Working Paper

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THE RELATIONSHIPS BETWEEN STATE HIGHER EDUCATION FUNDING STRATEGIES AND COLLEGE ACCESS AND SUCCESS

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State governments invest in public higher education to grow the state's economy, develop a well-educated labor force, and foster social mobility for students from historically underrepresented populations. This investment includes nearly $100 billion annually in funding to public colleges and universities, and 46 states have explicit goals to increase college attainment rates (HCM Strategists, 2021; Laderman & Heckert, 2021). A sizable body of research shows a relationship between the amount of state funding for public higher education and key student success metrics, such as the number of completions and post-college earnings (Bound et al., 2019; Chakrabarti et al., 2020; Deming & Walters, 2017; Monarrez et al., 2021).

States allocate financial support to public colleges and universities through a range of funding mechanisms. These include using enrollment metrics to determine funding levels, performance-based funding (PBF) systems that tie funding to student outcomes, base-adjusted systems that provide across-the-board increases or decreases in funding to colleges, a combination of these mechanisms, or no clear funding formula. Yet the only mechanism to be rigorously examined in the literature is PBF, which accounts for less than 10% of state funding toward public higher education (Rosinger et al., 2022). The research on PBF generally finds null or modest effects on completion outcomes, with concerns about unintended impacts that have the potential to widen entrenched gaps by race/ethnicity and family income unless PBF systems are carefully designed (see Ortagus et al. (2020) for a comprehensive review). Even when carefully designed to include equity metrics, PBF systems are unlikely to expand college access and success for underserved students (Ortagus et al., 2023; Rosinger et al., 2023).

Our work leverages novel data and represents the first effort to examine the relationships between a range of different higher education funding strategies and student enrollment and completion outcomes. As states continue to invest billions of dollars in a variety of funding strategies for their public colleges and universities, little is known regarding students' academic outcomes when subject to one state funding approach relative to another. The consistent focus of prior work on the impacts of PBF is a glaring issue when one considers that the vast majority of state public higher education funding is not directly tied to student outcomes (Rosinger et al., 2022), and PBF systems have frequently been suspended during recessions (Dougherty et al., 2012; Kelchen et al., 2023). Therefore, research documenting how states fund public higher education and the implications of these funding decisions for college access and student success, particularly for underserved students, is important to inform state policy.

States have undergone substantial legislative and court-enacted funding reforms in an attempt to remediate unequal and inadequate funding levels at the K-12 level (Jackson et al., 2016), and there have been recent overviews of K-12 funding efforts and approaches (Baker et al., 2021; Kolbe et al., 2020). However, recent evidence suggests that prior work has not fully captured many of the school finance reforms that have been enacted over time (Candelaria et al., 2022). In the higher education literature, there have been occasional snapshots of funding mechanisms (e.g., Layzell, 2007; Syverson et al., 2020), but there has not been a systematic effort to track how states fund public higher education over time aside from recent research focused solely on PBF. Without data capturing how states fund their public colleges and universities over time, researchers have been unable to link these varying funding mechanisms to college access and student success, particularly among underserved student groups. This is a concern due to the historic underfunding of colleges that serve large numbers of students from minoritized groups. For example, the 18 public land-grant HBCUs have been funded at much lower per-student levels than their predominantly white peers, leading to an estimated $12.8 billion shortfall since 1987 (Adams & Tucker, 2022).

In this study, we compiled the first longitudinal dataset with detailed state higher education funding information to examine how different funding strategies relate to college access and student completion, with a focus on racially minoritized students. Our research questions are the following:

(1) To what extent do different mechanisms of providing state funding to public colleges and universities relate to student enrollment outcomes?

(2) To what extent do different mechanisms of providing state funding to public colleges and universities relate to student completion outcomes?

(3) To what extent do results vary according to students' race/ethnicity?

Literature Review

Approximately 90% of all state support for public higher education comes through appropriations made to public colleges and universities, with the remainder of funds going directly to students through state financial aid programs (Laderman & Heckert, 2021). Partisan control of state legislatures, political ideologies, and governing structures influence funding levels for public higher education. A higher percentage of Democrats in the state legislature, a Democratic governor, and more liberal political ideologies are generally associated with higher funding levels for public higher education (e.g., Ortega, 2020; Tandberg, 2013). The effects of partisan control may be a function of whether students at public institutions are disproportionately White (Taylor et al., 2020), but others find that the relationship between increased racial diversity and lower spending on public higher education holds across the ideological spectrum (Foster & Fowles, 2018). Research on the extent to which higher education governance structures affect state funding levels finds a mix of positive and negative relationships (e.g., McLendon et al., 2014; Tandberg, 2013).

