Optional ERIC Coversheet — Only for Use with U.S. Department of Education Grantee Submissions

This coversheet should be completed by grantees and added to the PDF of your submission if the information required in this form **is not included on the PDF to be submitted**.

INSTRUCTIONS

- Before beginning submission process, download this PDF coversheet if you will need to provide information not on the PDF.
- Fill in all fields—information in this form **must match** the information on the submitted PDF and add missing information.
- Attach completed coversheet to the PDF you will upload to ERIC [use Adobe Acrobat or other program to combine PDF files]—do not upload the coversheet as a separate document.
- Begin completing submission form at https://eric.ed.gov/submit/ and upload the full-text PDF with attached coversheet when indicated. Your full-text PDF will display in ERIC after the 12-month embargo period.

GRANTEE SUBMISSION REQUIRED FIELDS

Title of article, paper, or other content

Does State Allocation of University Funding Moderate Effectively Maintained Inequality?

All author name(s) and affiliations on PDF. If more than 6 names, ERIC will complete the list from the submitted PDF.

Last Name, First Name	Academic/Organizational Affiliation	ORCID ID
Smith, Christian Michael	Department of Sociology, University of Californ	0000- 0002-8024-3832

Publication/Completion Date—(if *In Press,* enter year accepted or completed) June 2022

Check type of content being submitted and complete one of the following in the box below:

- ☑ If article: Name of journal, volume, and issue number if available
- ☐ If paper: Name of conference, date of conference, and place of conference
- ☐ If book chapter: Title of book, page range, publisher name and location
- ☐ If book: Publisher name and location
- ☐ If dissertation: Name of institution, type of degree, and department granting degree

Social Currents, volume 9, issue 3

DOI or URL to published work (if available) https://doi.org/10.1177/23294965211054050

Acknowledgement of Funding— Grantees should check with their grant officer for the preferred wording to acknowledge funding. If the grant officer does not have a preference, grantees can use this suggested wording (adjust wording if multiple grants are to be acknowledged). Fill in Department of Education funding office, grant number, and name of grant recipient institution or organization.

"This work was supported by U.S. Department of Education **[Office name]** Institute of Education Scie through **[Grant number]** #R305B150 to **Institution]** the University o. The opinions expressed are those of the authors and do not represent views of the **[Office name]** Institute of Education Scie or the U.S. Department of Education.

Article

Social Currents
2022, Vol. 9(3) 245–264

DOI: 10.1177/23294965211054050
journals.sagepub.com/home/scu
SAGE

Does State Allocation of University Funding Moderate Effectively Maintained Inequality?

Christian Michael Smith[1]

Abstract

According to the theory of Effectively Maintained Inequality (EMI), economically advantaged individuals not only enter each level of education at higher rates than do their less advantaged peers, but also enjoy qualitative advantages at each level that position them more favorably to continue to the next level. Governments may play a role in facilitating or limiting EMI because they allocate appropriations to public universities; the more between-university variability in these funds, the more horizontal differences high-income students may exploit. I ask whether Wisconsin's unequal pattern of appropriations across its institutions of higher education exacerbates income-based disparities in college persistence. I test two hypotheses: (1) Economically advantaged students sort into the universities with greatest appropriations; (2) Appropriations promote first-to-second-year persistence. Evidence in favor of both hypotheses would support the claim that an unequal pattern of appropriations exacerbates college persistence disparities and, accordingly, suggest that unequal allocation facilitates EMI. Results support hypothesis (1) but not hypothesis (2). The results do not present evidence that the Wisconsin state government facilitated or limited EMI based on its allocation of funds across universities.

Keywords

social stratification, sociology of education, higher education, college persistence, university finance

Introduction

This study concerns the potential link between horizontal educational stratification and state governmental policy. The distinction between vertical and horizontal educational stratification is foundational in the sociology of education. Vertical stratification arises when advantaged groups enter a given level of education at greater rates than disadvantaged groups, while horizontal stratification arises when advantaged students at that level receive a qualitatively superior education that better promotes advancement to the next level of education (Gerber and Cheung 2008). While scholars of social stratification have documented horizontal stratification in

[1]Department of Sociology, University of California, Merced, Merced, CA, USA

Corresponding Author:
Christian Michael Smith, Department of Sociology, Berea College, 101Chestnut St, Berea, KY 40403, USA.
Email: smithc3@berea.edu

postsecondary education (Andrew 2017; Roksa et al. 2007), the field knows less about how policies, especially state governmental policies, mitigate this form of stratification.

The unequal outcome of interest in this study is the economic college persistence gap, which is very wide in the United States. Economically disadvantaged students' college completion rates have proven stubbornly meager (Kelchen 2017), and as is clear from many years of research, dropout before the second year is a substantial contributing factor (Shapiro et al. 2014; Smith 1995). Pell grant recipients' 6-year graduation rate is now about 10 percentage points lower than that of students not receiving the grants (Kelchen 2017). College persistence disparities are pragmatically important because, first, college confers private benefits like better wages (Webber 2016) and health (Cutler and Lleras-Muney 2006), and second, college-educated individuals bring public benefits like increased tax revenue and civic engagement (Baum, Ma, and Payea 2013).

Despite how persistence gaps have endured, most states rolled back their funding of postsecondary education after the Great Recession (Ma et al. 2015), causing universities to compete for an increasingly scarce pool of money. States usually end up funding some universities far more generously than others. It may matter how states allocate appropriations across universities because this allocation may affect which universities can afford the academic support, instructional, and student service expenditures that research shows promote persistence (Gansemer-Topf and Schuh 2006; Ryan 2004; Webber and Ehrenberg 2010). If state appropriations promote persistence, and if economically advantaged students tend to attend the universities with the greatest state appropriations, then an uneven allocation of state appropriations exacerbates persistence gaps by channeling funds to the universities that serve economically advantaged students.

To test the role that state governments' allocation of university funding plays in horizontal stratification, I test two hypotheses using data from Wisconsin: (1) Economically advantaged students sort into the universities with the greatest per-student state appropriations and (2) Increased state appropriations promote first-to-second-year persistence. The evidence supports Hypothesis (1): compared to the most economically advantaged students, the least economically advantaged students attend Wisconsin public universities that receive an average of US$600 less in per-student state appropriations. However, the evidence does not support Hypothesis (2): I precisely estimate a very small impact of university-level changes in state appropriations on student persistence. I then attempt to explain this null result by showing that university-level changes in state appropriations have little impact on academic support expenditures, the type of expenditures that matter most for persistence in Wisconsin. I situate the results within Lucas's (2001) framework of Effectively Maintained Inequality (EMI), which formalizes a particular theory of horizontal stratification, making this study the first to theorize and test a potential link between EMI and state governmental policy, though I do not formally test for the presence or absence of EMI. I argue that the results do not present evidence that the Wisconsin state government facilitated or limited EMI based on its pattern of state appropriations to universities.

Background

Theoretical Framework: Effectively Maintained Inequality

Drawing on educational transitions literature (Mare 1980) and high school tracking literature (Gamoran and Mare 1989), Lucas (2001) finds that socioeconomically advantaged students reinforce inequality in educational advancement by taking college-preparatory high school courses that increase the probability of progressing to the next grade. On the basis of this finding, Lucas proposes that high-SES groups secure vertical educational advantages when such advantages are commonly possible and secure horizontal educational advantages when such advantages are commonly possible. Because this theory implies that the highest

socioeconomic echelons maintain horizontal educational advantages even in the absence of vertical stratification at a given level of education, Lucas calls his theory Effectively Maintained Inequality.

