. (2021) found that surveyed students preferred synchronous and in-person learning modalities due to increased social interaction, learning engagement and motivation. Students who were found to prefer asynchronous learning often indicated they chose this modality due to its flexibility.

Table 7. Willingness-to-Pay for Synchronous versus Asynchronous Learning Modalities and Having On-Campus Experiences

University	A	B	C	D	E	F
WTP for Synchronous Learning in a Blended Model (Scenario 3 – Scenario 4)						
In-State Students	1.6*	4.6***	6.0***	3.0	1.6	1.4
Out-of-State Students	-0.21	-1.3	-1.8	-0.71	-0.21	-0.13
International Students	0.043	-0.088	-0.15	-0.020	0.043	0.053
WTP for Synchronous Learning in an Online Model (Scenario 5 – Scenario 6)						
In-State Students	-1.3	-0.30	-3.2	0.27	-10.3***	-2.6
Out-of-State Students	1.1	0.74	1.8	-0.094	4.2	1.5
International Students	0.067	0.025	0.15	-0.012	0.46*	0.13
WTP for On-Campus Experiences (Scenario 1 – Scenario 5)						
In-State Students	-30.1***	56.8***	56.4***	56.5***	11.5	-6.3
Out-of-State Students	8.9	-21.6	-21.4	-22.1	-5.7	0.52
International Students	1.5***	-2.4***	-2.3***	-2.4***	-0.37	0.41

Note: *,**,*** indicate statistical significance at the 10%, 5% and 1% levels of significance. Asymptotic standard errors for WTP estimates are available from the authors upon request.

5.4 WTP for On-Campus Experiences

The on-campus and residential experience from attending college or university plays a significant influence in students' intentions to enroll (Aucejo et al., 2021; Delavande et al., 2020). Such experiences as living on campus, being part of Greek society, leadership opportunities, student government, amongst others, play a significant role in student's lives and decisions to attend a college or university (Dalavande et al., 2020; Jacob et al., 2018). Following Aucejo et al. (2021) we examine student's WTP for on-campus social experiences by examining the difference in WTP across two scenarios. The two scenarios are Scenario 1, business as usual, and Scenario 5, synchronous online model. While the difference in WTP between these two scenarios will not be completely due to on-campus experiences given the set-up of the choice experiment, we assume that a significant effect will indicate the possibility of the importance of on-campus experience given both scenarios have synchronous learning modalities and they compare situations where students either potentially get the full experience or no on-campus experiences at all due to a closed campus. We estimate the WTP for on-campus experiences using NLOGIT 6.

WTP estimates for on-campus experience by university and student type are provided in Table 7. For in-state students at University A, students required a decrease in tuition by 30% on average to have on-campus experiences. However, this may be due to the fact that early hot spots for COVID-19 occurred along the west coast and, on average, students where not willing to return back to campus. Thomas and Allen (2021) found that COVID-19 related worries for others played a statistically significant indirect role in enrollment intentions at a university in the Southern U.S. In contrast, WTP for on-campus experiences at Universities B, C, and D where all approximately 56%, indicating students were willing-to-pay a significant amount to retain or

keep their on-campus experiences in the Fall 2020 term. This result is much higher than a similar mean WTP for social experience of 8% by Aucejo et al. (2021). Interestingly, international students required a decrease in tuition by about 2.5 percent to have on-campus experiences, indicating a preference to avoid social interactions.

6. Discussion and Conclusion

A quickly expanding literature has examined the impact of COVID-19 on students. Among studies which have examined the impact of this pandemic on U.S. higher education, a majority are case studies focused on COVID-19 impacts on students enrolled at a single university or in a particular program or course. This study is one, among a small number of efforts to examine and compare the impact of COVID-19 across multiple, similar institutions - in this case 4-year public, land grant universities. Further, and importantly, invitations to participate in this study were widely distributed to the full population of students in each university's College of Agriculture, rather than convenience sampling (often through social media) used by many other studies. Our study examined undergraduate students' enrollment and attendance intentions for the Fall 2020 term during the COVID-19 pandemic under different learning modalities and campus experience scenarios using a choice experiment approach with a large sample. The study design offered a unique opportunity to examine not only enrollment decisions of agriculture students, but also to examine how these decisions vary by and within different campuses across the U.S.

Overall, results indicate that there was a large amount of uncertainty among the surveyed undergraduate students concerning their upcoming Fall enrollment – even only a few months prior to the semester starting. Results of our analysis finds that 57% to 73% of students

indicating they would at least by somewhat likely to take classes in the Fall 2020 term. The variance in this result is important. Further, these results also differ from findings of the few other studies which examined student post-pandemic enrollment plans. Aucejo et al. (2021) found that, on average, 75.7% to 89.7% of surveyed Arizona State University students intended to enroll and return to campus across different enrollment scenarios.

