Covid on Campus

An Empirical Analysis of Covid Infection Rates

at US Colleges and Universities

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Abstract

We provide an empirical analysis of the determinants of cumulative Covid infection rates at over 1,100 US colleges and universities during the 2020-21 academic year. We propose a simple theoretical framework in which financially constrained educational institutions face a trade-off between educational quality and the reduction of Covid infection risks. This framework suggests that an institution's equilibrium Covid infection rate will be determined by a set of exogenous variables describing its finances, demographics, selectivity, governance, and location. We find that cumulative campus infection rates are higher at wealthier institutions, measured by higher endowments per student or higher tuition rates. Institutions with lower enrollment yields in admissions also have higher Covid infection rates, perhaps reflecting the greater influence of student preferences on decision making at these institutions. Economies of scale in Covid mitigation emerge gradually over the course of the year. Finally, we find that infection rates are higher at public institutions and that this effect is fully explained by higher infection rates at public institutions in states with Republican governors.

Key Words: Covid-19 pandemic; US colleges and universities; tuition and endowment; public vs. private universities; political economy

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Section 1: Introduction

The Covid-19 pandemic has forced colleges and universities to adopt a wide variety of detection and mitigation strategies to reduce the number of Covid infections on their campuses (Walke et al. 2020). While the adoption of Covid mitigation policies reduced campus infection rates, it comes with significant costs for students, faculty and the institutions themselves, including reductions in educational quality, social opportunities, and mental health for students, the significant time costs of redesigning courses for hybrid and virtual delivery for faculty, and the financial costs associated with implementing these policies for institutions. The potential effects of campus Covid mitigation polices extend beyond the institutions themselves to the surrounding communities (Watson et al., 2020).

Campus Covid infection rates are both substantial and highly varied. In a sample of over 1,200 public and private US colleges and universities, the mean value of the cumulative Covid infection rate for the 2020-21 academic year was 6.4%, while over 30 schools had infection rates of over 20%, and nearly 100 had infection rates below 0.5%. In spite of the importance of campus Covid infection risk to members of the campus community, including potential students and their families, faculty, staff, school administrators and the surrounding communities, very little is known about its determinants. This paper provides an initial attempt to address this gap in our knowledge. In particular, we analyze the determinants of Covid infection rates at US colleges and universities during the first year of the pandemic.

In determining how to respond to the pandemic, institutions face fundamental trade-offs between cost, safety and educational quality. For example, CDC guidance for colleges and universities provides an overview of recommended interventions and their associated levels of

infection risk.[1] In this menu of policy options, the lowest risk approach is to adopt an entirely virtual model of education, an approach taken by only small minority of institutions (Walke et al., 2020). Instead, most institutions accepted a positive infection risk in order to meet other objectives related to their educational mission.

In the second section of this paper, we present a simple model in which institutions face a trade-off between two desired outcomes, lower infection rates and greater educational quality, and a budget constraint determined by the range and effectiveness of possible interventions. The model suggests that we should focus not on particular mitigation efforts or policies, which are endogenous and can vary over time as an institution updates its beliefs about the effectiveness of particular interventions and responds to infection shocks. Instead, we should examine the more fundamental set of strictly exogenous variables that determine the education-health trade-off faced by a particular institution and the institution's preferences over its options. Second, the model informs our empirical analysis by suggesting a range of factors that may influence this trade-off, including the production functions for Covid mitigation technologies, the preferences of students and faculty, and an institution's selectivity, finances and governance.

To investigate the determinants of campus infection rates, we analyze data on cumulative infection rates at over 1,200 institutions of higher education, collected by the *New York Times*.[2] We use data on cumulative Covid infection rates for three dates, October 20, 2020, February 21, 2021 and May 26, 2021, near the beginning, middle and end of the 2020-21 academic year. This allows us to consider the evolution of factors determining Covid infection rates. These data are matched to institution-level data from IPEDS describing key variables related to institutional

[1] See CDC guidance for colleges and universities, https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/considerations.html, accessed May 30, 2021.
[2] This data is subject to periodic updates. For example, see https://www.nytimes.com/interactive/2021/us/college-covid-tracker.html.

finances, selectivity, and governance, and the size and demographic characteristics of the student body. To reduce the influence of omitted variables related to an institution's external environment, we also control for state and urbanization fixed effects.

To the best of our knowledge, our paper is the first to provide a systematic empirical analysis of the determinants of Covid infection rates at US institutions of higher education. The most closely related work includes Booeshaghi et al. (2020), who analyze the importance of endowment resources, governance and competitiveness as determinants of an institution's Covid testing strategy, and Mulholland (2020), who provides evidence on the impact of Covid infection rates on undergraduate admissions. A larger literature addresses the merits and challenges of different mitigation strategies, e.g. Walke et al. (2020), Wang et al. (2020), and Wrighton and Lawrence (2020).