Since Lucas posed his theory, several social scientists have presented evidence that universities differ in the extent to which they promote school continuation, in an analogous fashion to that of high school curricula. Cunha and Miller (2014) find that the postsecondary institution one attends has a substantial conditional association with both graduation and first-to-second-year persistence. Furthermore, net of many student characteristics, selective colleges graduate their students at a higher rate than do their less selective counterparts (Bowen, Chingos, and McPherson 2009). Institutions with greater expenditures on academic support (Gansemer-Topf and Schuh 2006; Ryan 2004), instruction, and student services (Webber and Ehrenberg 2010) also seem to promote student persistence and graduation. To the extent that high-SES individuals are overrepresented in the best institutions—which is the case at minimum when proxying institutional quality with selectivity (Roksa et al. 2007)—variation in educational quality exacerbates college persistence disparities. Thus, it is unsurprising that Andrew (2017) finds support for EMI in what is, to my knowledge, the only explicit test of EMI at the postsecondary level. While formal tests of EMI at the postsecondary level are scarce, some studies include *initial enrollment*—rather than persistence—in postsecondary education as the final transition in their analyses (Byun and Park 2017; Lucas 2001), and researchers often assess who attends the most coveted postsecondary institutions without formally testing EMI (Davies, Maldonado, and Zarifa 2014; Kopycka 2021).

Differentiation

Differentiation in postsecondary education facilitates EMI at the postsecondary level. A system of postsecondary education is highly differentiated if the institutions within it vary widely in how efficaciously they beget desired assets for their students. The most obvious asset that postsecondary institutions can help their students acquire is an educational credential. Therefore, given the previously reviewed evidence that institutions vary in how much they promote college persistence and graduation, the U.S. system of postsecondary education is highly differentiated.

Differentiation facilitates EMI because high-SES individuals can more easily secure horizontal advantages in postsecondary education if such advantages are available to secure based on which institution one attends. In the framework of EMI, the more horizontal advantages are commonly possible for high-SES individuals, the more one expects that they will seize these advantages. The international body of research on differentiation supports this expectation: systems of postsecondary education with the most differentiation see the greatest horizontal stratification in the postsecondary destinations of high- and low-SES students (Ayalon et al. 2008; Shavit, Arum, and Gamoran 2007; Thomsen 2015), even if the lowest-tier institutions in highly differentiated systems play an inclusive role (Shavit et al. 2007).

Linking the Effectively Maintained Inequality and Differentiation Literature with Government Policy

Governments may play a role in differentiating their postsecondary education systems because they directly allocate funds to institutions. In U.S. public postsecondary education, the task of differentiating institutions via nonuniform funding falls mostly on state governments, which allocate blocks of money to each public postsecondary institution in their respective states. Historically and during the period presently studied, state appropriations were the greatest source of revenue at most public institutions, though tuition revenue now rivals state appropriations as both constitute about 46% of revenue (State Higher Education Executive Officers Association 2019). The share of revenue coming from net tuition varies considerably across states—17.5% at the low end in Wyoming and 87% at the other end in Vermont—with Wisconsin falling near the average at a 50%

share. If generous state appropriations give institutions the resources to promote student persistence, then a state government helps differentiate its system of postsecondary education when it allocates appropriations unevenly across institutions.

Because EMI emphasizes individual actors, most studies of EMI, reasonably, focus on documenting the outcomes achieved by individuals from different socioeconomic backgrounds. However, perhaps more subtly, the theory also emphasizes structure: the theory proposes that socioeconomically advantaged actors will only secure the educational advantages that are commonly possible; therefore, from the perspective of this theory, governments may have power to mitigate EMI because they can allocate resources in ways that constrain the qualitative advantages that are commonly possible, as detailed in the previous paragraph. In turn, governments may constrain advantaged students' abilities to secure qualitative advantages. The comparative scarcity of studies that link EMI with policy, especially state governmental policy, presents a worthwhile opportunity to emphasize an underappreciated structural factor in the study of EMI.

Several years after formalizing his theory of EMI, Lucas himself wrote about the importance of policy in the framework. According to him, "Ostensibly inescapable dynamics and patterns may actually be escapable. Thus, EMI has policy implications" (Lucas 2017:25). He argues that policymakers do have the power to mitigate EMI, prevalent as it may be. Social scientists ought to test potential avenues for this mitigation. Whether or not the results indicate that the avenue in question is viable, the results pragmatically help policymakers focus their efforts and theoretically help sociologists identify the structures to which EMI is linked. State funding is a useful avenue to test because state funding is straightforwardly in policymakers' hands, constitutes a sizeable share of universities' resources (State Higher Education Executive Officers Association 2019), and is at a policy scale underexamined in EMI research, namely the scale of state governments.

Why Might State Appropriations Impact Persistence?

Why might more state appropriations promote first-to-second-year persistence? Tinto's (1993) Institutional Departure Model helps clarify the possible pathways. Applying Durkheimian frameworks, Tinto argues that dropout, especially during the first year of college, results from a lack of academic and social integration into the institution. He further emphasizes that institutional factors influence how well or poorly students integrate into the academic and social norms of the institution. State appropriations plausibly affect several institutional factors, so the Institutional Departure Model points to an effect of state appropriations on student persistence.

As a first example, increased per-student revenue from state appropriations could allow the institution to bolster its academic support, for example, by hiring and retaining more academic advisors. Academic advisors may be especially important in helping students progress during the first year, when they are especially likely to lack other mentors and forms of guidance. Second, institutions may use additional revenue from state appropriations to offer more courses per student. With smaller class sizes, students are likely to have more favorable impressions of their classes (Cuseo 2007), potentially promoting persistence as a result. Finally, institutions may use additional revenue from state appropriations to boost their student support services, including tutoring programs, counseling services, and general health services. High expenditures on student support services seem to promote persistence, especially at institutions with a high share of low-income students, who plausibly benefit more from these services if they tend to have heightened academic or socioemotional needs (Webber and Ehrenberg 2010). Of course, not all revenue from increased appropriations may necessarily go toward expenses that promote student persistence. For example, institutions that direct a large share of their money toward administration harm student persistence (Titus 2006b). Nevertheless,

national evidence on the effects of statewide reductions in appropriations (rather than between-institution disparities therein) points to a substantial effect of state appropriations on persistence and graduation: Bound et al. (2019) estimate that a 10% statewide drop in appropriations leads to a 3.6% drop in bachelor's degree production at research universities and Deming and Walters (2017) estimate that a movement from the 25th to the 75th percentile of state support causes a 5% increase in degrees and certificates awarded in the state. These findings suggest that, at the national level, institutions apply at least some state appropriations toward educationally-conducive efforts.

On the other hand, state appropriations may promote persistence but appear not to due to statistical artifacts. For example, if Wisconsin tends to grant more appropriations to universities during periods when they are struggling with other forms of revenue, then increases in state appropriations might not be associated with increases in overall funds that the university can wield. More generally, any unobserved factor that is associated with increases in state appropriations and decreases in persistence rates, or vice versa, will make it appear that state appropriations are less beneficial to persistence than they really are.

State Appropriations in Wisconsin

The Wisconsin state government allocates funding very unevenly across its public, 4-year universities. This pattern is most pronounced when comparing the flagship campus, Madison, to the other 12 campuses. Madison typically receives around US$11,000 per full time equivalent student in state appropriations, while almost every other campus receives less than half of that amount (calculations my own, drawn from the Integrated Postsecondary Education Data System)[1].

To the extent that (1) state appropriations promote college persistence, and (2) economically advantaged Wisconsinites sort into the institutions with the greatest state appropriations, there is evidence that Wisconsin's unequal allocation of appropriations exacerbates income-based disparities in college persistence. Furthermore, this result would suggest that state governments facilitate EMI when they allocate university funding highly unequally across universities, and mitigate EMI when they allocate funding more evenly[2].

Formally, the Madison campus is more economically exclusive than the other 12 campuses because its tuition and fees are the greatest—US$10,725 annually versus US$7422 at the least expensive campus (University of Wisconsin System 2020). Formal economic exclusion is not a necessary condition for unequal access, though: It is possible that the especially selective admissions criteria of the Madison campus exclude the bulk of economically disadvantaged students from attending. Economically advantaged individuals could then disproportionately secure spots at the Madison campus by adapting to exclusion criteria that are formally class-neutral.

