The Influence of Peer Institutions on Colleges' Decisions: Evidence from Fall 2020 Reopening Plans

Riley K. Acton
Miami University

Emily E. Cook
Tulane University

Allison Luedtke
St. Olaf College

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Abstract

We study how colleges and universities influence each other's behavior in the context of fall reopening plans during the COVID-19 pandemic. By leveraging high-frequency data on colleges' reopening announcements and using a fixed-effects model to control for unobserved factors at the college and state-day levels, we provide evidence that colleges respond strongly to prior decisions made by their peer institutions. A 10 percentage point (pp) increase in the share of one's peers who have announced an in-person plan —roughly equivalent to 2 additional peers announcing in-person plans —increases the probability of doing so by 2.5pp. An equivalent increase in the share of one's peers who have announced an online decision increases the probability of doing so by 4.0pp. These effects are robust to a variety of specifications and definitions of peer institutions.

Keywords: Higher education, peer institutions, COVID-19

JEL Codes: I2, H4, L3

Riley K. Acton: Corresponding author. Department of Economics, Miami University. 800 E. High St., Oxford, OH 45056. actonr@miamioh.edu

Emily E. Cook: Department of Economics, Tulane University. 6823 St. Charles Avenue, New Orleans, LA 70118. ecook4@tulane.edu

Allison Luedtke: Department of Economics, St. Olaf College. 1520 St. Olaf Avenue, Northfield, MN 55057. luedtk2@stolaf.edu

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1 Introduction

Understanding the behavior of firms and organizations is a central area of interest across many subfields of economics. Within the economics of education literature, a recent line of inquiry investigates the strategic behavior of colleges and universities. The decisions made by these institutions can have important consequences for both student and societal outcomes, but most prior work only considers decisions that take place on an annual basis in predictable systems, such as admissions and financial aid policies. Colleges, like other types of organizations, must also make decisions in unpredictable and uncertain environments, such as the recent COVID-19 pandemic. Within this context, we provide some of the first evidence that peer institutions can influence colleges' behavior. Specifically, we document that colleges and universities responded to their peers' decisions to open in-person, online, or in a hybrid model for the fall 2020 semester.

Higher education leaders faced great uncertainty as they made these reopening decisions. It was unclear at the time to what extent in-person instruction would lead to the spread of the novel coronavirus among students and staff, as well as in the broader local community. In addition, it was unclear how students would respond to the announcement of different plans. While in-person instruction presented real, though uncertain, health risks, many institutions feared that the alternative of online instruction could limit student experiences and potentially reduce revenues both for the institution and for businesses in the local community.[1] The variation in choices reflects the difficulty of this decision; no alternative strictly dominated another for every college. Ultimately, 36% of four-year colleges opened primarily in-person, 27% chose a hybrid option, and 37% conducted the semester primarily online (Marsicano et al. 2020).[2]

Leading up to decision announcements, many colleges and universities reported that they were looking to the decisions of their peers for ideas and guidance. In April of 2020, an article in *The Daily Northwestern* presented the reopening plans of many of Northwestern's peers, pointing

[1] A recent working paper based on students at Arizona State University shows that students were willing to pay more for the in-person experience (Aucejo, French, and Zafar 2021).

[2] We know now that fall 2020 reopening decisions had meaningful implications for the spread of COVID-19 in their communities (Andersen et al. 2020), which leaves open the question of whether peer influence on colleges' reopening decisions would have a positive or negative effect on public health. One might think that the public health effects would be negative, because colleges were acting on incentives unrelated to local health conditions. However, if peers are a source of information, it could be that colleges' responses were better suited to deal with the public health crisis as a result of the information flow from peers. We do not take a stand on the public health effects in this paper.

out that Purdue and the University of Nebraska - Lincoln were planning to open in person, while Harvard and Michigan State University were planning a remote semester (Birenbaum 2020). By May, many institutions' decision-making documents explicitly stated that they were monitoring the decisions of peer institutions as they contemplated reopening plans (CU Boulder Planning Team 2020). As the summer continued, colleges continued to emphasize that they would look to their peers for best practices. For example, a July 2020 article in *The Daily Texan*, the student newspaper at the University of Texas at Austin, quoted the university's media relations manager as saying "UT-Austin looks closely at what peer institutions are doing for good ideas but does not specifically follow the plans of one university" (Zhang 2020).

In this paper, we quantify the responsiveness of colleges to their peers' decisions by leveraging two unique, rich datasets: (1) institution-by-day data on colleges' instruction mode decisions from the College Crisis Initiative at Davidson College, and (2) self-reported peer institutions from the National Center for Education Statistics' Integrated Postsecondary Education Data System (IPEDS). These data, combined with publicly available county-by-day COVID-19 death counts, allow us to pursue a fixed-effects strategy that controls for unobservable characteristics at both the state-by-day and institution levels. This method rules out potential sources of bias caused by differences across states over time, such as differences in the timing and intensity of shutdown policies, or differences in COVID-19 reporting or data collection. It also controls for political and demographic differences across states and counties, and differences in resources across colleges.

Our results indicate that peer institutions were influential in determining whether colleges reopened in-person, online, or in a hybrid model. A 10 percentage point (pp) increase in the share of one's peers who have announced an in-person reopening plan —which is roughly equivalent to 2 additional peers announcing in-person reopening plans —increases the probability of doing the same by 2.5pp. An equivalent increase in the share of one's peers who have announced an online reopening plan increases the probability of announcing an online plan by 4.0pp. We also find that colleges, particularly those that are small relative to their counties' populations, were more likely to reopen online when local COVID-19 deaths increased.[3] These findings are robust to alternative

[3]We note that our empirical strategy controls for unobservable factors at the state-by-day level and, thus, we are unable to draw conclusions about institutions' responsiveness to COVID-19 severity at the state or national level.

definitions of peer institutions, and a placebo test with randomly selected peers generates no effects on colleges' choices. The results are further supported by an instrumental variables specification in which we instrument for peer institutions' decisions with the severity of the COVID-19 pandemic in their respective counties.

Our finding that peer institutions' can influence colleges' behavior adds to a large body of empirical work on the role of peers and networks in economic decision-making. At the individual level, prior work has documented that peers can affect everything from financial decisions (Bursztyn et al. 2014), to educational achievement (Sacerdote 2011), productivity in the workplace (Mas and Moretti 2009), and the take-up of social programs (Dahl, Løken, and Mogstad 2014). At the firm or organization level, researchers have identified peer effects in a variety of decisions, including investments (Bustamante and Frésard 2021), stock splits (Kaustia and Rantala 2015), dividend payments (Grennan 2019), corporate governance (Foroughi et al. 2021), social responsibility practices (Cao, Liang, and Zhan 2019), and IPOs (Aghamolla and Thakor 2021). However, there is little work on the effect of peers among and social and educational institutions, such as the colleges and universities we study in this paper. The only paper on the topic of which we are aware is Luedtke and Urban (2021), which aligns with our work and finds that high schools add financial education programs in response to their peers doing so.

We also contribute to a growing literature on the market structure of U.S. higher education and the behavior of colleges, which primarily studies colleges' decisions that occur before enrollment is realized for a given year (Epple, Romano, and Sieg 2006; Fu 2014; Epple et al. 2019). For example, financial aid and admission policies affect admission and aid offers to students, which then affect student enrollment behavior. Our setting is different. In most cases, institutions required students to accept offers of admission and pay their enrollment deposits by June 1, 2020 (Dickler 2020), but 89.5% of colleges in our sample waited until after this date to announce reopening decisions. Thus, four-year colleges generally were not competing for current-year enrollment by choice of instruction mode, as the enrollment deadline had passed.[4]

A large part of the uncertainty facing colleges surrounded the degree to which college-level

[4]However, students could still choose not to attend any institution in fall 2020.

decisions would affect community-level public health outcomes. In the months leading up to the fall semester, college leaders often cited concerns about COVID-19 spread in the local community and ensured constituents that they were "prioritizing metrics related to physical health and safety" (Turk and Ramos 2020). Emerging research confirms these concerns. For example, Mangrum and Niekamp (2020) show that colleges that brought students back to their campuses following spring breaks in early March 2020 experienced higher rates of COVID-19 cases in their county, compared to colleges with later spring breaks who instructed students not to return. Directly relevant to the reopening decisions we study in this paper, Andersen et al. (2020) show that colleges that opened in-person increased local COVID-19 incidence by 0.024 cases per 1,000 residents, while colleges that opened online did not increase the spread of the virus. Given this link between colleges' decisions and local public health outcomes, it is important to understand why some colleges opened in-person while others did not.

Other researchers have examined institution and community factors that predicted colleges' reopening decisions, with a particular focus on the political environments in which they operate. Collier et al. (2020) find that institutions in Republican-led states were more likely to postpone decisions and ultimately open in-person. Felson and Adamczyk (2021) similarly report that institutions located in cities and states with a high Republican vote share in 2016 were more likely to reopen in-person, while Collier et al. (2021) show that a variety of state and county sociopolitical measures influenced institutions' decisions more than the severity of the pandemic. Whatley and Castiello-Gutiérrez (2021) further find that private institutions with a high share of international students were more likely to reopen in-person following an early July policy decision from the U.S. Citizenship and Immigration Services that required that international students enroll in face-to-face classes to maintain their student visas.[5] We build on this prior work by abstracting away from institution differences to shed light on why institutions located in similar communities or sharing similar characteristics may make markedly different decisions depending on the prior decisions made by their peers.

[5]We note that this policy was quickly reversed. However, it appeared to still affect the reopening decisions of institutions that are dependent on tuition revenue from international students.

2 Data

Our analysis combines daily data on college reopening decisions and county-level COVID-19 deaths. We also incorporate data on institution-level characteristics, enrollment patterns, and self-reported peers from IPEDS to support multiple definitions of peer institutions.

2.1 College Reopening Decisions

The College Crisis Initiative (C2i) at Davidson College provided us with a detailed, institution-by-day dataset on colleges' reopening plans (Marsicano et al. 2020). To build this dataset, a team of researchers at C2i continuously scraped colleges' reopening websites and announcements, and then categorized colleges' announced instruction modes based on the degree to which they indicated they would operate in-person or online. For our purposes, we focus on three categories of reopening decisions: primarily in-person, primarily online, or hybrid.[6] We define a college's reopening decision as the decision that dictated how they began the fall semester and the decision date as the date on which this decision was first communicated on their website.[7] We limit our analysis to four-year public and private non-profit institutions, as community colleges and four-year for-profit institutions likely faced very different decision environments and incentives.[8] We also exclude any institution that announced a decision prior to April 1st of 2020 or did not announce a reopening decision by August 31, 2020.

Table 1 describes patterns of final reopening decisions of the 1,247 four-year institutions in our sample by institutional control, basic Carnegie classification, geographic region, terciles of selectivity based on average ACT scores, and terciles of endowment per student.[9] Overall, 36% of four-year colleges opened primarily in-person, 27% chose a hybrid option, and 37% conducted the semester primarily online. Private institutions were more likely than public institutions to

[6] Our in-person definition includes institutions that reported they were operating fully or primarily in-person, while our online definition includes institutions operating online (regardless of whether any students were residing on-campus). Our hybrid definition includes all other reopening plans, including those that left instructional mode decisions to individual instructors or offered a variety of instructional modes. While the extent to which on-campus activities actually occurred in the fall 2020 semester likely varies within these categories (Huntington-Klein 2021), we believe they are the most relevant groupings for understanding peer institutions' decisions.

[7] 91.5% of institutions in our sample only made one decision prior to the start of the fall 2020 semester.

[8] Four-year for-profit institutions enroll only about 3% of recent high school graduates. Community colleges typically do not have on-campus housing, so they faced different trade-offs during the COVID-19 pandemic.

[9] The Carnegie classification system classifies colleges based on programs offered at different levels. We drop any institutions that do not fall into the bachelor's, master's, or doctoral definitions in the Carnegie classification system, such as art institutes.

Table 1: Descriptive Statistics on Colleges' Fall 2020 Reopening Decisions

	Obs.	Share In-Person	Share Hybrid	Share Online
All	1247	0.359	0.273	0.368
Control: Public	482	0.268	0.284	0.448
Control: Private	765	0.417	0.265	0.318
Carnegie: Bachelor's	464	0.425	0.282	0.293
Carnegie: Master's	535	0.355	0.254	0.391
Carnegie: Doctoral	248	0.246	0.294	0.460
Region: Northeast	324	0.256	0.343	0.401
Region: Midwest	319	0.470	0.248	0.282
Region: South	431	0.427	0.274	0.299
Region: West	173	0.179	0.185	0.636
Selectivity: Low	351	0.402	0.293	0.305
Selectivity: Middle	370	0.378	0.270	0.351
Selectivity: High	295	0.312	0.278	0.410
Missing Selectivity	231	0.325	0.238	0.437
Endowment: Low	404	0.307	0.267	0.426
Endowment: Middle	404	0.438	0.235	0.327
Endowment: High	404	0.354	0.285	0.361
Missing Endowment	35	0.114	0.629	0.257

Note: This table describes the final reopening decisions of four-year institutions in our sample. We define selectivity terciles based on institutions' average ACT scores in 2017-18, and endowment terciles based on their endowment per student in 2017-18.

reopen in-person, as were those that focus on bachelor's-level education (as opposed to master's or doctoral institutions). Institutions in the West and Northeast were less likely than institutions in the Midwest and South to reopen in person, which corresponds with the severity of COVID-19 by region in the early stages of the pandemic, as well as different political climates. Less selective institutions were more likely to reopen in person than institutions of a higher selectivity classification, while institutions at both the low and high ends of the endowment distribution were more likely to reopen in person than those in the middle.