Our key findings are as follows. First, money matters. Contrary to what we might have expected, there is a significant positive relationship between the value of an institution's endowment per student and the Covid infection rate. As shown in our theoretical model, this outcome may occur if educational quality is a superior good; if so, institutions that can afford to spend money to maintain educational outcomes through the pandemic accept somewhat higher infection rates in order to protect their students' ability to learn. There is also a positive relationship between the natural log of average tuition and fees and Covid infection rates, though this relationship is only significant at the end of the year, a finding that may reflect the time required to collect tuition payments, and early uncertainty over student residency and enrollment decisions.

Second, demographics matter. Larger institutions have higher Covid infection rates early in the year, but this effect is absent by year's end. This result is consistent with presence of

initial diseconomies of scale in Covid interventions and significant learning-by-doing over the course of the year. Covid infection rates are also increasing in the shares of white and male students in their student body, a finding that may reflect a number of important differences in preferences and behavior across genders and racial categories. Early in the academic year, but not subsequently, Covid infection rates are also higher at more selective institutions.

Finally, governance matters. At the end of the year, public institutions have cumulative Covid infection rates that are 30% higher than otherwise similar private institutions; this difference does not exist earlier in the year. We propose and find empirical support for a political-economic explanation of this difference, based on the fact that Covid policies at public institutions may be influenced by partisan political concerns. Consistent with this hypothesis, we find that public institutions in states with a Republican governor have cumulative Covid infection rates that are 38% higher than otherwise similar institutions located in state with a Democratic governor. Covid infection rates at public institutions in states with Democratic governors are not significantly different from those at private institutions.

Section 2: Theory

When the pandemic began, institutions were forced to alter their operations in order to reduce Covid infection risks for students, faculty, and staff. However, the changes required faculty to teach in ways which were less effective than those they had used prior to the pandemic. Institutions could respond by devoting resources to two types of interventions. One set of interventions was designed to directly mitigate the health shock by reducing the Covid infection risk, allowing student to return to campus where they could be taught more effectively; for

example, adjusting classrooms and dormitories to allow for social distancing, or testing regimes. They could also mitigate the education shock by adopting policies and technologies allowed faculty to teach more effectively remotely, such as cameras and microphones to allow faculty to teach via Zoom, course management software to make online learning more effective, and training faculty in new teaching methods. Most institutions made at least some expenditures on most of these things; different combinations of interventions allowed institutions to trade between more effective learning and lower infection rates.

Figure 1 demonstrates this tradeoff graphically. The dashed curves that are convex up and left are budget sets that represent possible combinations of infections and education outcomes for institutions. The curve to the left shows a relatively poor institution which cannot spend much, and hence must accept either relatively low learning outcomes or relatively high infection rates. Wealthier institutions have curves that are down and right from poorer institutions; they can spend more to get better learning outcomes or lower infection rates or both.

Institutions have preferences over learning outcomes and infection rates, which are described by indifference curves, shown as solid lines in Figure 1 which are convex down and right. Tangency between the budget sets and the indifference curve shows the optimal outcomes for both Covid infections and learning outcomes for institutions with different levels of wealth. The effect of increased wealth on infection rates depends on the location of the tangency points. If the tangencies are as shown in the graph on the left, then an increase in wealth will increase learning and reduce Covid infection rates. But if they are as shown in the graph on the right, where learning outcomes are a superior good and Covid infection rates are an inferior good, then as schools gain more wealth, they use it to increase education outcomes back towards pre-pandemic levels and accept a slightly higher infection rates as the cost of maintaining learning.

The optimal combination of learning and Covid infections will also depend on other variables that affect the locations of the budget sets and indifference curves. The shape and position of the budget sets reflects a variety of factors including the set of feasible interventions, institutional wealth, the local infection environment, and the willingness of students and other members of the campus community to behave in ways that reduce the risk of Covid transmission, such as wearing masks, maintaining social distance, and avoiding social activities at which masking and social distance are unlikely to occur. An institution's indifference map may be thought of as reflecting the preferences over educational and health outcomes of different sets of individuals, including students and their families, faculty and staff, and an institution's administration. In particular, the indifference curves will be affected by the tolerance of students (and faculty and staff) for Covid risk and their desire to maintain learning standards through the pandemic. For public universities they may also depend on the willingness of the state government, or lack thereof, to impose Covid safety measures.

Section 3: Data

Data on Covid infections at colleges and universities come from the *New York Times*. The data are compiled from reports by institutions and governments; the most recent release is available via GitHub. We use data on cumulative infections measured at three different times, October 20, 2020, February 21, 2021, and May 26, 2021, corresponding roughly to the beginning, middle and end of the 2020-21 academic year. Comparing results across the three dates allows us to investigate how the response to Covid has evolved over the year. We exclude any institution

whose note in the data file suggests that there may be concerns about how the case count was generated, to minimize problems of non-comparable measurements.

Most of our other variables come from the Integrated Postsecondary Education Data System (IPEDS) compiled by the National Center for Education Statistics. Data are taken for the 2019-20 year when they were available on IPEDS. Variables with data from that year include tuition and fees, and demographic data, both of which are known at the start of the academic year. Other variables are measured for the 2018-19 academic year because they were not yet available for 2019-20. Because these data are measured well prior to the onset of Covid, we do not need to worry about the endogeneity of these measures to an institution's perceived exposure or response to the pandemic.