State funding for higher education plays a crucial role in improving student outcomes, as increased resources positively affect completion rates (e.g., Webber & Ehrenberg, 2010). Public universities have responded to state funding cuts by reducing spending and increasing tuition (Bound et al., 2019). These responses then lead to reduced completion rates and diminished research capacity. Both Deming and Walters (2017) and Monarrez et al. (2021) found a strong positive relationship between state funding levels and both enrollment and completions, with the latter study also demonstrating a larger effect for Black and Hispanic students. However, they focus on the total level of funding and do not consider funding mechanisms in their analysis. Chakrabarti et al. (2020) found different effects and mechanisms across two-year and four-year institutions. Community colleges responded to increased state funding levels by spending more on instruction and other student supports, resulting in increased levels of educational attainment and lower student loan default rates in spite of higher debt burdens. In the four-year sector, more state funding yielded reductions in tuition, time to degree, and student debt.

While prior research has largely focused on the predictors and consequences of state funding levels, we know far less about the specific funding mechanisms that states use to allocate public funds and the implications of state funding approaches for college access and student success. As a result, state policymakers have little empirical evidence regarding how to effectively and equitably allocate funds to public colleges and universities.

State Funding Models

Many states have developed, maintained, and adjusted funding mechanisms over time to help allocate limited funds across public colleges and universities and to change institutional behaviors (e.g., Caruthers & Marks, 1988). In Fiscal Year 2020, 45 states had an approved policy, mechanism, or framework regarding funding allocations (Syverson et al., 2020). Drawing on a prior typology of state funding approaches (Kelchen et al.,

2023), we conceptualize these models into three categories based on the extent to which institutions can have at least some control over their funding levels. Based on principal-agent theory (Jensen & Meckling, 1976; Spence & Zeckhauser, 1971), we would expect colleges as agents to be more responsive to funding mechanisms that provide them with the possibility of additional funding if they meet goals established by the principal (state).

Under the first set of funding models, institutions have no ability to influence their funding levels. We call this a *traditional* funding model because higher education funding has historically relied on a combination of political wrangling for resources (no clear funding formula) and standardized percentage change in allocations (a base-adjusted formula) (Hearn, 2015). The alternate approach of a traditional funding model is what we call an *incentive model*, in which state appropriations are entirely based on factors that an institution may be able to at least partially control. This approach assumes that colleges are not operating as effectively as possible and that directly incentivizing certain metrics will improve performance on those metrics (Kelchen, 2018).

Incentive models include two common funding models that are typically examined separately, but function in theoretically similar ways. The first is enrollment-based models, which fund institutions based on the number of enrolled students (typically measured by full-time equivalents) and provide an incentive to increase enrollment (Hearn, 2015). These models often attempt to account for differential costs to educate students based on their field of study or credential level to produce more graduates in particular fields (Davis et al., 2021). While these models theoretically provide an incentive for colleges to increase enrollment, there is little research on the effects of enrollment models on student enrollment or completion outcomes.

The second incentive funding mechanism is PBF, in which state funding is tied to institutional outcomes such as student retention, degree completion, or post-college outcomes. A large body of research has generally found null or small effects of PBF across a range of states and model specifications (e.g., Ortagus et al., 2020). The third funding model is a *hybrid model*, which includes a combination of traditional and incentive components. This model provides some level of stability for colleges through adjustments to base funding while also providing additional funds if an institution excels in increasing enrollment and/or completions.

Substantial gaps already exist between a small number of well-resourced, predominantly white institutions and the majority of institutions that serve more minoritized and lower-income students (Cheslock & Shamekhi, 2020; Taylor & Cantwell, 2019). Each of these funding models has the potential to increase inequality across institutions. Traditional funding models often disadvantage minority-serving institutions, which have historically had lower state appropriations while also heavily relying on appropriations to fund operations (Harris, 2021; Kelchen et al., 2020). Because flagship public universities tend to have more alumni in the legislature and more lobbying power (McLendon et al., 2009), having no funding formula can also widen resource disparities.