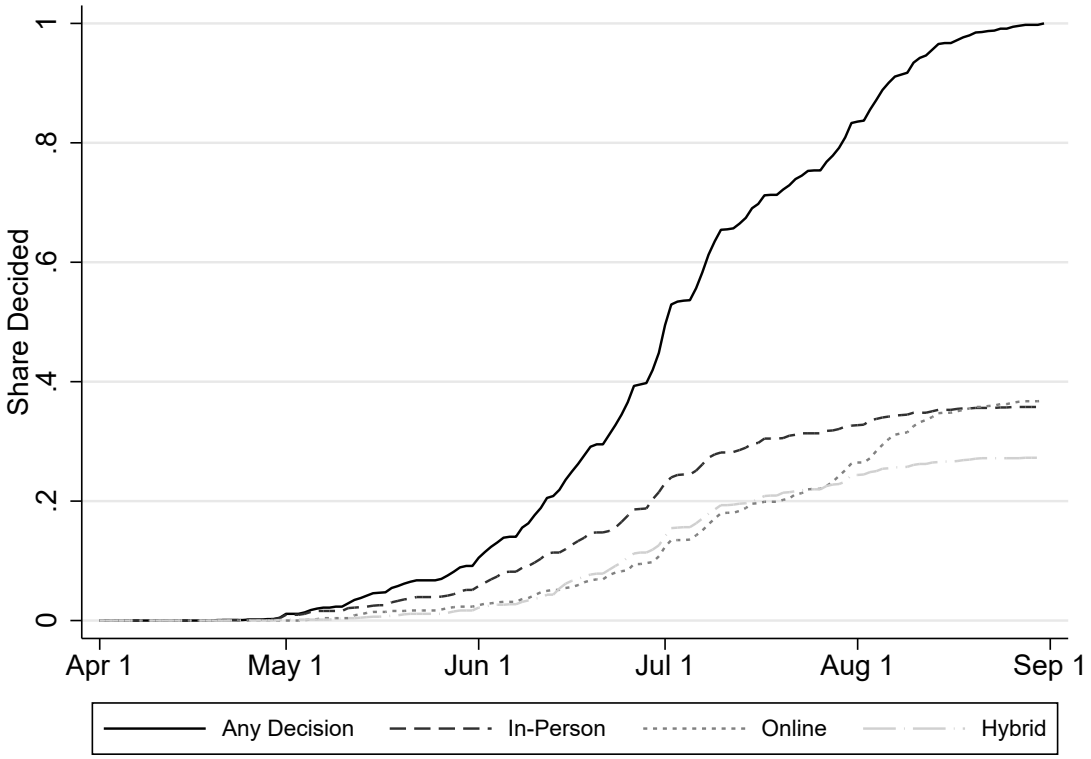
These differences in reopening plans across institution type and location suggest that local

COVID-19 severity and the centrality of the undergraduate residential experience at each institution factored into reopening decisions. While differences across institutions are interesting in their own right, we control for these fixed differences at the institution level when we quantify the role of peers and county-level COVID-19 severity on institutional reopening decisions. This fixed-effects analysis is only possible because the C2i data was collected daily, allowing for the comparison of decisions over time.

Figure 1 plots when institutions announced reopening decisions over the time period of our sample: April 1, 2020, to August 31, 2020. By fall 2020, all institutions had to make a decision, but there is substantial variation in *when* institutions made decisions, with many institutions delaying until late summer. By June 1st, only 10.5% of institutions had announced a decision. By July 1st, 49.5% had announced a decision, and by August 1st, 84% had announced a decision. Conditional on making an announcement, institutions that announced later were more likely to announce an online or hybrid reopening plan, and less likely to announce an in-person reopening plan.

This variation in decision timing persists even among public institutions located in the same state, who may have been subject to centralized decision-making by state boards of education or may have been responding to the same public health policies. A simple regression of decision dates on state fixed effects indicates that state-specific unobservables explain only 23.9% of the variation in decision dates among public colleges and universities (and only 14.8% of the variation among private institutions). In Appendix Figure A.1, we plot histograms of the decision dates of public institutions in the 25 states with the most public institutions. In many states, such as Georgia, North Carolina, and Virginia, decisions occurred steadily throughout the summer. In others, such as Pennsylvania and New York, there are some "spikes" where multiple public institutions announced decisions on the same day. In Section 4.2, we show that our main results are robust to excluding institutions who made decisions during these spikes, excluding all public institutions in states that had spikes, or excluding all public institutions.

Figure 1: Colleges' Reopening Decisions Between March and September 2020



Note: This figure depicts the proportion of institutions that had made a reopening decision across time, indicating that most institutions waited until late in the summer to make a decision.

2.2 Local COVID-19 Severity

While the primary interest of our analysis is the effect of peer decisions on colleges' reopening plans, we also investigate whether colleges responded directly to local COVID-19 severity. Data on county-level deaths from the New York Times forms the basis of our COVID-19 severity measurements.[10] Our preferred measure of local severity is the cumulative number of COVID-19 deaths per capita, which is less likely than other measures (such as hospitalizations or positive tests) to be affected by local policies surrounding testing or hospitalization rules, including increases in testing related to colleges' reopening decisions.[11]

[10] In the New York Times COVID-19 data, several geographic areas were aggregated. The largest of these aggregated areas is New York City, which includes New York, Kings, Queens, Bronx, and Richmond counties. For these counties, we used information from the New York City Department of Health and Mental Hygiene to obtain disaggregated counts. We aggregate two other areas to be consistent across our data sources: Kansas City, MO (including all of Cass, Clay, Jackson, and Platte counties), and Joplin, MO (Joplin, Jasper, and Newton counties).

[11] We verify that, in our sample of college counties, the New York Times data are nearly identical to daily death data available from Johns Hopkins University and USAFacts.

Appendix Figure A.2 summarizes county-level COVID-19 deaths per capita for the colleges in our sample. It shows the average per-capita deaths and the standard deviation of deaths, along with the proportion of colleges located in counties with zero deaths over time. By the end of the summer, cumulative deaths approached 4 per 10,000 people on average in the counties that surround college campuses. Few counties had zero deaths, even at the start of the summer. By May 1, just over 20% of colleges were located in counties that had zero deaths.

3 Empirical Strategy

The first step in our analysis is to identify a college's peer institutions —the set of institutions each college is likely to look to for precedent. There is no one clear way to define peers, so we present and incorporate into our analysis several different measures.

3.1 Classification of Peer Institutions

There are many different classification systems and rankings that can be used to determine which institutions are most similar to each other, but perhaps none are as informative as who institutions state are their peers. We obtain self-reported peer information through C2i's partnership with *The Chronicle of Higher Education*. As part of the IPEDS reporting process (which all institutions that participate in federal financial aid programs must complete each year), institutions may select a set of peer institutions to use as comparisons in customized reports from IPEDS.[12] This set of colleges is referred to as an institution's "peers" or "comparison group" in the reporting system and related documentation. If an institution does not select its own peers, the system automatically generates a list of peer institutions based on similarity of measures such as institution level and control, Carnegie classification, and enrollment. In 2012, *The Chronicle* obtained and analyzed these self-reported peer selections, and later provided the complete network of peers to C2i (Fuller and O'Leary 2012). Our preferred classification of peers is to use an institution's self-selected

[12]These customized Data Feedback Reports show graphs and statistics comparing the institution to its peer group, and "are intended to provide institutions a context for examining the data they submitted to IPEDS. [The report author's] goal is to produce a report that is useful to institutional executives and that may help improve the quality and comparability of IPEDS data" (Institute of Education Sciences 2013). Since these feedback reports are used to inform institutional strategy, institutions are incentivized to pick only the institutions that they truly consider peers. Adding less relevant institutions would make the peer group aggregate statistics less informative.

peers when available, and the IPEDS default comparison group otherwise.[13]

Appendix Table A.1 summarizes the number and characteristics of institutions' peers using this definition. Across our sample of 1,247 colleges, an institution both lists and is listed as a peer 21.24 times on average. The number of peers listed by institutions is relatively stable across different types of institutions, with all of the group-specific averages falling between 20 and 23.2. In addition, the number of times an institution is listed as a peer does not vary much across control types, Carnegie classifications, or regions. However, there is variation in the number of times an institution is listed as a peer depending on its selectivity and endowment level. Colleges in the highest tercile of selectivity are named as a peer an average of 26.8 times, as opposed to colleges in the lowest tercile of selectivity, which are named as a peer an average of 18.5 times. Similarly, colleges in the highest tercile of endowment size are named as a peer an average of 25.2 times, whereas colleges in the lowest tercile of endowment size are named as a peer an average of 18.7 times.

In general, institutions list peers within the same control and Carnegie classification as their own: on average, 97% of peers listed by an institution share their same control and 82% share their same Carnegie classification. Geographic ties between an institution and its peers are much weaker. On average, only 1.5% of peers listed by an institution are located within their same county, while 17% are located in the same state, and 52% are in the same broad geographic region (Northeast, Widwest, South, or West). There is also variation in the selectivity and resources of institutions' listed peers. On average, 44% of peers fall within the same selectivity tercile as an institution, while 55% fall within the same endowment tercile.

While we believe that these self-reported peers best capture the set of institutions colleges would have been observing and responding to during the COVID-19 pandemic, we also construct several other classifications of peers to test the robustness of our results. We do so by separating institutions into 24 subgroups based on their control (public vs. private), basic Carnegie classification, and region, and define all institutions within a group as each other's peers. This definition captures

[13] We note that the 2012 automatically generated groups are not publicly available in IPEDS, so we use the 2013 automatically generated groups for institutions that did not self-report peer institutions in the 2012 data obtained from *The Chronicle*. In addition, it is possible that institutions non-randomly select in to providing self-selected peers, so we complement this definition with several alternative measures that we explain in this subsection.

institutions that offer similar types of education in the same area of the country, such as private, bachelor's level institutions in the Northeast. We then narrow this definition in three ways. First, we use the U.S. Census Bureau's "division" geographic definition (rather than region) to allow for a higher level of geographic granularity. For example, this definition separates institutions in the Northeast into those in New England and those in the Mid-Atlantic. Second, we divide the subgroups based on terciles of their selectivity to capture institutions in the same region, Carnegie classification, and control that enroll similar students. Finally, we divide the subgroups based on terciles of their endowment per student to restrict institutions' responses to other institutions with similar resources.[14]

Appendix Table A.2 presents summary statistics on the number and characteristics of peers under these constructed peer groups. While our first definition at the region, Carnegie, and control level produces large peer groups (74.5 peers, on average), the subsequent definitions where we narrow groups based on geography, selectivity, or endowment levels produce similarly sized peer groups to the number of peers that institutions list in IPEDS. On average, these groups range in size from 25 to 35 peers. Moreover, they produce similar geographic, selectivity, and endowment variation to the self-reported peers, with relatively few peers located in the same county or state as an institution.

3.2 Regression Framework

To understand the effects of prior peer decisions on colleges' reopening decisions, we estimate regressions of the following form:

$$\text{Decision}_{icst} = \alpha + \beta \mathbf{PeerShare}_{ics,t-1} + \gamma \text{COVID}_{cst} + \theta_i + \lambda_{st} + \varepsilon_{icst} \tag{1}$$

where Decision_{icst} is a binary variable indicating whether college i, in county c and state s, has made a certain reopening decision by date t.[15] Across our specifications, we consider four mutually exclusive outcomes: (1) a college has not yet announced a reopening decision, (2) a college

[14] For both the selectivity and endowment definitions, we drop institutions that do not report average ACT scores or endowments, respectively.

[15] In Appendix B, we consider survival analysis models instead of linear regressions and find results that are broadly similar to our findings from this specification.

has announced an in-person reopening decision, (3) a college has announced an online reopening decision, and (4) a college has announced a hybrid reopening decision. We consider how the probability of these outcomes is influenced by the share of one's peers who have made corresponding decisions by the prior day, which is expressed as the $\mathbf{PeerShare}_{ics,t-1}$ vector.[16] We lag these measures by one day to avoid any simultaneous, unobserved shocks that may affect both a college and its peers on the same day (e.g., an athletic conference's decision regarding fall sports).[17] Depending on the specification, we consider either the share of college i's peers that have made any decision, or separately, the share that have made in-person, online, and hybrid decisions.

COVID_{cst} is the cumulative number of COVID-19 deaths, per 10,000 residents, that have occurred in county c by date t. In additional specifications, we interact this measure with county-level population density to observe the effect of COVID-19 deaths per square mile on institutions' decisions. θ_i is an institution fixed effect that captures any characteristics of a college that do not vary over time, such as their size, selectivity, control (public vs. private), and local political environment. λ_{st} is a vector of state-by-day fixed effects that capture any characteristics of states that vary across the time frame of our data, including COVID-19 severity and state reopening policies. Throughout the analysis, we cluster standard errors at the county level to account for correlation in the ε term within a county, over time.[18]

Because our specification includes institution fixed effects, the β and γ coefficients summarize institutions' responsiveness *to changes* in their peers' decisions and their county's cumulative number of COVID-19 deaths per capita. That is, the coefficients capture the effects of new decisions made by an institutions' peers and new COVID-19 deaths. In addition, the state-by-day fixed effects account for any state and national trends in other colleges' decisions over time. As such, the β coefficients provide the effect of peers' decisions *above and beyond* any response to general trends in the higher education market. If colleges respond similarly to all other institutions' deci-

[16] Our preferred specification uses a peer share measure to standardize effects across institutions that list different numbers of peers and across peer definitions that vary in the average number of peers. However, in Appendix Table A.3, we show that our results are qualitatively similar if we use peer counts instead: as more peers announce in-person or online decisions, institutions are more likely to do the same. In Appendix Figure A.3, we further show that our effects using the share measure are similar across institutions with different numbers of peers.