For comparability, we limit the analysis to schools in the Carnegie classifications of doctoral and master's colleges and universities and baccalaureate colleges. 1634 colleges and universities are in these classifications, almost all of which are also in the *New York Times* case data, though some do not report values for all the variables we use in the analysis. The IPEDS variables we include measure key dimensions of institutional difference that may be expected to affect Covid infection rates, including finances, demographics, selectivity, governance, and location. We introduce key variables related to each of these dimensions below, including a brief discussion of how each is related to our theoretical framework.

We measure the financial resources of an institution with two variables that reflect its income and wealth, effective tuition and fees per student and endowment funds per student. These variables play an important role in determining an institution's budget set. Higher values of both indicate that the institution has more financial resources available to spend on educational improvements and safety measures. An important difference between these two

measures that endowment is a stock, and can be tapped immediately to make investments related to the pandemic; tuition is a flow that can only be used to fund investments as it arrives, unless it can be used to pay interest on loans that finance immediate purchases, which is costly. In the fall of 2020, there was great uncertainty regarding student enrollment and residency decisions, which created uncertainty regarding the expected level of income from these sources. For both of these reasons, we anticipate that endowment will have a greater and earlier effect on the Covid infection rate than tuition.

We include four variables that reflect important demographic characteristics of the student body. The first of these is total enrollment, measured as fall term, full-time equivalent students. We interpret this variable as a basic measure of an institution's size, which may affect Covid infections through at least wo distinct channels. First, if teaching and mitigation interventions are subject to economies of scale, then larger institutions may have a significant advantage in their use. Moreover, if institutions engage is significant learning by doing regarding the available interventions, then this relationship may also become stronger over time. Second, larger institutions may have less cohesive social structures and, therefore, lower levels of voluntary compliance with Covid-related restrictions, such as those involving social distancing and mask wearing, resulting in a positive relationship between size and infection rates.[3] Because these two channels work in opposite directions, the expected sign of coefficient on lnenroll is ambiguous.

The other demographic variables, *white*, *female* and *instate*, equal the shares of the student body that are white and female and the share of first-year students that are state residents. The first two of these variables potentially influence Covid infection rates through two separate

[3] See, for example, Bartscher et al. (2020) and Durante et al. (2020).

mechanisms. First, they will capture systematic differences in preferences for health and educational outcomes across races and genders. Student preferences play a key role in determining the structure of the indifference map faced by a given institution. Second, if there are systematic racial and gender difference in private behavior, such as differences in sociability or compliance with social distancing and other Covid mitigation policies, these will affect an institution's budget sets. The share of instate students may influence infection rates through its impact on student travel, which may affect Covid infection risk.

We include two variables that reflect the institution's selectivity and the segment of the higher education market that an institution serves.[4] Our first measure is the admission rate, *admit_rate*, defined as the share of an institution's applicants that are admitted. An institution with a lower admission rate admits stronger students which may affect the institution's preferences about expenditures, though it is unclear *ex ante* whether these students will prioritize educational quality or lower infection risks.

Our second measure is the enrollment yield, *admit_yield*, defined as the share of admitted students that matriculate at an institution. The enrollment yield is an important measure of the demand for education at a given institution, and has been shown to be sensitive to a variety of factors, including the tuition, fees, financial aid, and perceived institutional quality (Buss et al. 2004). Institutions with a lower enrollment yield are competing for students who have more choices about where to matriculate. Because of this, we expect schools with lower enrollment yields to place more importance on student preferences when considering tradeoffs between educational outcomes and health.

[4] We also considered a measure of the average SAT score, but this variable was not significant and including it reduced the sample size by roughly 15% since many institutions do not report it to IPEDS.

We consider a single measure of institutional governance, *public*, a dummy variable that takes a value of one for public institutions. Public governance may affect an institution's response to Covid through a number of channels. First, public status may indicate an implicit commitment to fund the institution from state governments. In this, case public status should affect Covid infection rates in a manner similar to endowments, since it represents a flow of future revenue. Second, because the upper-level administrators for public institutions are political appointees, the indifference maps for these institutions may reflect political and ideological preferences of state politicians. In particular, it may be that the desire to signal a commitment to certain partisan ideas, "Respect the science" or "Covid is a hoax," affects the political payoffs to different health-educational outcomes for institutional administrators.

Finally, we include two measures of the extent of Covid risk on campus and in the surrounding area. We include IPEDS' urbanization variable, which divides institutions into twelve categories, based on whether they are located in a city, a suburb, a small town, or a rural area; in the case of cities and suburbs whether the city is large, midsize, or small, and in the case of small town and rural area, whether the location is on the fringe of, near, or remote from the nearest metropolitan area. We treat this variable as categorical, including a binary variable for each of the 12 categories, minus one for large cities which serve as a reference case. We also include fixed effects for the state in which the institution is located. Both of these are intended to capture unobserved variation in the prevalence of Covid in the community in which the institution is located, and the amount of contact between that community and the institution's students, faculty, and staff.