Incentive-based funding models such as PBF can create the potential for unintended consequences, as colleges have responded by increasing selectivity, decreasing access for students from historically underrepresented groups, and shifting students to shorter-term certificates (Gándara & Rutherford, 2020; Hillman et al., 2015). Additionally, lesser-resourced and minority-serving institutions frequently lose funds under PBF, further widening institutional disparities in resources (Hagood, 2019, Li et al., 2018).

Based on the logical rationale associated with principal-agent theory (Jensen & Meckling, 1976; Spence & Zeckhauser, 1971), we hypothesize the following four relationships compared to a traditional funding model:

- **Hypothesis 1:** An incentive funding model will have a consistent but modest positive relationship with student enrollment and completion outcomes in the aggregate.
- **Hypothesis 2:** A hybrid funding model will have an inconsistent, modest positive relationship with student enrollment and completion outcomes in the aggregate.
- **Hypothesis 3:** An incentive funding model will have a stronger positive relationship with student enrollment and completion outcomes among White and Asian students and no relationship with other race/ethnicity subgroups.
- **Hypothesis 4:** A hybrid funding model will have an inconsistent but stronger positive relationship with student enrollment and completion outcomes among White and Asian students and no relationship with other race/ethnicity subgroups.

Sample, Data, and Methods

To examine how state funding mechanisms relate to college enrollment and completion, we compiled the first longitudinal dataset of how state funding is allocated to public colleges and universities. The following section describes our sample, dataset and data collection procedures, and methods.

Sample

We analyzed state-funded degree-granting two-year and four-year public institutions in the 50 states, excluding the District of Columbia, Puerto Rico, and other territories and commonwealths due to their unique governance structures. We eliminated graduate-only institutions because funding formulas predominantly focus on undergraduate students, and removed tribal colleges because they receive little state funding. This resulted in an analytic sample of 576 four-year and 1,098 two-year institutions, although not all institutions were represented in each year due to openings, consolidations and mergers, and missing data.

Data

We collected data on how state legislatures, governing boards, and coordinating agencies provided money to individual institutions, using the data collection guidelines of Kelchen et al. (2019) as our template. We collected data between Fiscal Years 2004 and 2020 through examining nearly 3,500 artifacts, including state

budgets, approved legislation, board meeting packets, and financial statements.[1] Our default unit of data collection was the sector by state level, with sector (two-year versus four-year) defined using Carnegie classifications.[2] In some cases, colleges within a sector were subject to different funding mechanisms due to their membership in a system that had the ability to allocate state funding directly to institutions or was treated differently in state legislation. We coded those cases (seven in the four-year sector and four in the two-year sector) separately.

As described above, we focused on three primary funding mechanisms: traditional, incentive, and hybrid models. Traditional models included base-adjusted models and no funding formula, which we coded if we could not find evidence of an active funding formula and year-to-year funding changes across institutions did not reflect a base-adjusted model. Incentive funding included enrollment-based funding, in which colleges received funding based on the number of students enrolled and performance funding, for which we drew upon previous data collection (Ortagus et al., 2021). Finally, we coded for the presence of hybrid models if both traditional and incentive components were present. For example, Louisiana's Board of Regents allocated 63% of funding using a base-adjusted model, 20% using performance funding, and 17% using a mix of enrollment and facilities expenses in 2020 (Louisiana Board of Regents, 2021).

Table 1 shows the frequency of funding formula models by sector at three points during the period of study: 2004, 2012, and 2020. In 2004, traditional models were the most common in the four-year sector (46% of all institutions), followed by hybrid models (40%) and incentive models (14%). During the panel, there was a gradual shift toward hybrid models (52% by 2020) at the expense of traditional models (41%) and incentive models (7%). Enrollment-only models disappeared from the four-year sector, while models combining base and enrollment components became more popular. Among two-year institutions, hybrid models were the most common throughout the panel, increasing from 57% in 2004 to 72% in 2020. That largely came at the expense of traditional models. Hybrid models that included base, enrollment, and performance categories covered 4% of two-year colleges in 2004, but increased to 48% in 2020.

See Table 1: Frequency of funding formula models by sector and year.