[17] In Appendix Figure A.4, we show that our results are robust to lagging decisions by one week or two weeks (instead of one day), or aggregating the data at the weekly level rather than the daily level. In Appendix Figure A.5, we further show that the results are similar if we estimate logit and probit specifications using the weekly data.

[18] We aggregate the counties that are aggregated in the New York Times COVID data into the same cluster. There are 717 unique counties and 716 unique clusters in our sample. 70% of institutions are located in a county with three or fewer institutions. Nevertheless, in Appendix Figure A.6 we show that our results are robust to dropping counties with ten or more, five or more, or two or more institutions.

sions, or only respond to the total number of colleges that have announced a particular decision, these coefficients will equal zero. Similarly, the γ coefficient identifies the effect of local COVID-19 severity *above and beyond* state and national trends in COVID-19 severity and will equal zero if colleges respond only to state or national trends regarding the pandemic, rather than the specific public health situation of their county.

In order for the β coefficient to represent the causal effect of peers decisions' on a college's decision, it must be the case that there are no unobserved, time-varying factors at either the college or peer group level that affect the decisions of both an institution and its peers.[19] Given that peer institutions are likely to share a number of characteristics, this assumption could be threatened if public policies or the changing public health landscape throughout the summer altered the likelihood that certain types of institutions (e.g., public vs. private, small vs. large) decided to reopen in a particular way. As such, in Section 5, we present additional specifications that allow the day fixed effects to vary not only by state, but also by control, by Carnegie classification, and by size quartile. We also estimate specifications that interact linear time trends with peer group definitions and employ an instrumental variables approach that predicts peers' decisions based on the COVID-19 severity in their counties. These specifications all produce similar results, bolstering our interpretation of the coefficients as the effects of peer institutions on colleges' reopening plans.

4 Results

The results from the regression framework described above are broadly consistent with two findings. First, colleges followed their peers when making reopening decisions. The share of peers making any decision as of yesterday increased the likelihood an institution would make a decision today. Conditional on making a decision, an increase in the share of peers going online increased the likelihood that an institution would go online, and similarly for in-person decisions. Second, colleges, especially those that are small relative to their counties' populations, were more likely to reopen online when local COVID-19 deaths increased.

[19] Throughout our analysis, we remain agnostic about the potential channels through which colleges' decisions affect the decisions of their peers and acknowledge that direct communication or coordination between peer institutions could be an unobserved mechanism driving our results.

4.1 Main Effects

Table 2 presents our main estimates of equation (1). In Panel A, we separately regress the four binary, mutually exclusive outcomes of interest on the share of one's peers that have made any reopening decision by the prior day and county-level COVID-19 deaths per capita, along with the fixed effects outlined in equation (1). Column (1) shows that a 10pp increase in the share of one's peers who have announced a reopening decision —equivalent to about two more peers announcing decisions given the average number (21) of peers listed —decreases the likelihood that an institution has not yet made a reopening decision by 2.1pp. That is, as more peers make a decision, an institution is more likely to do so as well. Moving across the columns, we see that this effect is predominantly driven by an increase in institutions making an online reopening decision: a 10pp increase in the share of one's peers who have made a decision increases the probability of announcing an online decision by 1.5pp and the effect is statistically significant at the 1% level. The effects on in-person and hybrid decisions are 0.28pp and 0.27pp, respectively, and neither is statistically significant at conventional levels.

The coefficients on our COVID-19 death rate measure in the second row of Panel A indicate that, on average, local COVID-19 severity did not meaningfully affect the timing of institutions' reopening announcements, nor the probability that they announced an in-person reopening plan. Increases in local COVID-19 deaths per capita did, however, induce institutions to announce online reopenings rather than hybrid ones. Specifically, an additional death per 10,000 residents decreases the likelihood of a hybrid announcement by 1.1pp and increases the likelihood of an online announcement by 1.0pp.

In Appendix Table A.4, however, we show that these average effects mask important heterogeneity. In particular, colleges' responses to local COVID-19 deaths vary based on how large they are relative to their surrounding communities. We create measures of a college's relative size by dividing their 2017-18 total enrollment by their county's population. We then interact this measure, linearly in Panel A and as a quadratic in Panel B, with the county's cumulative COVID-19 deaths per capita. In both specifications, we find that colleges that are small relative to their county are less likely to announce an in-person or hybrid reopening plan, and more likely to announce an

Table 2: Effects of Prior Peer Decisions on Colleges' Reopening Decisions

	Not Yet Decided (1)	Decided In-Person (2)	Decided Online (3)	Decided Hybrid (4)
Panel A. Share of peers who have made any decision				
Share decided, t-1	-0.205***	0.028	0.150***	0.027
	(0.055)	(0.039)	(0.040)	(0.037)
County deaths per 10,000	0.004	-0.004	0.010***	-0.011***
	(0.003)	(0.004)	(0.003)	(0.003)
Observations	189,544	189,544	189,544	189,544
Panel B. Share of peers who have made each decision				
Share decided in-person, t-1	-0.205***	0.251***	0.004	-0.050
	(0.063)	(0.062)	(0.054)	(0.060)
Share decided online, t-1	-0.222***	-0.220***	0.401***	0.041
	(0.063)	(0.055)	(0.056)	(0.056)
Share decided hybrid, t-1	-0.184***	0.005	0.091	0.088
	(0.065)	(0.075)	(0.072)	(0.074)
County deaths per 10,000	0.004	-0.003	0.010***	-0.011***
	(0.003)	(0.004)	(0.003)	(0.003)
Observations	189,544	189,544	189,544	189,544

Note: This table presents the main estimates of equation (1): the effect of peers' announced decisions and county-level COVID-19 deaths on individual institutions' decisions. Panel A describes the effect of peers making any decision and Panel B describes the effect of each type of decision. Column 1 describes the effects on the likelihood of an institution having not yet made an announcement. Columns 2 - 4 describe the effects on the likelihood of an institution announcing each of the three types of reopening styles. In all specifications, we control for institution and state-by-day fixed effects and cluster standard errors at the county level.$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

online reopening plan, when COVID-19 deaths increase. This response dissipates for colleges that are large relative to their county, indicating that these institutions may have faced other pressures to open in-person, such as maintaining local employment opportunities.

In Panel B of Table 2, we disaggregate our peer measure by the the types of decisions one's peers have made. Column (1) shows that an increase in the share of one's peers making in-person, online, or hybrid decisions increases the likelihood that an institution has made a decision by similar amounts. A 10pp increase in the share of one's peers making any one of these decisions increases the probability of making a decision by 1.8-2.2pp. The types of decisions institutions

make, however, are highly dependent on what decisions their peers have made. A 10pp increase in the share of peers who have made an in-person decision increases the probability of doing so by 2.5pp, with little detectable effect on the likelihood of announcing an online or hybrid decision. Meanwhile, a 10pp increase in the share of one's peers who have announced an online decision reduces the probability of announcing an in-person decision by 2.2pp and increases the probability of announcing an online decision by 4.0pp.[20] The effect of an increase in peers announcing hybrid decisions is distributed across the different reopening plans and none are statistically significant. This finding is not surprising since hybrid plans can vary substantially and may not provide useful information to peer institutions still planning for the fall 2020 semester. The final row of Table 2 again shows that, on average, local COVID-19 deaths rates had little effect on announcement timing nor the probability of an in-person announcement, but had a modest effect on the decision to announce an online reopening plan rather than a hybrid one.

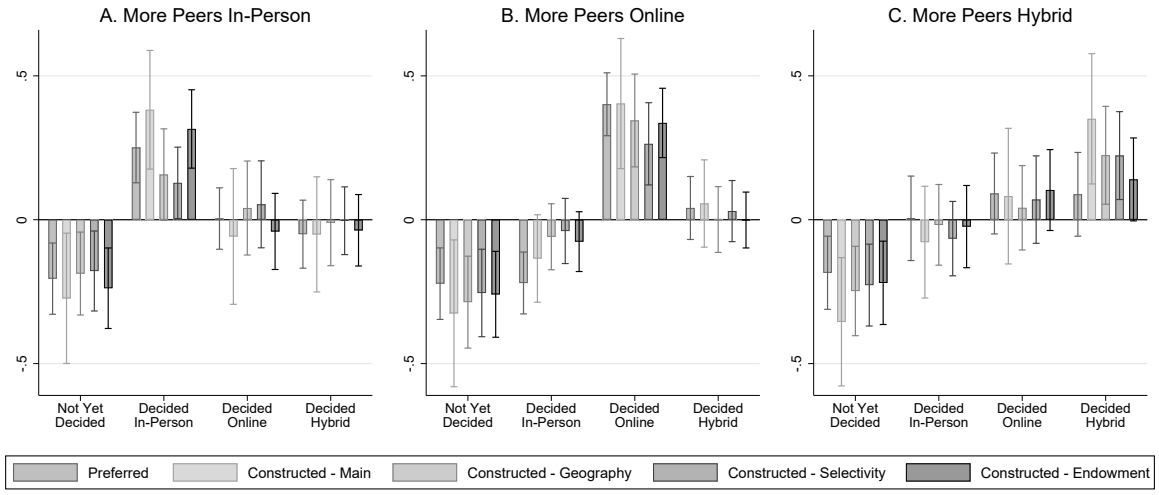
4.2 Alternative Peer Definitions & Heterogeneous Effects

We next explore whether our results vary across different definitions of peer institutions and different types of institutions. First, in Figure 2, we show the estimated coefficients and confidence intervals for the peer definitions discussed in subsection 3.1. Panel A presents the effect of more peers announcing in-person decisions, while Panel B and C show effects for increases in online and hybrid decisions, respectively. In general, our estimated effects are quite similar across peer definitions. As more peers announce in-person decisions, institutions are induced to make in-person decisions. As more announce online decisions, institutions are more likely to announce online decisions and somewhat less likely to announce in-person decisions. The hybrid results remain noisy, although there is a statistically significant increase in the probability of announcing a hybrid decision when using our constructed peer measure based on region, Carnegie classification, and control, and when narrowing it by geography and selectivity.

Figure 3 then repeats our main analysis using sub-samples of the data to show how the estimated

[20] While the point estimate for the influence of peers' online decisions on the probability that a college will announce an online decision is larger than that for the analogous in-person effect, we note that these effects are not statistically different from one another at the 95% confidence level.

Figure 2: Effects of Prior Peer Decisions Across Peer Definitions



Note: This figure shows how estimated effects of peers on reopening decisions vary across peer definitions, as described in Section 3.1. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings, where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

effects vary across institutional control and Carnegie classification.[21] Because we estimate these effects by stratifying our main sample, these specifications also implicitly capture any state-by-day trends that uniquely affected colleges within a particular sector or Carnegie classification.[22] In Panel A we show the estimated effect of more peers announcing in-person reopening decisions. We find that private institutions are somewhat more likely than public institutions to respond to peers' decisions to reopen in-person and that doctoral institutions are much more responsive than other Carnegie classifications. The large effect from these institutions could be due to them having more resources to accommodate in-person activities (e.g., testing and medical infrastructure), or more pressure to "keep up" with their peer institutions.

Panel B then shows the effect of peers' online reopening announcements on decisions made by institutions of different types. Bachelor's-focused institutions see an especially large drop in in-person reopening announcements when peers announce that they will be reopening online, but all types of institutions are similarly more likely to announce an online reopening. Similar to our

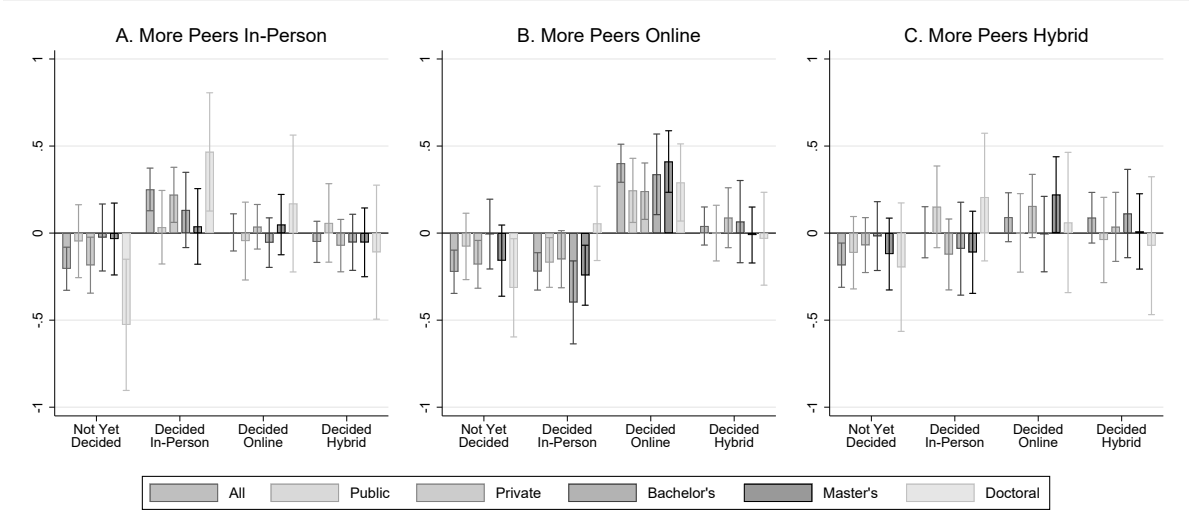
[21] Across the different stratifications of our sample, we continue to construct our measures of peers' decisions using the full sample.

