Completion at the Expense of Access? The Relationship Between Performance-Funding Policies and Access to Public 4-Year Universities

Denisa Gándara[1] and Amanda Rutherford[2]

Efforts to improve college-completion rates have dominated higher education policy agendas. Performance-based funding (PBF) intends to improve college completion and links state funding for public colleges and universities to performance measures. One critique of PBF policies is that institutions might restrict student access. This study uses a difference-in-differences design and institution-level data from 2001 to 2014 to examine whether 4-year, public institutions become more selective or enroll fewer underrepresented students under PBF. Our findings, supported by various robustness checks, suggest that institutions subject to PBF enroll students with higher standardized test scores and enroll fewer first-generation students. PBF models tied to institutions' base funding are more strongly associated with increased standardized test scores and enrollment of Pell students.

Keywords: access; equity; higher education, state educational policies

For nearly a decade, policymakers in the United States have pursued a college-completion agenda—one that emphasizes the completion of postsecondary degrees and certificates (Lester, 2014). Public rhetoric suggests the focus on completion represents an explicit shift away from a college-access agenda (Adams, 2015). Yet gaps in college access across demographic groups persist; in 2014, 84% of high school graduates from high-income families went to college compared to 58% of low-income graduates (National Center for Education Statistics, 2015). Equity-focused higher education observers worry the college-completion agenda not only may deemphasize access for historically underserved groups but also may counter the college-access agenda by producing perverse incentives (Kantrowitz, 2012). For instance, campus officials could seek to improve completion rates precisely by limiting access to students deemed less likely to graduate (Lester, 2014).

Proposals for improving college-completion rates abound, and performance-based funding (PBF) has been particularly appealing to state policymakers. In 2017, 35 states employed PBF models to fund either some or all of their public higher education institutions (Li, 2018a). PBF models link state appropriations for public colleges and universities to institutional performance on metrics identified in the funding models (e.g., degrees awarded). These policies warrant scrutiny given their prevalence across states and their potential for yielding negative unintended consequences, such as limiting access to historically underserved groups (Dougherty et al., 2016).

This study provides a comprehensive analysis of the degree to which PBF is associated with restricting access to public 4-year universities and how these potential effects differ based on key institutional and policy characteristics. To date, the literature on PBF has overwhelmingly focused on policy impacts related to *intended* outputs (e.g., Dougherty et al., 2016; Hillman et al., 2014b; Hillman et al., 2015; Hillman et al., 2018; Rabovsky, 2012; Rutherford & Rabovsky, 2014; Sanford & Hunter, 2011); these studies have generally found null effects of PBF on completion metrics (see Bell et al., 2018, for a meta-analysis of this research). Recent quantitative and qualitative studies also suggest PBF may limit access for different groups of students (Birdsall, 2018; Dougherty et al., 2016; Jones et al., 2017; Kelchen, 2018a; Kelchen & Stedrak, 2016; Li & Zumeta, 2016; Umbricht et al.,

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2017). These studies primarily focus on a single state (Birdsall, 2018; Ness et al., 2015; Umbricht et al., 2017) or a few states (Dougherty et al., 2016; Li & Zumeta, 2016), although studies using national data have recently analyzed the relationship between PBF and access for certain students. Kelchen (2018a), for instance, examined whether PBF is associated with the enrollment of racial/ethnic minority, low-income, and adult students.

The present study extends this prior work in a number of ways. First, our study examines various access-related outcomes. Like Kelchen (2018a, 2019), we examine underrepresented student enrollment. Our analyses go beyond this focus to examine indicators of institutional selectivity, including admission rates and standardized test scores (single-state examples using similar indicators include Birdsall, 2018, and Umbricht et al., 2017). We further extend our contribution by considering the enrollment of first-generation students, who have not been the focus of prior PBF research. Attending to first-generation students is especially important because these students face unique challenges navigating the college application and matriculation process and remain less likely to enroll in higher education than their peers whose parents attended college (Cataldi et al., 2018; Redford & Hoyer, 2017). Moreover, higher education can promote social mobility (Chetty et al., 2017); denying access to students who would be the first to enroll in college could systematically hinder intergenerational mobility.

Second, this study accounts for important differences across PBF policies. A few extant studies have considered differences in PBF designs, albeit in limited ways—examining whether the policy includes extra funding for science, technology, engineering, and mathematics majors (Li, 2018b) or for minority students (Gándara & Rutherford, 2018; Kelchen, 2018a). For instance, Gándara and Rutherford (2018) studied the effect of including premiums for underrepresented students on outcomes related to college access, conditional on a state's having PBF. The present study departs from that study primarily by comparing states with PBF to those without such policies.

Specifically, in this study, we account for institutional and policy characteristics potentially relevant for college access outcomes, including institutional selectivity, whether PBF is tied to a portion of an institution's *base* funding (PBF 2.0) or linked to bonus funds (PBF 1.0), and whether the PBF policy includes an equity premium. By examining numerous access outcomes and distinguishing by institutional and policy features, this study provides a comprehensive, systematic evaluation of the degree to which PBF is associated with college access. We employ difference-in-differences to compare institutions funded through PBF to similar institutions not subject to PBF. This study reveals the degree to which PBF is associated with changes in selectivity and underrepresented student enrollment, illuminating how PBF, one manifestation of the college-completion agenda, may have implications for college access.

Understanding PBF Through Principal-Agent Theory

Principal-agent theory sheds light on the reasons college and university officials might restrict access to their institutions when subject to PBF. Broadly, the theory seeks to explicate individual behavior in relationships between principals (individuals needing certain tasks to be performed but lacking the necessary expertise, skills, or time) and agents (those with delegated authority to perform the tasks for the principals; Moe, 1984).

Consistent with previous research on PBF (see Bell et al., 2018; Dougherty & Natow, 2019, for reviews), we conceptualize state policymakers as principals in higher education who fund public colleges and universities to provide postsecondary education and produce other public goods (e.g., research and service; Lane & Kivisto, 2008). Officials, including staff and administrators, at these institutions constitute agents who answer to the governments funding them and are expected to fulfill policymakers' preferred goals and policies.

One key tenet of principal-agent theory is the possibility that an agent's interests diverge from those of the principal. For example, officials at one public university might be interested in enhancing their institution's prestige, leading to greater spending on research (Brewer et al., 2002). State policymakers, however, might want the institution to prioritize degree production over other institutional goals. This departure in interests between principals and agents can lead to misalignment between the agent's performance and the principal's preferences (Eisenhardt, 1989).

Another major problem that can emerge in principal-agent relationships is information asymmetry, which occurs when the agent has more information (e.g., specialized knowledge of day-to-day operations) than the principal. Information asymmetry hinders the principal's ability to monitor the actions of agents (e.g., campus officials) and evaluate whether those actions conform to the principal's goals (Lane & Kivisto, 2008; Moe, 1984). The complexities of higher education, both its organization (Birnbaum, 1988) and production technology (Bowen, 1977), compound information asymmetry.

When agents have more information than principals or when their respective interests conflict, agents may *shirk* and fail to complete the work desired by the principals (Fiorina, 1982). Principals employ performance-management systems, such as PBF, to mitigate shirking. As noted previously, research shows PBF has not been particularly effective at improving outcomes in ways intended by the policies (Bell et al., 2018). Reacting to this evidence, recent work has highlighted the limitations of principal-agent theory, particularly with respect to PBF (Bell et al., 2018; Dougherty & Natow, 2019). For instance, these authors note that principal-agent theory generally assumes a single principal and a single agent. In reality, in higher education, there are multiple principals (e.g., ranking schemes, donors, governing board members) and multiple agents (e.g., administrators, student affairs professionals, academic staff; Bell et al., 2018). If principals have different demands, the response to a PBF model might become diluted for reasons beyond interest divergence. Furthermore, the multitude of agents in higher education might filter responsiveness to PBF.

Notwithstanding these findings regarding PBF and intended outcomes, principal-agent theory provides a useful framework for understanding why higher education officials might respond to PBF by restricting access to higher education, including due to shirking (Dougherty & Natow, 2019). Specifically, agents might manipulate inputs when PBF models reward institutions for outputs and outcomes, a practice known as cream-skimming (Kelchen, 2018b). This push to become more selective in admissions reflects the understanding that some of the strongest predictors of college success are related to prior academic performance (American Institutes for Research, 2013). Likewise, racial/ethnic minority, first-generation, and low-income students have been associated with a lower probability of success (notwithstanding structural and institutional factors leading to these outcomes; Lohfink & Paulsen, 2005; National Center for Education Statistics, 2017a). Thus, university officials may perceive students in these groups as less likely to succeed and respond to PBF by denying admission to those students. If this restriction of access were not policymakers' intent, this behavior would constitute shirking.

It is reasonable to expect greater effects of PBF on college access than on student outcomes for a number of reasons. In contrast to outcomes, such as degrees awarded, student inputs (e.g., enrollments) might be easier to control. For example, there are fewer agents involved in enrollment-management decisions than in college completion, where the behaviors of myriad actors can affect outcomes (Bell et al., 2018; Dougherty & Natow, 2019). Moreover, managing enrollment is presumably a less complex technology than "producing" a college graduate. Another explanation for the restriction of admissions in response to PBF is not addressed in principal-agent theory: the possibility that principals' and agents' interests actually align (Dougherty & Natow, 2019). For instance, some policymakers may expect institutions to become more selective in response to PBF.

Indeed, previous studies suggest cream-skimming may be a consequence of PBF. A recent study seeking to understand actual and perceived impacts of PBF in Indiana, Ohio, and Tennessee—three states with long-standing PBF programs—found that of the eight major categories of unintended impacts, restricting student admissions was cited most frequently in interviews (14 of 18 institutions; Dougherty et al., 2016; Lahr et al., 2014). Among the universities included in the study, several were broad-access institutions; the authors concluded, "At those institutions, increasing selectivity would also lead to a reduction in the number of low-income and minority students enrolled" (Lahr et al. 2014, p. 14). This line of research also identified mechanisms by which college and university officials restrict admissions. The most common was raising admissions requirements, with 23 out of 222 interview participants reporting this behavior. The second most common admissions restriction reported was selective student recruitment, and other mechanisms included general restrictions (e.g., not admitting "weaker" students) and targeted financial aid (Dougherty et al., 2016; Lahr et al., 2014).

Recent quantitative studies also suggest institutions may engage in cream-skimming when subject to PBF. In the case of Indiana, Umbricht et al., (2017) found that PBF was associated with decreased admission rates. The authors also considered the 25th percentile of ACT scores and found public institutions in Indiana had higher scores when subject to PBF than comparison institutions. Finally, the total number of entering minority students was lower at Indiana institutions subject to PBF than at comparison institutions. Additional work by Birdsall (2018) similarly concluded PBF led to restrictions in college access in Indiana, and a case study of Colorado found that a market-based policy—higher education student vouchers coupled with performance contracts for colleges and universities—may have led to reductions in the enrollment of racial/ethnic minority students (Hillman et al., 2014a).

Beyond these state-specific studies, a national study of institutions' financial profiles found that Pell Grant revenue was lower at 2- and 4-year institutions funded through PBF (Kelchen & Stedrak, 2016). These authors posited that "colleges may be trying to recruit more students from higher-income families" (p. 317). More recently, Kelchen (2018a) examined whether PBF affected racial/ethnic minority and low-income student enrollment and whether the presence of an equity metric in PBF models affected these relationships. He concluded that PBF does not have strong deleterious effects on underrepresented student enrollments.

The present study extends prior literature by examining how PBF implementation relates to both underrepresented student enrollment—including first-generation student enrollment—and selectivity (admission rates and test scores). Moreover, we respond to recent calls for differentiating across PBF design (Kelchen et al., 2019) by attending to key PBF characteristics.

Data Sources

Data for the analyses come from multiple sources. First, data for state PBF policies (see Table 1 in the appendix, available on the journal website) were collected from state records and a review of prior research on PBF. Next, institutional data, including information related to student characteristics, were gathered from the Integrated Postsecondary Education Data System (IPEDS) and the College Scorecard, both within the U.S. Department of Education. Third, state-level data related to the demand for postsecondary education were obtained from the Bureau of Labor Statistics, the U.S. Census Bureau, the Western Interstate Commission for Higher Education, and the National Association of State Student Grant and Aid Programs. As described in further detail below, our final data set focuses on within-institution changes between 2001 and 2014 for 587 4-year higher education institutions.

To best determine which 4-year institutions were covered by PBF, we referenced both extant research (most prominently Dougherty & Natow, 2015; Hagood, 2019; Rutherford & Rabovsky, 2014) and state policy documents, especially budget documents. Our criteria for coding a state as having an active PBF policy were the following: (a) the state (or state system) adopted a PBF policy, (b) the PBF policy focused on student success or completion (e.g., not exclusively research output), and (c) at least one institution received some funding through PBF. The resulting variable is a dichotomous measure that is equal to one in the years in which a state PBF policy is implemented and zero otherwise.

Research Design

Our analysis includes up to 7,345 institution-year observations across 587 4-year public institutions. Across the study period

Table 1
Means and Standard Deviations for Key Variables, 2001–2014

Variable	All Institutions	PBF Institutions	Non-PBF Institutions
Admission rate (percentage)	70.368	72.046	68.460
	(16.481)	(15.025)	(17.805)
25th percentile test scores	956.386	963.463	948.136
	(99.322)	(94.480)	(104.095)
75th percentile test scores	1174.019	1183.441	1163.024
	(99.838)	(98.180)	(100.646)
Black students (ln)	5.860	6.078	5.566
	(1.675)	(1.607)	(1.719)
Hispanic students (ln)	5.430	5.531	5.293
	(1.680)	(1.648)	(1.714)
Percentage students ever received Pell	60.372	61.841	58.407
	(14.980)	(14.911)	(14.848)
Percentage first-generation students	38.492	40.038	36.373
	(9.292)	(9.382)	(8.736)
Total enrollment (ln)	8.787	8.906	8.627
	(1.136)	(1.071)	(1.202)
Instruction/student (ln)	8.630	8.581	8.704
	(0.700)	(0.724)	(0.655)
Percentage part-time undergraduate	26.183	28.731	22.642
	(19.286)	(20.078)	(17.526)
Sticker price (ln, 2014 CPI)	8.457	8.450	8.467
	(0.596)	(0.578)	(0.623)
Full-time faculty/100 students (ln)	1.388	1.327	1.471
	(0.654)	(0.578)	(0.606)
State unemployment	6.304	6.420	6.145
	(1.992)	(1.935)	(2.056)
Total high school graduates in state (ln)	11.178	11.249	11.080
	(0.936)	(0.750)	(1.136)
Percentage Black high school graduates	12.869	13.133	12.508
	(9.539)	(8.644)	(10.633)
Percentage Hispanic high school graduates	9.960	10.625	9.050
	(11.104)	(11.845)	(9.934)
Need, non-need-based state aid (millions, 2014 CPI)	324.218	264.357	406.073
	(330.455)	(200.542)	(438.136)
Percentage bachelor's degrees in state	27.413	26.582	28.554
	(4.625)	(4.228)	(4.900)
State per capita income (thousands, 2014 CPI)	43.336	41.813	45.427
	(6.417)	(4.907)	(7.555)

Note. PBF = performance-based funding; CPI = consumer price index.