For estimation, we adjust this data in two ways. First, we divide total infections and total endowment funds by total enrollment. This puts these variables into per-student terms, making

them comparable to other variables in the data and facilitating comparisons of large and small schools. Infections per student is a measure of the infection rate, which we believe is an appropriate variable to use from a welfare perspective, e.g., individuals care about the likelihood that they will get infected. Second, theoretical epidemiological models indicate that infections are exponential functions of the parameters that describe a pathogen's rate of spread e.g., Fernández-Villaverde and Jones (2020). Because of this, we estimate linear functions with the natural log of the infection rate as the dependent variable. The three logged infection rates are also roughly normally distributed. We also used natural logs of three other variables, *lnenroll*, *lnendow* and *lntuition*, in the analysis, because the unlogged values of these variables are highly skewed, making linear analysis sensitive to outliers. Their logged values are roughly normally distributed.

Means and standard deviations of all variables used in the analysis are found in Table 1. There are 1140 institutions with complete observations on the independent variables and May infection rates. Earlier measures include fewer institutions; there are 1134 in the sample with February infection rates and 1096 in the sample with October rates. The mean cumulative infection rate rises from 2.0% to 4.6% to 6.4% over the course of the year. Table 2 shows the correlation matrix for the infection rates in the three months. As might be expected the three measures are positively correlated, with correlation coefficients between 0.69 and 0.93, and the correlation is higher for rates closer in time. Schools that had relatively high Covid infection rates in October tended to still have them later in the year, but there were some schools whose infection rates rose more than other schools after October, and some whose rates rose less. Even after the main peak of infections had passed, there was still some variation in rates between February and May; we will return to this point in discussing the results.

Section 4: Results

We estimate the determinants of cumulative Covid infection rates at three points during the school year. The first, October 20, 2020, is roughly six weeks after Labor Day, the traditional start of the fall term for many schools. The second, February 21, 2021, is relatively early in the spring term, and fell about six weeks after the post-holiday peak in Covid infections in the United States in early January. The third, May 26, 2021, is at or near the end of the regular academic year for most schools. Equation 1 shows the natural log of cumulative Covid infections per student as a function of demographic variables related to the student body, key financial variables, measures of institutional selectivity, and an indicator variable for whether the school is a public institution, plus state fixed effects and fixed effects for each of the 12 urbanization categories of schools from IPEDS:

$$\begin{aligned} \text{lninfect}_i = {} & \beta_0 + \beta_1 * \text{lnenroll}_i + \beta_2 * \text{white}_i + \beta_3 * \text{female}_i + \beta_4 * \text{instate}_i + \beta_5 * \text{lnendow}_i + \\ & \beta_6 * \text{lntuition}_i + \beta_7 * \text{admitrate}_i + \beta_8 * \text{admityield}_i + \beta_9 * \text{public}_i + \alpha_u + \delta_s + \varepsilon_i \end{aligned} \quad (1)$$

where α_u represents the fixed effect for school i's urbanization category and δ_s represents the fixed effect for its state. Our results are shown in the first three columns of Table 3, one column for each of the three dates at which we measure the infection rate.

Financial Resources

We begin by examining the effects of the school's financial resources on its Covid infection rate. Our specification includes two measures of a school's finances, the natural log of tuition and fees

per student, *lntuition*, and the natural log of the endowment per student, *lnendow*.[5] In all three regressions there is a positive and highly significant relationship between *lnendow* and the cumulative Covid infection rate. This result is also visible in a simple scatterplot of the data, shown in figure 2; the slope of the best-fit line is 0.2088, with a t-stat of 10.51 for the hypothesis that the slope is 0. The coefficient on the natural log of tuition becomes both larger over the year, becoming significant at the 5% level for the May infection rates. This positive relationship between tuition and infection rates is parallel to the positive relationship between endowments and infection rates, but takes longer to come into effect. Overall, greater financial resources are generally associated with higher Covid infection rates. Our findings suggest that importance of income from tuition and fees rises relative to that of endowment resources as the year progresses; but even at the end of the year, a school's wealth mattered more than its income for expected Covid infection rates. A one-standard deviation increase in *lntuition* is associated with an 20% increase in the May 26 cumulative infection rate, compared to a 27% increase for a one-standard deviation increase in *lnendow*.

The relative importance of an institution's endowment and its income from tuition and fees likely reflects a number of factors. First, if schools expect the financial shock of Covid to be temporary, then it is reasonable for them to engage in consumption smoothing, such that Covid interventions are paid for primarily out of their stock of endowment wealth rather than the income flows derived from tuition and fees. Second, schools that rely primarily on current income to meet expenses may have been credit constrained when it came to financing Covid interventions. And, finally, early in the year, there was a great deal of uncertainty about how the pandemic would affect institutional income from tuition and fees, arising from uncertainty over

[5] We also considered the possibility of a quadratic relationship between infection rates and the two financial variables, but the squared terms were not significant in the specifications we considered.

student residency and enrollment decisions. As the year progressed, this uncertainly would have decreased, increasing the importance of tuition and fees as a source of financing for anti-Covid interventions.