[22] In Appendix Figure A.7, we further present heterogeneous effects by endowment and selectivity terciles. The results indicate that institutions with limited resources, as measured by endowment per student, were not sensitive to their peers' decisions to reopen in-person. In contrast, we see that highly selective institutions were the most responsive to their peers' in-person decisions.

main results, the heterogeneity analysis for an increase in hybrid reopening decisions (Panel C) is very noisy and nearly all of the estimate coefficients are statistically insignificant. We continue to interpret this effect as evidence that hybrid decisions provide little information or guidance to peer institutions still deciding their fall instructional mode.

Across the three panels, we see that the effects for private institutions are quite similar to our main estimates, indicating that any simultaneous decisions of public institutions in the same state are not a main driver of our results. In Appendix Figure A.8, we further show that this is the case by dropping (1) any public institution that made a decision on the same day as at least two other public institutions in its state (i.e., in a "spike"), (2) any public institution in a state that has at least one spike, and (3) all public institutions.[23] All of the effects are statistically indistinguishable from those estimated with the full sample.

Figure 3: Heterogeneous Effects of Prior Peer Decisions



Note: This figure describes how the effect of peer decisions differs across institutional control (public vs. private) and Carnegie classification. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings, where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

[23] In spikes in California, Indiana, and New York, we further include institutions that made a decision in the days immediately following the spike.

5 Robustness

Our empirical approach relies on the assumption that, after accounting for unobservable factors at the institution and state-by-day levels, the decisions of peers are uncorrelated with unobserved determinants of a college's own decision. This assumption may be violated if peer institutions, which tend to share characteristics like their control and Carnegie classification, are responding to common shocks throughout the summer. In the following sections, we test the validity of this assumption by accounting for potential correlated shocks and by implementing an instrumental variables strategy. We also demonstrate that the results are not driven by secular trends through a placebo test where we randomly assign peers to institutions.

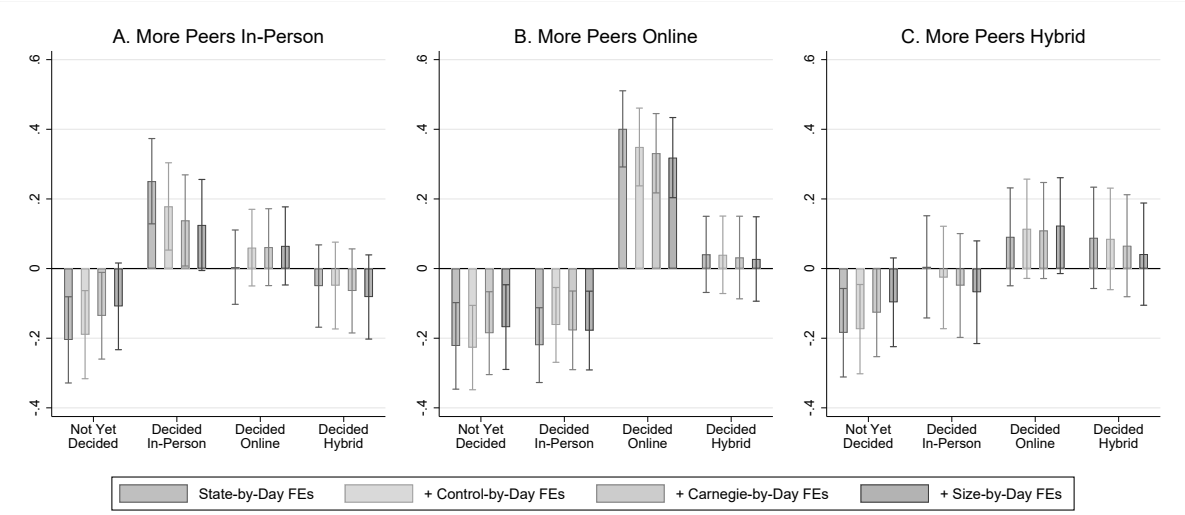
5.1 Accounting for Correlated Shocks

To account for the presence of correlated shocks across institutions with similar characteristics, we first estimate several alternative specifications of equation (1) with additional day fixed effects included. Specifically, we sequentially add interactions of day fixed effects with dummy variables for an institution's control, Carnegie classification, and size quartile. Figure 4 presents these results. Panel A shows how the additional fixed effects change the effects of more peers announcing in-person decisions, Panel B shows effects of more peers announcing online decisions, and Panel C shows effects of more peers announcing hybrid decisions. Across the different outcomes, our results only change slightly when allowing the day fixed effects to vary by institutional characteristics. Further, none of the most saturated regressions (with state-by-day, Carnegie-by-day, control-by-day, and size-by-day fixed effects) produce statistically different effects than our preferred main specification that only allows the day fixed effects to vary at the state level. We interpret these results as evidence that institutions are indeed responding to the decisions of their peers, as opposed to changes in other unobserved factors unique to their institution type.

We then estimate specifications that include linear time trends for even narrower groups of institutions. Specifically, we interact linear time trends with indicators for the region/Carnegie/control groups we use as an alternative peer definition in Section 4.2, as well as the groups that narrow

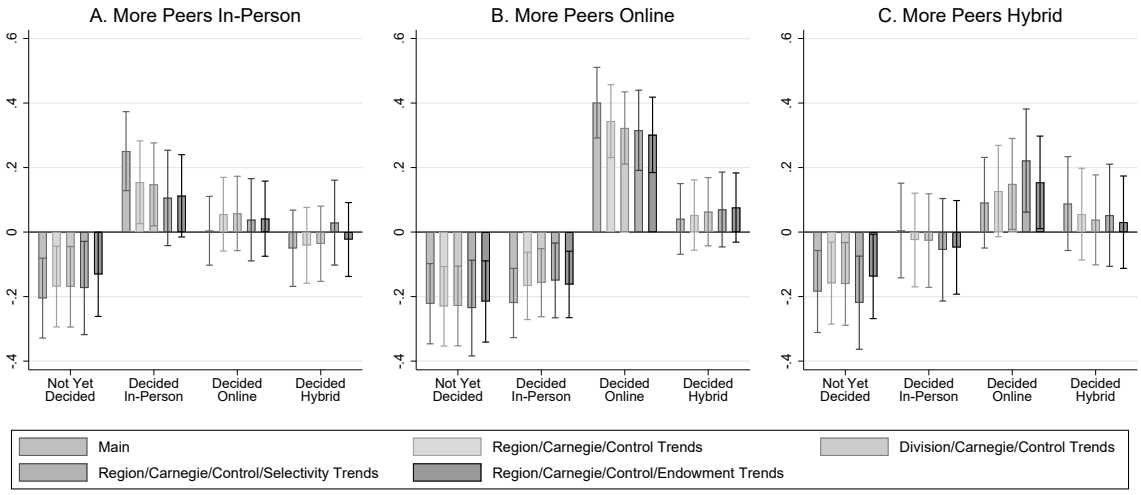
the geography, selectivity, and endowment of institutions. These trends will pick up any unobserved factors that were changing linearly over time and differentially affecting different groups of institutions. Figure 5 presents these results. Panel A shows how the inclusion of trends alters the estimated effect of more peers announcing in-person decisions, Panel B shows effects of more peers announcing online decisions, and Panel C shows effects of more peers announcing hybrid decisions. Once again, across the different outcomes, our results only attenuate slightly when including linear time trends. As in Figure 4, we do not detect statistically significant differences between any of our estimates, again indicating that colleges were responding to their peers' decisions and not other factors that were changing over time.

Figure 4: Specifications with Additional Day Fixed Effects



Note: This figure shows how estimated effects of peers on reopening decisions vary when including additional interactions with the day fixed effects. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings, where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

Figure 5: Specifications with Group-Specific Linear Time Trends



Note: This figure shows how estimated effects of peers on reopening decisions vary when including group-specific linear time trends. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings, where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

5.2 Instrumental Variables Approach

Even with additional day fixed effects and linear time trends, we cannot completely rule out the possibility that an institution and its peers are responding to group-specific shocks. We thus implement an instrumental variables (IV) approach that relies on the assumption that COVID-19 severity in peers' counties affects an institution's decision only through its peers' decisions. We believe that this assumption is likely to hold because the median distance between peer institution pairs is 378 miles and, as noted in Section 3.1, most peers are located outside of an institution's county or state. To further bolster the validity of our exclusion restriction, we also present specifications that only include peers located outside of an institution's state or county.

The first stage equation for this approach is:

$$\text{PeerShare}_{ics,t-1} = \delta + \eta \text{PeerCOVID}_{ics,t-1} + \rho \text{COVID}_{cst} + \mu_i + \pi_{st} + \upsilon_{icst} \tag{2}$$

and the second stage equation is:

$$\text{Decision}_{icst} = \alpha + \beta \widehat{\text{PeerShare}}_{ics,t-1} + \gamma \text{COVID}_{cst} + \theta_i + \lambda_{st} + \varepsilon_{icst} \tag{3}$$

where $\widehat{\text{PeerShare}}_{ics,t-1}$ is predicted from the first stage. The instrument is $\text{PeerCOVID}_{ics,t-1}$, which we define as the average number of COVID-19 deaths per 10,000 residents that have occurred by day $t-1$ in the counties where institution i's peers are located. We also estimate specifications where we define this variable as the average number of COVID-19 deaths per square mile in the peers' counties to account for differences in institutions' responsiveness to COVID-19 deaths in low-density and high-density areas. In all specifications, we include institution and state-by-day fixed effects and control for an institution's own county's COVID-19 deaths per capita or per square mile, interacted with a quadratic of their relative size, as defined in Section 4.1.[24]

Appendix Table A.5 presents the first stage estimates using these instruments on three different peer measures of interest: the share of peers who have made any decision, the share who have made in-person decisions, and the share who have made online decisions. Panel A presents the results using all of an institution's peers, while Panels B and C restrict the sample of peers to those that are out-of-county or out-of-state, respectively. Across these different samples, Columns (1) and (2) consistently show that, as peers are exposed to more COVID-19 deaths, they are less likely to announce a decision. Columns (3) and (4) show that this effect is even larger in magnitude for in-person decisions, while columns (5) and (6) show that peers are more likely to make online decisions when exposed to higher levels of COVID-19 deaths in their counties. Across both instruments, the partial F-statistics are larger when considering the overall decision and in-person decision results, suggesting that the online results should be interpreted with caution.

Figure 6 then presents comparisons of the OLS and IV estimates for (1) the effect of more peers making decisions on the probability of a college making a decision, (2) the effect of more peers making in-person decisions on the probability of a college making an in-person decision, and (3) the effect of more peers making online decisions on the probability of a college making an online

[24] We include the interaction with an institution's relative size to improve the precision of our estimates. Specifications controlling only for COVID-19 deaths per capita or per square mile produce qualitatively similar results and are available from the authors by request.

decision. Again, Panel A presents the results using all of an institution's peers, while Panels B and C restrict the sample of peers to those that are out-of-county or out-of-state. We note that one limitation of the IV approach is that we are unable to include multiple measures of peers' decisions in the latter two specifications, since we only have one instrument. As such, we compare our OLS results from the specifications in Table 2 to specifications that only include the single peer decision variable. The first two columns in each subfigure show that the estimated effects are very similar across the two types of specifications.[25]

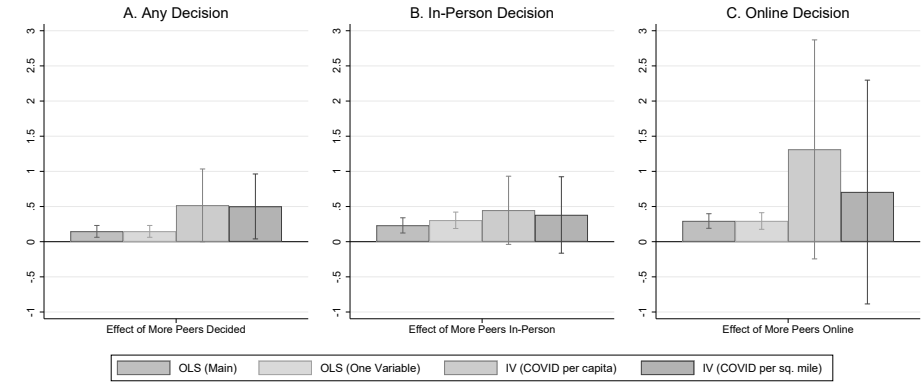
The third and fourth columns in each subfigure in Figure 6 show that our IV specifications produce qualitatively similar, although noisier, results compared to our OLS specifications. The first figure in each panel shows that the IV approach produces larger, and still statistically significant estimates of the influence of peers decisions' on a college's own likelihood of making a decision. However, in all three specifications, we cannot rule out that these effect sizes are different than those produced by our OLS approach. The second figure in each panel shows that IV specifications for the influence of peers' in-person decisions on an institution's likelihood of making an in-person decision are approximately the same magnitude. Again, these estimates are noisier and we cannot rule out that the effects are the same size. Finally, the third figure in each panel shows that the IV estimates for online decisions are much larger, but much noisier, than our OLS results, which is not surprising given the weak first stage results we present in Appendix Table A.5. For all three outcomes, the effects are similar if we exclude in-county (Panel B of Figure 6) or in-state (Panel C of Figure 6) peers, supporting our exogeneity assumption. Taken together, we interpret these results as providing evidence that endogenous peer decisions are not driving our main findings.[26]

[25] Note that the estimates are the same for the first estimated effect, since both approaches only include one independent variable: the share of peers that have made any decision.