(2001–2014), slightly less than one fifth of the observations (18.51%) are actively subject to PBF. To examine whether PBF has any meaningful relationship with student access to 4-year institutions, we test whether these policies are related to several outcomes. First, we estimate the admission rate, the 25th percentile standardized test scores, and the 75th percentile standardized test scores in considering entry to postsecondary education. Admission rates are measured as the share of total applicants who were accepted by the institution each year. The higher the admission rate (share of applicants admitted), the less selective is the institution and the larger is the share of students who were admitted. For 25th and 75th test score percentiles, the verbal/English and math scores are combined for each test, respectively. ACT scores are then converted to SAT scores using a College Board concordance table where SAT scores were not reported but ACT scores were available. This results in single variables for 25th and 75th percentile scores.

We also test for the relationships between PBF and the enrollment of four student groups—the number of all students who are Black, logged (IPEDS); the number of all students who are Hispanic, logged (IPEDS); the percentage of students who ever received a Pell Grant while in school (College Scorecard), and the percentage of students who are first generation (College Scorecard). The hardest measure to interpret is that for low-income students, as students may not indicate their family/individual income and may not apply for Pell funding (e.g., Bettinger et al., 2012).

We include a number of variables to control for mechanisms other than PBF policies that may influence our outcomes. To capture the overall size and resources of each institution, we control for total student enrollment (logged), instructional expenditures per student (logged), the percentage of undergraduate students who are enrolled at the institution part-time, sticker price (logged and adjusted to the 2014 consumer price index [CPI]), and full-time faculty per 100 students (logged). Several measures are logged to prevent undue influence in our models from outlier observations.

At the state level, we account for unemployment rates (Bureau of Labor Statistics), as they have been shown to both increase the demand for higher education and threaten state financial support of higher education (McLendon et al., 2009; Tandberg, 2010). We control for the potential level of demand for higher education by accounting for total high school graduates in the state (logged) as well as the percentage of high school graduates who are Black and the percentage of graduates who are Hispanic (Western Interstate Commission for Higher Education's Knocking at the College Door data set). We include the percentage of individuals in the state who have bachelor's degrees (census), which could signal a college-going culture, and per capita income, reported in thousands and adjusted for inflation to the 2014 CPI (census), because income is positively associated with college enrollment (Cahalan et al., 2018). Finally, we include total need-based and non-need-based state grant aid to college students, reported in millions and adjusted for inflation to the 2014 CPI (National Association of State Student Grant and Aid Programs), because previous research finds that greater levels of merit-based state aid are associated with increases in college enrollment (Toutkoushian & Hillman, 2012). Table 1 presents descriptive statistics for all variables in our analysis. This table also splits summaries by those institutions in states that ever operated PBF between 1993 and 2014 and those states that never adopted a PBF policy during this time period. Perhaps the most notable differences in these groups occur in need-based and non-need-based state aid and, to a smaller extent, the percentage of first-generation students.

In examining the relationships between PBF policies and both admissions and student enrollment, we include models for all institution-year observations as well as separate models for institutions we classify as having low or high selectivity (based on the mean admission rate of 70% in this data set). This approach helps us pinpoint whether the direction or strength of any meaningful changes observed in our dependent variables may be influenced by the selectivity of the institution.

For this study, a model specification that can estimate important differences in public institutions in states with and without PBF policies is needed. Although we cannot be certain of what would happen in institutions in the absence of state PBF policies, we can use difference-in-differences regression to obtain strong approximations of our outcome variables pre- and post-policy treatment. Trends for treated institutions (those subjected to PBF) can be compared to those for similar 4-year public institutions in states that did not implement PBF. Of course, in the absence of an experimental design, the relationships below cannot be interpreted as causal and should therefore be viewed with some caution. For example, we test multiple comparison groups to minimize the threat that our choice of control group does not bias findings (see the online appendix for more detail). Of course, we have little control over which states select into the treatment group and the timing of when PBF policies were implemented. It should also be noted that, in the event that not all assumptions hold in order to provide an analysis that can be viewed as causal, the contribution of this analysis is still important. Biases withstanding, the findings should produce a rough average of effects. In other words, policies that have little to no influence likely have observed effects that are smaller than our estimates. Similarly, those policies that are most substantive likely have observed effects that are larger than our coefficients.

For both the treatment and control groups in our models, we include year and institution fixed effects to account for unobserved trends across time and space. This produces a model that can be specified as follows:

$$Y_{it} = \alpha + \beta_1 \left(\text{treat} \times \text{post}\right)_{it} + \beta_2 \left(\text{policy time}\right)_{it} + \gamma X_{it} + \eta_t + \delta_i + \varepsilon_i,$$

where Y is one of the key dependent variables (admission rate, 25th percentile test scores, 75th percentile test scores, Black student enrollment, Hispanic student enrollment, low-income student enrollment, first-generation student enrollment) in each institution (i) for each year of time (t), and α is the intercept. Because of the presence of different time periods in which treatment begins, the (Treat $\times$ Post) interaction is set to equal one for all institutions in the years during and following the adoption of PBF (see also Kelchen et al. 2019; Tandberg & Hillman, 2014). Next, the variable *policy time* accounts for the number of years a PBF policy has been in place for each institution. $\mathbf{X}_{it}$ represents a vector of included covariates. Finally, η_t represents year (t) fixed effects, δ_i represents institution (i) fixed effects, and ε_i represents an error term that is clustered by institution to better adjust for autocorrelation and heteroscedasticity (Wooldridge, 2002).

We also consider the assumption of parallel trends and run a series of robustness checks as described in the online appendix (appendix Tables 2–9, Figures 1–14). For example, figures produced from an event-study approach in which the analysis focused on the first adoption period for PBF states result in similar conclusions to the analysis presented below, and draw attention to pre-adoption trends.[1] Such figures allow researchers to consider whether and how the effect of a treatment may vary with time since exposure or anticipation effects (Goodman-Bacon, 2019; Jacobson et al., 1993). Parallel trends appear most concerning in the case of admissions rates where clear pre-post trends are difficult to define. Furthermore, although multiple control groups and regressions support the robustness of the findings shown here, some of the key independent and dependent variables here may influence one another in a cyclical pattern. Interpreting such results as causal and without error can be problematic. Still, among additional checks (excluding control variables, considering large vs. small states, or focusing on policy developments since 2005), our primary findings largely remain intact.

Findings

Admissions and Test Scores

Table 2 displays findings related to admission rates, 25th percentile test scores, and 75th percentile test scores. Overall, results

Table 2
Effect of Performance Funding Policies on Admission Rates and Test Scores

	Admission Rate	25th Percentile Scores	75th Percentile Scores
Policy Treat × Post	–2.172*	9.277*	2.644
	(0.565)	(1.657)	(2.056)
Duration of policy (years)	0.359*	–1.098*	–0.556
	(0.101)	(0.300)	(0.372)
Total enrollment (ln)	2.796	16.504*	–10.311
	(1.745)	(5.526)	(6.845)
Instruction/student (ln)	0.905	0.891	4.068
	(1.028)	(3.019)	(3.743)
Percentage part-time undergraduate	0.078†	–0.113	0.212
	(0.042)	(0.131)	(0.162)
Sticker price (ln, 2014 CPI)	–1.303	1.917	3.402
	(0.854)	(2.495)	(3.095)
Full-time faculty/100 students (ln)	0.643	18.168*	14.505*
	(1.437)	(4.330)	(5.371)
State unemployment	0.434†	–1.987*	–2.830*
	(0.230)	(0.680)	(0.843)
Total high school graduates in state (ln)	–7.026†	23.556*	13.940
	(3.662)	(10.890)	(13.509)
Percentage Black high school graduates	–0.086	2.792*	1.713*
	(0.216)	(0.640)	(0.794)
Percentage Hispanic high school graduates	–0.097	–1.323*	–1.066*
	(0.133)	(0.396)	(0.492)
Need, non-need-based state aid (millions, 2014 CPI)	0.004†	–0.004	–0.009
	(0.002)	(0.007)	(0.008)
Percentage bachelor's degrees in state	0.351*	–1.261*	0.451
	(0.147)	(0.438)	(0.542)
State per capita income (thousands, 2014 CPI)	–0.055	0.778*	–0.726†
	(0.113)	(0.340)	(0.421)
Constant	117.972*	468.733*	1032.768*
	(42.051)	(124.738)	(154.678)
n	5,515	5,277	5,282
R^2	.04	.10	.06
Institution fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

suggest that institutions become more selective when subject to PBF. In Model 1, PBF is linked with a more than 2% drop in the admission rate, meaning institutions under PBF policies become more selective (by admitting fewer applicants). As suggested by the duration variable, this relationship may subside over time but would require 6 to 7 years to normalize. When models (not shown here) are run on total applicants (ln) and total admits (ln), the treatment variable has a positive and significant correlation with applicants but not admits. This would suggest that university officials may be working to recruit larger pools of students to apply to their institutions but not necessarily expanding admission pools at the same rate. This strategy would allow institutions to select students deemed more desirable among a larger pool.

In Model 2, institutions in the treated group experience a nearly 9.3 point rise in 25th percentile scores of first-time full-time students on the 1600 SAT scale. For the average treated institution, the 25th percentile score would shift from 963.5 to 972.8, which constitutes a substantial change in shaping enrollments for many institutions and signals that students with lower scores are less likely to enroll in institutions subject to PBF. Similar to Model 1, the duration variable suggests that, when PBF stays in place for longer periods of time, a slight downward rebound in 25th percentile scores might be observed. Changes are less apparent for 75th percentile scores in Model 3. This may be due, in part, to the fact that it is often more difficult to shift an average toward the top of the distribution.

We also consider whether these general findings hold for institutions with lower or higher levels of selectivity. Table 3 provides models similar to those in Table 2, with low and high selectivity. Results for admission rates mirror the results in Table 2 for both types of institution. Interesting to note, although findings suggest that 25th percentile scores become higher in highly selective institutions, the 25th and 75th percentile score models are stronger for

Table 3
Effect of Performance-Based Funding Policies on Admission Rates and Test Scores, by Institutional Selectivity

	Low Selectivity			High Selectivity		
	Admission Rate	25th Percentile Scores	75th Percentile Scores	Admission Rate	25th Percentile Scores	75th Percentile Scores
Policy Treat × Post	–1.535*	8.462*	5.504*	–1.666*	5.628†	–4.514
	(0.422)	(2.025)	(2.523)	(0.712)	(2.999)	(3.872)
Duration of policy (years)	0.048	–0.665†	–0.243	0.303*	–0.765	–0.241
	(0.077)	(0.376)	(0.469)	(0.143)	(0.596)	(0.770)
Total enrollment (ln)	–4.225*	–1.278	–20.534*	5.962*	45.432*	–18.771
	(1.416)	(7.517)	(9.350)	(2.256)	(10.053)	(12.980)
Instruction/student (ln)	1.554*	0.501	4.395	0.215	7.101	–0.499
	(0.675)	(3.205)	(3.991)	(1.714)	(7.385)	(9.535)
Percentage part-time undergraduate	0.010	–0.067	0.425*	–0.097	0.590*	0.237
	(0.031)	(0.156)	(0.194)	(0.059)	(0.263)	(0.339)
Sticker price (ln, 2014 CPI)	–1.434†	6.807†	8.282	–0.862	0.572	1.731
	(0.848)	(4.058)	(5.054)	(0.829)	(3.491)	(4.507)
Full-time faculty/100 students (ln)	–3.863*	24.948*	18.402*	0.686	1.982	15.956†
	(1.197)	(5.959)	(7.421)	(1.615)	(6.945)	(8.967)
State unemployment	0.022	–2.237*	–4.156*	0.741*	–0.897	–0.484
	(0.181)	(0.871)	(1.084)	(0.265)	(1.126)	(1.454)
Total high school graduates in state (ln)	1.106	1.696	21.543	–5.068	61.557*	7.859
	(2.894)	(14.202)	(17.691)	(4.957)	(21.060)	(27.189)
Percentage Black high school graduates	0.334†	2.058*	1.202	0.023	1.279	0.891
	(0.189)	(0.919)	(1.145)	(0.241)	(1.025)	(1.323)
Percentage Hispanic high school graduates	0.127	–1.881*	–1.955*	–0.393*	–0.986	0.698
	(0.103)	(0.501)	(0.624)	(0.177)	(0.756)	(0.976)
Need, non-need-based state aid (millions, 2014 CPI)	0.003	–0.010	–0.035*	0.002	–0.004	0.011
	(0.002)	(0.010)	(0.012)	(0.002)	(0.010)	(0.013)
Percentage bachelor's degrees in state	0.218†	–1.935*	–1.120	0.050	–0.325	2.290*
	(0.113)	(0.554)	(0.688)	(0.177)	(0.757)	(0.978)
State per capita income (thousands, 2014 CPI)	–0.110	0.115	–1.124*	0.286*	1.071†	–0.374
	(0.089)	(0.437)	(0.544)	(0.145)	(0.621)	(0.801)
Constant	109.139*	869.259*	1058.171*	52.102	–271.057	1151.837*
	(32.102)	(157.054)	(195.598)	(60.746)	(259.645)	(335.216)
n	3,048	2,891	2,896	2,466	2,379	2,379
R^2	.06	.09	.08	.05	.12	.06
Institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

less selective institutions. Although these institutions perhaps have more room to move scores upward, it also means this increase in test scores, and thus selectivity, comes at a cost of student access. This is particularly notable when considering that underserved students typically enroll in less selective institutions.

As noted previously, not all PBF policy designs look the same. We consider whether PBF was intended as a bonus incentive (often termed PBF 1.0) or as a part of base funding (PBF 2.0). Table 4 shows the results of accounting for structural differences in 1.0 versus 2.0 policies; the funding types are codified in these models as dichotomous variables. All three models suggest that institutional shifts toward becoming less accessible are driven in large part by 2.0 policies. Indeed, 25th percentile scores rise by more than 11 points in institutions covered by 2.0 policies as compared to non-PBF institutions. Additional models in the online appendix (appendix Table 16) suggest that accessibility is threatened much more by PBF policies with no bonus credits for disadvantaged or underrepresented student groups compared to those policies that provide premiums for these students (see additional discussion of PBF premiums in Gándara & Rutherford, 2018; Kelchen, 2018a).