We had two sets of outcomes of interest, with one set of access metrics and one set of completion metrics. The access metrics come from the Integrated Postsecondary Education Data System (IPEDS) and reflect the number of first-time undergraduate students in several categories. We began with all students and then

[1] Most of our data were collected through documents that were available online through state or system agency websites or archived pages from the Internet Archive: Wayback Machine. We had weekly research team meetings to check data across multiple individuals collecting data, resolve any areas of confusion, and identify missing data. Finally, we contacted state agencies and higher education systems with any remaining questions.

[2] We classified institutions with the Carnegie classification of baccalaureate/associate colleges as two-year institutions to reflect their primary degree offerings and how they are typically viewed by states.

focused on underrepresented minority (URM) students (Black, Hispanic, and Native American).[3] We next considered the number of Black and Hispanic students separately due to evidence that state funding policies may affect students across different racial/ethnic groups in different ways (Gándara & Rutherford, 2018). We were unfortunately unable to analyze Native American students separately due to many colleges enrolling relatively few Indigenous students. We then separately examined the number of White and Asian students.

We focused on undergraduate certificate and degree completions (from IPEDS data) as our other set of outcomes. We separately examined the number of certificates and associate degrees awarded by two-year colleges because research on PBF has found that colleges may have encouraged students to complete certificates instead of associate degrees in response to funding incentives (e.g., Hillman et al., 2015). For four-year universities, we considered the number of bachelor's degrees awarded. We examined the same subgroups of students for completion as for first-time undergraduate enrollment.

The covariates in our model include institution-level and state-level characteristics that could also affect student enrollment and completion. Institutional characteristics include the number of FTE undergraduate students (logged), the percentage of undergraduates enrolled part-time, the number of race unknown students, in-state tuition (logged), per-FTE instructional expenses (logged), and per-FTE state appropriations (logged); all of these variables came from IPEDS. State-level characteristics from the Census Bureau and the Bureau of Labor Statistics included per-capita income (logged), the unemployment rate, the share of adults with a bachelor's degree or higher, the number of college-aged adults (logged), and the share of adults who were Black, Hispanic, or Native American. We drew upon a list of states with affirmative action bans by Baker (2019) to account for a characteristic that could potentially affect minoritized student enrollment. We also included the share of state grant aid that was allocated based on financial need using NASSGAP data and created a measure of state grant aid per 18-24 year old using Census Bureau and NASSGAP data.

Based on prior research showing a relationship between state political characteristics and funding for public higher education, we controlled for partisan control of the state legislature and governor's office. We created indicators using National Conference of State Legislatures data representing when either Democrats or Republicans controlled both chambers of the legislature along with an indicator for Republican control of the governor's office. Although Nebraska officially has a unicameral, nonpartisan literature, we followed guidance

[3] During the period of our panel, IPEDS data reporting on race/ethnicity changed, especially regarding Pacific Islander and multiracial students. We focus on the three groups of students that were consistently reported over time. For more information on the changes to IPEDS data, see Ford et al. (2020). We also controlled for the number of race unknown students due to differences in how colleges used that category. We excluded Pell Grant recipients because the number of Pell graduates was first available in 2017, near the end of our panel. We also excluded the number of adult learners because enrollment by age is only available for all undergraduate students and the number of completions by age was first available in 2012.

from Masket and Shor (2015) along with our Lexis-Nexis search of Nebraska newspapers and coded the state as being under unified Republican control. Table 2 shows the summary statistics for our dataset.

See Table 2: Summary statistics of the dataset.

Methods

We examined the relationship between state funding models and student enrollment and completion outcomes using panel regressions with two-way (state and year) fixed effects. We used traditional models as the reference group and examined whether the relationships differed based on the presence of an incentive or hybrid funding model. We lagged (logged) enrollment and completion outcomes to provide institutions with an opportunity to respond to funding model changes. For enrollment of first-year students, we focused on enrollment levels in the year following when the funding model was measured. For the number of completions, we focused on five years after the funding model was measured for bachelor's degrees, three years later for associate degrees, and two years later for certificates. We used these delays to allow students who entered college around when the funding model was measured to complete their credentials. We also estimated all of these models one year before and one year after our preferred time period. The results were generally similar to what we present in this paper and are available upon request.