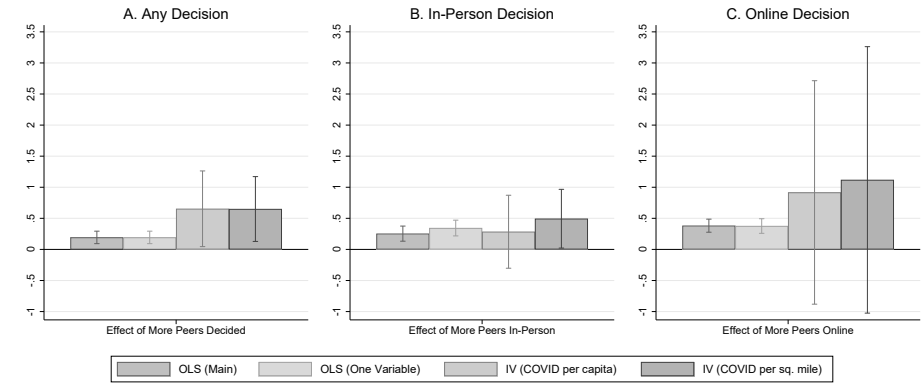
[26] If anything, these results indicate that any endogeneity present in our OLS specifications biases the estimates towards zero. This could be the case if institutions pause to take in the new information revealed by their peers (causing them to delay a decision) or if they face new pressure from students, faculty, or external stakeholders as a result of their peers' decisions that alters their decisions.

Figure 6: Instrumental Variables Specifications

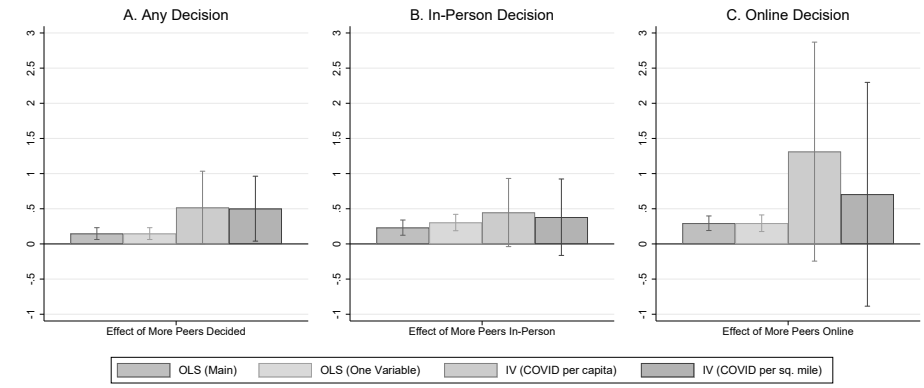
(a) All Peers



(b) Only Out-of-County Peers



(c) Only Out-of-State Peers

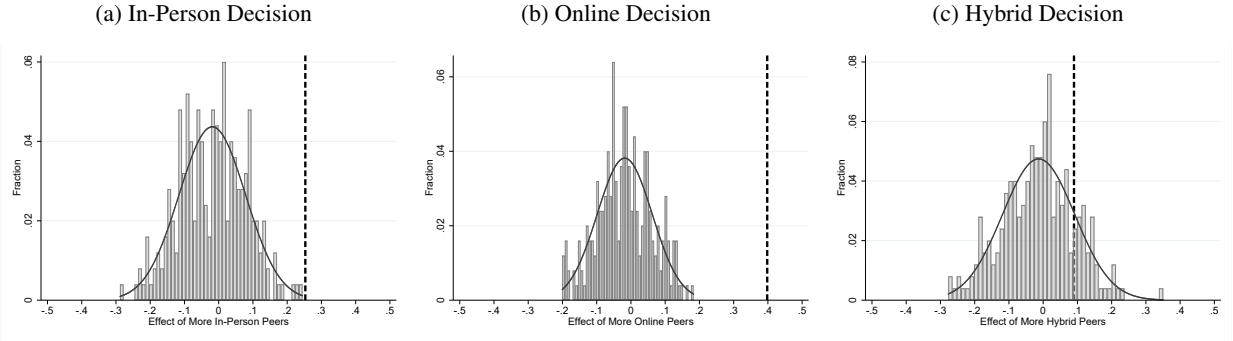


Note: These figures compares our OLS and IV approaches. The first figure in each panel shows the estimated effects for how the share of peers who have made any decision affect a college's likelihood of making a decision. The second figure shows the estimated effects for how the share of peers who have made an in-person decision affects the college's likelihood of making an in-person decision. The third figure shows the estimated effects for how the share of peers who have made an online decision affects the college's likelihood of making an online decision.

5.3 Placebo Test

As a final test of the validity of our empirical approach, we conduct a placebo test as follows. We randomly assign 25 peer institutions to each college in our data. Then we reconstruct the measures of prior decisions using the randomly assigned peers and re-run our main specification. We repeat this process 250 times, saving the estimated effects each time. Figure 7 shows the distribution of the estimated effects from the randomly assigned peers, with a vertical dashed bar showing our estimated effects from the preferred peer definition. The estimated effects from the random peers are centered near zero.

Figure 7: Placebo Tests with Randomly Selected Peers



Note: This figure depicts the results of a placebo test in which we assign random peers to institutions. Each panel describes the distribution of the estimated effect of the random peers' decision to open online, hybrid, or in person on the institutions to open in the same way. The vertical line represents this estimated effect in our preferred specification using an institution's peers as reported in IPEDS.

The estimated effect from our main peer definition is in the very far-right tail of the distribution for each outcome, except for the hybrid decision. The estimated effects for hybrid were noisy to begin with, so we do not find this result concerning. We further interpret the results for in-person and online decisions as evidence that colleges were truly responding to their peer institutions, and not to the higher education market as a whole.

6 Conclusion

Within the U.S. higher education market, colleges make strategic decisions about advertising, recruitment, financial aid, tuition, admissions, and a host of other factors on a routine basis, all centered around the academic calendar. Given the decentralized and autonomous nature of higher education within the U.S., colleges may look to their peer institutions for ideas and guidance when making decisions in uncertain environments. We study this influence of peer institutions on colleges' decisions in the context of colleges' reopening plans during the COVID-19 pandemic, where colleges faced substantial uncertainty and generally were not competing with one another for current-year enrollment.

By leveraging unique, high-frequency data on colleges' decisions leading up to the fall 2020 semester, we find evidence that institutions responded strongly to prior decisions made by their peers. As more of an institution's peers announced they would be reopening in-person or online, they were more likely to do the same. These effects hold across a variety of definitions of peer institutions and are robust to a variety of specifications with additional trends and fixed effects, as well as an instrumental variables approach. Importantly, the effects of peers' decisions persist even after controlling for local COVID-19 severity and flexible state-by-day trends, indicating that colleges' reopening decisions were not driven solely by contemporaneous local or statewide COVID-19 conditions.

These results have important implications for understanding the behavior of colleges and other institutions during the COVID-19 pandemic, as well as for understanding decision-making under uncertainty more broadly. Our findings suggest that peers may have an influence on colleges' decisions as the pandemic continues —such as instructional modes, public health practices, and accommodations for faculty and students —as well as on more routine decisions regarding admissions policies, curricular offerings, and staffing. Outside of higher education, we expect that peers may affect a variety of pandemic-related decisions —such as cities and states' reopening policies and firms' return-to-work plans —and likely have an important role in decisions during other crises or times of uncertainty. Future research on decisions during these types of scenarios

would be a valuable contribution to understanding how institutions operate and the role that peers play in decision-making.

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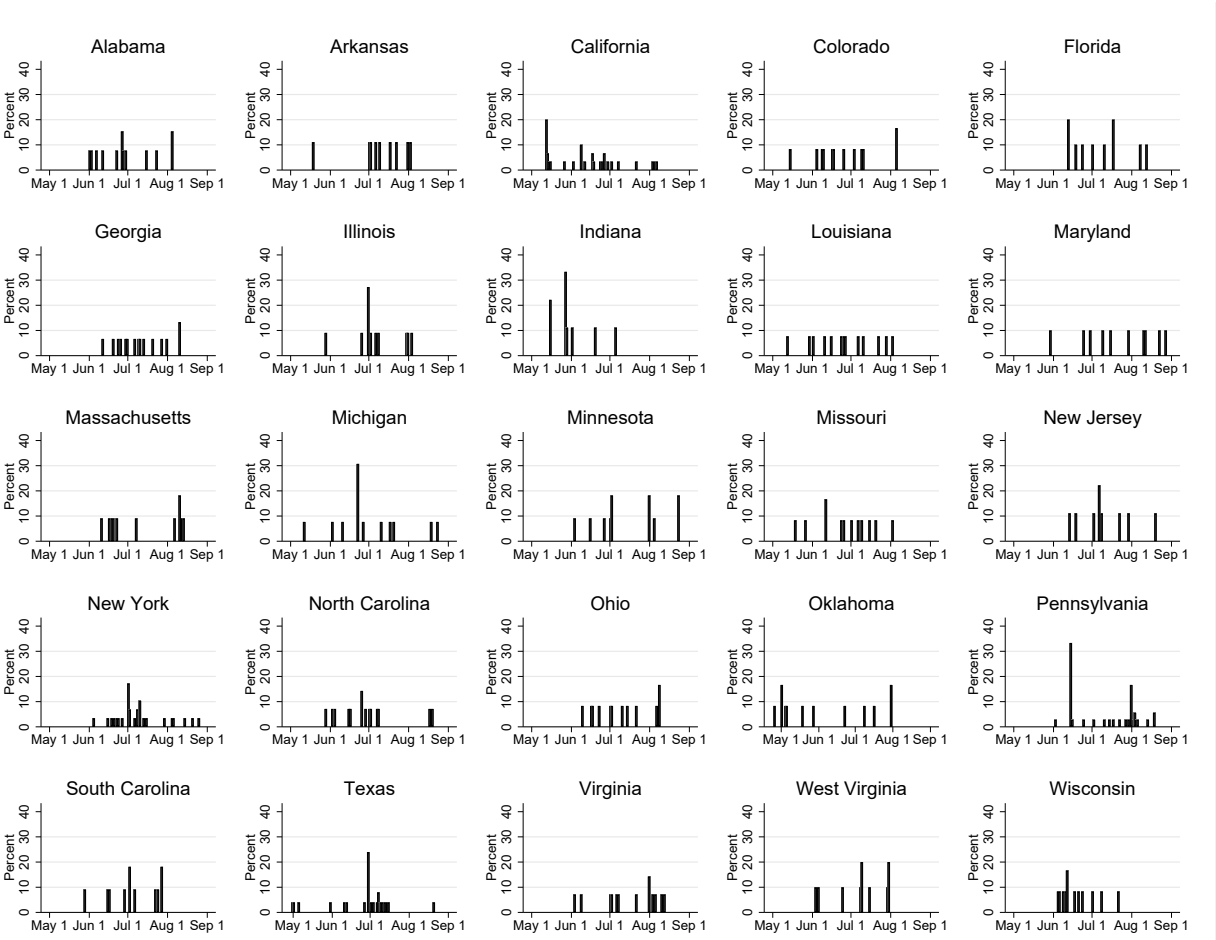
Online Appendix