Demographics and Selectivity

The coefficient on *lnenroll* is positive and significant at the five percent level in the fall, but insignificant in the other two specifications. The positive coefficient on the log of enrollments suggests the presence of significant diseconomies of scale to anti-Covid interventions at the start of the year. The insignificance of this variable in next two columns suggests these diseconomies of scale were less important later in the year. This is the pattern of coefficients that one would expect if, faced with a highly novel situation, if school administrators were engaged in learning-by-doing and gradually refined their Covid interventions, and smaller schools were able to adapt more quickly than larger ones.

Two more demographic variables, *white* and *female*, are significant at the one percent level and relatively constant in value in all three regressions, indicating that the number of Covid cases is larger for institutions with larger shares of white and male students. Coefficient estimates indicate that the racial composition of the student body matter more than its gender composition for the covid infection rate; a one-standard deviation increase in share of white students, equal to 20.9 percentage points, is associated with a 41% increase in the May infection rate, while a one-standard deviation increase in the share of women, equal to 11.0 percentage points, is associated with a 9% decrease in the May infection rate. The last demographic variable, *instate*, is not significant in any specification; holding other factors constant, bringing in more students from out of state does not affect an institution's infection rate.

The significance of these variables may reflect race and gender-related differences in student preferences, risk aversion, or behavior. The finding that the number of cases is greater for schools with whiter student bodies is particularly interesting, as Covid infection rates are lower among whites in the general population. Several factors may contribute to this relationship. First, white students may be less risk-avoiding than nonwhite students. It may also be that minority students are less integrated into campus social life, and that this reduces infection rates with larger minority populations. Finally, the greater prevalence of Covid among nonwhites relative to whites in the general population may also reflect a number of socioeconomic differences - lower incomes, higher population densities, and greater likelihood of working in positions that cannot go remote – that are less pronounced among white and nonwhite college students, who are not randomly selected from the general population. Racial differences in in-person school attendance for K-12 students are consistent with the idea that whites are less averse to the health risks associated with Covid (Camp and Zamarro, 2021).

Selectivity and Market Niche

Of the two variables that measure the institution's selectivity and market niche, only the enrollment yield is significant in all three regressions; the admission rate is significant in fall but not subsequently. The result for admission rate suggests that early in the year, more selective institutions spent more to maintain educational quality, and less to reduce infection risk, than less selective institutions; later in the year this distinction disappeared. The effect is moderately large. A one-standard deviation increase in an institution's admission rate, equal to 20.2 percentage points, is associated with a 11.9% reduction in Covid infections by October. In February the difference was down to 6.1% and by May was less than 2%.

The result for the enrollment yield shows that institutions with higher yields have lower infection rates. A one-standard deviation increase in the enrollment yield, an increase of 13.2 percentage points, decreases the infection rate by 11.3%. Because the yield is measured for the year prior to the pandemic, this cannot be due to students preferring schools with lower rates. Instead, it suggests that institutions with relatively low yield rates, who are more likely to lose students who choose to enroll at other institutions, make choices that more closely reflect student preferences and hence make them more attractive relative to their competitors. Since students are relatively young, hence at low risk of severe cases of Covid, and are the direct beneficiaries of higher educational quality, schools with low yields spend more resources to maintain educational quality and fewer to reduce infections than otherwise similar schools with higher yields.

Governance

We capture a key dimension of institutional governance by the public dummy variable. This measure is insignificant in the first two columns, but is positive and significant in the third. Our results indicates that by May 26, 2021, a public institution is expected to have a cumulative infection rate that is 30% higher than an otherwise similar private institution (the regression coefficient is 0.264 and $e^{0.264} - 1 = 0.302$). This finding suggests the presence of significant and systematic differences in the resources or incentives that influence how public and private institutions responded to Covid in the late winter and early spring of 2021.

What accounts for higher Covid infection rates at public institutions at the end of the year? An important difference in the governance structures of public and private institutions is that public institutions are part of a state's executive branch and, as such, partisan politics may play a greater role in influencing the incentives or feasible policy sets of administrators at public

institutions. Existing research finds that partisanship plays an important empirical role in explaining the adoption and timing of state-level Covid policies, Adolf et al. (2020), Gusmano et al. (2020, 380), Fowler et al. (2020). Indeed, Gusmano et al. (2020, 380) report that "the party affiliation of a state's Governor was the most important factor shaping the nature and timing of the response." Similar evidence exists for partisan identity and the policy response to Covid at the local level (Van Lieshout and Seddon, 2020). A substantial empirical literature also documents a role for partisan identity in the response to state and local policies, such as stay-at-home orders and mask requirements, but these effects are unlikely to explain differences in Covid infection rates between public and private institutions in a given state.