Limitations

While we present the first detailed analysis of the relationship between state funding models and student enrollment and completion outcomes, there are some important limitations of our work. In some cases, our data reflects funding mechanisms that were approved to be used but that may have been replaced with another funding mechanism instead of considering models that were actually used to allocate money to institutions in a given year. We are confident that performance and incremental funding variables only capture funded models due to our data collection protocols. Another limitation of our dataset is that we were unable to consider the dosage of different funding models due to missing data in many states. While information was generally available about the share of state funding allocated based on performance, information was often unavailable on how much funding was allocated using enrollment-based or base-adjusted formulas.

Results

We first present results from regressions that examine the relationships between funding models and first-year student enrollment. Table 3 shows results separately for four-year and two-year institutions. Compared to the reference group of traditional funding mechanisms, we did not find a consistent relationship between the presence of an incentive funding model and student enrollment in either sector. However, there is some evidence that hybrid funding models may have increased the enrollment of White, Asian, and Black students in the two-year sector. This suggests that funding based on a combination of a protected base and rewards for enrolling and/or graduating more students may help increase enrollment levels in the following year.

See Table 3: Regressions examining the relationship between state funding model characteristics and student enrollment outcomes.

We then examined the relationship between the type of funding model and the number of degrees or certificates produced in future years. We found no evidence of a relationship between either incentive or hybrid funding models and credential production. This suggests that although hybrid funding mechanisms may have increased enrollment of new community college students, they did not lead to increased credential completion. Additionally, the null relationships in the four-year sector provide evidence that funding mechanisms are not effective in moving the needle on bachelor's degree completions.

See Table 4: Regressions examining the relationship between state funding model characteristics and student completion outcomes.

Discussion

The amount of state funding for public higher education plays a crucial role in improving student outcomes. But in an era of increased skepticism of the value of higher education and competing state budget demands in the aftermath of the coronavirus pandemic, it is crucial to ensure that every dollar invested in public colleges and universities is used as efficiently as possible to improve educational attainment and reduce longstanding racial gaps in enrollment and completion. In this paper, we provide the first comprehensive examination of how different components of state higher education funding formulas relate to student outcomes.

Compared to the reference category of traditional funding models (base-adjusted only or no funding formula), we found no differences across funding models in terms of student enrollment or completions at four-year institutions. However, we found that hybrid models that combine traditional and incentive components were associated with higher levels of student enrollment in community colleges, particularly among Black, White, and Asian students. This relationship did not carry over to the number of associate degrees or certificates completed, though.

Contrary to expected relationships in alignment with principal-agent theory (Jensen & Meckling, 1976; Spence & Zeckhauser, 1971), our findings reveal that incentive funding models do not actually improve student outcomes in the ways in which theory would suggest. This finding aligns with the overarching body of literature on PBF (Ortagus et al., 2020), which suggests that formula tweaks in the absence of increased funding are unlikely to improve college access or student success in substantive ways. Given that base-adjusted funding strategies are designed to maintain historic funding inequities facing community colleges, MSIs, and other under-resourced institution types, policymakers seeking to improve the equity and effectiveness of state funding for higher education should consider a combined approach to provide stability and promote equity across institution types.

Taken together, our work calls into question the effectiveness of funding models in meaningfully improving student outcomes, particularly in the four-year sector. Many states and systems have held onto traditional funding models that tie most or all of state funding to previous funding levels. These models may be more politically palatable for legislators and avoid battles with flagship public universities by maintaining historically high levels of funding for these institutions (Gándara, 2020). However, they continue to disadvantage institutions that have historically received lower levels of state funding (Harris, 2021; Kelchen et al., 2020) yet also serve large numbers of racially minoritized students.

Hybrid models that combine a protected base with some funds tied to enrollment and performance are growing in popularity in both the four-year and two-year sectors, but only result in enrollment growth among community colleges (without corresponding gains in completion). This raises questions about the exact metrics used to incentivize enrollment and performance at public universities and whether they are large enough to generate increases in enrollment. States and systems may need to explicitly fund institutions for enrolling and/or graduating racially minoritized students, which they have not always done in PBF systems (Gándara, 2019; Rosinger et al., 2022).

There are several ways in which this work should be extended in the future. First, we did not examine other important groups of students who have been underserved by higher education institutions, such as adult learners and Pell Grant recipients, due to data not being available over the entire panel. Second, we were unable to examine the share of funding allocated using each component of a funding formula (such as base-plus versus enrollment) due to data limitations. This would be an important analysis to conduct using either a subsample of states with clearly delineated funding percentages or by attempting to collect additional data on the share of funds allocated through each funding mechanism for more recent years.