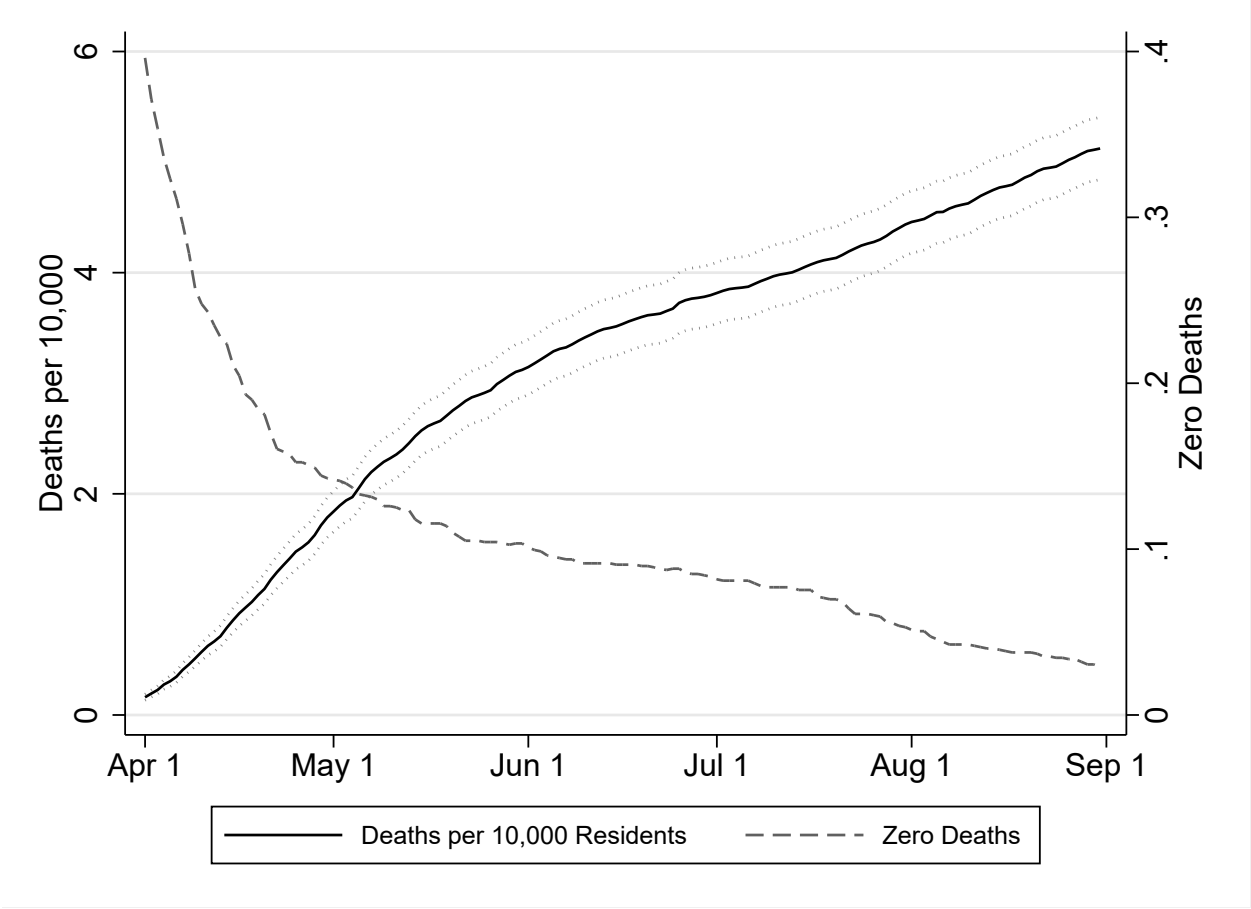
A Additional Figures & Tables

Figure A.1: Decision Dates of Public Universities by State



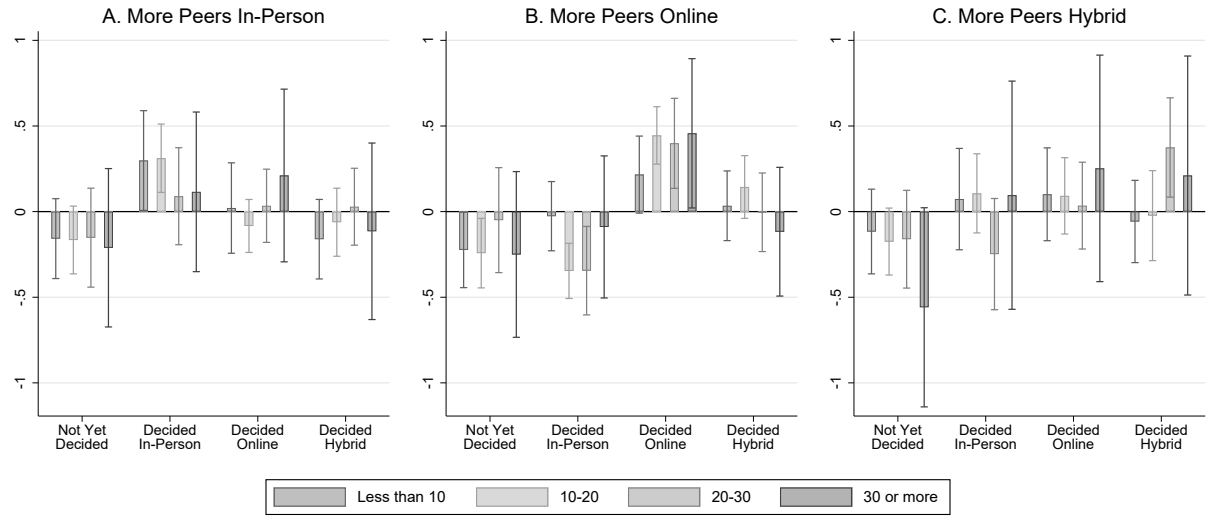
Note: This figure shows the share of public institutions in each state who announced a reopening decision on each day of the summer. In many states, these decisions did not happen simultaneously.

Figure A.2: COVID-19 Deaths Per Capita in College Counties



Note: This figure depicts the average county-level COVID-19 deaths per capita for colleges in our sample. The solid line describes average deaths per 10,000 residents over time. The dashed line describes the proportion of colleges with 0 county-level deaths over time. Only a small proportion of colleges are located in counties that had no deaths, even at the beginning of the summer.

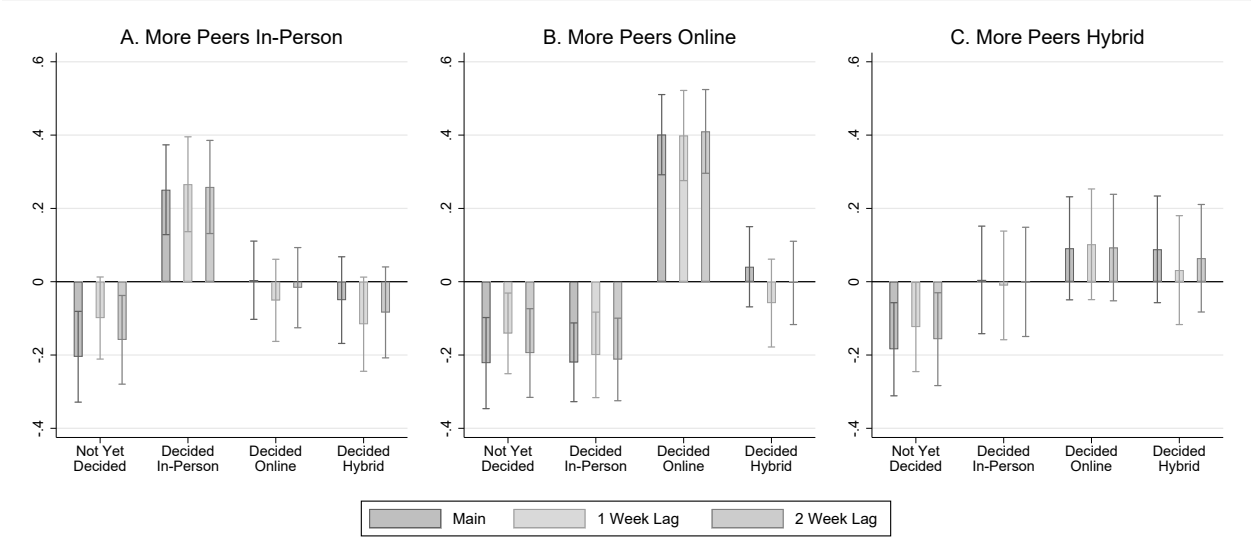
Figure A.3: Heterogeneity by Number of Peers Listed



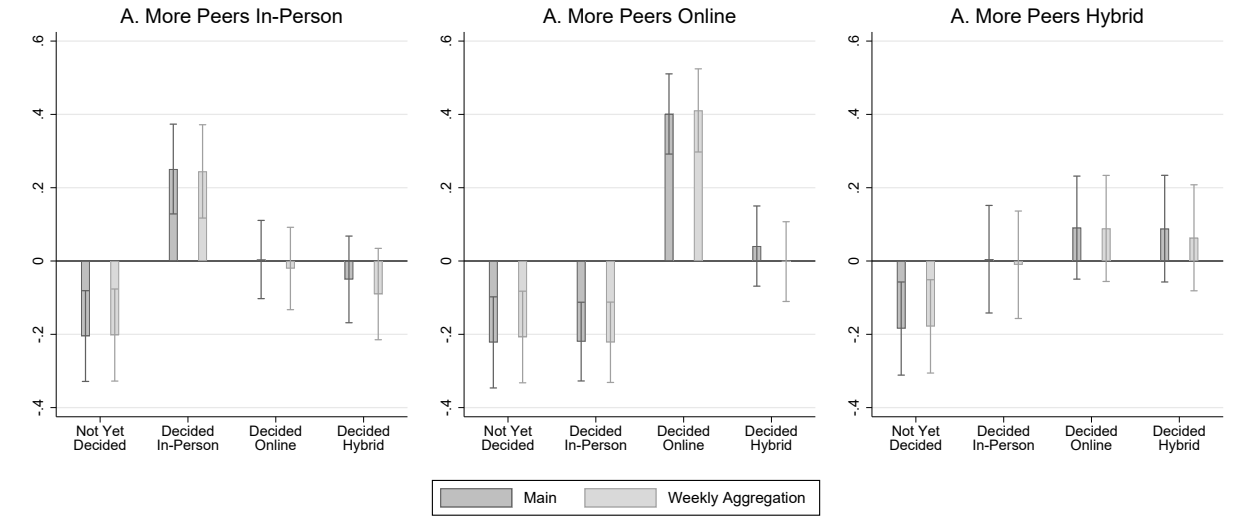
Note: This figure shows how estimated effects of peers on reopening decisions vary by the number of peer institutions a college or university lists. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings,where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

Figure A.4: Specifications Using Different Lags or Aggregations

(a) Different Lags

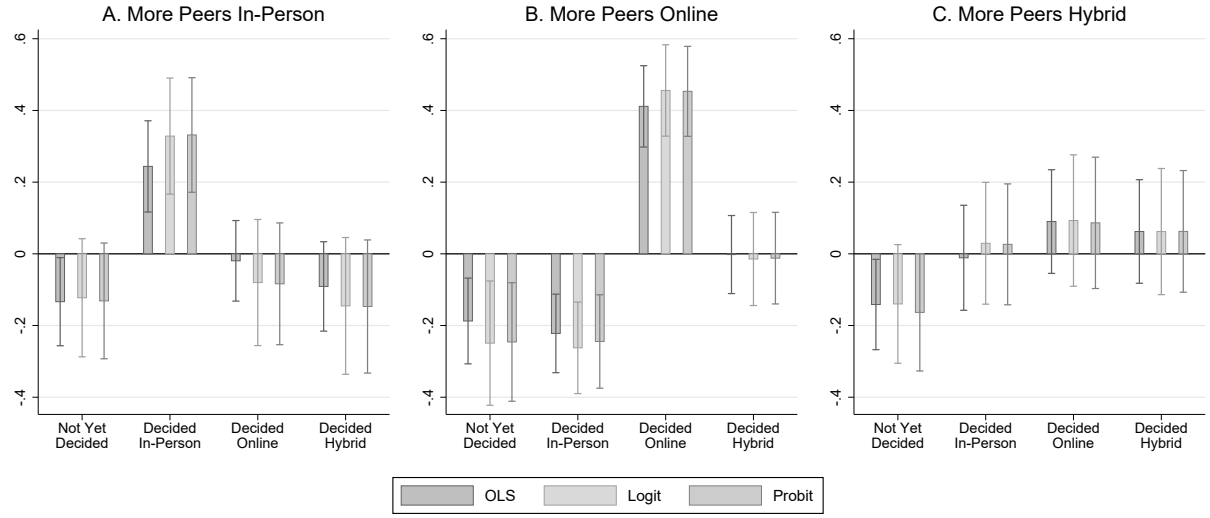


(b) Weekly vs. Daily Aggregation



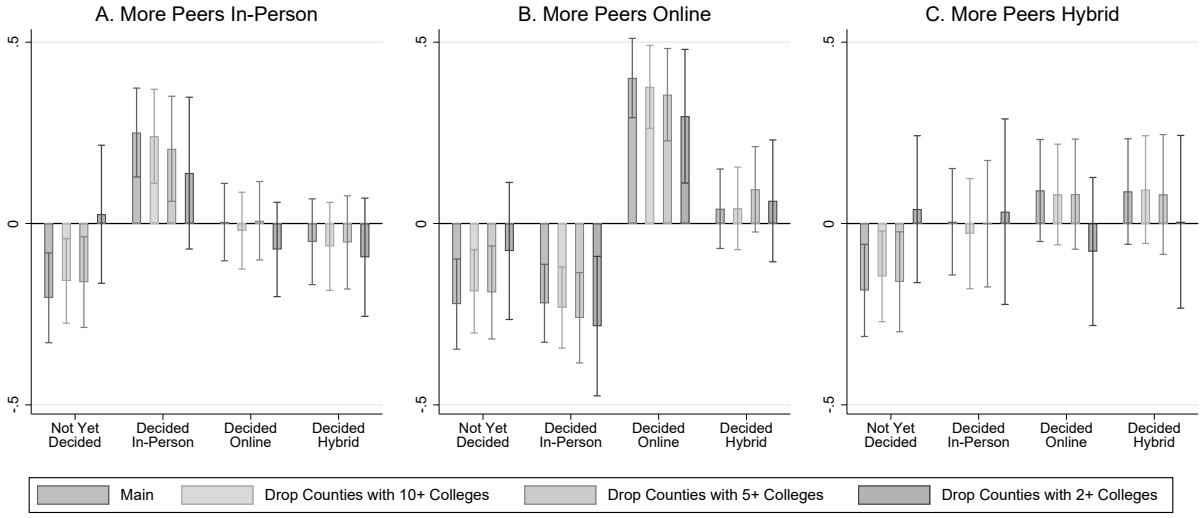
Note: Panel A shows the estimated effects of peers on reopening decisions, using different lagged measures of peer decisions. The main specification includes peer decisions up to date $t-1$, and the 1- and 2-week lagged measures include peer decisions up to date $t-7$ and $t-14$, respectively. Panel B compares our main specification where t represents one day to a version in which t represents one week.