Underserved Student Enrollments

We expect the total enrollment of underserved student populations could take longer to shift than admission variables given

Table 4
Effect of Performance-Based Funding on Admission Rates and Test Scores by 1.0 and 2.0 Policies

	Admission Rate	25th Percentile Scores	75th Percentile Scores
Performance-based funding 1.0	0.077	3.099†	–2.551
	(0.588)	(1.719)	(2.131)
Performance-based funding 2.0	–3.252*	11.585*	7.045*
	(0.694)	(2.038)	(2.525)
Total enrollment (ln)	2.517	17.222*	–9.655
	(1.744)	(5.527)	(6.840)
Instruction/student (ln)	0.612	1.674	4.778
	(1.028)	(3.021)	(3.742)
Percentage part-time undergraduate	0.097*	–0.162	0.171
	(0.042)	(0.131)	(0.162)
Sticker price (ln, 2014 CPI)	–1.582†	2.672	4.078
	(0.854)	(2.497)	(3.095)
Full-time faculty/100 students (ln)	0.303	19.244*	15.237*
	(1.435)	(4.326)	(5.361)
State unemployment	0.429†	–1.961*	–2.838*
	(0.230)	(0.679)	(0.842)
Total high school graduates in state (ln)	–5.463	18.648†	10.571
	(3.648)	(10.856)	(13.454)
Percentage Black high school graduates	0.126	2.185*	1.204
	(0.217)	(0.641)	(0.795)
Percentage Hispanic high school graduates	–0.177	–1.103*	–0.903†
	(0.133)	(0.395)	(0.490)
Need, non-need-based state aid (millions, 2014 CPI)	0.003	–0.003	–0.008
	(0.002)	(0.007)	(0.008)
Percentage bachelor's degrees in state	0.325*	–1.221*	0.522
	(0.147)	(0.438)	(0.542)
State per capita income (thousands, 2014 CPI)	–0.030	0.689*	–0.786†
	(0.113)	(0.339)	(0.420)
Constant	105.762*	511.256*	1057.751*
	(41.910)	(124.343)	(154.049)
n	5,515	5,277	5,282
R^2	.04	.10	.06
Institution fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

that admission rounds occur in each academic year whereas enrollments are totaled across all students in the institution (not merely incoming students). Table 5 provides results for total Black student enrollment (ln), total Hispanic student enrollment (ln), the percentage of students who ever received a Pell Grant, and the percentage of first-generation students. Three of the four models—those for Black students, Hispanic students, and percentage of first-generation students—suggest that PBF policies have a short-term negative association with underserved student enrollment. In the case of Hispanic students, a rebound effect may occur over time given that the duration variable is positive and significant. Only the percentage of students ever to receive Pell is not influenced by PBF.

When institutions are split by selectivity (see Table 6), findings become less clear. No meaningful linkages are detected for the low-selectivity group. When considering the duration variable, first-generation enrollment may decline over time whereas the percentage of students who ever received a Pell Grant may actually increase. Relationships are also largely lacking for institutions in the high-selectivity group, although there appears to be a positive linkage between PBF treatment and the percentage of first-generation students enrolled. Similar longer term findings are present given that the duration model picks up a negative linkage with first-generation students and a positive linkage between PBF and Hispanic student enrollment. Overall, this may suggest that the general relationships between PBF and student enrollment are weaker and may be better suited to a case-by-case institutional assessment. Consequently, we take caution in interpreting ties between PBF and student enrollment.

Finally, we consider policy types by controlling for PBF 1.0 and 2.0 in Table 7. Although associations should still be noted with caution, these results suggests PBF 1.0 may have negative consequences for Black students and first-generation students whereas PBF 2.0 has negative consequences only for first-generation

Table 5
Effect of Performance-Based Funding Policies on Student Enrollment

	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation
Policy Treat × Post	–0.026*	–0.020†	0.123	–0.335*
	(0.011)	(0.011)	(0.143)	(0.100)
Duration of policy (years)	0.001	0.006*	0.060*	–0.016
	(0.002)	(0.002)	(0.024)	(0.017)
Total enrollment (ln)	1.022*	1.098*	0.115	0.890*
	(0.029)	(0.029)	(0.379)	(0.257)
Instruction/student (ln)	0.017	0.010	–0.070	0.290†
	(0.019)	(0.019)	(0.263)	(0.174)
Percentage part-time undergraduate	0.002*	0.004*	0.002	0.022*
	(0.001)	(0.001)	(0.008)	(0.006)
Sticker price (ln, 2014 CPI)	–0.021	0.040*	–0.660*	0.220
	(0.016)	(0.016)	(0.204)	(0.141)
Full-time faculty/100 students (ln)	–0.018	–0.046*	0.617*	–0.559*
	(0.022)	(0.022)	(0.287)	(0.198)
State unemployment	0.010*	0.009*	0.162*	0.058
	(0.004)	(0.004)	(0.056)	(0.039)
Total high school graduates in state (ln)	–0.824*	0.129†	4.013*	–1.644*
	(0.071)	(0.071)	(0.921)	(0.636)
Percentage Black high school graduates	–0.004	0.001	0.167*	–0.302*
	(0.004)	(0.004)	(0.055)	(0.038)
Percentage Hispanic high school graduates	0.004†	–0.028*	0.218*	0.438*
	(0.003)	(0.003)	(0.033)	(0.023)
Need, non-need-based state aid (millions, 2014 CPI)	–0.000*	0.000*	0.000	0.002*
	(0.000)	(0.000)	(0.001)	(0.000)
Percentage bachelor's degrees in state	0.010*	0.001	–0.087*	–0.075*
	(0.003)	(0.003)	(0.037)	(0.026)
State per capita income (thousands, 2014 CPI)	0.000	0.011*	–0.185*	0.021
	(0.002)	(0.002)	(0.028)	(0.019)
Constant	5.494*	–6.931*	26.578*	49.598*
	(0.818)	(0.809)	(10.563)	(7.303)
n	7,337	7,345	7,203	7,337
R^2	.49	.78	.38	.52
Institution fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

students. Given that the first-generation student measure has commonly been excluded from empirical analyses of PBF, additional work should be done to fully assess the potential negative association of these policies with this at-risk student group. It also should be noted that PBF 2.0 policies have a positive association with the percentage of students who ever received a Pell. This could be because the share of undergraduates with Pell increased after the Great Recession (National Center for Education Statistics, 2017b), which coincides with increased adoption of PBF 2.0.

It also should be noted that when PBF policies are split according to whether a premium for underrepresented students is present (see Table 18 in the online appendix), those without premiums appear to dampen Black and Hispanic student enrollment whereas those with premiums tend to boost the share of students who have ever received a Pell grant but also lower the number of Black students and the share of first-generation students. One possible cause of this was noted in interviews with policymakers—crafting policy premiums that center on low-income students is less divisive than premiums for racial or ethnic minority groups (Gándara, 2020).

Discussion

The college-completion agenda and efforts that encourage PBF focus on ensuring postsecondary students complete a credential. Of course, as with all policies, the potential for unintended consequences can undermine the intention of PBF to bolster student outcomes. In this study, we focus on examining the extent to which PBF may restrict college access.

With respect to selectivity, we find that admission rates appear slightly lower at institutions subject to PBF. Our findings

Table 6
Effect of Performance-Based Funding Policies on Enrollment, by Selectivity

	Low Selectivity				High Selectivity			
	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation
Policy Treat × Post	–0.010	0.009	0.069	–0.202	–0.014	–0.003	–0.111	0.394*
	(0.016)	(0.014)	(0.178)	(0.132)	(0.018)	(0.018)	(0.248)	(0.163)
Duration of policy (years)	–0.003	0.000	0.139*	–0.045†	–0.000	0.010*	0.004	–0.108*
	(0.003)	(0.002)	(0.032)	(0.024)	(0.004)	(0.004)	(0.050)	(0.033)
Total enrollment (ln)	1.002*	1.074*	–2.006*	–0.102	1.012*	0.891*	–2.482*	0.520
	(0.056)	(0.046)	(0.604)	(0.444)	(0.058)	(0.058)	(0.789)	(0.517)
Instruction/student (ln)	0.018	–0.024	0.760*	0.596*	0.019	–0.094*	0.154	–0.828*
	(0.026)	(0.022)	(0.285)	(0.211)	(0.044)	(0.044)	(0.600)	(0.393)
Percentage part-time undergraduate	0.003*	0.003*	0.066*	0.046*	0.006*	0.006*	0.079*	0.055*
	(0.001)	(0.001)	(0.013)	(0.010)	(0.002)	(0.002)	(0.021)	(0.014)
Sticker price (ln, 2014 CPI)	–0.024	–0.048†	–2.766*	0.774*	–0.069*	–0.010	0.132	0.437*
	(0.033)	(0.027)	(0.358)	(0.266)	(0.021)	(0.021)	(0.289)	(0.190)
Full-time faculty/100 students (ln)	–0.165*	–0.122*	0.977†	–0.990*	0.060	0.019	0.798	–0.472
	(0.047)	(0.039)	(0.506)	(0.375)	(0.042)	(0.042)	(0.565)	(0.370)
State unemployment	0.008	0.015*	0.161*	–0.137*	0.011	0.008	0.400*	0.106†
	(0.007)	(0.006)	(0.076)	(0.057)	(0.007)	(0.007)	(0.092)	(0.061)
Total high school graduates in state (ln)	–0.591*	–0.178†	3.778*	0.238	–0.839*	0.681*	–2.965†	–4.203*
	(0.113)	(0.093)	(1.223)	(0.906)	(0.127)	(0.128)	(1.735)	(1.135)
Percentage Black high school graduates	–0.028*	–0.001	0.177*	–0.293*	0.014*	–0.005	–0.066	–0.247*
	(0.007)	(0.006)	(0.080)	(0.059)	(0.006)	(0.006)	(0.084)	(0.055)
Percentage Hispanic high school graduates	–0.009*	–0.017*	0.215*	0.474*	0.025*	–0.028*	0.345*	0.485*
	(0.004)	(0.003)	(0.043)	(0.032)	(0.005)	(0.005)	(0.062)	(0.041)
Need, non-need-based state aid (millions, 2014 CPI)	–0.000	0.000*	0.001	0.001†	–0.000*	0.000*	0.002*	0.003*
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Percentage bachelor's degrees in state	0.017*	0.005	–0.043	–0.024	0.003	0.001	–0.219*	–0.130*
	(0.004)	(0.004)	(0.048)	(0.035)	(0.005)	(0.005)	(0.062)	(0.041)
State per capita income (thousands, 2014 CPI)	–0.003	0.012*	–0.384*	0.005	0.010*	0.003	–0.275*	0.045
	(0.003)	(0.003)	(0.038)	(0.028)	(0.004)	(0.004)	(0.051)	(0.033)
Constant	3.222*	–2.691*	62.616*	30.802*	5.867*	–9.502*	120.927*	84.475*
	(1.247)	(1.037)	(13.539)	(10.056)	(1.557)	(1.570)	(21.206)	(13.906)
n	3,046	3,048	3,045	3,047	2,461	2,465	2,461	2,462
R^2	.51	.84	.46	.64	.39	.79	.47	.59
Institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

also indicate that standardized test scores are higher at the 25th and 75th percentiles for less selective institutions and at the 25th percentile for more selective institutions. These findings are consistent with work by Umbricht et al. (2017) and Birdsall (2018), which provide evidence that PBF is associated with increased selectivity in the state of Indiana. Our findings suggest this phenomenon is not unique to one state but, rather, is a concern for institutions in many other states with PBF. These findings are robust to alternative specifications, but we urge caution in interpretation because the parallel trends assumption may not hold, especially for the models for admission rates and standardized scores at the 75th percentile, and these particular models explain a low level of variation observed in the data. For instance, unobserved variables that could affect college access variables include universities' enrollment-management goals unrelated to performance funding (e.g., prestige maximization) and factors in neighboring K–12 schools, including college readiness programs and counselor advising practices that could affect how many and which students apply to universities.

Nevertheless, such findings suggest this type of policy limits access for students to institutions that serve as the primary route for students traditionally underrepresented in higher education. Our finding related to standardized test scores is especially concerning because research shows racial gaps in standardized

Table 7
Effect of Performance-Based Funding on Student Enrollment by 1.0 and 2.0 Policies

	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation
Performance-based funding 1.0	–0.027*	–0.010	0.073	–0.444*
	(0.012)	(0.012)	(0.150)	(0.105)
Performance-based funding 2.0	–0.016	–0.002	0.566*	–0.258*
	(0.014)	(0.013)	(0.175)	(0.122)
Total enrollment (ln)	1.023*	1.100*	0.129	0.873*
	(0.029)	(0.029)	(0.379)	(0.257)
Instruction/student (ln)	0.018	0.009	–0.050	0.307†
	(0.019)	(0.019)	(0.263)	(0.174)
Percentage part-time undergraduate	0.002*	0.005*	0.002	0.021*
	(0.001)	(0.001)	(0.008)	(0.006)
Sticker price (ln, 2014 CPI)	–0.021	0.038*	–0.647*	0.241†
	(0.016)	(0.016)	(0.204)	(0.141)
Full-time faculty/100 students (ln)	–0.018	–0.047*	0.618*	–0.553*
	(0.022)	(0.022)	(0.287)	(0.198)
State unemployment	0.010*	0.009*	0.159*	0.060
	(0.004)	(0.004)	(0.056)	(0.039)
Total high school graduates in state (ln)	–0.824*	0.138†	4.030*	–1.704*
	(0.071)	(0.071)	(0.921)	(0.635)
Percentage Black high school graduates	–0.004	0.002	0.168*	–0.310*
	(0.004)	(0.004)	(0.055)	(0.038)
Percentage Hispanic high school graduates	0.004†	–0.029*	0.215*	0.445*
	(0.003)	(0.003)	(0.033)	(0.023)
Need, non-need-based state aid (millions, 2014 CPI)	–0.000*	0.000*	0.001	0.002*
	(0.000)	(0.000)	(0.001)	(0.000)
Percentage bachelor's degrees in state	0.010*	0.001	–0.083*	–0.071*
	(0.003)	(0.003)	(0.038)	(0.026)
State per capita income (thousands, 2014 CPI)	0.000	0.011*	–0.184*	0.022
	(0.002)	(0.002)	(0.028)	(0.019)
Constant	5.478*	–7.029*	25.843*	50.003*
	(0.817)	(0.809)	(10.556)	(7.297)
n	7,337	7,345	7,203	7,337
R^2	.49	.78	.38	.52
Institution fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

testing (Reeves & Halikias, 2017). These gaps have persisted over time and reveal important questions related to equal access where institutions, under the influence of PBF, are raising their average test scores.