Taken together, the results of this study illustrate that there are significant differences in student enrollment preferences by learning modality and campus experience across universities. In interpreting these results, context, is important. The results indicate there was no "one size fits all" policy and that local circumstances mattered. Furthermore, our findings are not necessarily reflective only of potential differences in the relative risk aversion of students in these locations. Rather, the prevalence of COVID-19 cases in campus communities, the extent and nature of state restrictions, university information (signals) about reopening plans and policies, or other factors may instead have accounted for these finding. This issue has been further explored by Felson and Adamcyzk (2021), who find that regional differences played a significant role in college and university reopening plans.

At the other end of the spectrum, are students who have decided not to return to campus. In findings of the three scenarios reported in Table 4, which examined hybrid and blended learning modalities, 4 to 6% of students indicated that they would definitely *not* enroll in Fall 2020. As seen earlier, this learning modality was the most prevalent option adopted by colleges and universities in the U.S. Interestingly this result is consistent across universities and is very well-aligned with a separate ex-post analysis of actual Fall enrollment which found that, on average, it declined by 4.9% across colleges and universities (Causey et al., 2020). Thus, on average, it seems that stated student enrollment intentions may align to actual enrollment

behavior. Further analysis will be needed to evaluate whether this is true for the student populations examined herein.

While this study examined a variety of potential campus reopening plans and course delivery formats, with the Fall 2020 semester now completed, timing of this study offers an interesting opportunity to consider this study's findings relative to the actual reopening strategies adopted by campuses. The willingness to pay results are particularly instructive for this comparison. Here it was found that there was considerable heterogeneity in student preferences (WTP) for the considered instructional options. First, as observed earlier in this study, differences in the WTP distributions presented in Figures 1 and 2 indicate that there are significant differences in these preferences between different universities. Perhaps even more importantly, however, is the nature of the WTP distributions for each university (Figure 1). While for some scenarios, student Likert scale responses generally followed a normal distribution (e.g. Scenario 4 – Asynchronous Blended Model), other scenarios elicited a rather bimodal distribution of responses. Scenario 1, for example, explored student preference for campuses to return to normal operations; for most campuses, students were split, in several cases almost evenly, in their strong preferences to either return to normal operations, or not to return to normal operations.

As noted in Table 3, the participating campuses adopted a variety of reopening strategies. These approaches, however, are similar in that schools offered their students a variety of learning modalities, which generally consisted of online synchronous and asynchronous options and, for some schools, in-person options. Given the variance in students' course delivery preferences, the flexibility offered by universities was needed to improve the utility of students. Further, these results find that the reopening strategy adopted by each school is generally consistent with

student reopening preferences at that school. This finding – that the preferred enrollment scenarios at each school were aligned with final reopening strategies - indicate that universities made appropriate reopening decisions for their students. Importantly as well, these results emphasize that there was no "one size fits all" strategy which would have been acceptable or appropriate across all campuses. On this point as well, it seems that university administrators made the right decision in their efforts to tailor each campuses response to local circumstances and the preferences of their students. Indeed, it quite possible that university enrollment, revenue, and other impacts of COVID-19 may have been more adversely impacted should tailoring campus responses and the specific types of class modality flexibility developed on each campus not been offered.

Overall, findings of this study offer several important contributions to the literature and our understanding of short-term impacts of significant disturbances (e.g. COVID-19 pandemic, natural disasters) to education delivery and campus life at institutions of higher learning. First, in providing insight about student's enrollment intentions during a significant shock, provides higher education administrators useful and actionable information. For example, understanding student intentions and concerns can help university or college administrators better frame communications to address student concerns, and can help improve planning to help sustain enrollment and meet student needs (Bannister, 2021). Secondly, these results provide insight into undergraduate student willingness to make tradeoffs, and to pay for, features of campus life during times of disruption. In the context of the current pandemic, these insights into features of campus and residential experiences, and asynchronous relative to synchronous learning modalities are particularly relevant. Taken together, our findings provide insight into student's preferences for different enrollment and reopening options in the face of the COVID-19

pandemic, providing a unique, incentive compatible, approach that allows for examinations of tradeoffs and valuation between different learning modalities. Future research will continue to explore this issue by considering the effect of student demographic and health (mental, physical) characteristics, and student accommodation and other circumstances on their enrollment decisions.

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