To test the hypothesis that the partisan identity of a state's governor matters for how public institutions responded to Covid, we augment our initial specification to include *GOP_public*, which is generated by interacting the public institution indicator with a dummy variable that equals one if a school is located in a state with a Republican governor. It thus takes the value 1 for public schools in Republican-governed states, and 0 for all other schools. Our results are shown in column 4 of table 3. Two results are notable. First, the coefficient on the interaction term is large, positive and highly significant. In particular, our finding indicates that the expected infection rate at a public institution in a state with a Republican governor is 38% higher than at a similar institution located in a state with a Democratic governor. Second, we find that the public institution dummy, which reflects the common impact of public institutional status on Covid infection rates across all states, is no longer significant. In particular, this means that in states with a Democratic governor, Covid infection rates at public institutions are not significantly different from rates at otherwise similar private institutions.

It is notable that the *gop_public* interaction term is not significant using the infection rate measures from earlier in the year. The emergence of partisan differences in Covid infection rates at public institutions may reflect different approaches in vaccination policy that developed early in 2021. According to Zahneis (2021), the first public schools to announce that vaccinations would be required for students in the fall of 2021 were all in states led by Democratic governors. Around the same time, five states led by Republican governors - Florida, Idaho, Montana, Utah, and Texas – passed laws making it illegal for any public agency to require a Covid vaccine. As of June 16, 2021, the *Chronicle of Higher Education* lists 220 public institutions that will require vaccinations for all students or all residential students. Less than 5% of these schools are in states with Republican governors.[6]

Section 5: Conclusion

This paper provides the first empirical analysis of the determinants of Covid infection rates at US colleges and universities. To motivate our analysis, we propose an analytical framework in which institutions are faced with a trade-off between educational quality and Covid infection risks. This framework suggests investigating factors that play important roles in determining the position and shape of an institution's budget sets and indifference curves in the education-infection risk space. These factors include an institution's financial resources, the demographic characteristics of its student body, selectivity, governance, and location.

[6] The list of schools that will require some form of vaccine mandate is available here: https://www.chronicle.com/blogs/live-coronavirus-updates/heres-a-list-of-colleges-that-will-require-students-to-be-vaccinated-against-covid-19.

We investigate the determinants of Covid infection rates at three points in time near the beginning, middle and end of the 2020-21 academic year. Self-reported data on cumulative Covid infections at over 1100 colleges and universities are matched with institution-level data from the IPEDS database.

Our key findings are as follows. First, for the year as a whole, Covid infection rates are higher at institutions with greater wealth and annual incomes. We interpret this surprising result as reflecting a greater emphasis on educational quality at wealthier institutions. Second, Covid infection rates are also influenced by demographic factors, with higher infection rates at schools where a greater share of the student body is white or male. These findings are consistent with significant differences in student preferences or behavior across genders and racial groups. Third, we find that Covid infection rates are lower at schools with higher enrollment yields, which is consistent with a greater weight on faculty relative to student preferences at these institutions. Finally, we find that public institutions have infection rates that are significantly higher than otherwise similar private institutions. Evidence suggests this difference arises due to differences in the response to Covid at public institutions located in states with Republican governors. In contrast, Covid infection rates at public institutions in states with Democratic governors are not significantly different from otherwise similar private institutions.

References

Adolph, Christopher, Kenya Amano, Bree Bang-Jensen, Nancy Fullman, Beatrice-Magistro, Grace Reinke, John Wilkerson (2020) "Governor partisanship explains the adoption of statewide mandates to wear face coverings," Manuscript.
doi**:** https://doi.org/10.1101/2020.08.31.20185371

Bartscher, Alina K., Sebatian Seitz, Michaela Slotwinski, Sebastian Siegloch, and Nils Wehrhöfer. "Social Capital and the Spread of COVID-19: Insights from European Countries." *IZA Institute of Labor Economics*, (May 2020).

Booeshaghi, A. Sina, Fayth Hui Tan, Benjamin Renton, Zackary Berger, and Lior Pachter. "Markedly heterogeneous COVID-19 testing plans among US colleges and universities." medRxiv (2020).

Buss, Christian, Jeffrey Parker, and Jon Rivenburg (2004) "Cost, quality and enrollment demand at liberal arts colleges," Economics of Education Review 23(1), 57-65.

Camp, Andrew, and Gema Zamarro. (2021). Determinants of Ethnic Differences in School Modality Choices during the COVID-19 Crisis. (EdWorkingPaper: 21-374). Retrieved from Annenberg Institute

Centers for Disease Control and Prevention (2021) "Considerations for Institutions of Higher Education." Available at: https://www.cdc.gov/coronavirus/2019-ncov/community/colleges-universities/considerations.html. Accessed January 15, 2021.

Durante, Ruben, Luigi Guiso, and Giorgio Gulino. "Civic capital and social distancing: Evidence from Italians' response to COVID-19." *VoxEU*, (2020).

Fernández-Villaverde, Jesus and Charles I. Jones (2020) "Estimating and Simulating a SIRD Model of Covid-19 for Many Countries, States and Cities," NBER Working Paper 27128.