Our findings regarding the enrollment of underrepresented students are more mixed than those on institutional selectivity. Among four underrepresented groups, PBF policies are associated with lower enrollment of Black and Hispanic students as well as a lower share of first-generation students in the full sample. The event-study results (see Figures 8–14 in the online appendix) shine additional light on these relationships. In particular, figures for Hispanic and Black student enrollment show declining enrollment of these student groups preceding PBF. Although these declines continue in the early years of PBF (and are substantial among Black students), these drops ameliorate in subsequent years of PBF implementation. The event-study finding for first-generation students, on the other hand, shows, on average, declining enrollment of these students following PBF implementation. This finding is especially noteworthy given its persistence across varying models and the fact that first-generation status is distinct from others, including Pell eligibility and race or ethnicity. One potential reason for this finding is that PBF models rarely include incentives to increase first-generation student enrollment (Gándara & Rutherford, 2018). Given the potential role of higher education in promoting social mobility (Chetty et al., 2017), we argue this trend is concerning and warrants further attention. This finding also highlights the importance of specific equity metrics; first-generation students are distinct from Pell students, and incentivizing the latter group while neglecting the former may inadvertently hurt access for a historically disadvantaged group.

The linkages between underrepresented student enrollment and PBF appear less straightforward when the sample is divided by institutional selectivity; more long-standing policies appear to have mixed associations with both types of institutions. The mixed evidence provided here generally aligns with work by Umbricht and associates (2017) and Kelchen (2018a), who also discerned little evidence that PBF affects underrepresented student enrollment; the former study was state specific, and the latter was national in scope. Unexpectedly, we find that whereas the percentage of first-generation students may suffer regardless of institutional selectivity, the share of Pell students may increase in less selective institutions, and the number of Hispanic students may increase in more selective institutions. Although Kelchen and Stedrak (2016) find that 2- and 4-year institutions under PBF receive less Pell Grant revenue, we find that 4-year institutions under PBF, particularly less selective institutions, may actually see an increase in the percentage of students who have ever received a Pell Grant. Moreover, our robustness checks suggest this finding is likely picking up responses to those policies that have premiums, or bonuses, for underserved students, which would somewhat align with Kelchen (2018a), who finds that premiums help to mitigate negative consequences of PBF on underrepresented students.

We also recognize that not all PBF policies are alike. The share and type of funding, indicators of performance, and reporting mechanisms are influenced by the particular context of a state and the legislators designing the policy (Gándara, 2020). Although we do not account for all of these design intricacies, we do provide models split by whether they reflect a 1.0 (bonus funding) or 2.0 (base funding) approach. Important to note, institutions appear to respond much more strongly to 2.0 policies in terms of admission rates and test scores. That institutions appear to be reacting more strongly to 2.0 policies, which have become more popular since the most recent recession, means concerns with PBF and college access hold continual relevance. This response appears less apparent for types of student enrollment, although first-generation students may lose under either type of policy design. An area of future study might allow for comparisons of early adopters to late adopters instead of adopters and nonadopters.

Practically, our results suggest university officials (agents) at less selective institutions are more likely to respond to the PBF incentive set by state policymakers (principals) in the admissions process. One possible explanation for this phenomenon is that less selective institutions are more dependent on state funds (Desrochers & Hurlburt, 2016; but see also Birdsall, 2018). This finding is consistent with a multiple-case study in Tennessee, where officials at the state's flagship institution were minimally concerned with PBF (Ness et al., 2015). Instead, consistent with interest divergence, those officials focused on their aspiration to become a top-ranked research institution. More selective institutions may have their own incentives that take precedence over those embedded in PBF models.

Evidence of increased selectivity at less selective institutions might be construed as shirking, depending on policymakers' intentions. Although the PBF system is assumed to align the goals of university officials with those of state policymakers, our results suggest some agents pursue a simpler path to securing performance funds (i.e., by raising test score standards). This shirking may result from a variety of factors that include but are not limited to interest divergence. For instance, because less selective institutions often have fewer financial resources (Hoxby, 2009), officials at these universities may calculate that they do not have sufficient resources to implement high-cost initiatives to improve outcomes (e.g., hiring additional advisors or leveraging technology; Dougherty et al., 2016). Instead, they might resort to selecting students deemed more likely to perform well on metrics specified in the PBF model.

On the other hand, it is possible that policymakers in some states expect university officials to restrict college access (or at least may not be opposed to such a strategy). That would be consistent with interest *convergence* between principals and agents, a possibility that is generally neglected by principal-agent theory (Dougherty & Natow, 2019).

This study highlights the importance of carefully crafting policies that advance the college-completion agenda without excluding students who have historically been left out of 4-year universities. Our findings also emphasize the importance of closely monitoring PBF policies and their effects on various populations. After sufficient implementation time, rigorous evaluations of individual policies should be conducted to examine how they are affecting different groups. Together with previous research, this study provides support for the inclusion of equity metrics in PBF models and suggests policymakers should consider incentives for serving first-generation students. In addition, policymakers and institutional leaders should give additional attention to gaps in standardized test scores that may decrease opportunities for equal access for underrepresented populations even at institutions that appear more open in that they admit a larger share of students. Although some ranking systems reward higher test scores and higher levels of selectivity, this shift may inherently advantage only specific groups. Furthermore, college and university officials should make a clear effort to recruit and retain underserved students to avoid denying them opportunities to obtain postsecondary degrees under PBF regimes.

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NOTES

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[1]An event-history model for the adoption of performance-based funding (PBF) policies, line graphs comparing PBF institutions to non-PBF institutions, and Granger causality tests also suggest the parallel trends assumption may not hold in our data. For more on event-history models, see Berry and Berry (1990); for more about Granger causality tests, see Cheon and An (2017).

REFERENCES

Adams, C. (2015). College policy focus moves over time from access to completion. *Education Week*. http://blogs.edweek.org/edweek/college_bound/2015/04/college_conversation_shifts_from_access_to_completion.html

American Institutes for Research. (2013). *Predictors of postsecondary success*. American Institutes for Research. http://www.ccrscenter.org/sites/default/files/CCRS%20Center_Predictors%20of%20Postsecondary%20Success_final_0.pdf

Bell, E., Fryar, A. H., & Hillman, N. (2018). When intuition misfires: A meta-analysis of research on performance-based funding in higher education. In E. Hazelkorn, H. Coates, & A. C. McCormick (Eds.), *Research handbook on quality, performance and accountability in higher education* (pp. 108–124). Edward Elgar.

Berry, F. S., & Berry, W. D. (1990). State lottery adoptions as policy innovations: An event history analysis. *American Political Science Review*, *84*(2), 395–415.

Bettinger, E. P., Long, B. T., Oreopoulos, P., & Sanbonmatsu, L. (2012). The role of application assistance and information in college decisions: Results from the H&R Block FAFSA experiment. *Quarterly Journal of Economics*, *127*(3), 1205–1242.

Birdsall, C. (2018). Performance management in public higher education: Unintended consequences and the implications of organizational diversity. *Public Performance and Management Review*, *41*(4), 669–695. https://doi.org/10.1080/15309576.2018.1481116

Birnbaum, R. (1988). Problems of governance, management, and leadership in academic institutions. In *How colleges work: The cybernetics of academic organization and leadership* (pp. 27–29). Jossey-Bass.

Bowen, H. W. (1977). Investment in learning. In *Investment in learning: The individual and social value of American higher education*. Jossey-Bass.

Brewer, D. J., Gates, S. M., & Goldman, C. A. (2002). *In pursuit of prestige: Strategy and competition in U.S. higher education*. Transaction.

Cahalan, M., Perna, L. W., Yamashita, M., Wright, J., & Santillan, S. (2018). *Indicators of higher education equity in the United States: Historical trend report*. Pell Institute for the Study of Opportunity in Higher Education, Council for Opportunity in Education (COE), and Alliance for Higher Education and Democracy of the University of Pennsylvania (PennAHEAD).

Cataldi, E. F., Bennett, C., & Chen, X. (2018). *First-generation students college access, persistence, and postbachelor's outcomes*. U.S. Department of Education. https://nces.ed.gov/surveys/B&B/

Cheon, O., & An, S. H. (2017). Blowing in the wind: A study for Granger causality between managerial strategy and organizational performance. *Public Management Review*, *19*(5), 686–704.

Chetty, R., Friedman, J. N., Saez, E., Turner, N., & Yagan, D. (2017). *Mobility report cards: The role of colleges in intergenerational mobility* (No. w23618). National Bureau of Economic Research.

Desrochers, D. M., & Hurlburt, S. (2016). *Trends in college spending: 2003–2013*. American Institutes for Research.

Dougherty, K. J., & Natow, R. S. (2015). *The politics of performance funding for higher education: Origins, discontinuations, and transformations*. JHU Press.

Dougherty, K. J., & Natow, R. S. (2019). *Analysing neoliberalism in theory and practice: The case of performance-based funding for higher education* (Centre for Global Higher Education Working Paper Series No. 44). www.researchcghe.org

Dougherty, K. J., Pheatt, L., Natow, R. S., & Reddy, V. (2016). *Performance funding for higher education*. JHU Press.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, *14*(1), 57–74.

Fiorina, M. (1982). *Divided government*. Longman.

Gándara, D. (2020). How the sausage is made: An examination of a state funding model design process. *The Journal of Higher Education*, *91*(2), 192–221.

Gándara, D., & Rutherford, A. (2018). Mitigating unintended impacts? The effects of premiums for underserved populations in performance-funding policies for higher education. *Research in Higher Education*, *59*(6), 681–703.

Goodman-Bacon, A. (2019). *Difference-in-differences with variation in treatment timing* (No. w25018). National Bureau of Economic Research.

Hagood, L. P. (2019). The financial benefits and burdens of performance funding in higher education. *Educational Evaluation and Policy Analysis*, *41*(2), 189–213.

Hillman, N. W., Tandberg, D. A., & Gross, J. P. K. (2014a). Market-based higher education: Does Colorado's voucher model improve higher education access and efficiency? *Research in Higher Education*. https://doi.org/10.1007/s11162-013-9326-3

Hillman, N., Tandberg, D., & Gross, J. (2014b). Performance funding in higher education: Do financial incentives impact college completions? *Journal of Higher Education*, *85*(6), 826–857. https://doi.org/10.1353/jhe.2014.0031

Hillman, N., Tandberg, D., & Fryar, A. (2015). Evaluating the impacts of "new" performance funding in higher education. *Educational Evaluation and Policy Analysis*, *37*(4), 501–519.

Hillman, N. W., Hicklin Fryar, A., & Crespín-Trujillo, V. (2018). Evaluating the impact of performance funding in Ohio and Tennessee. *American Educational Research Journal*, *55*(1), 144–170.

Hoxby, C. M. (2009). The changing selectivity of American colleges. *Journal of Economic Perspectives*, *23*(4), 95–118.

Jacobson, L. S., LaLonde, R. J., & Sullivan, D. G. (1993). Earnings losses of displaced workers. *American Economic Review*, *83*(4), 685–709.

Jones, T., Jones, S., Elliott, K. C., Owens, L. T. R., Assalone, A. E., & Gándara, D. (2017). *Outcomes based funding and race in higher education: Can equity be bought?* https://doi.org/10.1007/978-3-319-49436-4

Kantrowitz, M. (2012). *The college completion agenda may sacrifice college access for low-income, minority and other at-risk students*. http://www.finaid.org/educators/20120910completionagenda.pdf

Kelchen, R. (2018a). Do performance-based funding policies affect underrepresented student enrollment? *Journal of Higher Education*, *89*(5), 702–727.

Kelchen, R. (2018b). *Higher education accountability*. Johns Hopkins University Press.

Kelchen, R. (2019). Exploring the relationship between performance-based funding design and underrepresented student enrollment at community colleges. *Community College Review*, *47*(4), 382–405.

Kelchen, R., Rosinger, K. O., & Ortagus, J. C. (2019). How to create and use state-level policy data sets in education research. *AERA Open*, *5*(3), 233285841987361. https://doi.org/10.1177/2332858419873619

Kelchen, R., & Stedrak, L. J. (2016). Does performance-based funding affect colleges' financial priorities? *Journal of Education Finance*, *41*(3), 302–321.

Lahr, H., Pheatt, L., Dougherty, K. J., Jones, S. M., Natow, R. S., & Reddy, V. (2014). Unintended impacts of performance funding on community colleges and universities in three states (CCRC Working Paper No. 78). Community College Research Center. http://ccrc.tc.columbia.edu/Performance-Funding.html

Lane, J. E., & Kivisto, J. A. (2008). Interests, information, and incentives in higher education: Principal-agent theory and its potential applications to the study of higher education governance. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 18, pp. 141–179). Agathon Press.

Lester, J. (2014). The completion agenda: The unintended consequences for equity in community colleges. In M. B. Paulsen (Ed.), *Higher education: Handbook of theory and research* (Vol. 29, pp. 423–466). Springer Netherlands.

Li, A. (2018a). *Lessons learned: A case study of performance funding in higher education*. Third Way. https://www.thirdway.org/report/lessons-learned-a-case-study-of-performance-funding-in-higher-education

Li, A. Y. (2018b). Performance funding policy impacts on STEM degree attainment. *Educational Policy*, *34*(2), 312–349. https://doi.org/10.1177/0895904818755455

Li, A. Y., & Zumeta, W. (2016). *Performance funding on the ground: Campus responses and perspectives in two states*. TIAA Institute. https://www.tiaainstitute.org/publication/performance-funding-ground-campus-responses

Lohfink, M. M., & Paulsen, M. B. (2005). Comparing the determinants of persistence for first-generation and continuing-generation students. *Journal of College Student Development*, *46*(4), 409–428.

McLendon, M. K., Hearn, J. C., & Mokher, C. (2009). Partisans, professionals, and power: The role of political factors in state higher education funding. *Journal of Higher Education*, *80*(6), 686–713.

Moe, T. M. (1984). The new economics of organization. *American Journal of Political Science*, *28*, 739–777.

National Center for Education Statistics. (2015). Percentage of recent high school completers enrolled in 2-year and 4-year colleges, by income level: 1975 through 2014 [Table]. *Digest of Education Statistics*. https://nces.ed.gov/programs/digest/d15/tables/dt15_302.30.asp

National Center for Education Statistics. (2017a). Number and percentage distribution of first-time postsecondary students starting at 2- and 4-year institutions during the 2011–12 academic year, by attainment and enrollment status and selected characteristics: Spring 2014 [Table]. *Digest of Education Statistics*. https://nces.ed.gov/programs/digest/d17/tables/dt17_326.50.asp

National Center for Education Statistics. (2017b). *Percent of undergraduate students receiving Pell grants*. U.S. Department of Education. https://nces.ed.gov/ipeds/TrendGenerator/app/answer/8/35

Ness, E. C., Deupree, M. M., & Gándara, D. (2015). *Campus responses to outcomes-based funding in Tennessee: Robust, aligned, and contested*. Tennessee Higher Education Commission.

Rabovsky, T. (2012). Accountability in higher education: Exploring impacts on state budgets and institutional spending patterns. *Journal of Public Administration Research and Theory*, *22*(4), 675–700. https://doi.org/10.1093/jopart/mur069

Redford, R., & Hoyer, K. M. (2017). *First-generation and continuing-generation college students: A comparison of high school and postsecondary experiences*. U.S. Department of Education.