Figure A.5: Non-Linear Functional Forms



Note: This figure shows how estimated marginal effects of peers on reopening decisions vary across functional form assumption. For computational reasons, all results use the weekly aggregation from Appendix Figure A.4. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings,where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

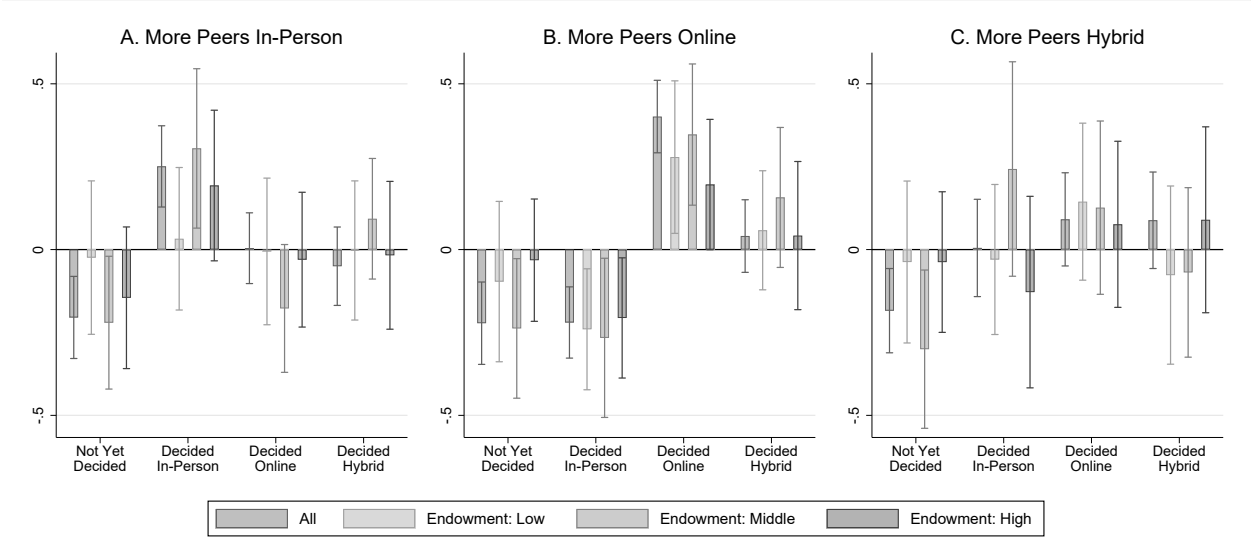
Figure A.6: Specifications with Different Counties Excluded



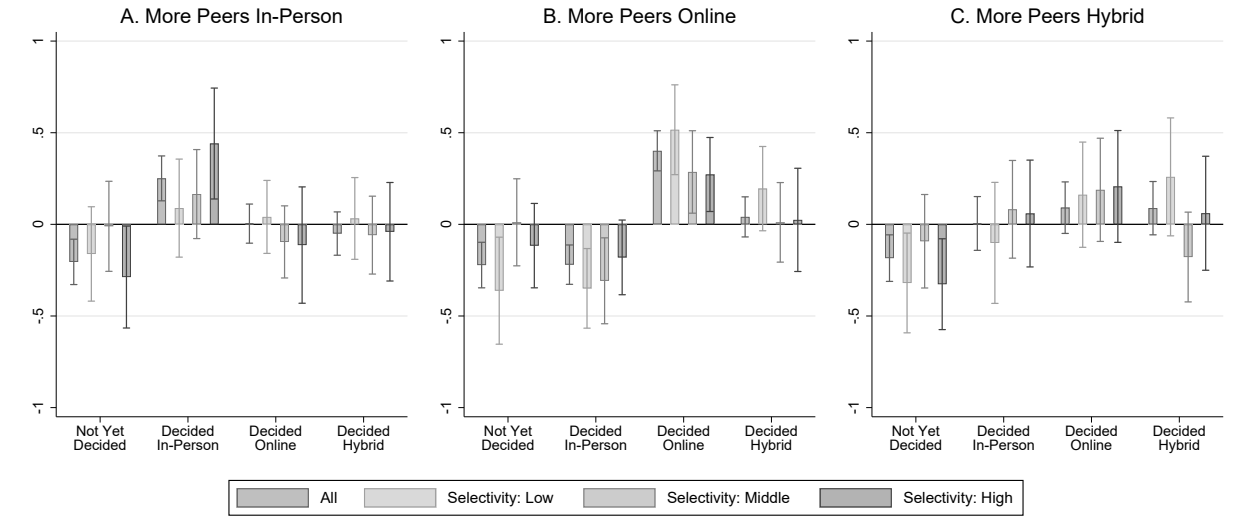
Note: This figure shows how estimated effects of peers on reopening decisions vary when excluding counties with many colleges. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings,where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

Figure A.7: Heterogeneity by Endowment and Selectivity Terciles

(a) Heterogeneity by Endowment Tercile

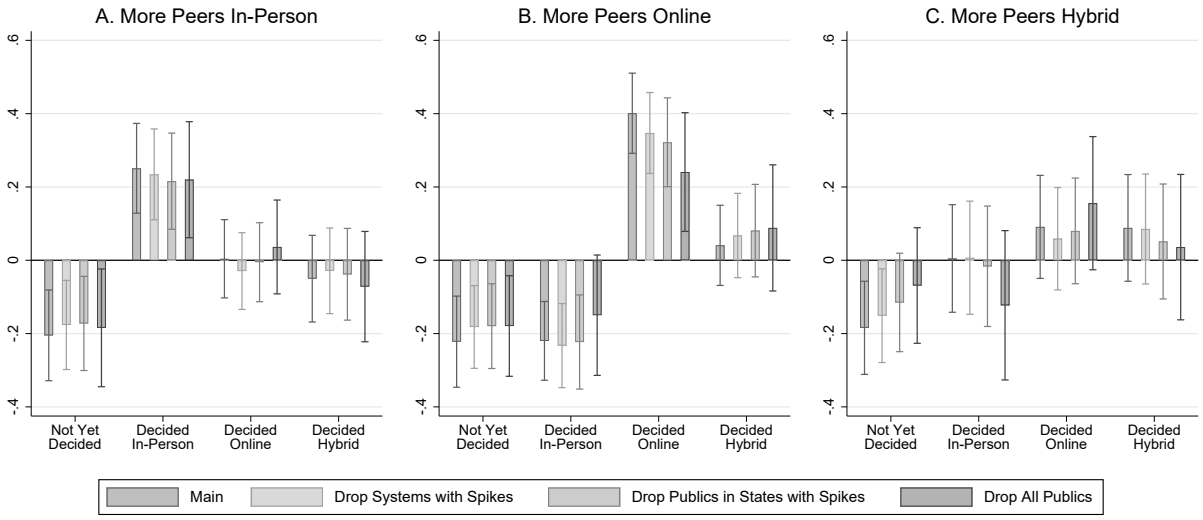


(b) Heterogeneity by Selectivity Tercile



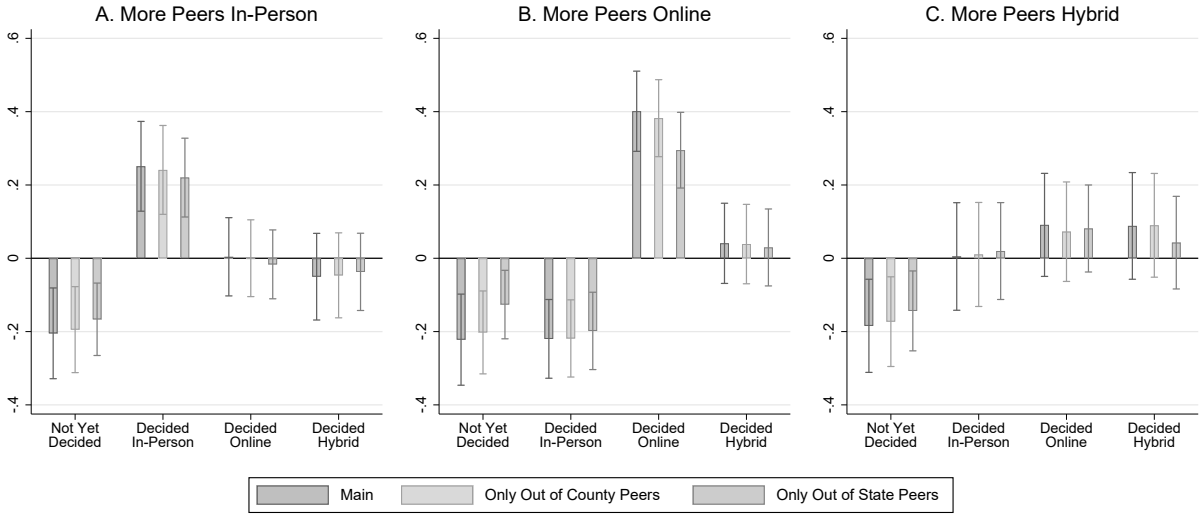
Note: These figures describe how the effect of peer decisions differs across endowment and selectivity terciles. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings, where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

Figure A.8: Specifications with Public Universities Excluded



Note: This figure shows how estimated effects of peers on reopening decisions vary when excluding different types of public institutions. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings,where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

Figure A.9: Specifications Excluding Within-County or Within-State Peers



Note: This figure shows how estimated effects of peers on reopening decisions vary when excluding peers in the same county or same state as the institution of interest. Panel A shows the estimated coefficient on the share of peers that have announced in-person reopenings,where the dependent variable is an indicator for each decision type as shown on the X-axis. Panels B and C show the estimated effects for the share of peers that have announced an online or hybrid reopening.

Table A.1: Similarity Between Institutions and Identified Peers

	Obs.	Avg. Peers Listed	Avg. Times Named Peer	Same County	Same State	Same Region	Same Control	Same Carnegie	Same Select. Terc.	Same Endow. Terc.
All	1247	21.24	21.24	0.015	0.167	0.520	0.970	0.824	0.442	0.553
Public	482	20.62	21.07	0.003	0.107	0.449	0.965	0.851	0.452	0.542
Private	765	21.63	21.34	0.023	0.205	0.565	0.974	0.807	0.436	0.560
Bachelor's	464	20.82	20.90	0.011	0.170	0.535	0.977	0.838	0.404	0.572
Master's	535	21.74	20.55	0.019	0.195	0.539	0.965	0.782	0.387	0.524
Doctoral	248	20.95	23.37	0.015	0.100	0.451	0.967	0.888	0.635	0.582
Northeast	324	21.83	21.16	0.025	0.212	0.535	0.960	0.831	0.422	0.570
Midwest	319	20.98	22.00	0.012	0.154	0.508	0.977	0.830	0.458	0.546
South	431	21.47	21.27	0.008	0.138	0.572	0.970	0.820	0.452	0.535
West	173	20.01	19.90	0.022	0.178	0.383	0.977	0.807	0.427	0.580
Less Selective	351	21.58	18.52	0.011	0.204	0.563	0.981	0.797	0.413	0.477
Moderately Selective	370	21.45	20.61	0.015	0.173	0.540	0.970	0.793	0.401	0.502
More Selective	295	20.54	26.76	0.017	0.115	0.457	0.953	0.880	0.687	0.706
Missing Average ACT	231	21.26	19.33	0.021	0.167	0.502	0.975	0.841	0.242	0.555
Low Endowment	404	20.79	18.73	0.012	0.159	0.492	0.971	0.811	0.389	0.531
Medium Endowment	404	22.42	20.44	0.016	0.182	0.551	0.971	0.792	0.407	0.408
High Endowment	404	20.33	25.16	0.020	0.164	0.530	0.968	0.864	0.538	0.758
Missing Endowment	35	23.20	14.09	0.001	0.119	0.360	0.968	0.866	0.350	0.117

Note: This table describes the similarity between a college or university and the peer institutions they identify. Each column reports the average proportion of one's peers that share a given attribute. We define selectivity terciles based on institutions' average ACT scores in 2017-18, and endowment terciles based on their endowment per student in 2017-18.

Table A.2: Peer Similarity Using Alternative Peer Definitions

	Obs.	Avg. Peers Listed	Avg. Times Named Peer	Same County	Same State	Same Region	Same Control	Same Carnegie	Same Select. Terc.	Same Endow. Terc.
Self-Reported Peers	1247	21.24	21.24	0.015	0.167	0.520	0.970	0.824	0.442	0.553
Same Region, Carnegie, and Control	1247	74.530	74.530	0.032	0.161	1.000	1.000	1.000	0.350	0.470
Same Division, Carnegie, and Control	1247	35.661	35.661	0.064	0.309	1.000	1.000	1.000	0.370	0.489
Same Region, Carnegie, Control, and Selectivity Tercile	1016	25.880	25.880	0.080	0.213	1.000	1.000	1.000	1.000	0.572
Same Region, Carnegie, Control, and Endowment Tercile	1212	34.243	34.243	0.066	0.192	1.000	1.000	1.000	0.424	1.000

Note: This table describes the similarity between a college or university and the peer institutions using our alternative defintions of peers. Each column reports the average proportion of one's peers that share a given attribute. We define selectivity terciles based on institutions' average ACT scores in 2017-18, and endowment terciles based on their endowment per student in 2017-18.