Methods

Data Sources

Data come from a unique merger of three sources: the Wisconsin Statewide Longitudinal Data System (WSLDS), the National Student Clearinghouse (NSC), and the Integrated Postsecondary Education Data System (IPEDS). For student-level data, I merge WSLDS with NSC. WSLDS records academic and demographic information on every student in Wisconsin public K-12 schools, while NSC is a national data source that tracks where and when individuals enroll in postsecondary education. For institution-level data, I use IPEDS, which longitudinally records information on postsecondary institutions, including information on finances, student enrollment, and admissions. All institutions that participate in federal student aid programs must report to IPEDS, and thus IPEDS covers virtually every institution of postsecondary education in the United States. Prior research on the impacts of state appropriations uses university- or state-level data only (Bound et al. 2019; Deming and Walters (2017); Zhang 2009), making it difficult to study how financial factors influence different student

subgroups to varying degrees. The data merger in this study facilitates such analyses because of the rich information it provides on individual students and the statistical power that large, population-level data provide.

The analytic sample encompasses the full population of 180,000 people who attended a Wisconsin public high school sometime between the 2007–2008 and 2015–2016 school years, whose first postsecondary enrollment occurred during or before the 2017–2018 school year, whose first postsecondary enrollment was at a UW 4-year campus, and who have observed ACT scores (about 15,000 out of about 195,000, 7.7%, are missing ACT scores). Within the analytic sample, there are no missing values to impute, due to the administrative nature of the data.

For several reasons, Wisconsin is a valuable state in which to conduct this research. First, the state is average in terms of the percentage of revenue that its public institutions obtain from state appropriations (State Higher Education Executive Officers Association 2019), implying a degree of representativeness not available from states at the extremes. Second, Wisconsin embodies the model found in many other states, in which one flagship university differs markedly from the state's branch campuses in terms of state appropriations, selectivity, and research activity. Third, as the group from which stratification scholars gleaned some of the most seminal findings on the educational attainment process (Sewell et al. 2003; Sewell, Haller, and Portes 1969), the Wisconsin population is historically important to the field's understanding of higher education and social stratification. Finally, Wisconsin's Statewide Longitudinal Data System is more thorough than many states' (Education Commission of The States 2019), with crucial linkages to postsecondary enrollment data as well as many available control variables, including ACT scores and school suspension incidences.

Effect of State Appropriations

Measures. The outcome variable is a binary indicator of college persistence, operationalized as whether the student enrolled in an institution of postsecondary education the academic year following their first enrollment in postsecondary education. I measure the outcome based on year-to-year persistence, rather than ultimate graduation, because the independent variable, per-student state appropriations, is different for the same student during different years of attendance even at the same institution. Nevertheless, in later supplementary analyses, I show results from a more complex model of persistence in all years rather than just first-to-second-year persistence.

The key independent variable is an institution-level measure of per-student state appropriations, as measured during the academic year that the student entered college[3]. State appropriations are the funds that institutions receive through acts of a state legislative body. The Wisconsin state government allocates funds to universities only every other year, with changes in total appropriations occurring when the state begins a new budget period during the summer of odd-numbered years. However, *per-student* state appropriations change every year because university enrollments are not constant within budget periods. Thus, both government allocations and shifts in enrollment drive changes in the independent variable (Bound and Turner 2007).

The moderator variable is an economic disadvantage, which I operationalize as the proportion of years the student is observed to have received[4] free- or reduced-price lunch (FRPL) while attending Wisconsin K-12 public schools. Students are eligible for reduced-price lunch if their gross family income is at or below 185% of the federal poverty line, which in the 2015–2016 school year was US$44,863 of annual income for a family of four (U.S. Department of Agriculture 2015). I follow Michelmore and Dynarski's (2017) methodological insights and operationalize economic disadvantage using longitudinal information about FRPL receipt, since FRPL receipt at a single point in time yields a coarser view of the material resources students enjoy. Specifically, among those receiving FRPL, those who receive it for more years tend to have lower family incomes and see worse academic outcomes compared to those who receive it for only 1 year

(Michelmore and Dynarski 2017). These patterns also accord with the fact that many children go in and out of economic disadvantage (Rank and Hirschl 1999), implying that economic disadvantage in a single year is a poor proxy for a child's long-run exposure to economic disadvantage. I use *persistently-FRPL* to describe students who were always observed to receive FRPL and *never-FRPL* to describe students who were never observed to receive it[5].

Ideally, I would be able to include non-pecuniary dimensions of socioeconomic status, like parental education and parental occupational status, but the available administrative data only record economic disadvantage without other measures of socioeconomic status. The added breadth would more comprehensively capture the set of factors that the EMI literature has considered. Still, the available measure is useful because economic circumstances constitute one important dimension of socioeconomic status, and the inclusion of economic measures in EMI research (Andrew 2017; Lucas 2001) and school transitions research generally (Mare 1980) reflects this importance. It would also be ideal if the available measure differentiated all levels of the economic distribution. The measure differentiates various bottom levels of the distribution from a combined middle/top group but does not differentiate the top of the distribution from the middle. While the theoretical framework inspiring this study emphasizes "socioeconomically advantaged actors" (Lucas 2001: 1652), it is still worthwhile to compare the outcomes of students with the least economic advantage to the outcomes of students in a combined middle/top group. Even the least advantaged students in the combined group are still socioeconomically advantaged compared to the students at the bottom of the economic distribution, and thus the EMI framework still applies. Interpretations of this research, however, should focus narrowly on the economic dimension of socioeconomic status.

I adjust for several student attributes to reduce potential confounding. Students who persist are different from those who do not, and characteristics that predict persistence may covary with within-institution, year-to-year changes in state appropriations. To reduce the threat of bias due to confounding factors, I control for a quadratic transformation of ACT math score[6], a quadratic transformation of ACT English score[7], proportion of years on FRPL, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other/multiple race), sex, whether the student was ever suspended in high school, and binary high school indicators[8] (high school fixed effects), which adjust for factors shared by all graduates of the high school, such as rurality, proximity to the nearest university, and any school compositional characteristics that are practically the same across cohorts.[9]

Analytic Strategy. Observational estimates of how state appropriations affect persistence are fallible for two chief reasons. First, the students most likely to persist may sort into the most generously-funded universities, and not all of the student characteristics predicting persistence may be observable to adjust. Second, years when universities are most generously funded overall may be years during which students are most inclined to persist for reasons not necessarily related to state appropriations. If either of these problems is present, then estimates of the effect that state appropriations have on persistence will be upwardly biased when using standard regression adjustment techniques that only control for student-level characteristics.

My approach is to simultaneously compare outcomes of students who entered the same institution but in different years and outcomes of students who entered college the same year but at different institutions. Perhaps most importantly, if institution-level differences in students' academic skills are effectively constant over the period of study, then this approach adjusts for such differences without requiring error-free measures of academic skills. More generally, the strategy adjusts for all unobserved, aggregate student characteristics that, within each institution, are practically constant over time, as well as adjusting for unobserved, secular changes in the population of UW 4-year

campus students across years. In particular, I estimate a logistic regression model of the form

$$\log\left(\frac{p_{ijk}}{1-p_{ijk}}\right) = \alpha + \beta A_{jk} + \zeta X_{ijk} + \gamma_j + \delta_k + \varepsilon_{ijk} \quad (1)$$

where p_{ijk} is the probability that student i at institution j in year k persists, α is an intercept term, β is the coefficient corresponding to per-student state appropriations A_{jk} at institution j in year k, ζ is a vector of coefficients corresponding to the vector $\boldsymbol{X_{ijk}}$ of student-level explanatory variables, γ_j is the fixed effect of institution j, δ_k is the fixed effect of year k, and ε_{ijk} is an idiosyncratic error term (α, β, ζ, γ_j, and δ_k, are all parameters to be estimated). $\boldsymbol{X_{ijk}}$ contains measures of economic disadvantage, an interaction between per-student state appropriations and economic disadvantage[10], and all control variables listed above.