Reeves, R., & Halikias, D. (2017). *Race gaps in SAT score highlight inequality and hinder upward mobility*. Brookings Institute. https://www.brookings.edu/research/race-gaps-in-sat-scores-highlight-inequality-and-hinder-upward-mobility/

Rutherford, A., & Rabovsky, T. (2014). Evaluating impacts of performance funding policies on student outcomes in higher education. *Annals of the American Academy of Political and Social Science*, *655*(1), 185–208.

Sanford, T., & Hunter, J. M. (2011). Impact of performance-funding on retention and graduation rates. *Education Policy Analysis Archives*, *19*(33), *33*. http://epaa.asu.edu/ojs/article/view/949

Tandberg, D. A. (2010). Politics, interest groups and state funding of public higher education. *Research in Higher Education*, *51*(5), 416–450.

Tandberg, D. A., & Hillman, N. W. (2014). State higher education performance funding: Data, outcomes, and policy implications. *Journal of Education Finance*, *39*(1), 222–243.

Toutkoushian, R. K., & Hillman, N. W. (2012). The impact of state appropriations and grants on access to higher education and out-migration. *Review of Higher Education*, *36*(1), 51–90.

Umbricht, M. R., Fernandez, F., & Ortagus, J. C. (2017). An examination of the (un)intended consequences of performance funding in higher education. *Educational Policy*, *31*(5), 643–673.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. MIT Press.

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2017). These studies primarily focus on a single state (Birdsall, 2018; Ness et al., 2015; Umbricht et al., 2017) or a few states (Dougherty et al., 2016; Li & Zumeta, 2016), although studies using national data have recently analyzed the relationship between PBF and access for certain students. Kelchen (2018a), for instance, examined whether PBF is associated with the enrollment of racial/ethnic minority, low-income, and adult students.

The present study extends this prior work in a number of ways. First, our study examines various access-related outcomes. Like Kelchen (2018a, 2019), we examine underrepresented student enrollment. Our analyses go beyond this focus to examine indicators of institutional selectivity, including admission rates and standardized test scores (single-state examples using similar indicators include Birdsall, 2018, and Umbricht et al., 2017). We further extend our contribution by considering the enrollment of first-generation students, who have not been the focus of prior PBF research. Attending to first-generation students is especially important because these students face unique challenges navigating the college application and matriculation process and remain less likely to enroll in higher education than their peers whose parents attended college (Cataldi et al., 2018; Redford & Hoyer, 2017). Moreover, higher education can promote social mobility (Chetty et al., 2017); denying access to students who would be the first to enroll in college could systematically hinder intergenerational mobility.

Second, this study accounts for important differences across PBF policies. A few extant studies have considered differences in PBF designs, albeit in limited ways—examining whether the policy includes extra funding for science, technology, engineering, and mathematics majors (Li, 2018b) or for minority students (Gándara & Rutherford, 2018; Kelchen, 2018a). For instance, Gándara and Rutherford (2018) studied the effect of including premiums for underrepresented students on outcomes related to college access, conditional on a state's having PBF. The present study departs from that study primarily by comparing states with PBF to those without such policies.

Specifically, in this study, we account for institutional and policy characteristics potentially relevant for college access outcomes, including institutional selectivity, whether PBF is tied to a portion of an institution's *base* funding (PBF 2.0) or linked to bonus funds (PBF 1.0), and whether the PBF policy includes an equity premium. By examining numerous access outcomes and distinguishing by institutional and policy features, this study provides a comprehensive, systematic evaluation of the degree to which PBF is associated with college access. We employ difference-in-differences to compare institutions funded through PBF to similar institutions not subject to PBF. This study reveals the degree to which PBF is associated with changes in selectivity and underrepresented student enrollment, illuminating how PBF, one manifestation of the college-completion agenda, may have implications for college access.

Understanding PBF Through Principal-Agent Theory

Principal-agent theory sheds light on the reasons college and university officials might restrict access to their institutions when subject to PBF. Broadly, the theory seeks to explicate individual behavior in relationships between principals (individuals needing certain tasks to be performed but lacking the necessary expertise, skills, or time) and agents (those with delegated authority to perform the tasks for the principals; Moe, 1984).

Consistent with previous research on PBF (see Bell et al., 2018; Dougherty & Natow, 2019, for reviews), we conceptualize state policymakers as principals in higher education who fund public colleges and universities to provide postsecondary education and produce other public goods (e.g., research and service; Lane & Kivisto, 2008). Officials, including staff and administrators, at these institutions constitute agents who answer to the governments funding them and are expected to fulfill policymakers' preferred goals and policies.

One key tenet of principal-agent theory is the possibility that an agent's interests diverge from those of the principal. For example, officials at one public university might be interested in enhancing their institution's prestige, leading to greater spending on research (Brewer et al., 2002). State policymakers, however, might want the institution to prioritize degree production over other institutional goals. This departure in interests between principals and agents can lead to misalignment between the agent's performance and the principal's preferences (Eisenhardt, 1989).

Another major problem that can emerge in principal-agent relationships is information asymmetry, which occurs when the agent has more information (e.g., specialized knowledge of day-to-day operations) than the principal. Information asymmetry hinders the principal's ability to monitor the actions of agents (e.g., campus officials) and evaluate whether those actions conform to the principal's goals (Lane & Kivisto, 2008; Moe, 1984). The complexities of higher education, both its organization (Birnbaum, 1988) and production technology (Bowen, 1977), compound information asymmetry.

When agents have more information than principals or when their respective interests conflict, agents may *shirk* and fail to complete the work desired by the principals (Fiorina, 1982). Principals employ performance-management systems, such as PBF, to mitigate shirking. As noted previously, research shows PBF has not been particularly effective at improving outcomes in ways intended by the policies (Bell et al., 2018). Reacting to this evidence, recent work has highlighted the limitations of principal-agent theory, particularly with respect to PBF (Bell et al., 2018; Dougherty & Natow, 2019). For instance, these authors note that principal-agent theory generally assumes a single principal and a single agent. In reality, in higher education, there are multiple principals (e.g., ranking schemes, donors, governing board members) and multiple agents (e.g., administrators, student affairs professionals, academic staff; Bell et al., 2018). If principals have different demands, the response to a PBF model might become diluted for reasons beyond interest divergence. Furthermore, the multitude of agents in higher education might filter responsiveness to PBF.

Notwithstanding these findings regarding PBF and intended outcomes, principal-agent theory provides a useful framework for understanding why higher education officials might respond to PBF by restricting access to higher education, including due to shirking (Dougherty & Natow, 2019). Specifically, agents might manipulate inputs when PBF models reward institutions for outputs and outcomes, a practice known as cream-skimming (Kelchen, 2018b). This push to become more selective in admissions reflects the understanding that some of the strongest predictors of college success are related to prior academic performance (American Institutes for Research, 2013). Likewise, racial/ethnic minority, first-generation, and low-income students have been associated with a lower probability of success (notwithstanding structural and institutional factors leading to these outcomes; Lohfink & Paulsen, 2005; National Center for Education Statistics, 2017a). Thus, university officials may perceive students in these groups as less likely to succeed and respond to PBF by denying admission to those students. If this restriction of access were not policymakers' intent, this behavior would constitute shirking.

It is reasonable to expect greater effects of PBF on college access than on student outcomes for a number of reasons. In contrast to outcomes, such as degrees awarded, student inputs (e.g., enrollments) might be easier to control. For example, there are fewer agents involved in enrollment-management decisions than in college completion, where the behaviors of myriad actors can affect outcomes (Bell et al., 2018; Dougherty & Natow, 2019). Moreover, managing enrollment is presumably a less complex technology than "producing" a college graduate. Another explanation for the restriction of admissions in response to PBF is not addressed in principal-agent theory: the possibility that principals' and agents' interests actually align (Dougherty & Natow, 2019). For instance, some policymakers may expect institutions to become more selective in response to PBF.

Indeed, previous studies suggest cream-skimming may be a consequence of PBF. A recent study seeking to understand actual and perceived impacts of PBF in Indiana, Ohio, and Tennessee—three states with long-standing PBF programs—found that of the eight major categories of unintended impacts, restricting student admissions was cited most frequently in interviews (14 of 18 institutions; Dougherty et al., 2016; Lahr et al., 2014). Among the universities included in the study, several were broad-access institutions; the authors concluded, "At those institutions, increasing selectivity would also lead to a reduction in the number of low-income and minority students enrolled" (Lahr et al. 2014, p. 14). This line of research also identified mechanisms by which college and university officials restrict admissions. The most common was raising admissions requirements, with 23 out of 222 interview participants reporting this behavior. The second most common admissions restriction reported was selective student recruitment, and other mechanisms included general restrictions (e.g., not admitting "weaker" students) and targeted financial aid (Dougherty et al., 2016; Lahr et al., 2014).

Recent quantitative studies also suggest institutions may engage in cream-skimming when subject to PBF. In the case of Indiana, Umbricht et al., (2017) found that PBF was associated with decreased admission rates. The authors also considered the 25th percentile of ACT scores and found public institutions in Indiana had higher scores when subject to PBF than comparison institutions. Finally, the total number of entering minority students was lower at Indiana institutions subject to PBF than at comparison institutions. Additional work by Birdsall (2018) similarly concluded PBF led to restrictions in college access in Indiana, and a case study of Colorado found that a market-based policy—higher education student vouchers coupled with performance contracts for colleges and universities—may have led to reductions in the enrollment of racial/ethnic minority students (Hillman et al., 2014a).

Beyond these state-specific studies, a national study of institutions' financial profiles found that Pell Grant revenue was lower at 2- and 4-year institutions funded through PBF (Kelchen & Stedrak, 2016). These authors posited that "colleges may be trying to recruit more students from higher-income families" (p. 317). More recently, Kelchen (2018a) examined whether PBF affected racial/ethnic minority and low-income student enrollment and whether the presence of an equity metric in PBF models affected these relationships. He concluded that PBF does not have strong deleterious effects on underrepresented student enrollments.

The present study extends prior literature by examining how PBF implementation relates to both underrepresented student enrollment—including first-generation student enrollment—and selectivity (admission rates and test scores). Moreover, we respond to recent calls for differentiating across PBF design (Kelchen et al., 2019) by attending to key PBF characteristics.

Data Sources

Data for the analyses come from multiple sources. First, data for state PBF policies (see Table 1 in the appendix, available on the journal website) were collected from state records and a review of prior research on PBF. Next, institutional data, including information related to student characteristics, were gathered from the Integrated Postsecondary Education Data System (IPEDS) and the College Scorecard, both within the U.S. Department of Education. Third, state-level data related to the demand for postsecondary education were obtained from the Bureau of Labor Statistics, the U.S. Census Bureau, the Western Interstate Commission for Higher Education, and the National Association of State Student Grant and Aid Programs. As described in further detail below, our final data set focuses on within-institution changes between 2001 and 2014 for 587 4-year higher education institutions.

To best determine which 4-year institutions were covered by PBF, we referenced both extant research (most prominently Dougherty & Natow, 2015; Hagood, 2019; Rutherford & Rabovsky, 2014) and state policy documents, especially budget documents. Our criteria for coding a state as having an active PBF policy were the following: (a) the state (or state system) adopted a PBF policy, (b) the PBF policy focused on student success or completion (e.g., not exclusively research output), and (c) at least one institution received some funding through PBF. The resulting variable is a dichotomous measure that is equal to one in the years in which a state PBF policy is implemented and zero otherwise.

Research Design

Our analysis includes up to 7,345 institution-year observations across 587 4-year public institutions. Across the study period

Table 1
Means and Standard Deviations for Key Variables, 2001–2014

Variable	All Institutions	PBF Institutions	Non-PBF Institutions
Admission rate (percentage)	70.368	72.046	68.460
	(16.481)	(15.025)	(17.805)
25th percentile test scores	956.386	963.463	948.136
	(99.322)	(94.480)	(104.095)
75th percentile test scores	1174.019	1183.441	1163.024
	(99.838)	(98.180)	(100.646)
Black students (ln)	5.860	6.078	5.566
	(1.675)	(1.607)	(1.719)
Hispanic students (ln)	5.430	5.531	5.293
	(1.680)	(1.648)	(1.714)
Percentage students ever received Pell	60.372	61.841	58.407
	(14.980)	(14.911)	(14.848)
Percentage first-generation students	38.492	40.038	36.373
	(9.292)	(9.382)	(8.736)
Total enrollment (ln)	8.787	8.906	8.627
	(1.136)	(1.071)	(1.202)
Instruction/student (ln)	8.630	8.581	8.704
	(0.700)	(0.724)	(0.655)
Percentage part-time undergraduate	26.183	28.731	22.642
	(19.286)	(20.078)	(17.526)
Sticker price (ln, 2014 CPI)	8.457	8.450	8.467
	(0.596)	(0.578)	(0.623)
Full-time faculty/100 students (ln)	1.388	1.327	1.471
	(0.654)	(0.578)	(0.606)
State unemployment	6.304	6.420	6.145
	(1.992)	(1.935)	(2.056)
Total high school graduates in state (ln)	11.178	11.249	11.080
	(0.936)	(0.750)	(1.136)
Percentage Black high school graduates	12.869	13.133	12.508
	(9.539)	(8.644)	(10.633)
Percentage Hispanic high school graduates	9.960	10.625	9.050
	(11.104)	(11.845)	(9.934)
Need, non-need-based state aid (millions, 2014 CPI)	324.218	264.357	406.073
	(330.455)	(200.542)	(438.136)
Percentage bachelor's degrees in state	27.413	26.582	28.554
	(4.625)	(4.228)	(4.900)
State per capita income (thousands, 2014 CPI)	43.336	41.813	45.427
	(6.417)	(4.907)	(7.555)

Note. PBF = performance-based funding; CPI = consumer price index.

(2001–2014), slightly less than one fifth of the observations (18.51%) are actively subject to PBF. To examine whether PBF has any meaningful relationship with student access to 4-year institutions, we test whether these policies are related to several outcomes. First, we estimate the admission rate, the 25th percentile standardized test scores, and the 75th percentile standardized test scores in considering entry to postsecondary education. Admission rates are measured as the share of total applicants who were accepted by the institution each year. The higher the admission rate (share of applicants admitted), the less selective is the institution and the larger is the share of students who were admitted. For 25th and 75th test score percentiles, the verbal/English and math scores are combined for each test, respectively. ACT scores are then converted to SAT scores using a College Board concordance table where SAT scores were not reported but ACT scores were available. This results in single variables for 25th and 75th percentile scores.

We also test for the relationships between PBF and the enrollment of four student groups—the number of all students who are Black, logged (IPEDS); the number of all students who are Hispanic, logged (IPEDS); the percentage of students who ever received a Pell Grant while in school (College Scorecard), and the percentage of students who are first generation (College Scorecard). The hardest measure to interpret is that for low-income students, as students may not indicate their family/individual income and may not apply for Pell funding (e.g., Bettinger et al., 2012).