Table A.3: Main Effects with Peer Decision Counts

	Not Yet Decided (1)	**Decided In-Person (2)**	**Decided Online (3)**	**Decided Hybrid (4)**
Panel A. Number of peers who have made any decision				
Number decided, t-1	-0.002***	0.000	0.002	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
County deaths per 10,000	0.005*	-0.004	0.010***	-0.011***
	(0.003)	(0.004)	(0.003)	(0.003)
Observations	189,544	189,544	189,544	189,544
Panel B. Number of peers who have made each decision				
Number decided in-person, t-1	-0.001	0.013***	-0.005***	-0.007**
	(0.001)	(0.003)	(0.002)	(0.003)
Number decided online, t-1	-0.002	-0.011***	0.018***	-0.006**
	(0.002)	(0.003)	(0.002)	(0.002)
Number decided hybrid, t-1	-0.002	-0.005	-0.008***	0.014***
	(0.002)	(0.003)	(0.003)	(0.004)
County deaths per 10,000	0.005*	-0.004	0.010***	-0.011***
	(0.003)	(0.004)	(0.003)	(0.003)
Observations	189,544	189,544	189,544	189,544

Note: This table presents the main estimates of equation (1): the effect of peers' announced decisions and county-level COVID-19 deaths on individual institutions' decisions, using counts of peer decisions rather than shares. Panel A describes the effect of peers making any decision and Panel B describes the effect of each type of decision. Column 1 describes the effects on the likelihood of an institution having not yet made an announcement. Columns 2 - 4 describe the effects on the likelihood of an institution announcing each of the three types of reopening styles. In all specifications, we control for institution and state-by-day fixed effects, as well as the days remaining before an institution's semester start date. We cluster all standard errors at the county level.$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A.4: Interactions of County Deaths with Institution Relative Size

	Not Yet Decided (1)	**Decided In-Person (2)**	**Decided Online (3)**	**Decided Hybrid (4)**
Panel A. Linear interaction with relative size				
County deaths per 10,000	0.004	-0.005	0.012***	-0.010***
	(0.003)	(0.004)	(0.003)	(0.003)
(County deaths per 10,000)*(Relative size)	0.017	0.071*	-0.072**	-0.016
	(0.019)	(0.041)	(0.033)	(0.037)
Observations	189,544	189,544	189,544	189,544
Panel B. Quadratic interaction with relative size				
County deaths per 10,000	0.004	-0.008**	0.013***	-0.008**
	(0.003)	(0.004)	(0.003)	(0.003)
(County deaths per 10,000)*(Relative size)	0.021	0.327***	-0.160*	-0.187*
	(0.073)	(0.113)	(0.094)	(0.101)
(County deaths per 10,000)*(Relative size)^2	-0.010	-0.765***	0.265	0.511*
	(0.196)	(0.287)	(0.266)	(0.291)
Observations	189,544	189,544	189,544	189,544

Note: The table shows the effects of per-capita COVID-19 deaths on institutions' decisions when we vary the effect by institution size (enrollment) relative to the institution's county population. Panel A shows that institutions that are large relative to the county population are less likely to respond to COVID deaths by reopening online. Panel B shows a quadratic interaction with county size, demonstrating non-linearity in the relationship between size and response to COVID deaths. We cluster all standard errors at the county level.$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table A.5: First Stage Estimates for IV Approach

	Peers Decided		Peers Decided In-Person		Peers Decided Online	
Variable:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**6)**
Panel A. All Peers						
Peers' COVID-19 deaths per 10,000 residents	-0.014*** (0.002)		-0.019*** (0.002)		0.007*** (0.002)	
Peers' COVID-19 deaths per square mile		-0.011*** (0.001)		-0.014*** (0.002)		0.006*** (0.002)
Partial F-Statistic	55.14	49.72	60.81	32.47	8.958	8.830
Observations	189,544	189,544	189,544	189,544	189,544	189,544
Panel B. Only Out-of-County Peers						
Peers' COVID-19 deaths per 10,000 residents	-0.014*** (0.002)		-0.019*** (0.002)		0.006*** (0.002)	
Peers' COVID-19 deaths per square mile		-0.011*** (0.001)		-0.014*** (0.002)		0.004** (0.002)
Partial F-Statistic	65.40	70.62	66.91	34.70	7.265	4.035
Observations	189,544	189,544	189,544	189,544	189,544	189,544
Panel C. Only Out-of-State Peers						
Peers' COVID-19 deaths per 10,000 residents	-0.015*** (0.002)		-0.021*** (0.003)		0.008*** (0.003)	
Peers' COVID-19 deaths per square mile		-0.016*** (0.002)		-0.018*** (0.002)		0.006** (0.002)
Partial F-Statistic	54.19	85.59	65.30	71.31	9.074	6.567
Observations	189,544	189,544	189,544	189,544	189,544	189,544

Note: This table presents estimates of equation (2): the effect of peers' COVID-19 exposure on their decisions. In all specifications, we control for institution and state-by-day fixed effects, as well as the institution's COVID-19 severity at the county level interacted with a quadratic of their relative size. We cluster all standard errors at the county level.$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

B Survival Analysis

Because our outcomes of interest can be interpreted as durations (e.g., the time until a college makes a reopening decision), it is natural to consider a survival analysis framework as an alternative to linear regression. We favor the linear regression approach in the main text because it enables us to flexibly account for unobservable changes at the state-by-day levels and easily extends to an IV approach to address potential endogeneity concerns. However, in this appendix, we conduct the survival analysis to demonstrate that the results are generally consistent with those from the linear framework.

We begin with a Cox proportional hazards model (Cox 1972), where the hazard of institution i making any decision at time t, conditional on not having made a decision until time t, is given by:

$$\lambda(t|X_i) = \lambda_0(t)\exp(\mathbf{X_i}\boldsymbol{\beta}) \tag{4}$$

where term $\lambda_0(t)$ is the baseline hazard, which can vary arbitrarily with time. With this specification of the hazard rate, the likelihood that we observe institution i making a decision at time Y_i, given that we observe at least one institution making a decision, is:

$$L_i(\beta) = \frac{\lambda(Y_i|X_i)}{\sum_{js.t.Y_j \geq Y_i}\lambda(Y_j|X_j)} = \frac{\exp(\mathbf{X_i}\boldsymbol{\beta})}{\sum_{js.t.Y_j \geq Y_i}\exp(\mathbf{X_i}\boldsymbol{\beta})}. \tag{5}$$

The key assumption in the Cox proportional hazard model is that the hazards for any two institutions are proportional over time by the factor $\exp(\mathbf{X_i}\boldsymbol{\beta})$, which is why the baseline hazard cancels out in equation 5. What remains is a likelihood function that depends only upon the parameters $\boldsymbol{\beta}$ and the observable characteristics $\mathbf{X}$. We estimate the parameters $\boldsymbol{\beta}$ via maximum likelihood estimation, as is standard. For more details on the estimation procedure, see Greene 2017 and StataCorp 2021. The model can further be extended to allow the observables $\mathbf{X_i}$ to vary with time or to allow coefficients β to vary as a function of time. The estimates shown in Table B.1 show the results from several different specifications.

In column (1), we include the share of peer institutions that have made a decision as of the

previous date and the COVID-19 deaths per capita in the county. The coefficient of 0.769 on the peer share can be interpreted as follows: a 10-pp increase in the share of peers that have made a decision increases the hazard rate by $(\exp(0.769 * 0.10) - 1) * 100 = 8\%$. In column (2), we check for time-varying effects to assess the proportional hazards assumption. We find a negative, though insignificant, coefficient on the interaction of peers' prior-day decisions and the day variable, where days are measured from 1 (April 1) to 153 (August 31). Adding time-invariant, institution-level controls (Carnegie classification and public/private control), as shown in columns (3) and (4), or state fixed effects, as shown in columns 5 and 6, does not change the sign of the estimates but reduces the magnitudes.

Table B.1: Proportional Hazards Model Estimates

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Share decided, t-1	0.769***	2.458*	0.434*	3.054**	0.124	2.347*
	(0.230)	(1.292)	(0.248)	(1.337)	(0.257)	(1.341)
(Share decided , t-1)*Day		-0.017		-0.027**		-0.023*
		(0.013)		(0.013)		(0.013)
County deaths per 10,000	-0.021***	-0.021***	-0.021***	-0.021***	-0.020**	-0.020**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.010)	(0.010)
Observations	116,625	116,625	116,625	116,625	116,625	116,625
Institution controls	N	N	Y	Y	Y	Y
State FEs	N	N	N	N	Y	Y
Time-varying effect	N	Y	N	Y	N	Y

Note: This table presents estimated coefficients for the survival models as described in this section, where the dependent variable is the time when a university makes any decision. Standard errors are clustered at the county level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

In columns (4) and (6), the time-varying coefficient is marginally significant and negative, suggesting that the peer share may not matter to institutions that have made it through most of the summer without announcing a decision. To interpret the estimates in column (6), consider the effect on the hazard of making a decision in the middle of the summer (e.g., on the 75th day of our sample). On day 75, a 10 percentage point increase in the share of peers who have made a decision increases the hazard rate by $(\exp((2.347 - 0.023 * 75) * 0.10) - 1) * 100 = 6.4\%$. While the magnitude of this estimate is not directly comparable to the results from our linear regression

specifications, the fact that peers' decisions increase the likelihood of an institution announcing a decision confirms our main findings. In addition, the estimated coefficients on the cumulative deaths measure in Table B.1 continue to indicate that institutions were less likely to announce reopening decisions when COVID-19 deaths were increasing.

We can also use survival analysis methods to examine the *type* of decision an institution makes (whether to reopen in-person, hybrid, or online). To do so, we use the competing risks survival model, which accounts for the presence of several "competing" outcomes by constructing subhazard functions that account for the fact that an institution may decide to reopen in-person, online, or hybrid, but can only do one of these (Fine and Gray 1999). The subhazards are assumed to be proportional over time by a factor of $\exp(\mathbf{X}\boldsymbol{\beta})$, analogous to the hazard function in the Cox proportional hazards model.

We present the estimated coefficients for the subhazard of making an in-person reopening decision in Table B.2. Column (1) shows the estimated coefficients without institution-level controls nor state fixed effects and without time-varying coefficients. All of the coefficients on peers' prior-day decisions are positive, but the share of peers that have announced in-person reopening decisions has the strongest positive effect on the likelihood that an institution will reopen in person. These findings differ somewhat from the linear regression framework, where we found a negative relationship between peers' decisions to reopen online and an institution's likelihood of making an in-person decision. However, the estimates in column (2) demonstrate that the proportional subhazard assumption does not hold: the effects vary substantially over time. Still, each specification supports the conclusion that the share of peers that have made an in-person decision has a strong positive effect on an institution's decision to announce an in-person reopening. When a peer announces an online decision, that may be positively associated with a decision to reopen in person because *any* peer decision may encourage a university to make a decision. Adding institution-level controls and state fixed effects in columns (3) through (6) changes the magnitude but not the sign of the estimated effects. In addition, the estimated coefficient on the county-level cumulative deaths variable remains negative across specifications, indicating that institutions are less likely to announce an in-person reopening decision when COVID-19 cases are increasing.

Table B.2: Competing Risk Model Estimates for In-Person Decision

	(1)	(2)	(3)	(4)	(5)	(6)
Share decided in-person, t-1	4.583***	-2.191	4.139***	-2.857	3.338***	-4.218*
	(0.376)	(2.351)	(0.398)	(2.347)	(0.420)	(2.302)
(Share decided in-person, t-1)*Day		0.072***		0.074***		0.0780***
		(0.024)		(0.023)		(0.023)
Share decided online, t-1	1.942***	-8.776***	2.432***	-7.872***	2.668***	-7.942***
	(0.489)	(2.579)	(0.490)	(2.577)	(0.551)	(2.726)
(Share decided online, t-1)*Day		0.108***		0.103***		0.104***
		(0.024)		(0.024)		(0.025)
Share decided hybrid, t-1	3.828***	-5.920**	3.729***	-5.822*	4.040***	-5.905*
	(0.518)	(3.005)	(0.528)	(3.040)	(0.562)	(3.134)
(Share decided hybrid, t-1)*Day		0.098***		0.097***		0.100***
		(0.029)		(0.029)		(0.030)
County deaths per 10,000	-0.035***	-0.038***	-0.041***	-0.043***	-0.028*	-0.030*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.017)	(0.018)
Observations	116,625	116,625	116,625	116,625	116,625	116,625
University Controls	N	N	Y	Y	Y	Y
State FE	N	N	N	N	Y	Y
Time-Varying Effect	N	Y	N	Y	N	Y

Note: This table presents estimated coefficients for the competing risk regressions as described in this section. The outcome is an in-person reopening decision. Standard errors are clustered at the county level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table B.3 then shows analogous estimates for the subhazard of announcing an online reopening decision. Across the specifications, we find that peers' decisions increase the likelihood that an institution announces a reopening decision, and in particular, that increases in peers announcing online reopening decisions increases the likelihood that an institution does the same. We also find that institutions are more likely to announce online decisions when COVID-19 deaths in their county are increasing. Taken together with Tables B.1 and B.2, we interpret these results as supporting our conclusions in the main text that peers encourage institutions to announce reopening decisions, and that institutions are most likely to announce the same reopening decision as their peer institutions.

Table B.3: Competing Risk Model Estimates for Online Decision

	(1)	(2)	(3)	(4)	(5)	(6)
Share decided in-person, t-1	3.121***	-5.934***	4.004***	-5.096**	4.472***	-3.211
	(0.389)	(2.330)	(0.422)	(2.469)	(0.450)	(2.647)
(Share decided in-person, t-1)*Day		0.085***		0.085***		0.073***
		(0.022)		(0.023)		(0.024)
Share decided online, t-1	6.194***	-3.503	6.224***	-3.010	5.481***	-5.281**
	(0.424)	(2.510)	(0.388)	(2.656)	(0.493)	(2.496)
(Share decided online, t-1)*Day		0.089***		0.085***		0.098***
		(0.022)		(0.023)		(0.021)
Share decided hybrid, t-1	5.442***	-3.795	5.494***	-3.980	6.055***	-3.251
	(0.475)	(2.484)	(0.481)	(2.567)	(0.482)	(2.677)
(Share decided hybrid, t-1)*Day		0.084***		0.087***		0.085***
		(0.022)		(0.023)		(0.023)
County deaths per 10,000	0.024***	0.020**	0.024***	0.021**	0.053***	0.047***
	(0.011)	(0.011)	(0.010)	(0.010)	(0.017)	(0.017)
Observations	116,625	116,625	116,625	116,625	116,625	116,625
University Controls	N	N	Y	Y	Y	Y
State FE	N	N	N	N	Y	Y
Time-Varying Effect	N	Y	N	Y	N	Y

Note: This table presents estimated coefficients for the competing risk regressions as described in this section. The outcome is an online reopening decision. Standard errors are clustered at the county level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

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