In the foregoing analysis, I compute Liang–Zeger standard errors, adjusting for clustering by university. While the analysis draws on population-level data, inferential statistics are still necessary when estimating causal effects because only half of all potential outcomes are observed (Abadie et al. 2020). Additionally, it is necessary to adjust standard errors for clustering because, while observations are not sampled based on a cluster variable, levels of the independent variable are assigned based on one (Abadie et al. 2017).

Economic Sorting

To assess the extent to which economically advantaged students in Wisconsin sort into universities with the highest per-student state appropriations, I estimate a bivariate, ordinary least squares regression model of per-student state appropriations using the proportion of years on FRPL as the sole predictor. For this model, I use the same analytic sample as used when estimating the effect of state appropriations on persistence in Wisconsin. The purpose is purely descriptive, simply to show how economically advantaged and disadvantaged students differ in terms of mean per-student state appropriations. Thus, there is no need to control for additional student characteristics. Furthermore, inferential statistics are meaningless in population-level descriptive analyses, in contrast to causal analyses (Abadie et al. 2020), thus I do not compute a standard error.

The analysis of economic sorting is best seen as replication, since earlier work has tested whether more economically advantaged students tend to attend more well-resourced institutions (e.g., Titus 2006a). Still, these results are worth presenting. As a crucial part of scientific confirmation, replication is valuable in its own right (Zwaan et al. 2017), and can be especially illuminating when conducted in a different context from that of original studies. In the present case, the context is different; the present data cover recent cohorts not previously studied—for example, Titus (2006a) analyzed data from the 1990s. Thus, for the purpose of rigor, I confirm that prior findings about economic sorting hold in the context I study.

The Role of Expenditures

To assess the role that different forms of university expenditures play in the effect or null effect of state appropriations on persistence, I conduct two analyses. First, again clustering standard errors by university, I estimate a similar model as shown in Equation (1) except that the model omits state appropriations and the state appropriations × economic disadvantage interaction term as predictors, while including three categories of expenditure as measured in IPEDS: academic support, instructional, and student services[11]. Academic support expenditures support the instruction, research, and public service missions of a university. Expenses in this category include academic advising, curriculum development, libraries, audio/visual services, and technology support for instruction. Instructional expenditures are those deemed directly related to instruction, most notably faculty salaries. Student services expenditures are those deemed to contribute to student wellbeing. Expenses in this category include psychological counseling, student organizations, intramural athletics,

Table 1. Means and Standard Deviations of Measures Analyzed in the Present Study. State Appropriations and All Expenditures are Inflation-Adjusted (using the Consumer Price Index) to 2018 Dollars and Measured Per-Student.

	Mean	SD
Persisted 1st to 2nd year	0.83	0.37
State appropriations	5220	2960
Academic support expenditures	2630	1200
Instructional expenditures	8770	3300
Student services expenditures	2700	450
Proportion of years FRPL	0.14	0.31
White (non-Hispanic)	0.87	0.33
Black (non-Hispanic)	0.04	0.18
Hispanic	0.04	0.19
Other/Multiple race	0.06	0.23
Female	0.53	0.5
Ever suspended in high school	0.04	0.2
ACT English score	22.72	5.05
ACT math score	23.16	4.62

FRPL: free- or reduced-price lunch.

and registrar activities. I measure each of these expense categories on a per-student level[12].

After assessing which expenditures substantially influence persistence, I estimate how changes in state appropriations affect these expenditures. To do so, I use an institution-level, panel dataset that includes all of the IPEDS measures for each year in the period of analysis. There is no within-university-year, between-student variation to capture in this analysis, so there is no reason to include student-level data from the WSLDS. With this dataset, I then estimate a linear regression model of each expenditure measure that I find to be conditionally associated with persistence. I include per-student state appropriations as the sole predictor in descriptive analyses, and then add university fixed effects to the model to estimate the causal effect of appropriations on relevant expenditures.

Results

Summary of Sample

As a student-level description, Table 1 shows means and standard deviations of each variable analyzed in this study. Overall, 83% persist from the first year to the second year. On average, a first-year student attends a UW campus that receives about US$5200 in per-student appropriations, but there is considerable variation around that mean (standard deviation = US$3000). The analytic sample does not appear to have unusually high or low academic achievement: the average student in the sample achieved an ACT math score of slightly above 23 (the 67th percentile among all ACT-takers nationwide, including those who forwent postsecondary education) and an ACT English score between 22 and 23 (between the 63rd and 68th percentiles nationwide). However, reflecting the uneven selectivity across Wisconsin's public universities, ACT scores are quite dispersed (standard deviations of 5.1 points for English and 4.6 points for math).

Table 2. Means and Standard Deviations of Per-Student State Appropriations at Each UW Campus, between 2008–2009 and 2017–2018.

	Mean	SD	SD/Mean
Madison	11,100	1510	0.14
Superior	8850	960	0.11
Parkside	6190	730	0.12
Milwaukee	5090	550	0.11
Green Bay	4300	690	0.16
Stevens point	4190	820	0.20
River falls	4050	700	0.17
Eau Claire	3940	1030	0.26
Oshkosh	3830	660	0.17
Stout	3790	730	0.19
La Crosse	2920	1110	0.38
Platteville	2720	830	0.31
Whitewater	2680	960	0.36

As an institution-level description, Table 2 shows means and standard deviations of state appropriations for each UW campus, across years. The table demonstrates that year-to-year variation in per-student state appropriations is quite wide. At all 13 universities, the standard deviation across years is greater than 10% of the mean, being a much greater percentage in most cases (as high as 38% at the La Crosse campus). Consequently, there is sufficient within-university variation in the independent

variable to conduct an analysis that includes university fixed effects.

Economic Sorting

Compared to never-FRPL students, persistently-FRPL students attend UW 4-year campuses that receive an average of US$610 less in per-student state appropriations. This difference is about 12% of the mean per-student state appropriations (US$5220) and 21% of the standard deviation of per-student state appropriations (US$2960). Thus, there is economic sorting, with more economically advantaged students attending universities that the state funds more generously. This finding replicates national evidence showing that socioeconomically disadvantaged students attend the least financially well-off universities (Titus 2006a).

What explains this economic sorting? Differentially selective admissions criteria likely contribute. The flagship UW campus, Madison, is an outlier in terms of both per-student state appropriations and admissions selectivity. For example, the average ACT score of students (including out-of-state students) admitted to the Madison campus is 29 (CollegeData 2020), which represents the 93rd percentile score nationally. If economically disadvantaged students tend to be especially unable to meet the selective admissions criteria of University of Wisconsin-Madison, then they will be excluded from the most generously-funded campus. Indeed, among persistently-FRPL 11th graders in Wisconsin, only 1% score at or above the average ACT score of admitted applicants to the Madison campus, while 13% of never-FRPL 11th graders score at or above this threshold (calculations my own, drawn from Wisconsin's Statewide Longitudinal Data System). Therefore, it is likely that economically advantaged individuals disproportionately secure spots at the Madison campus—by far the most selective and generously funded—by adapting to exclusion criteria that are formally class-neutral.

Effect of State Appropriations

Table 3 shows estimates from a logistic regression model of college persistence. Results do not support a substantial effect of state appropriation changes on persistence in Wisconsin. The state appropriations coefficient, representing the estimated effect of a US$1000 increase in per-student state appropriations on never-FRPL students' persistence, is slightly positive but not practically or statistically significant. I compute the marginal effect of state appropriations and find a 0.34 percentage point increase in the probability of persistence per US$1000 increase in per-student state appropriations. The 95% confidence interval of this marginal effect estimate (−0.12 percentage points to 0.79 percentage points) includes, and does not stray far from, zero.