We include a number of variables to control for mechanisms other than PBF policies that may influence our outcomes. To capture the overall size and resources of each institution, we control for total student enrollment (logged), instructional expenditures per student (logged), the percentage of undergraduate students who are enrolled at the institution part-time, sticker price (logged and adjusted to the 2014 consumer price index [CPI]), and full-time faculty per 100 students (logged). Several measures are logged to prevent undue influence in our models from outlier observations.

At the state level, we account for unemployment rates (Bureau of Labor Statistics), as they have been shown to both increase the demand for higher education and threaten state financial support of higher education (McLendon et al., 2009; Tandberg, 2010). We control for the potential level of demand for higher education by accounting for total high school graduates in the state (logged) as well as the percentage of high school graduates who are Black and the percentage of graduates who are Hispanic (Western Interstate Commission for Higher Education's Knocking at the College Door data set). We include the percentage of individuals in the state who have bachelor's degrees (census), which could signal a college-going culture, and per capita income, reported in thousands and adjusted for inflation to the 2014 CPI (census), because income is positively associated with college enrollment (Cahalan et al., 2018). Finally, we include total need-based and non-need-based state grant aid to college students, reported in millions and adjusted for inflation to the 2014 CPI (National Association of State Student Grant and Aid Programs), because previous research finds that greater levels of merit-based state aid are associated with increases in college enrollment (Toutkoushian & Hillman, 2012). Table 1 presents descriptive statistics for all variables in our analysis. This table also splits summaries by those institutions in states that ever operated PBF between 1993 and 2014 and those states that never adopted a PBF policy during this time period. Perhaps the most notable differences in these groups occur in need-based and non-need-based state aid and, to a smaller extent, the percentage of first-generation students.

In examining the relationships between PBF policies and both admissions and student enrollment, we include models for all institution-year observations as well as separate models for institutions we classify as having low or high selectivity (based on the mean admission rate of 70% in this data set). This approach helps us pinpoint whether the direction or strength of any meaningful changes observed in our dependent variables may be influenced by the selectivity of the institution.

For this study, a model specification that can estimate important differences in public institutions in states with and without PBF policies is needed. Although we cannot be certain of what would happen in institutions in the absence of state PBF policies, we can use difference-in-differences regression to obtain strong approximations of our outcome variables pre- and post-policy treatment. Trends for treated institutions (those subjected to PBF) can be compared to those for similar 4-year public institutions in states that did not implement PBF. Of course, in the absence of an experimental design, the relationships below cannot be interpreted as causal and should therefore be viewed with some caution. For example, we test multiple comparison groups to minimize the threat that our choice of control group does not bias findings (see the online appendix for more detail). Of course, we have little control over which states select into the treatment group and the timing of when PBF policies were implemented. It should also be noted that, in the event that not all assumptions hold in order to provide an analysis that can be viewed as causal, the contribution of this analysis is still important. Biases withstanding, the findings should produce a rough average of effects. In other words, policies that have little to no influence likely have observed effects that are smaller than our estimates. Similarly, those policies that are most substantive likely have observed effects that are larger than our coefficients.

For both the treatment and control groups in our models, we include year and institution fixed effects to account for unobserved trends across time and space. This produces a model that can be specified as follows:

$$Y_{it} = \alpha + \beta_1 \left(\text{treat} \times \text{post}\right)_{it} + \beta_2 \left(\text{policy time}\right)_{it} + \gamma X_{it} + \eta_t + \delta_i + \varepsilon_i,$$

where Y is one of the key dependent variables (admission rate, 25th percentile test scores, 75th percentile test scores, Black student enrollment, Hispanic student enrollment, low-income student enrollment, first-generation student enrollment) in each institution (i) for each year of time (t), and α is the intercept. Because of the presence of different time periods in which treatment begins, the (Treat $\times$ Post) interaction is set to equal one for all institutions in the years during and following the adoption of PBF (see also Kelchen et al. 2019; Tandberg & Hillman, 2014). Next, the variable *policy time* accounts for the number of years a PBF policy has been in place for each institution. $\mathbf{X}_{it}$ represents a vector of included covariates. Finally, η_t represents year (t) fixed effects, δ_i represents institution (i) fixed effects, and ε_i represents an error term that is clustered by institution to better adjust for autocorrelation and heteroscedasticity (Wooldridge, 2002).

We also consider the assumption of parallel trends and run a series of robustness checks as described in the online appendix (appendix Tables 2–9, Figures 1–14). For example, figures produced from an event-study approach in which the analysis focused on the first adoption period for PBF states result in similar conclusions to the analysis presented below, and draw attention to pre-adoption trends.[1] Such figures allow researchers to consider whether and how the effect of a treatment may vary with time since exposure or anticipation effects (Goodman-Bacon, 2019; Jacobson et al., 1993). Parallel trends appear most concerning in the case of admissions rates where clear pre-post trends are difficult to define. Furthermore, although multiple control groups and regressions support the robustness of the findings shown here, some of the key independent and dependent variables here may influence one another in a cyclical pattern. Interpreting such results as causal and without error can be problematic. Still, among additional checks (excluding control variables, considering large vs. small states, or focusing on policy developments since 2005), our primary findings largely remain intact.

Findings

Admissions and Test Scores

Table 2 displays findings related to admission rates, 25th percentile test scores, and 75th percentile test scores. Overall, results

Table 2
Effect of Performance Funding Policies on Admission Rates and Test Scores

	Admission Rate	25th Percentile Scores	75th Percentile Scores
Policy Treat × Post	–2.172*	9.277*	2.644
	(0.565)	(1.657)	(2.056)
Duration of policy (years)	0.359*	–1.098*	–0.556
	(0.101)	(0.300)	(0.372)
Total enrollment (ln)	2.796	16.504*	–10.311
	(1.745)	(5.526)	(6.845)
Instruction/student (ln)	0.905	0.891	4.068
	(1.028)	(3.019)	(3.743)
Percentage part-time undergraduate	0.078†	–0.113	0.212
	(0.042)	(0.131)	(0.162)
Sticker price (ln, 2014 CPI)	–1.303	1.917	3.402
	(0.854)	(2.495)	(3.095)
Full-time faculty/100 students (ln)	0.643	18.168*	14.505*
	(1.437)	(4.330)	(5.371)
State unemployment	0.434†	–1.987*	–2.830*
	(0.230)	(0.680)	(0.843)
Total high school graduates in state (ln)	–7.026†	23.556*	13.940
	(3.662)	(10.890)	(13.509)
Percentage Black high school graduates	–0.086	2.792*	1.713*
	(0.216)	(0.640)	(0.794)
Percentage Hispanic high school graduates	–0.097	–1.323*	–1.066*
	(0.133)	(0.396)	(0.492)
Need, non-need-based state aid (millions, 2014 CPI)	0.004†	–0.004	–0.009
	(0.002)	(0.007)	(0.008)
Percentage bachelor's degrees in state	0.351*	–1.261*	0.451
	(0.147)	(0.438)	(0.542)
State per capita income (thousands, 2014 CPI)	–0.055	0.778*	–0.726†
	(0.113)	(0.340)	(0.421)
Constant	117.972*	468.733*	1032.768*
	(42.051)	(124.738)	(154.678)
n	5,515	5,277	5,282
R^2	.04	.10	.06
Institution fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

suggest that institutions become more selective when subject to PBF. In Model 1, PBF is linked with a more than 2% drop in the admission rate, meaning institutions under PBF policies become more selective (by admitting fewer applicants). As suggested by the duration variable, this relationship may subside over time but would require 6 to 7 years to normalize. When models (not shown here) are run on total applicants (ln) and total admits (ln), the treatment variable has a positive and significant correlation with applicants but not admits. This would suggest that university officials may be working to recruit larger pools of students to apply to their institutions but not necessarily expanding admission pools at the same rate. This strategy would allow institutions to select students deemed more desirable among a larger pool.

In Model 2, institutions in the treated group experience a nearly 9.3 point rise in 25th percentile scores of first-time full-time students on the 1600 SAT scale. For the average treated institution, the 25th percentile score would shift from 963.5 to 972.8, which constitutes a substantial change in shaping enrollments for many institutions and signals that students with lower scores are less likely to enroll in institutions subject to PBF. Similar to Model 1, the duration variable suggests that, when PBF stays in place for longer periods of time, a slight downward rebound in 25th percentile scores might be observed. Changes are less apparent for 75th percentile scores in Model 3. This may be due, in part, to the fact that it is often more difficult to shift an average toward the top of the distribution.

We also consider whether these general findings hold for institutions with lower or higher levels of selectivity. Table 3 provides models similar to those in Table 2, with low and high selectivity. Results for admission rates mirror the results in Table 2 for both types of institution. Interesting to note, although findings suggest that 25th percentile scores become higher in highly selective institutions, the 25th and 75th percentile score models are stronger for

Table 3
Effect of Performance-Based Funding Policies on Admission Rates and Test Scores, by Institutional Selectivity

	Low Selectivity			High Selectivity		
	Admission Rate	25th Percentile Scores	75th Percentile Scores	Admission Rate	25th Percentile Scores	75th Percentile Scores
Policy Treat × Post	–1.535*	8.462*	5.504*	–1.666*	5.628†	–4.514
	(0.422)	(2.025)	(2.523)	(0.712)	(2.999)	(3.872)
Duration of policy (years)	0.048	–0.665†	–0.243	0.303*	–0.765	–0.241
	(0.077)	(0.376)	(0.469)	(0.143)	(0.596)	(0.770)
Total enrollment (ln)	–4.225*	–1.278	–20.534*	5.962*	45.432*	–18.771
	(1.416)	(7.517)	(9.350)	(2.256)	(10.053)	(12.980)
Instruction/student (ln)	1.554*	0.501	4.395	0.215	7.101	–0.499
	(0.675)	(3.205)	(3.991)	(1.714)	(7.385)	(9.535)
Percentage part-time undergraduate	0.010	–0.067	0.425*	–0.097	0.590*	0.237
	(0.031)	(0.156)	(0.194)	(0.059)	(0.263)	(0.339)
Sticker price (ln, 2014 CPI)	–1.434†	6.807†	8.282	–0.862	0.572	1.731
	(0.848)	(4.058)	(5.054)	(0.829)	(3.491)	(4.507)
Full-time faculty/100 students (ln)	–3.863*	24.948*	18.402*	0.686	1.982	15.956†
	(1.197)	(5.959)	(7.421)	(1.615)	(6.945)	(8.967)
State unemployment	0.022	–2.237*	–4.156*	0.741*	–0.897	–0.484
	(0.181)	(0.871)	(1.084)	(0.265)	(1.126)	(1.454)
Total high school graduates in state (ln)	1.106	1.696	21.543	–5.068	61.557*	7.859
	(2.894)	(14.202)	(17.691)	(4.957)	(21.060)	(27.189)
Percentage Black high school graduates	0.334†	2.058*	1.202	0.023	1.279	0.891
	(0.189)	(0.919)	(1.145)	(0.241)	(1.025)	(1.323)
Percentage Hispanic high school graduates	0.127	–1.881*	–1.955*	–0.393*	–0.986	0.698
	(0.103)	(0.501)	(0.624)	(0.177)	(0.756)	(0.976)
Need, non-need-based state aid (millions, 2014 CPI)	0.003	–0.010	–0.035*	0.002	–0.004	0.011
	(0.002)	(0.010)	(0.012)	(0.002)	(0.010)	(0.013)
Percentage bachelor's degrees in state	0.218†	–1.935*	–1.120	0.050	–0.325	2.290*
	(0.113)	(0.554)	(0.688)	(0.177)	(0.757)	(0.978)
State per capita income (thousands, 2014 CPI)	–0.110	0.115	–1.124*	0.286*	1.071†	–0.374
	(0.089)	(0.437)	(0.544)	(0.145)	(0.621)	(0.801)
Constant	109.139*	869.259*	1058.171*	52.102	–271.057	1151.837*
	(32.102)	(157.054)	(195.598)	(60.746)	(259.645)	(335.216)
n	3,048	2,891	2,896	2,466	2,379	2,379
R^2	.06	.09	.08	.05	.12	.06
Institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

less selective institutions. Although these institutions perhaps have more room to move scores upward, it also means this increase in test scores, and thus selectivity, comes at a cost of student access. This is particularly notable when considering that underserved students typically enroll in less selective institutions.

As noted previously, not all PBF policy designs look the same. We consider whether PBF was intended as a bonus incentive (often termed PBF 1.0) or as a part of base funding (PBF 2.0). Table 4 shows the results of accounting for structural differences in 1.0 versus 2.0 policies; the funding types are codified in these models as dichotomous variables. All three models suggest that institutional shifts toward becoming less accessible are driven in large part by 2.0 policies. Indeed, 25th percentile scores rise by more than 11 points in institutions covered by 2.0 policies as compared to non-PBF institutions. Additional models in the online appendix (appendix Table 16) suggest that accessibility is threatened much more by PBF policies with no bonus credits for disadvantaged or underrepresented student groups compared to those policies that provide premiums for these students (see additional discussion of PBF premiums in Gándara & Rutherford, 2018; Kelchen, 2018a).

Underserved Student Enrollments

We expect the total enrollment of underserved student populations could take longer to shift than admission variables given

Table 4
Effect of Performance-Based Funding on Admission Rates and Test Scores by 1.0 and 2.0 Policies

	Admission Rate	25th Percentile Scores	75th Percentile Scores
Performance-based funding 1.0	0.077	3.099†	–2.551
	(0.588)	(1.719)	(2.131)
Performance-based funding 2.0	–3.252*	11.585*	7.045*
	(0.694)	(2.038)	(2.525)
Total enrollment (ln)	2.517	17.222*	–9.655
	(1.744)	(5.527)	(6.840)
Instruction/student (ln)	0.612	1.674	4.778
	(1.028)	(3.021)	(3.742)
Percentage part-time undergraduate	0.097*	–0.162	0.171
	(0.042)	(0.131)	(0.162)
Sticker price (ln, 2014 CPI)	–1.582†	2.672	4.078
	(0.854)	(2.497)	(3.095)
Full-time faculty/100 students (ln)	0.303	19.244*	15.237*
	(1.435)	(4.326)	(5.361)
State unemployment	0.429†	–1.961*	–2.838*
	(0.230)	(0.679)	(0.842)
Total high school graduates in state (ln)	–5.463	18.648†	10.571
	(3.648)	(10.856)	(13.454)
Percentage Black high school graduates	0.126	2.185*	1.204
	(0.217)	(0.641)	(0.795)
Percentage Hispanic high school graduates	–0.177	–1.103*	–0.903†
	(0.133)	(0.395)	(0.490)
Need, non-need-based state aid (millions, 2014 CPI)	0.003	–0.003	–0.008
	(0.002)	(0.007)	(0.008)
Percentage bachelor's degrees in state	0.325*	–1.221*	0.522
	(0.147)	(0.438)	(0.542)
State per capita income (thousands, 2014 CPI)	–0.030	0.689*	–0.786†
	(0.113)	(0.339)	(0.420)
Constant	105.762*	511.256*	1057.751*
	(41.910)	(124.343)	(154.049)
n	5,515	5,277	5,282
R^2	.04	.10	.06
Institution fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

that admission rounds occur in each academic year whereas enrollments are totaled across all students in the institution (not merely incoming students). Table 5 provides results for total Black student enrollment (ln), total Hispanic student enrollment (ln), the percentage of students who ever received a Pell Grant, and the percentage of first-generation students. Three of the four models—those for Black students, Hispanic students, and percentage of first-generation students—suggest that PBF policies have a short-term negative association with underserved student enrollment. In the case of Hispanic students, a rebound effect may occur over time given that the duration variable is positive and significant. Only the percentage of students ever to receive Pell is not influenced by PBF.

