The Economic Impact of COVID-19 on Colleges: A Stress Test Approach

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Steering academic institutions through the COVID-19 pandemic is a complex and multifaceted task that can be supported with *model-based scenario analysis*. This article studies short-term and long-term economic effects of the pandemic on an academic institution using *scenario analysis* and *stress testing* (Sedlacek 2019; Zemsky et al. 2020) with a *system dynamics model* of a typical tuition-dependent college.

The college model (Pavlov and Katsamakas 2020; Lindner 2020; Pavlov and Katsamakas 2021) represents an academic institution as a *complex service system* (Lella et al. 2012; Massy 2016; Rouse 2016; Kezar 2018; Pavlov and Hoy 2019; Vedder 2019) that consists of students, faculty, facilities, and financial variables (Figure 1).

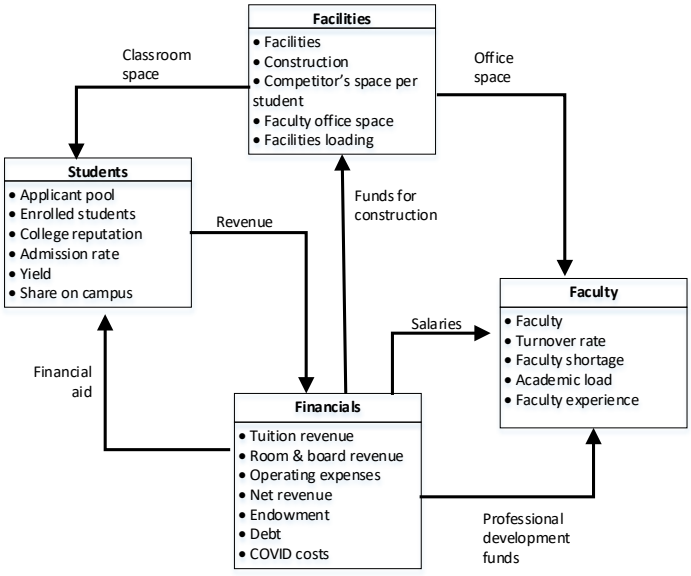

Figure 1: The four modules of the *college model*

Stress testing uses the Market Stress Test Score, MSTS, (Zemsky et al. 2020) that tracks four variables: the first-year enrollments, retention of students, market price, and endowment-to-operating-expense ratio. When the components drop below thresholds or exhibit strong negative trends, the MSTS score increases. Any institution with the MSTS above 4 faces a substantial market risk.

Pandemic risk: This study considers six components of the COVID-19 shock, which we call stressors S1 through S6. In Figure 2, short red arrows indicate whether a variable increases or decreases due to COVID-19. A positive link between two variables signifies a positive causality between them. Negative causalities are shown with negative links.

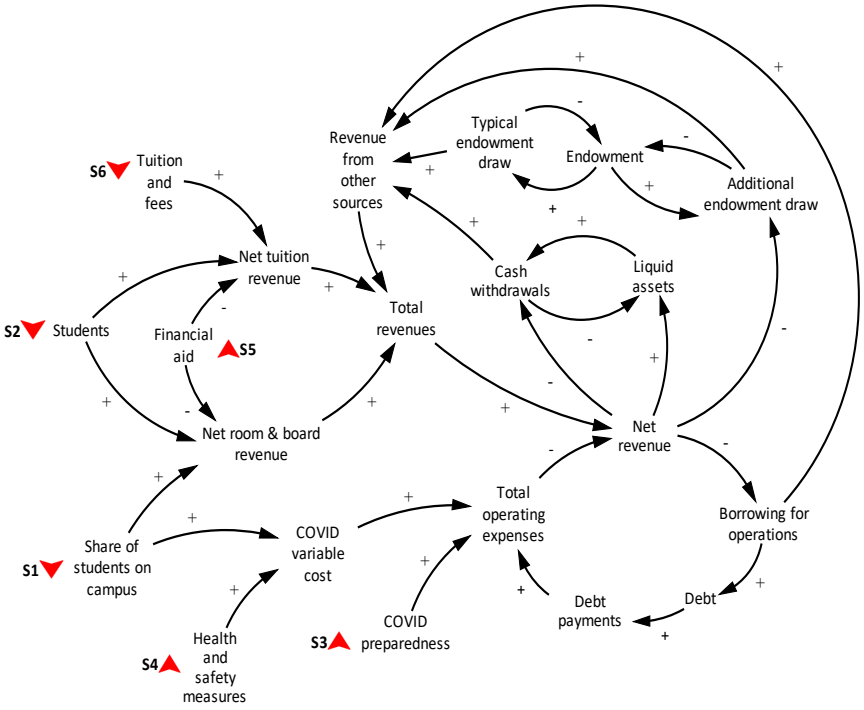

Figure 2: Six components of the COVID-19 shock on a college

Results: We find that due to the causal complexity, nonlinear responses and delays in the system, the negative shocks due to COVID-19 can propagate widely through the college, sometimes manifesting themselves with considerable delays and disproportionate effects. Breaking the COVID-19 shock into six components and simulating their impact on the college reveals that while in isolation each stressor is not likely to undermine a college, certain combinations of the shocks may destabilize even financially healthy institutions. These simulations explain why, despite extraordinary financial and operational challenges, only very few colleges have closed during the pandemic (Natow 2021). The simulations also suggest that some colleges may succumb to the negative effects of COVID-19 long after the pandemic is officially over.

We conclude that as colleges face multiple existential threats and challenges, they may want to rethink the provision of educational and auxiliary services in order to improve the sustainability of their business models. One potential approach is to leverage business model innovation and new technologies such as artificial intelligence (Katsamakas and Pavlov 2020). That should be an important direction for research on the future of higher education.

This article contributes to the literature on the economics of higher education (Massy 2016; Caskey 2018; Grawe 2018), management of the pandemic-related risk on campus (Wildman et al. 2020; Losina et al. 2020), model-informed academic management (Galbraith 1998, Kennedy and Clare 1999, Mansmann and Scholl, 2007; Massy 2020) and the wider efforts to establish stress-testing techniques suitable for higher education (Sedlacek 2019; Zemsky et al. 2020). When integrated with data and decision support systems used by colleges and universities, the approach developed in this article can help academic leaders make informed institutional planning decisions.

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