Results do not support significant effect heterogeneity, either. The logit interaction effect of 0.022 is small, with a 95% confidence interval (−0.05–0.10) that includes zero and is not substantially positive or negative at its extremes. Thus, even though the estimated interaction effect suggests that economically disadvantaged students may benefit slightly more from state appropriations than do economically advantaged students, the estimate is too statistically and practically insignificant to infer such heterogeneity.

All the core conclusions from this section hold when I estimate a linear probability model of first-to-second year persistence (Appendix 1), as well as when I estimate a complementary log-log model of persistence in all years rather than only the first (Appendix 2). The estimated main effect of state appropriations is statistically insignificant in all specifications. The estimated interaction term is practically insignificant in all specifications, although the large sample size means that even these small interaction terms have 95% confidence intervals that do not include the null hypothesis value (in the linear probability model) and barely include the null hypothesis value (in the complementary log-log model). Hence, results from these alternative specifications illustrate that statistically significant estimates do not always correspond to estimates that are sizeable enough to matter practically, a distinction that many have urged researchers to make (Anderson 2019; Kirk 1996). In sum, across the three model specifications,

Table 3. Point Estimates, Standard Errors, and Confidence Intervals from a Logistic Regression Model of First-to-Second Year Persistence. For Brevity, the Table Does Not Report University, Year, or High School Fixed Effects.

	Coefficient	Std. Err.	95% Conf. Int.
State appropriations	0.02	0.02	−0.02, 0.07
Proportion of years FRPL	−0.47	0.16	−0.78, −0.15
State appropriations × proport. of years FRPL	0.02	0.04	−0.05, 0.10
Black (non-Hispanic)	−0.05	0.04	−0.12, 0.04
Hispanic	−0.09	0.04	−0.18, 0.00
Other/Multiple race	0.10	0.04	0.01, 0.19
Female	0.30	0.03	0.24, 0.37
ACT English score	0.03	0.01	0.00, 0.05
ACT English score (sq.)	−0.00	0.00	−0.00, 0.00
ACT math score	0.04	0.02	0.01, 0.08
ACT math score (sq.)	−0.00	0.00	−0.00, 0.00
Ever suspended in high school	−0.56	0.06	−0.68, −0.45
Constant	0.43	0.46	−0.47, 1.33

FRPL: free- or reduced-price lunch.

there is very little evidence of a main effect of state appropriations, and equivocal evidence of a state appropriations × economic disadvantage interaction that is at most quite small.

The Role of Expenditures

The small estimated effect of increased state appropriations on persistence in Wisconsin is surprising given national, institution-level evidence—reviewed in *Linking the EMI and Differentiation Literature with Government Policy*—that shows a positive effect of per-student expenditures on persistence rates. This evidence either shows instructional and student services expenditures (Webber and Ehrenberg 2010) or academic support expenditures (Gansemer-Topf and Schuh 2006; Ryan 2004) to be the most important expenditure categories. Helping explain the apparent null effect of state appropriations on persistence, none of the three mechanisms speculated in *Linking the EMI and Differentiation Literature with Government Policy* appear to hold up to empirical scrutiny in Wisconsin, as I illustrate below.

Which expenditures matter for persistence in Wisconsin, and do boosts in state appropriations cause boosts in these expenditures? Table 4 answers the first question. In Wisconsin, the only expenditures category for which increases appear to have a practically and statistically significant effect on persistence is the academic support category. In terms of marginal effects, a US$1000 increase in per-student academic support expenditures is associated with a 2 percentage point increase in the probability of persistence.

Table 5 answers the question of whether changes in state appropriations cause changes in the expenditures that matter for persistence (academic support expenditures). The first column indicates that a university with US$1000 more in per-student state appropriations tends to spend US$230 more per student on academic support. Therefore, descriptively, universities with greater state appropriations have greater academic support expenditures, on average. However, the net association between state appropriations and academic support expenditures is, in fact, negative: after including university fixed effects, I find that a US$1000 within-university, across-year increase in per-student state appropriations is associated with a US$130 *decrease* in per-student academic support expenditures (Table 5, second column). This negative conditional association possibly reflects a pattern where the state government

Table 4. Point Estimates, Standard Errors, and Confidence Intervals from a Logistic Regression Model of First-to-Second Year Persistence, with Expenditures as the Key Independent Variables Rather than State Appropriations. For Brevity, the Table does not Report University, Year, or High School Fixed Effects.

	Coefficient	Std. Err.	95% Conf. Int.
Academic support expenditures	0.17	0.07	0.02, 0.32
Instructional expenditures	−0.01	0.05	−0.10, 0.08
Student services expenditures	−0.07	0.16	−0.39, 0.24
Proportion of years FRPL	−0.37	0.04	−0.46, −0.29
Black (non-Hispanic)	−0.04	0.04	−0.12, 0.04
Hispanic	−0.08	0.05	−0.17, 0.00
Other/Multiple race	0.10	0.04	0.02, 0.19
Female	0.30	0.03	0.24, 0.37
ACT English score	0.03	0.01	0.00, 0.05
ACT English score (sq.)	−0.00	0.00	−0.00, 0.00
ACT math score	0.06	0.00	0.05, 0.06
ACT math score (sq.)	−0.00	0.00	−0.00, 0.00
Ever suspended in high school	−0.56	0.06	−0.68, −0.45
Constant	0.25	0.68	−1.09, 1.59

FRPL: free- or reduced-price lunch.

Table 5. Estimates from Linear Regression Models of Per-Student Academic Support Expenditures with (First Column) and without (Second Column) University Fixed Effects. For Brevity, the Table does not Report University Fixed Effects.

	Without Fixed Effects		With Fixed Effects	
	Coef.	Std. Err	Coef.	Std. Err
State appropriations	0.23	0.02	−0.13	0.02
Constant	1.26	0.13	6.62	0.27

tries to compensate for an institution's loss in private revenue but fails to fill the gap. Regardless of the explanation, the result may help explain why state appropriations have little net association with persistence during the present years of study. In particular, even if increased state appropriations have the potential to improve persistence rates when institutions allocate the funding toward academic support, state appropriations were not conditionally positively associated with academic support expenditures among the present sample of universities.

Conclusion

This study offers two main findings related to postsecondary education in Wisconsin. First, more economically advantaged students tend to sort into public universities that receive greater per-student state appropriations. Second, university-level changes in state appropriations seem to have little conditional association with persistence in Wisconsin. This study also shows that the second finding may be explained by the fact that university-level increases in state appropriations are not conditionally associated with increases in academic support expenditures, the type of expenditures that matter most for Wisconsin students' persistence.

This study contributes to sociological theory by placing state governments in the EMI discussion. EMI concerns both individual actors *and* the structures that facilitate or hinder privileged individuals' acquisition of educational

advantages. Understandably, more studies focus on the former rather than identify the structures that facilitate or hinder EMI. Yet the formulator of EMI has recently emphasized that policy can mitigate or exacerbate EMI (Lucas 2017). To my knowledge, no other EMI-related study considers the role of state governmental policy. This gap is a shame since state governments play such a powerful role in the decentralized U.S. higher education system. This power may allow state governments to mitigate EMI. Appealing as this proposition may be, this study surprisingly does not offer support for it.

More specifically, the results of this study do not present evidence that the Wisconsin state government can easily facilitate or limit EMI based on its allocation of funding across universities. From the only explicit test of EMI at the postsecondary level (Andrew 2017), it is clear that economically advantaged students effectively maintain inequality by disproportionately attending highly selective universities. But the present study has not yielded evidence that public funding is an accomplice in this social closure. If, for example, peer effects rather than disparities in public funding explain the selective college persistence advantage identified by Andrew (2017) and others, then economically disadvantaged students can secure qualitative educational advantages by attending the most selective public universities, regardless of how evenly the state distributes university funding. In short, the results of this study fail to center state policy in the production of EMI.