When institutions are split by selectivity (see Table 6), findings become less clear. No meaningful linkages are detected for the low-selectivity group. When considering the duration variable, first-generation enrollment may decline over time whereas the percentage of students who ever received a Pell Grant may actually increase. Relationships are also largely lacking for institutions in the high-selectivity group, although there appears to be a positive linkage between PBF treatment and the percentage of first-generation students enrolled. Similar longer term findings are present given that the duration model picks up a negative linkage with first-generation students and a positive linkage between PBF and Hispanic student enrollment. Overall, this may suggest that the general relationships between PBF and student enrollment are weaker and may be better suited to a case-by-case institutional assessment. Consequently, we take caution in interpreting ties between PBF and student enrollment.

Finally, we consider policy types by controlling for PBF 1.0 and 2.0 in Table 7. Although associations should still be noted with caution, these results suggests PBF 1.0 may have negative consequences for Black students and first-generation students whereas PBF 2.0 has negative consequences only for first-generation

Table 5
Effect of Performance-Based Funding Policies on Student Enrollment

	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation
Policy Treat × Post	–0.026*	–0.020†	0.123	–0.335*
	(0.011)	(0.011)	(0.143)	(0.100)
Duration of policy (years)	0.001	0.006*	0.060*	–0.016
	(0.002)	(0.002)	(0.024)	(0.017)
Total enrollment (ln)	1.022*	1.098*	0.115	0.890*
	(0.029)	(0.029)	(0.379)	(0.257)
Instruction/student (ln)	0.017	0.010	–0.070	0.290†
	(0.019)	(0.019)	(0.263)	(0.174)
Percentage part-time	0.002*	0.004*	0.002	0.022*
undergraduate	(0.001)	(0.001)	(0.008)	(0.006)
Sticker price (ln, 2014 CPI)	–0.021	0.040*	–0.660*	0.220
	(0.016)	(0.016)	(0.204)	(0.141)
Full-time faculty/100 students	–0.018	–0.046*	0.617*	–0.559*
(ln)	(0.022)	(0.022)	(0.287)	(0.198)
State unemployment	0.010*	0.009*	0.162*	0.058
	(0.004)	(0.004)	(0.056)	(0.039)
Total high school graduates in	–0.824*	0.129†	4.013*	–1.644*
state (ln)	(0.071)	(0.071)	(0.921)	(0.636)
Percentage Black high school	–0.004	0.001	0.167*	–0.302*
graduates	(0.004)	(0.004)	(0.055)	(0.038)
Percentage Hispanic high school	0.004†	–0.028*	0.218*	0.438*
graduates	(0.003)	(0.003)	(0.033)	(0.023)
Need, non-need-based state aid	–0.000*	0.000*	0.000	0.002*
(millions, 2014 CPI)	(0.000)	(0.000)	(0.001)	(0.000)
Percentage bachelor's degrees	0.010*	0.001	–0.087*	–0.075*
in state	(0.003)	(0.003)	(0.037)	(0.026)
State per capita income	0.000	0.011*	–0.185*	0.021
(thousands, 2014 CPI)	(0.002)	(0.002)	(0.028)	(0.019)
Constant	5.494*	–6.931*	26.578*	49.598*
	(0.818)	(0.809)	(10.563)	(7.303)
n	7,337	7,345	7,203	7,337
R^2	.49	.78	.38	.52
Institution fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

students. Given that the first-generation student measure has commonly been excluded from empirical analyses of PBF, additional work should be done to fully assess the potential negative association of these policies with this at-risk student group. It also should be noted that PBF 2.0 policies have a positive association with the percentage of students who ever received a Pell. This could be because the share of undergraduates with Pell increased after the Great Recession (National Center for Education Statistics, 2017b), which coincides with increased adoption of PBF 2.0.

It also should be noted that when PBF policies are split according to whether a premium for underrepresented students is present (see Table 18 in the online appendix), those without premiums appear to dampen Black and Hispanic student enrollment whereas those with premiums tend to boost the share of students who have ever received a Pell grant but also lower the number of Black students and the share of first-generation students. One possible cause of this was noted in interviews with policymakers—crafting policy premiums that center on low-income students is less divisive than premiums for racial or ethnic minority groups (Gándara, 2020).

Discussion

The college-completion agenda and efforts that encourage PBF focus on ensuring postsecondary students complete a credential. Of course, as with all policies, the potential for unintended consequences can undermine the intention of PBF to bolster student outcomes. In this study, we focus on examining the extent to which PBF may restrict college access.

With respect to selectivity, we find that admission rates appear slightly lower at institutions subject to PBF. Our findings

Table 6
Effect of Performance-Based Funding Policies on Enrollment, by Selectivity

	Low Selectivity				High Selectivity			
	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation
Policy Treat × Post	–0.010	0.009	0.069	–0.202	–0.014	–0.003	–0.111	0.394*
	(0.016)	(0.014)	(0.178)	(0.132)	(0.018)	(0.018)	(0.248)	(0.163)
Duration of policy (years)	–0.003	0.000	0.139*	–0.045†	–0.000	0.010*	0.004	–0.108*
	(0.003)	(0.002)	(0.032)	(0.024)	(0.004)	(0.004)	(0.050)	(0.033)
Total enrollment (ln)	1.002*	1.074*	–2.006*	–0.102	1.012*	0.891*	–2.482*	0.520
	(0.056)	(0.046)	(0.604)	(0.444)	(0.058)	(0.058)	(0.789)	(0.517)
Instruction/student (ln)	0.018	–0.024	0.760*	0.596*	0.019	–0.094*	0.154	–0.828*
	(0.026)	(0.022)	(0.285)	(0.211)	(0.044)	(0.044)	(0.600)	(0.393)
Percentage part-time undergraduate	0.003*	0.003*	0.066*	0.046*	0.006*	0.006*	0.079*	0.055*
	(0.001)	(0.001)	(0.013)	(0.010)	(0.002)	(0.002)	(0.021)	(0.014)
Sticker price (ln, 2014 CPI)	–0.024	–0.048†	–2.766*	0.774*	–0.069*	–0.010	0.132	0.437*
	(0.033)	(0.027)	(0.358)	(0.266)	(0.021)	(0.021)	(0.289)	(0.190)
Full-time faculty/100 students (ln)	–0.165*	–0.122*	0.977†	–0.990*	0.060	0.019	0.798	–0.472
	(0.047)	(0.039)	(0.506)	(0.375)	(0.042)	(0.042)	(0.565)	(0.370)
State unemployment	0.008	0.015*	0.161*	–0.137*	0.011	0.008	0.400*	0.106†
	(0.007)	(0.006)	(0.076)	(0.057)	(0.007)	(0.007)	(0.092)	(0.061)
Total high school graduates in state (ln)	–0.591*	–0.178†	3.778*	0.238	–0.839*	0.681*	–2.965†	–4.203*
	(0.113)	(0.093)	(1.223)	(0.906)	(0.127)	(0.128)	(1.735)	(1.135)
Percentage Black high school graduates	–0.028*	–0.001	0.177*	–0.293*	0.014*	–0.005	–0.066	–0.247*
	(0.007)	(0.006)	(0.080)	(0.059)	(0.006)	(0.006)	(0.084)	(0.055)
Percentage Hispanic high school graduates	–0.009*	–0.017*	0.215*	0.474*	0.025*	–0.028*	0.345*	0.485*
	(0.004)	(0.003)	(0.043)	(0.032)	(0.005)	(0.005)	(0.062)	(0.041)
Need, non-need-based state aid (millions, 2014 CPI)	–0.000	0.000*	0.001	0.001†	–0.000*	0.000*	0.002*	0.003*
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Percentage bachelor's degrees in state	0.017*	0.005	–0.043	–0.024	0.003	0.001	–0.219*	–0.130*
	(0.004)	(0.004)	(0.048)	(0.035)	(0.005)	(0.005)	(0.062)	(0.041)
State per capita income (thousands, 2014 CPI)	–0.003	0.012*	–0.384*	0.005	0.010*	0.003	–0.275*	0.045
	(0.003)	(0.003)	(0.038)	(0.028)	(0.004)	(0.004)	(0.051)	(0.033)
Constant	3.222*	–2.691*	62.616*	30.802*	5.867*	–9.502*	120.927*	84.475*
	(1.247)	(1.037)	(13.539)	(10.056)	(1.557)	(1.570)	(21.206)	(13.906)
n	3,046	3,048	3,045	3,047	2,461	2,465	2,461	2,462
R^2	.51	.84	.46	.64	.39	.79	.47	.59
Institution fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

also indicate that standardized test scores are higher at the 25th and 75th percentiles for less selective institutions and at the 25th percentile for more selective institutions. These findings are consistent with work by Umbricht et al. (2017) and Birdsall (2018), which provide evidence that PBF is associated with increased selectivity in the state of Indiana. Our findings suggest this phenomenon is not unique to one state but, rather, is a concern for institutions in many other states with PBF. These findings are robust to alternative specifications, but we urge caution in interpretation because the parallel trends assumption may not hold, especially for the models for admission rates and standardized scores at the 75th percentile, and these particular models explain a low level of variation observed in the data. For instance, unobserved variables that could affect college access variables include universities' enrollment-management goals unrelated to performance funding (e.g., prestige maximization) and factors in neighboring K–12 schools, including college readiness programs and counselor advising practices that could affect how many and which students apply to universities.

Nevertheless, such findings suggest this type of policy limits access for students to institutions that serve as the primary route for students traditionally underrepresented in higher education. Our finding related to standardized test scores is especially concerning because research shows racial gaps in standardized

Table 7
Effect of Performance-Based Funding on Student Enrollment by 1.0 and 2.0 Policies

	Black Students (ln)	Hispanic Students (ln)	Percentage Pell Ever	Percentage First Generation
Performance-based funding 1.0	–0.027*	–0.010	0.073	–0.444*
	(0.012)	(0.012)	(0.150)	(0.105)
Performance-based funding 2.0	–0.016	–0.002	0.566*	–0.258*
	(0.014)	(0.013)	(0.175)	(0.122)
Total enrollment (ln)	1.023*	1.100*	0.129	0.873*
	(0.029)	(0.029)	(0.379)	(0.257)
Instruction/student (ln)	0.018	0.009	–0.050	0.307†
	(0.019)	(0.019)	(0.263)	(0.174)
Percentage part-time undergraduate	0.002*	0.005*	0.002	0.021*
	(0.001)	(0.001)	(0.008)	(0.006)
Sticker price (ln, 2014 CPI)	–0.021	0.038*	–0.647*	0.241†
	(0.016)	(0.016)	(0.204)	(0.141)
Full-time faculty/100 students (ln)	–0.018	–0.047*	0.618*	–0.553*
	(0.022)	(0.022)	(0.287)	(0.198)
State unemployment	0.010*	0.009*	0.159*	0.060
	(0.004)	(0.004)	(0.056)	(0.039)
Total high school graduates in state (ln)	–0.824*	0.138†	4.030*	–1.704*
	(0.071)	(0.071)	(0.921)	(0.635)
Percentage Black high school graduates	–0.004	0.002	0.168*	–0.310*
	(0.004)	(0.004)	(0.055)	(0.038)
Percentage Hispanic high school graduates	0.004†	–0.029*	0.215*	0.445*
	(0.003)	(0.003)	(0.033)	(0.023)
Need, non-need-based state aid (millions, 2014 CPI)	–0.000*	0.000*	0.001	0.002*
	(0.000)	(0.000)	(0.001)	(0.000)
Percentage bachelor's degrees in state	0.010*	0.001	–0.083*	–0.071*
	(0.003)	(0.003)	(0.038)	(0.026)
State per capita income (thousands, 2014 CPI)	0.000	0.011*	–0.184*	0.022
	(0.002)	(0.002)	(0.028)	(0.019)
Constant	5.478*	–7.029*	25.843*	50.003*
	(0.817)	(0.809)	(10.556)	(7.297)
n	7,337	7,345	7,203	7,337
R^2	.49	.78	.38	.52
Institution fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Note. CPI = consumer price index.
†$p < .10$. *$p < .05$.

testing (Reeves & Halikias, 2017). These gaps have persisted over time and reveal important questions related to equal access where institutions, under the influence of PBF, are raising their average test scores.

Our findings regarding the enrollment of underrepresented students are more mixed than those on institutional selectivity. Among four underrepresented groups, PBF policies are associated with lower enrollment of Black and Hispanic students as well as a lower share of first-generation students in the full sample. The event-study results (see Figures 8–14 in the online appendix) shine additional light on these relationships. In particular, figures for Hispanic and Black student enrollment show declining enrollment of these student groups preceding PBF. Although these declines continue in the early years of PBF (and are substantial among Black students), these drops ameliorate in subsequent years of PBF implementation. The event-study finding for first-generation students, on the other hand, shows, on average, declining enrollment of these students following PBF implementation. This finding is especially noteworthy given its persistence across varying models and the fact that first-generation status is distinct from others, including Pell eligibility and race or ethnicity. One potential reason for this finding is that PBF models rarely include incentives to increase first-generation student enrollment (Gándara & Rutherford, 2018). Given the potential role of higher education in promoting social mobility (Chetty et al., 2017), we argue this trend is concerning and warrants further attention. This finding also highlights the importance of specific equity metrics; first-generation students are distinct from Pell students, and incentivizing the latter group while neglecting the former may inadvertently hurt access for a historically disadvantaged group.

The linkages between underrepresented student enrollment and PBF appear less straightforward when the sample is divided by institutional selectivity; more long-standing policies appear to have mixed associations with both types of institutions. The mixed evidence provided here generally aligns with work by Umbricht and associates (2017) and Kelchen (2018a), who also discerned little evidence that PBF affects underrepresented student enrollment; the former study was state specific, and the latter was national in scope. Unexpectedly, we find that whereas the percentage of first-generation students may suffer regardless of institutional selectivity, the share of Pell students may increase in less selective institutions, and the number of Hispanic students may increase in more selective institutions. Although Kelchen and Stedrak (2016) find that 2- and 4-year institutions under PBF receive less Pell Grant revenue, we find that 4-year institutions under PBF, particularly less selective institutions, may actually see an increase in the percentage of students who have ever received a Pell Grant. Moreover, our robustness checks suggest this finding is likely picking up responses to those policies that have premiums, or bonuses, for underserved students, which would somewhat align with Kelchen (2018a), who finds that premiums help to mitigate negative consequences of PBF on underrepresented students.