Another additional area for research is to consider the details of enrollment-based and performance-based funding formulas. For example, the extent to which an enrollment-based formula funds first-year versus fourth-year undergraduates could have different implications for new student enrollment relative to degree completions. In addition, a focus on equity metrics in PBF systems could offer insight into their effects when operating as a part of a larger funding formula. Prior research that examines the impact of equity metrics in PBF systems has found mixed results on enrollment (e.g., Gándara & Rutherford, 2020; Kelchen, 2018), and analyses that consider the additional mechanisms states use to fund public higher education could help policymakers understand the contexts in which equity metrics are effective. Finally, there are opportunities to consider how enrollment-based funding models that provide incentives to enroll students in high-demand fields influence the number of graduates in those areas as well as future labor market outcomes.

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Table 1: Frequency of funding formula models by sector and year.

	Four-year universities			Two-year colleges		
Funding model (pct)	***FY04***	***FY12***	***FY20***	***FY04***	***FY12***	***FY20***
Traditional model	**45.7**	**49.9**	**40.8**	**19.2**	**18.9**	**7.0**
No formula	23.8	24.0	24.1	4.3	7.8	2.6
Base adjusted only	22.9	26.8	17.6	15.3	11.9	5.1
Incentive model	**13.9**	**2.0**	**7.2**	**23.6**	**13.7**	**21.4**
Enrollment only	13.7	0	0	23.6	13.7	7.7
Performance only	0.2	0.7	5.6	0	0	4.5
Enrollment+performance	0	1.3	1.6	0	0	9.2
Hybrid model	**40.4**	**48.1**	**51.9**	**57.2**	**67.3**	**71.5**
Base+enrollment	30.9	34.4	23.4	46.3	49.1	13.2
Base+performance	2.4	5.1	18.5	7.0	2.9	10.7
Base+enrollment+performance	7.1	8.6	10.0	3.9	15.3	47.7

Source: Authors' data collection.

Notes:

(1) The three main models (traditional, incentive, and hybrid) add up to 100 percent.

(2) Categories may not exactly add up due to rounding.

(3) Observations are at the institution level, not the system level.

Table 2: Summary statistics of the dataset.

	Four-year universities		Two-year colleges	
Characteristic	***Mean***	***(SD)***	***Mean***	***(SD)***
First-year enrollment				
All students	1,834	(1,648)	1,149	(1,256)
URM	438	(506)	420	(707)
Black	205	(263)	174	(291)
Hispanic	220	(411)	235	(543)
Asian	135	(299)	57	(137)
White	1,113	(1,140)	573	(582)
Undergraduate degree completions				
All students	1,979	(1,993)	657	(845)
URM	388	(556)	183	(398)
Black	172	(219)	71	(149)
Hispanic	203	(447)	106	(306)
Asian	148	(362)	35	(85)
White	1,267	(1,318)	389	(479)
Undergraduate certificate completions				
All students	--	--	420	(638)
URM	--	--	127	(255)
Black	--	--	61	(150)
Hispanic	--	--	62	(171)
Asian	--	--	18	(54)
White	--	--	247	(392)
Control variables				
FTE undergraduates	9,400	(8,286)	4,614	(5,071)
Percent part-time students	21.2	(15.4)	57.6	(14.5)
Number race unknown students	52	(88)	55	(136)
In-state tuition	8,082	(2,973)	3,736	(2,116)

Instructional expenses per FTE	9,246	(4,626)	5,690	(2,507)
State appropriations per FTE	7,924	(4,949)	4,582	(2,933)
State financial aid per 18-24 year old	335	(209)	337	(205)
Share of state aid allocated based on need	76.3	(32.7)	76.8	(32.8)
State per-capita income	48,790	(8,064)	48,536	(8,042)
State unemployment rate	5.9	(2.0)	6.1	(2.1)
State share of adults w/BA	21.1	(4.5)	20.9	(4.2)
State college-age population	768,176	(791,458)	897,324	(932,998)
Black share of college-age population	14.3	(10.8)	14.4	(10.8)
Hispanic share of college-age population	11.4	(11.7)	13.4	(13.3)
Native share of college-age population	1.1	(2.7)	1.1	(2.3)
State affirmative action ban	15.5	(36.2)	22.2	(41.6)
Republican unified legislative control	51.6	(50.0)	46.1	(49.8)
Democratic unified legislative control	33.5	(47.2)	41.0	(49.2)
Republican governor	53.9	(49.8)	52.3	(50.0)
Maximum number of observations	**9,406**		**17,600**	

Sources: National Conference of State Legislatures (state political characteristics), Bureau of Labor Statistics and Census Bureau (state-level demographic and economic characteristics), NASSGAP, state financial aid, Integrated Postsecondary Education Data System (all others)

Notes:
(1) All financial values were adjusted into 2020 dollars using the Consumer Price Index.