However, caution is necessary when interpreting the results of this study due to its limitations. For at least three reasons, the results leave open the possibility that future slashes in state funding of Wisconsin universities would lead to decreased persistence rates. First, if changes in state appropriations influence persistence more substantially at low base levels of appropriations, then reducing appropriations to levels lower than any observed in the period studied could very well hurt persistence rates. Second, the particulars of how universities allocated state appropriations during the period of study may not generalize in future years: if universities allocated the money in ways conducive only to outcomes other than persistence, then it is still uncertain how much future appropriations could matter for persistence rates if universities allocate the money differently. Economic evidence from other settings and time periods suggests that statewide cuts in appropriations reduce degree attainment rates (Deming and Walters 2017), thus, there is reason to believe that state appropriations make a difference for persistence if universities allocate the money in particular ways. Finally, despite the measures I have taken to identify the causal relationship between state appropriations and persistence, I cannot rule out certain forms of downward bias. In particular, factors that are directly related to appropriations and inversely related to persistence, or vice versa, would drive downward the estimated effect of appropriations on persistence (as long as the direct and inverse relationships exist conditional on university, cohort, and student-level control variables). In sum, before individuals take action based on the results of this study, they should consider the results alongside prior studies with mostly conflicting results, as well as considering any future studies that will, hopefully, emerge.

These future studies might consider the dynamics in other states and countries. Other states can offer useful insights because their public university systems may be more differentiated or may allocate funding dissimilarly compared to Wisconsin's. As one example, California has nearly three times as many public universities, and those universities are arguably more differentiated than any state's public universities. Furthermore, one of California's two public university systems has recently set its focus on undergraduate persistence (University of California System 2019), so state funding may uniquely affect persistence at these universities. When it comes to countries other than the U.S., it is clear that many countries have socioeconomic inequalities in who attends the most prestigious universities (Ayalon et al. 2008; Davies et al. 2014;

Kopycka 2021; Shavit et al. 2007; Thomsen 2015), but what are the implications of these attendance inequalities in terms of persistence? What role does differential public funding play or not play in this problem? While some countries, like Canada (Davies et al. 2014), fund their public universities more uniformly than the U.S. does, the way these universities allocate public funding may be different such that the funding matters more for persistence. Thus, the role of public funding in EMI is very much an open question in such countries.

Appendix 1

Estimates From Linear Probability Model

Because the unconditional probability of persistence is quite high (0.83), I prefer to estimate a logistic regression model rather than a linear probability model. However, to demonstrate that the substantive results are not very sensitive to this decision, I present results from a linear probability model in Table A1. The core conclusions are the same as with the logistic regression model. The main effect of state appropriations is practically and statistically insignificant, with a small point estimate and a 95% confidence interval that includes zero. Additionally, as in the preferred model, the state appropriations × economic disadvantage interaction term is practically insignificant, reflecting a difference of only three quarters of a percentage point per $1000 in per-student state appropriations. However, in contrast to the estimates in the preferred model, the confidence interval on the interaction term in the linear probability model does not include zero. In short: the practical significance of the main effect and interaction term are not sensitive to the linear versus logistic specification, nor is the statistical significance of the main effect, although the statistical significance of the interaction is sensitive to this specification choice, so there may be some effect heterogeneity that is present but not practically important.

Appendix 2

Estimates from Complementary Log-Log Model

For parsimony and ease of interpretation, I prefer to estimate a logistic regression model of first-to-second year persistence rather than conduct a survival analysis of persistence in all years.

Table A1. Point Estimates, Standard Errors, and Confidence Intervals from a Linear Probability Model of first-to-Second Year Persistence. Estimates are Expressed in Percentage Points Rather than in Probability Units. For Brevity, the Table does not Report University, Year, or High School fixed Effects.

	Coefficient	Std. Err.	95% Conf. Int.
State appropriations	−0.42	0.28	−1.02, 0.18
Proportion of years FRPL	−9.41	0.95	−11.48, −7.33
State appropriations × proportion of years FRPL	0.77	0.18	0.38, 1.15
Black (non-Hispanic)	−1.17	0.90	−3.14, 0.79
Hispanic	−1.51	0.66	−2.96, −0.07
Other/Multiple race	1.47	0.61	0.13, 2.80
Female	3.70	0.55	2.50, 4.89
ACT English score	0.92	0.17	0.56, 1.28
ACT English score (sq.)	−0.02	0.00	−0.02, −0.01
ACT math score	1.79	0.31	1.12, 2.46
ACT math score (sq.)	−0.02	0.01	−0.04, −0.01
Ever suspended in high school	−9.80	0.98	−11.92, −7.67
Constant	49.02	6.00	35.95, 62.10

Table B1. Point Estimates, Standard Errors, and Confidence Intervals from a Complementary Log-Log Model of College Persistence. For Brevity, the Table does not Report University, Year, or High School fixed Effects.

	Coefficient	Std. Err.	95% Conf. Int.
State appropriations	0.89	0.08	0.75, 1.06
Proportion of years FRPL	1.17	0.05	1.07, 1.28
State appropriations × proportion of years FRPL	1.01	0.01	1.00, 1.02
Black (non-Hispanic)	1.06	0.02	1.02, 1.11
Hispanic	1.03	0.02	1.00, 1.07
Other/Multiple race	0.96	0.03	0.91, 1.01
Female	0.84	0.01	0.81, 0.86
ACT English score	0.96	0.01	0.95, 0.98
ACT English score (sq.)	1.00	0.00	1.00, 1.00
ACT math score	0.93	0.01	0.91, 0.94
ACT math score (sq.)	1.00	0.00	1.00, 1.00
Ever suspended in high school	1.34	0.03	1.28, 1.41
Constant	3.07	3.50	0.33, 28.70

However, to demonstrate that the substantive results are not very sensitive to this decision, I show results from a survival analysis in which I operationalize the outcome more complexly. In this analysis, I model year-to-year dropout (not just in the first year) with a complementary log-log model applied to student-year observations, censoring students who graduate, are still enrolled at a UW campus during the last year of observation, or transfer from a UW campus to an institution outside of the UW system. The results do not differ substantially from the results from the simpler operationalization of persistence. As Table B1 shows, the main effect of state appropriations remains statistically insignificant, with a 95% confidence interval that includes 1 (in a complementary log-log model, a coefficient of one corresponds to no estimated effect of the variable on the hazard of the outcome, in this case the outcome of dropping out). The state appropriations × economic disadvantage interaction term is of arguable statistical significance, as the 95% confidence interval includes one at its extreme, but the point estimate is extremely small regardless. Thus, even if there truly is some effect heterogeneity, this heterogeneity is probably so slight that it does not matter practically.

Acknowledgments

I am grateful for comments on previous drafts of this manuscript that I received from Eric Grodsky, Felix Elwert, Monica Grant, Jordan Conwell, Nick Hillman, and Noah Hirschl.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Award #R305B150003 to the University of Wisconsin-Madison. The opinions expressed are those of the author and do not represent views of the U.S. Department of Education. This work was also supported by a grant from the U.S. Department of Education, Institute for Education Sciences to the Wisconsin Department of Public Instruction (R372A 150031). Any views, opinions, findings, or conclusions expressed in this paper are those of the author and do not necessarily reflect the views of the Institute for Education

Sciences, the Department of Public Instruction, WCER, or cooperating institutions.