Fowler, Luke, Jaclyn Kettler and Stephanie Witt (2020) "Democratic governors are quicker in responding to the coronavirus than Republicans," The Conversation. Available at: https://theconversation.com/democratic-governors-are-quicker-in-responding-to-the-coronavirus-than-republicans-135599

Gusmano, M.K., Miller, E.A., Nadash, P. and Simpson, E.J. (2020), Partisanship in Initial State Responses to the COVID-19 Pandemic. World Medical & Health Policy, 12: 380-389.

Integrated Post-Secondary Education Data System. https://nces.ed.gov/ipeds/use-the-data

Mulholland, Seth E. (2020), "Covid-19 Prevalence and Empty College Seats" manuscript, Western Carolina University.

New York Times Coronavirus Data Repository. https://github.com/nytimes/covid-19-data

Van Lieshout, Emma, and James Seddon (2020) “Acting, Fast or Slow: Partisanship and Local Government COVID-19 Policy Response,” Public Policy Studies, The University of Chicago.

Walke, Henry T., Margaret A. Honein, and Robert R. Redfield. "Preventing and responding to COVID-19 on college campuses." JAMA (2020).

Wrighton, Mark S., and Steven J. Lawrence. "Reopening Colleges and Universities During the COVID-19 Pandemic." Annals of Internal Medicine (2020).

Wang, Chuanyi, Zhe Cheng, Xiao-Guang Yue, and Michael McAleer (2020) “Risk Management of COVID-19 by Universities in China,” Journal of Risk and Financial Management 13(36). Doi:10.3390/jrfm13020036.

Watson S, Hubler S, Ivory D, Gebeloff R. (2020) “A new front in America’s pandemic: college towns. New York Times, September 6, 2020. https://www.nytimes.com/interactive/2020/us/covid-college-cases-tracker.html

Zahneis, Megan, “A Tipping Point? Dozens of Public Colleges Announce Covid-19 Vaccine Mandates,” Chronicle of Higher Education, April 23, 2021. Accessed on June 16, 2021.