(2) Degree completions include bachelor's degree completions at four-year universities and associate degree completions at two-year colleges. We omitted other types of degrees because those are typically a small part of a college's total credential production.

Table 3: Regressions examining the relationship between state funding model characteristics and student enrollment outcomes.

	Four-year universities		**Two-year colleges**	
Student type (log)	***Incentive***	***Hybrid***	***Incentive***	***Hybrid***
All students	0.009	-0.008	-0.021	0.031
	(0.009)	(0.007)	(0.045)	(0.020)
URM	0.004	0.043	-0.024	0.055
	(0.031)	(0.037)	(0.037)	(0.037)
Black	-0.026	0.013	-0.017	0.086*
	(0.034)	(0.042)	(0.068)	(0.046)
Hispanic	-0.001	0.044*	-0.054	0.041
	(0.023)	(0.026)	(0.062)	(0.037)
Asian	-0.060*	0.002	0.064	0.095**
	(0.034)	(0.023)	(0.081)	(0.037)
White	-0.019	-0.015	0.023	0.066**
	(0.013)	(0.010)	(0.057)	(0.029)
Number of observations	**8,204**		**15,599**	

Notes:

(1) Each row for each sector is the result of a separate regression, and the comparison group is a traditional funding model.

(2) All models include the covariates listed in Table 2, two-way fixed effects, and state-clustered standard errors.

(3) Enrollment outcomes are measured in the year following the funding model.

(4) * represents p<.10, ** represents p<.05, and *** represents p<.01.

Table 4: Regressions examining the relationship between state funding model characteristics and student completion outcomes.

	Bachelor's degrees (4-yr)		Associate degrees (2-yr)		Certificates (2-yr)	
Student type (log)	***Incentive***	***Hybrid***	***Incentive***	***Hybrid***	***Incentive***	***Hybrid***
All students	0.033	-0.005	-0.004	0.007	0.099	-0.033
	(0.047)	(0.052)	(0.059)	(0.042)	(0.165)	(0.070)
URM	-0.024	-0.027	0.017	0.039	0.004	0.021
	(0.043)	(0.045)	(0.043)	(0.034)	(0.100)	(0.054)
Black	-0.012	-0.007	0.027	0.030	0.017	0.002
	(0.048)	(0.040)	(0.036)	(0.032)	(0.076)	(0.045)
Hispanic	-0.026	0.016	-0.053	0.009	-0.100	0.013
	(0.034)	(0.042)	(0.046)	(0.033)	(0.087)	(0.051)
Asian	-0.027	0.012	-0.012	0.009	-0.066	0.022
	(0.040)	(0.036)	(0.050)	(0.037)	(0.064)	(0.041)
White	0.005	0.015	0.026	0.031	0.114	-0.033
	(0.052)	(0.050)	(0.061)	(0.044)	(0.153)	(0.069)
Number of observations	**5,586**		**12,634**		**13,655**	

Notes:

(1) Each row for each sector is the result of a separate regression, and the comparison group is a traditional funding model.

(2) All models include the covariates listed in Table 2, two-way fixed effects, and state-clustered standard errors.

(3) Completion outcomes are measured two years (certificate), three years (associate), or five years (bachelor's) later.

(4) * represents p<.10, ** represents p<.05, and *** represents p<.01.

Appendix 1:

Funding model by state/system and year, Fiscal Years 2004-2020.