ORCID iD

Christian Michael Smith https://orcid.org/0000-0002-8024-3832

Notes

1. Some of the between-university disparity likely arises because of differential proportions of graduate students across universities, with the Madison campus having the greatest proportion. Unfortunately, it is challenging to precisely separate spending on undergraduate students from spending on graduate students (Urban Institute 2017) and IPEDS does not attempt to do so. In light of this issue, the amount of money from state appropriations that each university applies toward the average undergraduate student is not perfectly apparent, and the difference in per-student state appropriations between Madison and the other campuses is an upper bound on the difference in per-undergraduate state appropriations applied toward undergraduates. When it comes to estimating the effect of state appropriations on persistence, one might worry about underestimating the effect because the amount of funding going toward undergraduates is overestimated at the Madison campus, whose students have the highest propensities to persist. However, as I detail in the Methods section, I include university fixed effects in my model, such that I estimate how *within-university, across-time* changes in state appropriations affect persistence. Thus, the estimate is robust to Madison's especially pronounced overestimated funding as long as the relative degree of this overestimation is similar across years.
2. Effectively maintained inequality can operate even if Wisconsin's allocation of appropriations does not exacerbate the process. Notably, this would be the case if economically advantaged students were more likely than disadvantaged students to attend high-quality private and out-of-state institutions. Those possibilities do not threaten the present study because it is less interested in whether EMI operates in postsecondary education and more interested in the role state distribution of postsecondary funding may or may not play in mitigating EMI.
3. I use the Consumer Price Index to adjust for inflation. Quantities are expressed in 2018 dollars. In regression models, a unit increase in per-student state appropriations corresponds to a $1000 increase. For expenditure variables, I scale and inflation-adjust the quantities equivalently.
4. I call this "receipt" of FRPL for brevity, but more precisely, it is receipt of FRPL except receipt that is exclusively from Community Eligibility Provision. Community Eligibility Provision is a national program that allows high-poverty schools to provide free lunch to all their students. Therefore, there are some students who receive FRPL through this program without individually qualifying. Such students are not listed as economically disadvantaged in a given year.
5. Because students do not attend Wisconsin public schools for the same number of years, and because many students were enrolled in Wisconsin public schools before WSLDS data collection, not all students are observed for the same number of years. Only 6.2% of those in the analytic sample are observed in the WSLDS for a full 12 years, and 1.7% are observed for only 1 year. About half are observed for between four and 7 years. Because of differential observation lengths, I measure some students' long-run economic disadvantage with more error than others. For the purpose of these models, I assume this error is ignorable. However, if the error is classical, it will in fact lead to attenuated estimates of how economic disadvantage moderates the effect of state appropriations on persistence, without attenuating the estimated main effect of state appropriations on persistence.
6. As measured by the Bayesian Information Criterion, quadratic terms for the ACT scores improve model fit substantially, more than enough to justify the loss in parsimony. Theoretically, the quadratic relation is unsurprising, given that a unit increase in academic achievement is likely to matter the least for persistence in the upper area of the academic achievement distribution, where nearly all students persist to the second year of college anyway.
7. The ACT has two other subtests (in Reading and Science), but prior research shows that these

subtests provide no additional predictive power when predicting college persistence (Bettinger, Evans, and Pope 2013). Estimates, presented later, relating state appropriations to college persistence are the same to two decimal places when I also include quadratic transformations of ACT Reading and Science subtest scores, as is the estimated interaction between state appropriations and economic disadvantage. Therefore, I omit these two subtest scores for parsimony.

8. I assign high schools based on where students spent 12th grade.
9. Unfortunately, controlling for high school GPA is not possible with the data at hand. Thus, residual components of academic achievement that are correlated with both per-student state appropriations and with the probability of persistence will likely cause my estimated effect of appropriations on persistence to be *greater* than the true effect. Nevertheless, university fixed effects probably substantially reduce residual components of academic achievement, since university admissions filter applicants based on academic factors that I am unable to measure. Omitting residual components of academic achievement may also bias the estimated interaction between state appropriations and economic disadvantage (Liu, Abrahamowicz, and Siemiatycki 2016), but as long as university fixed effects, ACT scores, demographics, and other observed covariates capture much of the association between the outcome and high school grades, the bias is likely to be small.
10. The interaction term follows research illustrating how certain institutional expenditures benefit economically disadvantaged students more than economically advantaged students (Webber and Ehrenberg 2010).
11. In analyses not shown, I also estimated the same model but with interaction terms between economic disadvantage and each expenditure category. Interaction terms would be relevant if, for example, the expenditure type had a positive effect on persistently-FRPL students' persistence but a negative effect on that of never-FRPL students, a pattern that a zero main effect might mask. The interaction terms ended up being trivially small (results available upon request), so I present results from the model without them, for the sake of clarity and parsimony.
12. These expenditure categories are correlated (pairwise correlations of 0.23 for instruction-service, 0.28 for academic support-service, and 0.82 for instruction-academic support). Thus, including all of them as predictors in the same model may bias estimates of how each one affects persistence. Therefore, I also estimate how each expenditure type affects persistence by estimating three separate models, one per expenditure category, including the same control variables and fixed effects as in the denser model. The marginal coefficient corresponding to each expenditure type is the same to two decimal places whether applying the full model or the models with a single expenditure type. Therefore, I do not expect that the correlation between different expenditure categories substantially biased the estimates of how expenditures affect persistence.

References

Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. 2017. *When Should You Adjust Standard Errors for Clustering?* 24003. Cambridge: National Bureau of Economic Research.

Abadie, Alberto, Susan Athey, Guido W. Imbens., and Jeffrey M., Wooldridge. 2020. "Sampling-Based versus Design-Based Uncertainty in Regression Analysis." *Econometrica* 88(1):265–96. doi: 10.3982/ECTA12675.

Anderson, Andrew A. 2019. "Assessing Statistical Results: Magnitude, Precision, and Model Uncertainty." *The American Statistician* 73(sup1): 118–21. doi:10.1080/00031305.2018.1537889.

Andrew, Megan. 2017. "Effectively Maintained Inequality in U.S. Postsecondary Progress: The Importance of Institutional Reach." *American Behavioral Scientist* 61(1):30–48. doi:10.1177/0002764216682809.

Ayalon, Hanna, Eric, Grodsky, Adam, Gamoran, and Abraham, Yogev. 2008. "Diversification and Inequality in Higher Education: A Comparison of Israel and the United States." *Sociology of Education* 81(3):211–41. doi:10.1177/003804070808100301.

Baum, Sandy, Jennifer, Ma, and Kathleen, Payea. 2013. "*Education Pays 2013*." The College Board.

Bettinger, Eric P., Brent J. Evans, and Devin G. Pope. 2013. "Improving College Performance and Retention the Easy Way: Unpacking the ACT Exam." *American Economic Journal: Economic Policy* 5(2):26–52. doi:10.1257/pol.5.2.26.

Bound, John, Breno, Braga, Gaurav, Khanna, and Sarah, Turner. 2019. "Public Universities: The Supply Side of Building a Skilled Workforce." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 5(5):43–66. doi:10.7758/RSF.2019.5.5.03.

Bound, John and Sarah, Turner. 2007. "Cohort Crowding: How Resources Affect Collegiate Attainment." *Journal of Public Economics* 91: 877–99. doi:10.1016/j.jpubeco.2006.07.006.

Bowen, William G., Matthew M. Chingos, and Michael S. McPherson. 2009. *Crossing the Finish Line: Completing College at America's Public Universities*. Princeton, NJ: Princeton University Press.

Byun, Soo Yong and Hyunjoon, Park. 2017. "When Different Types of Education Matter: Effectively Maintained Inequality of Educational Opportunity in Korea." *American Behavioral Scientist* 61(1):94–113. doi:10.1177/0002764216682810.

CollegeData. 2020. "College Profile: University of Wisconsin - Madison." Retrieved April 1, 2020 (https://www.collegedata.com/college/University-of-Wisconsin-Madison).

Cunha, Jesse M. and Miller, Trey. 2014. "Measuring Value-Added in Higher Education: Possibilities and Limitations in the Use of Administrative Data." *Economics of Education Review* 42: 64–77. doi:10.1016/j.econedurev.2014.06.001.

Cuseo, Joe. 2007. "The Empirical Case against Large Class Size: Adverse Effects on the Teaching, Learning, and Retention of First-Year Students." *The Journal of Faculty Development* 21(1):5–21.

Cutler, David M. and Lleras-Muney, Adriana. 2006. *Education and Health: Evaluating Theories and Evidence*. National bureau of economic research.