Figures and Tables

Figure 1: Possible effects of increased wealth on education-health tradeoffs

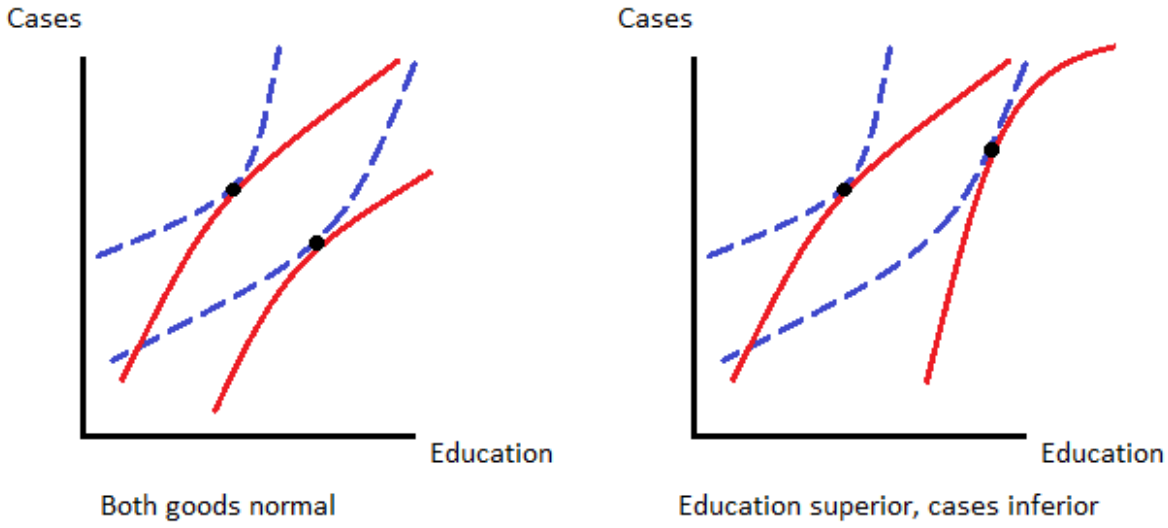

Figure 2: Scatter plot of log infection rate and log tuition

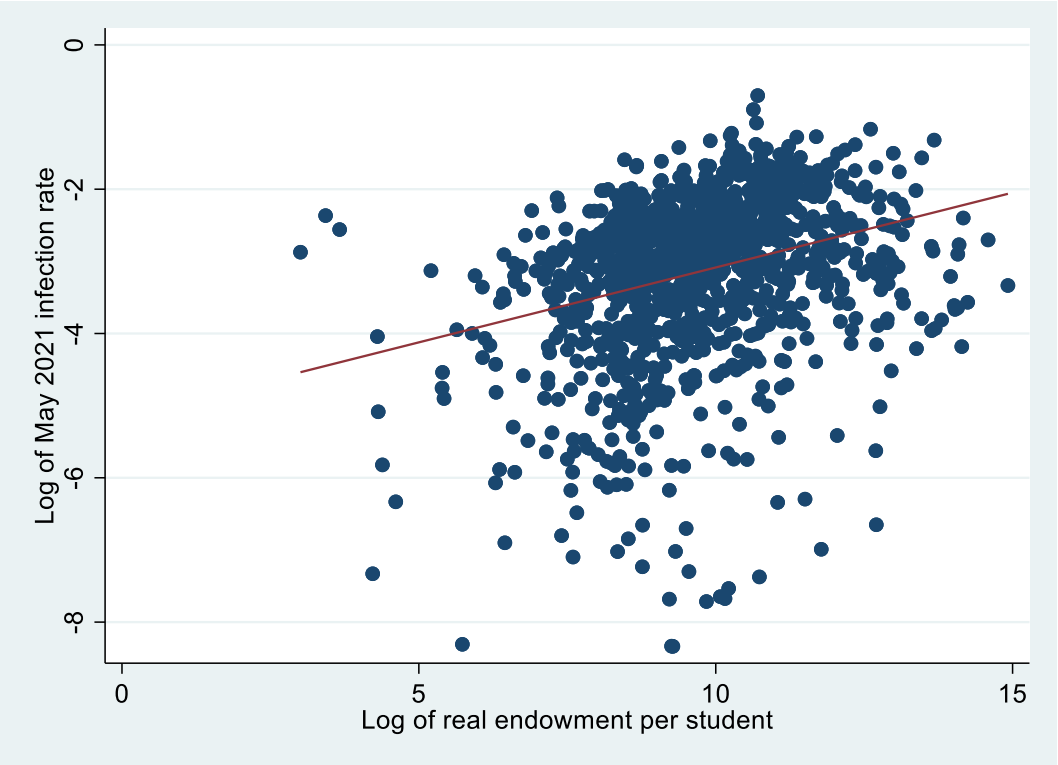

Table 1: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
infectOct20	1,163	0.0198924	0.0267735	0	0.2828508
infectFeb21	1,209	0.0462949	0.0453798	0	0.3925439
infectMay26	1,209	0.064134	0.0553188	0	0.4954233
lninfectOct20	1,134	-4.671965	1.393142	-9.704122	-1.262836
lninfectFeb21	1,173	-3.555816	1.185999	-8.335671	-0.935107
lninfectMay26	1,180	-3.165251	1.142663	-8.335671	-0.7023426
lnenroll	1,209	8.413859	1.111697	4.962845	11.63968
enrollment	1,227	8401.583	11492.4	0	113514
white	1,209	0.5729727	0.2087665	0	0.9321739
female	1,207	0.5718577	0.1095801	0	1
instate	1,220	0.6639016	0.2486741	0.0231363	1
tuitionperstudent	1,190	12928.04	7968.855	0	62002.26
endowperstudent	1,209	61760.97	184035.5	0	3021532
lnendow	1,185	9.684236	1.604522	3.00675	14.92127
lntuition	1,185	9.2811	0.6493591	4.411144	11.03493
instate	1,220	0.6639016	0.2486741	0.0231363	1
admit_rate	1,176	67.81293	20.21785	2	100
admit_yield	1,176	26.68197	13.19745	5	99
public	1,227	0.4368378	0.4961967	0	1

Table 2: Infection Rate Correlation Matrix

	infectOct20	infectFeb21	infectMay26
infectOct20	1		
infectFeb21	0.798	1	
infectMay26	0.6917	0.9267	1

Table 3: Determinants of Cumulative Campus Covid Infection Rates

	(1)	(2)	(3)	(4)
	All	All	All	All
VARIABLES	lninfectOct20	lninfectFeb21	lninfectMay26	lninfectMay26
lnenroll	0.118**	0.0412	-0.00952	-0.00765
	(2.572)	(1.078)	(-0.258)	(-0.208)
white	1.890***	1.604***	1.647***	1.659***
	(8.195)	(8.547)	(9.049)	(9.147)
female	-0.698**	-0.856***	-0.849***	-0.884***
	(-2.185)	(-3.242)	(-3.312)	(-3.455)
lnendow	0.122***	0.143***	0.151***	0.147***
	(3.685)	(5.216)	(5.654)	(5.508)
lntuition	0.0526	0.164*	0.279***	0.264***
	(0.479)	(1.795)	(3.145)	(2.976)
instate	0.432*	0.306	0.189	0.189
	(1.915)	(1.640)	(1.040)	(1.043)
admit_rate	-0.00589***	-0.00300	-0.000981	-0.00148
	(-2.653)	(-1.638)	(-0.550)	(-0.831)
admit_yield	-0.0105***	-0.00895***	-0.00859***	-0.00913***
	(-3.208)	(-3.264)	(-3.221)	(-3.425)
public	0.169	0.144	0.264**	0.107
	(1.245)	(1.277)	(2.435)	(0.879)
gop_public				0.322***
				(2.807)
Urbanization FE	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Constant	-6.636***	-6.966***	-7.757***	-7.647***
	(-5.932)	(-7.418)	(-8.504)	(-8.402)
Observations	1,069	1,104	1,110	1,110
R-squared	0.473	0.464	0.443	0.447

Table 3 notes: All regressions control for state and urbanization fixed effects. t-stats in parentheses. Asterisks indicate statistical significance: *** p<0.01, ** p<0.05, * p<0.1.