We also recognize that not all PBF policies are alike. The share and type of funding, indicators of performance, and reporting mechanisms are influenced by the particular context of a state and the legislators designing the policy (Gándara, 2020). Although we do not account for all of these design intricacies, we do provide models split by whether they reflect a 1.0 (bonus funding) or 2.0 (base funding) approach. Important to note, institutions appear to respond much more strongly to 2.0 policies in terms of admission rates and test scores. That institutions appear to be reacting more strongly to 2.0 policies, which have become more popular since the most recent recession, means concerns with PBF and college access hold continual relevance. This response appears less apparent for types of student enrollment, although first-generation students may lose under either type of policy design. An area of future study might allow for comparisons of early adopters to late adopters instead of adopters and nonadopters.

Practically, our results suggest university officials (agents) at less selective institutions are more likely to respond to the PBF incentive set by state policymakers (principals) in the admissions process. One possible explanation for this phenomenon is that less selective institutions are more dependent on state funds (Desrochers & Hurlburt, 2016; but see also Birdsall, 2018). This finding is consistent with a multiple-case study in Tennessee, where officials at the state's flagship institution were minimally concerned with PBF (Ness et al., 2015). Instead, consistent with interest divergence, those officials focused on their aspiration to become a top-ranked research institution. More selective institutions may have their own incentives that take precedence over those embedded in PBF models.

Evidence of increased selectivity at less selective institutions might be construed as shirking, depending on policymakers' intentions. Although the PBF system is assumed to align the goals of university officials with those of state policymakers, our results suggest some agents pursue a simpler path to securing performance funds (i.e., by raising test score standards). This shirking may result from a variety of factors that include but are not limited to interest divergence. For instance, because less selective institutions often have fewer financial resources (Hoxby, 2009), officials at these universities may calculate that they do not have sufficient resources to implement high-cost initiatives to improve outcomes (e.g., hiring additional advisors or leveraging technology; Dougherty et al., 2016). Instead, they might resort to selecting students deemed more likely to perform well on metrics specified in the PBF model.

On the other hand, it is possible that policymakers in some states expect university officials to restrict college access (or at least may not be opposed to such a strategy). That would be consistent with interest *convergence* between principals and agents, a possibility that is generally neglected by principal-agent theory (Dougherty & Natow, 2019).

This study highlights the importance of carefully crafting policies that advance the college-completion agenda without excluding students who have historically been left out of 4-year universities. Our findings also emphasize the importance of closely monitoring PBF policies and their effects on various populations. After sufficient implementation time, rigorous evaluations of individual policies should be conducted to examine how they are affecting different groups. Together with previous research, this study provides support for the inclusion of equity metrics in PBF models and suggests policymakers should consider incentives for serving first-generation students. In addition, policymakers and institutional leaders should give additional attention to gaps in standardized test scores that may decrease opportunities for equal access for underrepresented populations even at institutions that appear more open in that they admit a larger share of students. Although some ranking systems reward higher test scores and higher levels of selectivity, this shift may inherently advantage only specific groups. Furthermore, college and university officials should make a clear effort to recruit and retain underserved students to avoid denying them opportunities to obtain postsecondary degrees under PBF regimes.

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NOTES

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[1]An event-history model for the adoption of performance-based funding (PBF) policies, line graphs comparing PBF institutions to non-PBF institutions, and Granger causality tests also suggest the parallel trends assumption may not hold in our data. For more on event-history models, see Berry and Berry (1990); for more about Granger causality tests, see Cheon and An (2017).

REFERENCES

Adams, C. (2015). College policy focus moves over time from access to completion. *Education Week*. http://blogs.edweek.org/edweek/college_bound/2015/04/college_conversation_shifts_from_access_to_completion.html

American Institutes for Research. (2013). *Predictors of postsecondary success*. American Institutes for Research. http://www.ccrscenter.org/sites/default/files/CCRS%20Center_Predictors%20of%20Postsecondary%20Success_final_0.pdf

Bell, E., Fryar, A. H., & Hillman, N. (2018). When intuition misfires: A meta-analysis of research on performance-based funding in higher education. In E. Hazelkorn, H. Coates, & A. C. McCormick (Eds.), *Research handbook on quality, performance and accountability in higher education* (pp. 108–124). Edward Elgar.

Berry, F. S., & Berry, W. D. (1990). State lottery adoptions as policy innovations: An event history analysis. *American Political Science Review*, *84*(2), 395–415.

Bettinger, E. P., Long, B. T., Oreopoulos, P., & Sanbonmatsu, L. (2012). The role of application assistance and information in college decisions: Results from the H&R Block FAFSA experiment. *Quarterly Journal of Economics*, *127*(3), 1205–1242.

Birdsall, C. (2018). Performance management in public higher education: Unintended consequences and the implications of organizational diversity. *Public Performance and Management Review*, *41*(4), 669–695. https://doi.org/10.1080/15309576.2018.1481116

Birnbaum, R. (1988). Problems of governance, management, and leadership in academic institutions. In *How colleges work: The cybernetics of academic organization and leadership* (pp. 27–29). Jossey-Bass.

Bowen, H. W. (1977). Investment in learning. In *Investment in learning: The individual and social value of American higher education*. Jossey-Bass.

Brewer, D. J., Gates, S. M., & Goldman, C. A. (2002). *In pursuit of prestige: Strategy and competition in U.S. higher education*. Transaction.

Cahalan, M., Perna, L. W., Yamashita, M., Wright, J., & Santillan, S. (2018). *Indicators of higher education equity in the United States: Historical trend report*. Pell Institute for the Study of Opportunity in Higher Education, Council for Opportunity in Education (COE), and Alliance for Higher Education and Democracy of the University of Pennsylvania (PennAHEAD).

Cataldi, E. F., Bennett, C., & Chen, X. (2018). *First-generation students college access, persistence, and postbachelor's outcomes*. U.S. Department of Education. https://nces.ed.gov/surveys/B&B/

Cheon, O., & An, S. H. (2017). Blowing in the wind: A study for Granger causality between managerial strategy and organizational performance. *Public Management Review*, *19*(5), 686–704.

Chetty, R., Friedman, J. N., Saez, E., Turner, N., & Yagan, D. (2017). *Mobility report cards: The role of colleges in intergenerational mobility* (No. w23618). National Bureau of Economic Research.

Desrochers, D. M., & Hurlburt, S. (2016). *Trends in college spending: 2003–2013*. American Institutes for Research.

Dougherty, K. J., & Natow, R. S. (2015). *The politics of performance funding for higher education: Origins, discontinuations, and transformations*. JHU Press.

Dougherty, K. J., & Natow, R. S. (2019). *Analysing neoliberalism in theory and practice: The case of performance-based funding for higher education* (Centre for Global Higher Education Working Paper Series No. 44). www.researchcghe.org

Dougherty, K. J., Pheatt, L., Natow, R. S., & Reddy, V. (2016). *Performance funding for higher education*. JHU Press.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review*, *14*(1), 57–74.

Fiorina, M. (1982). *Divided government*. Longman.

Gándara, D. (2020). How the sausage is made: An examination of a state funding model design process. *The Journal of Higher Education*, *91*(2), 192–221.

Gándara, D., & Rutherford, A. (2018). Mitigating unintended impacts? The effects of premiums for underserved populations in performance-funding policies for higher education. *Research in Higher Education*, *59*(6), 681–703.

Goodman-Bacon, A. (2019). *Difference-in-differences with variation in treatment timing* (No. w25018). National Bureau of Economic Research.

Hagood, L. P. (2019). The financial benefits and burdens of performance funding in higher education. *Educational Evaluation and Policy Analysis*, *41*(2), 189–213.

Hillman, N. W., Tandberg, D. A., & Gross, J. P. K. (2014a). Market-based higher education: Does Colorado's voucher model improve higher education access and efficiency? *Research in Higher Education*. https://doi.org/10.1007/s11162-013-9326-3

Hillman, N., Tandberg, D., & Gross, J. (2014b). Performance funding in higher education: Do financial incentives impact college completions? *Journal of Higher Education*, *85*(6), 826–857. https://doi.org/10.1353/jhe.2014.0031

Hillman, N., Tandberg, D., & Fryar, A. (2015). Evaluating the impacts of "new" performance funding in higher education. *Educational Evaluation and Policy Analysis*, *37*(4), 501–519.

Hillman, N. W., Hicklin Fryar, A., & Crespín-Trujillo, V. (2018). Evaluating the impact of performance funding in Ohio and Tennessee. *American Educational Research Journal*, *55*(1), 144–170.

Hoxby, C. M. (2009). The changing selectivity of American colleges. *Journal of Economic Perspectives*, *23*(4), 95–118.

Jacobson, L. S., LaLonde, R. J., & Sullivan, D. G. (1993). Earnings losses of displaced workers. *American Economic Review*, *83*(4), 685–709.

Jones, T., Jones, S., Elliott, K. C., Owens, L. T. R., Assalone, A. E., & Gándara, D. (2017). *Outcomes based funding and race in higher education: Can equity be bought?* https://doi.org/10.1007/978-3-319-49436-4

Kantrowitz, M. (2012). *The college completion agenda may sacrifice college access for low-income, minority and other at-risk students*. http://www.finaid.org/educators/20120910completionagenda.pdf

Kelchen, R. (2018a). Do performance-based funding policies affect underrepresented student enrollment? *Journal of Higher Education*, *89*(5), 702–727.

Kelchen, R. (2018b). *Higher education accountability*. Johns Hopkins University Press.

Kelchen, R. (2019). Exploring the relationship between performance-based funding design and underrepresented student enrollment at community colleges. *Community College Review*, *47*(4), 382–405.

Kelchen, R., Rosinger, K. O., & Ortagus, J. C. (2019). How to create and use state-level policy data sets in education research. *AERA Open*, *5*(3), 233285841987361. https://doi.org/10.1177/2332858419873619

Kelchen, R., & Stedrak, L. J. (2016). Does performance-based funding affect colleges' financial priorities? *Journal of Education Finance*, *41*(3), 302–321.

Lahr, H., Pheatt, L., Dougherty, K. J., Jones, S. M., Natow, R. S., & Reddy, V. (2014). Unintended impacts of performance funding on community colleges and universities in three states (CCRC Working Paper No. 78). Community College Research Center. http://ccrc.tc.columbia.edu/Performance-Funding.html

Lane, J. E., & Kivisto, J. A. (2008). Interests, information, and incentives in higher education: Principal-agent theory and its potential applications to the study of higher education governance. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 18, pp. 141–179). Agathon Press.

Lester, J. (2014). The completion agenda: The unintended consequences for equity in community colleges. In M. B. Paulsen (Ed.), *Higher education: Handbook of theory and research* (Vol. 29, pp. 423–466). Springer Netherlands.

Li, A. (2018a). *Lessons learned: A case study of performance funding in higher education*. Third Way. https://www.thirdway.org/report/lessons-learned-a-case-study-of-performance-funding-in-higher-education

Li, A. Y. (2018b). Performance funding policy impacts on STEM degree attainment. *Educational Policy*, *34*(2), 312–349. https://doi.org/10.1177/0895904818755455

Li, A. Y., & Zumeta, W. (2016). *Performance funding on the ground: Campus responses and perspectives in two states*. TIAA Institute. https://www.tiaainstitute.org/publication/performance-funding-ground-campus-responses

Lohfink, M. M., & Paulsen, M. B. (2005). Comparing the determinants of persistence for first-generation and continuing-generation students. *Journal of College Student Development*, *46*(4), 409–428.

McLendon, M. K., Hearn, J. C., & Mokher, C. (2009). Partisans, professionals, and power: The role of political factors in state higher education funding. *Journal of Higher Education*, *80*(6), 686–713.

Moe, T. M. (1984). The new economics of organization. *American Journal of Political Science*, *28*, 739–777.

National Center for Education Statistics. (2015). Percentage of recent high school completers enrolled in 2-year and 4-year colleges, by income level: 1975 through 2014 [Table]. *Digest of Education Statistics*. https://nces.ed.gov/programs/digest/d15/tables/dt15_302.30.asp

National Center for Education Statistics. (2017a). Number and percentage distribution of first-time postsecondary students starting at 2- and 4-year institutions during the 2011–12 academic year, by attainment and enrollment status and selected characteristics: Spring 2014 [Table]. *Digest of Education Statistics*. https://nces.ed.gov/programs/digest/d17/tables/dt17_326.50.asp

National Center for Education Statistics. (2017b). *Percent of undergraduate students receiving Pell grants*. U.S. Department of Education. https://nces.ed.gov/ipeds/TrendGenerator/app/answer/8/35

Ness, E. C., Deupree, M. M., & Gándara, D. (2015). *Campus responses to outcomes-based funding in Tennessee: Robust, aligned, and contested*. Tennessee Higher Education Commission.

Rabovsky, T. (2012). Accountability in higher education: Exploring impacts on state budgets and institutional spending patterns. *Journal of Public Administration Research and Theory*, *22*(4), 675–700. https://doi.org/10.1093/jopart/mur069

Redford, R., & Hoyer, K. M. (2017). *First-generation and continuing-generation college students: A comparison of high school and postsecondary experiences*. U.S. Department of Education.

Reeves, R., & Halikias, D. (2017). *Race gaps in SAT score highlight inequality and hinder upward mobility*. Brookings Institute. https://www.brookings.edu/research/race-gaps-in-sat-scores-highlight-inequality-and-hinder-upward-mobility/

Rutherford, A., & Rabovsky, T. (2014). Evaluating impacts of performance funding policies on student outcomes in higher education. *Annals of the American Academy of Political and Social Science*, *655*(1), 185–208.

Sanford, T., & Hunter, J. M. (2011). Impact of performance-funding on retention and graduation rates. *Education Policy Analysis Archives*, *19*(33), *33*. http://epaa.asu.edu/ojs/article/view/949

Tandberg, D. A. (2010). Politics, interest groups and state funding of public higher education. *Research in Higher Education*, *51*(5), 416–450.

Tandberg, D. A., & Hillman, N. W. (2014). State higher education performance funding: Data, outcomes, and policy implications. *Journal of Education Finance*, *39*(1), 222–243.

Toutkoushian, R. K., & Hillman, N. W. (2012). The impact of state appropriations and grants on access to higher education and outmigration. *Review of Higher Education*, *36*(1), 51–90.

Umbricht, M. R., Fernandez, F., & Ortagus, J. C. (2017). An examination of the (un)intended consequences of performance funding in higher education. *Educational Policy*, *31*(5), 643–673.

Wooldridge, J. M. (2002). *Econometric analysis of cross section and panel data*. MIT Press.

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