Davies, Scott, Maldonado, Vicky, and Zarifa, David. 2014. "Effectively Maintaining Inequality in Toronto: Predicting Student Destinations in Ontario Universities." *Canadian Review of Sociology* 51(1):22–53. doi:10.1111/cars.12032.

Deming, David J. and Christopher R., Walters. 2017. The Impact of Price Caps and Spending Cuts on U.S. Postsecondary Attainment. NBER Working Paper Series No. 23736. Cambridge, MA: National Bureau of Economic Research.

Education Commission of The States. 2019. "Statewide Longitudinal Data Systems: 50-State Comparison." Retrieved September 20, 2021 (https://reports.ecs.org/comparisons/statewide-longitudinal-data-systems-all).

Gamoran, Adam and Mare, Robert D. 1989. "Secondary School Tracking and Educational Inequality: Compensation, Reinforcement, or Neutrality?" *American Journal of Sociology* 94(5):1146–83.

Gansemer-Topf, Ann M. and Schuh, John H. 2006. "Institutional Selectivity and Institutional Expenditures: Examining Organizational Factors That Contribute to Retention and Graduation." *Research in Higher Education* 47(6):613–42. doi:10.1007/s11162-006-9009-4.

Gerber, Theodore P. and Cheung, Sin Yi. 2008. "Horizontal Stratification in Postsecondary Education: Forms, Explanations, and Implications." *Annual Review of Sociology* 34:299–318. doi:10.1146/annurev.soc.34.040507.134604.

Kelchen, Robert. 2017. *A Look at Pell Grant Recipients' Graduation Rates*. Washington, D.C.: The Brookings Institution.

Kirk, Roger E. 1996. "Practical Significance: A Concept Whose Time Has Come." *Educational and Psychological Measurement* 56(5):746–59.

Kopycka, Katarzyna. 2021. "Higher Education Expansion, System Transformation, and Social Inequality. Social Origin Effects on Tertiary Education Attainment in Poland for Birth Cohorts 1960 to 1988." *Higher Education* 81(3): 643–64. doi:10.1007/s10734-020-00562-x.

Liu, Aihua, Abrahamowicz, Michal, and Jack, Siemiatycki. 2016. "Conditions for Confounding of Interactions." *Pharmacoepidemiology and Drug Safety* 25:287–96. doi:10.1002/pds.

Lucas, Samuel R. 2001. "Effectively Maintained Inequality: Education Transitions, Track Mobility, and Social Background Effects." *American Journal of Sociology* 10(6):1642–90. doi:10.1086/321300.

Lucas, Samuel R. 2017. "An Archaeology of Effectively Maintained Inequality Theory." *American*

Behavioral Scientist 61(1):8–29. doi:10.1177/0002764216682989.

Ma, Jennifer, Baum, Sandy, Pender, Matea, and Bell, D'Wayne. 2015. *Trends in College Pricing, 2015. Trends in Higher Education Series* New York, NY: College Board.

Mare, Robert D. 1980. "Social Background and School Contiunation Decisions." *Journal of the American Statistical Association* 75(370): 295–305.

Michelmore, Katherine and Susan M. Dynarski. 2017. "The Gap Within the Gap: Using Longitudinal Data to Understand Income Differences in Educational Outcomes." *AERA Open* 3(1):1–18. doi: 10.1177/2332858417692958.

Rank, Mark R, and Thomas A. Hirschl. 1999. "The Economic Risk of Childhood in America: Estimating the Probability of Poverty across the Formative Years." *Journal of Marriage and the Family* 61(4):1058. doi:10.2307/354024.

Roksa, Josipa, Grodsky, Eric, Arum, Richard, and Adam, Gamoran. 2007. "United States: Changes in Higher Education and Social Stratification." Pp. 165–91 in *Stratification in higher education: A comparative study*, edited by Y. Shavit, R. Arum, and A. Gamoran. Stanford: Stanford University Press.

Ryan, John F. 2004. "The Relationship between Institutional Expenditures and Degree Attainment at Baccalaureate Colleges." *Research in Higher Education* 45(2):97–114.

Sewell, William H., Haller, Archibald, and Portes, Alejandro. 1969. "The Educational and Early Occupational Attainment Process." *American Sociological Review* 34(1):82–92.

Sewell, William H., Hauser, Robert M., Springer, Kristen W., and Hauser, Taissa S. 2003. "As We Age: A Review of the Wisconsin Longitudinal Study, 1957-2001." *Research in Social Stratification and Mobility* 20:3–111. doi: 10.1016/S0276-5624(03)20001-9.

Shapiro, Doug, Dundar, Afet, Yuan, Xin, Harrell, Autumn T., Wild, Justin C., and Ziskin, Mary B.. 2014. *Some College, No Degree: A National View of Students with Some College Enrollment, but No Completion.* Herndon, VA: National Student Clearinghouse.

Shavit, Yossi, Arum, Richard, and Gamoran, Adam. 2007. *Stratification in Higher Education: A Comparative Study*. Stanford: Stanford University Press.

Smith, Theresa Y. 1995. "The Retention Status of Underrepresented Minority Students: An Analysis of Survey Results from Sixty-Seven U.S. Colleges and Universities." in *Association for Institutional Research Annual Forum*. Boston, MA: Association for Institutional Research.

State Higher Education Executive Officers Association. 2019. *State Higher Education Finance: FY 2018*. Boulder, CO: State Higher Education Executive Officers Association.

Thomsen, Jens Peter. 2015. "Maintaining Inequality Effectively? Access to Higher Education Programmes in a Universalist Welfare State in Periods of Educational Expansion 1984-2010." *European Sociological Review* 31(6):683–96. doi:10.1093/esr/jcv067.

Tinto, Vincent. 1993. *Leaving College: Rethinking the Causes and Cures of Student Attrition*. 2nd ed. Chicago: University of Chicago Press.

Titus, Marvin A. 2006a. "Understanding College Degree Completion of Students with Low Socioeconomic Status: The Influence of the Institutional Financial Context." *Research in Higher Education* 47(4):371–98. doi:10.1007/s11162-005-9000-5.

Titus, Marvin A. 2006b. "Understanding the Influence of the Financial Context of Institutions on Student Persistence at Four-Year Colleges and Universities." *Journal of Higher Education* 77(2):353–75. doi:10.1353/jhe.2006.0009.

U.S. Department of Agriculture. 2015. "Child Nutrition Programs—Income Eligibility Guidelines." *Federal Register* 80:9–10.

University of California System. 2019. "UC 2030 Dashboard." Retrieved June 29, 2021 (https://www.universityofcalifornia.edu/infocenter/uc-2030-dashboard).

University of Wisconsin System. 2020. "Budget & Planning: Tuition." Retrieved April 29, 2020 (https://www.wisconsin.edu/budget-planning/tuition/).

Urban Institute. 2017. "Understanding College Affordability: The Cost of Educating Students." Retrieved May 8, 2020 (http://collegeaffordability.urban.org/cost-of-educating/index.html).

Webber, Douglas A. 2016. "Are College Costs Worth It? How Ability, Major, and Debt Affect

the Returns to Schooling." *Economics of Education Review* 53:296–310.

Webber, Douglas A. and Ronald G. Ehrenberg. 2010. "Do Expenditures Other than Instructional Expenditures Affect Graduation and Persistence Rates in American Higher Education?" *Economics of Education Review* 29(6):947–58. doi:10.1016/j.econedurev.2010.04.006.

Zhang, Liang. 2009. "Does State Funding Affect Graduation Rates at Public Four-Year Colleges and Universities?" *Educational Policy* 23(5): 714–31. doi:10.1177/0895904808321270.

Zwaan, Rolf A., Alexander Etz, Richard E. Lucas, and M. Brent Donnellan. 2017. "Making Replication Mainstream." *Behavioral and Brain Sciences* 41(2018):1–50. doi:10.1017/S0140525X17001972.