	Four-year universities			Two-year colleges		
State	***Traditional***	***Incentive***	***Hybrid***	***Traditional***	***Incentive***	***Hybrid***
Alaska	2004-20			2004-14		
Alabama	2004-20			2004-18		2019-20
Arkansas			2004-20			2004-20
Arizona	2004, 2009-12, 2015, 2018-20		2005-08, 2013-14, 2016-17	2004, 2011-12, 2020		2005-10, 2013-19
California (UC, CCC)	2009-10, 2014-15		2004-08, 2011-13, 2016-20			2004-20
California (CSU)	2009-10, 2013		2004-08, 2011-12, 2014-20			
Colorado (most)	2004-05	2016-19	2006-15, 2020	2004-05	2016-19	2006-15, 2020
Colorado (Aims CC & CO Mtn.)				2004-20		
Connecticut (UConn)	2004-20					
Connecticut (CSU)			2004-20			2004-20
Delaware	2004-20			2004-20		
Florida			2004-20			2004-20
Georgia			2004-20			2004-20
Hawaii	2004-16		2017-20			2004-20
Iowa	2004-20			2004, 2008, 2016-19		2005-07, 2009-15, 2020
Idaho	2008, 2011-12		2004-07, 2009-10, 2013-20	2004-06, 2011-12		2007-10, 2013-20
Illinois	2004-12, 2015-20	2013-14			2004-20	
Indiana		2004-09	2010-20		2004-09	2010-20
Kansas	2004-05, 2010-12, 2014, 2016-18		2006-09, 2013, 2015, 2019-20			2004-20
Kentucky	2004-17		2018-20	2004-17		2018-20
Louisiana	2015-16	2004-11	2012-14, 2017-20	2015-16	2004-11	2012-14, 2017-20
Massachusetts (UMass, two-year)	2004-20			2004-13, 2018-20		2014-17
Massachusetts (others)	2004-13, 2018-20		2014-17			
Maryland (most)	2004-20				2004-20	
Maryland (Baltimore City CC)				2004-20		
Maine (most)	2004-13, 2019-20		2014-18	2004-20		
Maine (ME Maritime Academy)	2004-20					
Michigan	2004-05, 2008-12		2006-07, 2013-20	2004-06, 2010-11		2007-09, 2012-20
Minnesota (U of MN system)	2004-07, 2010-11, 2018-20	2008-09, 2012-17				
Minnesota (MN State system)			2004-20			2004-20

Missouri	2004-13, 2017-20		2014-16	2004-12		2013-20
Mississippi	2004-13, 2015-20		2014			2004-20
Montana (MT University system)	2010-11	2014-20	2004-09, 2012-13	2010-11	2014-20	2004-09, 2012-13
Montana (others)					2004-07	2008-20
North Carolina			2004-20			2004-20
North Dakota	2004-13		2014-20	2004-13		2014-20
Nebraska	2004-20					2004-20
New Hampshire	2004-20			2004-20		
New Jersey	2004-19		2020			2004-20
New Mexico			2004-20			2004-20
Nevada	2010-13	2004-09, 2014-20		2010-13	2004-09, 2014-20	
New York (SUNY)	2009-20	2004-08			2004-20	
New York (CUNY)	2004-20				2004-20	
Ohio		2014-20	2004-13		2015-20	2004-14
Oklahoma	2015-19		2004-14, 2020	2015-19		2004-14, 2020
Oregon		2004-15	2016-20		2004-20	
Pennsylvania (PASSHE, Thad. Stevens)			2004-20	2004-20		
Pennsylvania (others)	2004-20			2010-15	2004-05	2006-09, 2016-20
Rhode Island	2004-18		2019-20	2004-18		2019-20
South Carolina (USC)	2010-20	2004-09		2010-20	2004-09	
South Carolina (SCTCS)				2010-13	2004-09, 2014-20	
South Dakota	2004, 2011-12, 2014-20		2005-10, 2013			
Tennessee			2004-20			2004-20
Texas (tech colleges)					2014-20	2004-13
Texas (others)			2004-20			2004-20
Utah (tech colleges)				2009-17	2018-20	2004-08
Utah (others)			2004-20	2004-16		2017-20
Virginia			2004-20			2004-20
Vermont (Vermont State)	2004-19		2020	2004-20		
Vermont (UVM)	2004-20					
Washington	2004-20					2004-20
Wisconsin	2004-18	2019-20			2004-20	
West Virginia	2004-20			2004-20		
Wyoming	2004-20					2004-20

Source: Authors' data collection.

Notes: (1) If some institutions within a system have a different funding model in a given year, we show the most common model in this table. (2) Blank rows indicate there were no institutions within that sector.