Exploring the Relationship between Performance-Based Funding Design and Underrepresented Student Enrollment at Community Colleges

Robert Kelchen
Associate Professor, Department of Education Leadership, Management and Policy
Seton Hall University
robert.kelchen@shu.edu

413 Jubilee Hall, 400 South Orange Avenue, South Orange, NJ 07079. (973) 761-9106. I would like to thank my graduate assistant Olga Komissarova for her assistance in compiling data on individual states' performance funding policies. All errors and omissions in this paper remain my own.

Abstract

Objective/Research Question. An increasing number of states are adopting performance-based funding (PBF) systems for their public colleges, but there are concerns that PBF dissuades colleges from recruiting and enrolling students with a lower likelihood of success. Some states have attempted to address this concern by providing additional funds for successfully serving low-income, underrepresented minority, or adult students, but the effectiveness of these particular provisions has yet to be examined among two-year colleges. I explore whether these provisions have affected historically underrepresented student enrollments at community colleges in this paper.

Methods. I use generalized difference-in-difference panel regression techniques combined with data from the Integrated Postsecondary Education Data System and information from states on their performance funding policies from the 2004-05 to 2014-15 academic years to address the research questions. I classified colleges based on whether they had a PBF system with equity provisions, a PBF system without equity provisions, or no PBF in a given year and compared these three groups of institutions.

Results. I find little evidence that PBF policies, regardless of their design characteristics, have a relationship with traditionally underrepresented student enrollment levels.

Conclusions/Contributions. Although there are concerns that PBF systems induce community colleges to selectively recruit students with a higher probability of success, I find no systemic evidence of that practice. However, as PBF systems become higher-stakes and more ingrained in state higher education funding, this finding deserves further study.

Keywords: Performance-based funding; equity; accountability; community colleges

Exploring the Relationship between Performance-Based Funding Design and Underrepresented Student Enrollment at Community Colleges

A key frustration among many state policymakers is the perceived inefficiency of public institutions of higher education. These concerns are often focused on community colleges, even though education and related spending per credential completed declined by over 20% during this period—representing sizable efficiency gains (Desrochers & Hurlburt, 2016). A great deal of attention has been paid to low graduation rates for first-time, full-time students, which only represent 25% of community college students (Cook & Pullaro, 2010) but were the only cohort tracked by the federal government until part-time graduation rates were made available in late 2017. Three-year degree and certificate completion rates for this group of students remained around 25% in the last two decades, with sizable gaps across student demographics and enrollment status. For example, white students were nearly twice as likely to graduate as black students (29% versus 16%) and part-time students were half as likely to graduate within eight years as full-time students (17% versus 33) (Ginder, Kelly-Reid, & Mann, 2017; Snyder, de Brey, & Dillow, 2016).The low federal graduation rates led to a number of critiques of the effectiveness of community colleges. One prominent example was a billboard campaign by a Texas business association highlighting single-digit federal graduation rates at certain community colleges in an effort to get the state and colleges to improve student outcomes (Fain, 2011). Another prominent critique of listed graduation rates came from Complete College America, a nonprofit that has built an alliance of 35 states that have pledged to increase college completion rates. This group highlighted on-time associate degree completion rates of just five percent among full-time students in an effort to get colleges to improve their performance (Complete College America, 2014b). These critiques have influenced states to rethink how they fund community colleges in order to improve student outcomes.

Reformers have highlighted the financing of public higher education, which has traditionally been based on a mixture of enrollment levels or prior appropriations (e.g., Layzell, 1999), as a potential mechanism for institutional improvement. The idea of tying at least a portion of state appropriations to a college's outcomes, commonly referred to as performance-based funding (PBF) or outcomes-based funding (OBF), readily appeals to many state policymakers given the concerns noted above. Tennessee adopted the first PBF system in 1979 and a number of other states followed suit during the 1990s, primarily using PBF to award a small pool of bonus funds in addition to the base appropriation (Dougherty & Natow, 2015). However, the number of states with PBF declined from 19 to 11 following tight budgets and political turnover during the early 2000s recession (Dougherty & Natow, 2015; Dougherty, Natow, & Vega, 2012).

Performance funding experienced a renaissance during the early 2010s, with the number of states with PBF reaching 37 by 2015 (National Conference of State Legislatures, 2015). This renaissance can be attributed to efforts from the influential Gates and Lumina Foundations and Complete College America to advocate for PBF policies following a a wave of newly-elected conservative state politicians who supported tying state funding to student outcomes (Bill and Melinda Gates Foundation, 2016; Complete College America, 2014a; Dougherty & Natow, 2015; Gándara, Rippner, & Ness, 2017; Li, 2017a; Lumina Foundation, n.d.; Miller & Morphew, 2017; Murray, 2011). Altogether, at least some two-year colleges in 29 states were subject to performance funding systems in the 2015-16 academic year (National Conference of State Legislatures, 2015; author's research).

Unlike most of the previous PBF systems, many of the new programs put a portion of its college's base budget at stake. Typically, less than ten percent of state appropriations is at stake,

with funds being tied to metrics such as course completions, certificate and degree completions, and completions in fields such as STEM that align with state public policy goals. In Fiscal Year 2016, only five states (Nevada, North Dakota, Ohio, Tennessee, and Wisconsin) tied more than ten percent of funds to outcomes across all two-year colleges (Snyder & Fox, 2016). In a rather unusual case, the Texas State Technical College System volunteered to tie all of its funding to student labor market outcomes beginning in the 2014-15 academic year (Selingo & Van Der Werf, 2016).

A second major change with newer performance funding models is that many provide explicit bonuses to colleges which serve students whose success in higher education is far from guaranteed (e.g., McKinney & Hagedorn, 2017; National Conference of State Legislatures, 2015). Earlier PBF systems typically paid colleges based on course or credential completions, which had the unintended consequence of encouraging colleges to become more selective in the enrollment process in an effort to gain more funds. Even in the open-access two-year sector, there is both qualitative and quantitative evidence that colleges used financial aid to strategically recruit students with a higher probability of success in order to meet performance metrics (e.g., Dougherty, Jones, Lahr, Natow, Pheatt, & Reddy, 2016; Kelchen & Stedrak, 2016). Both researchers and PBF advocates now consider providing bonus funds for successfully serving traditionally underrepresented students such as Pell Grant recipients, racial/ethnic minority students, and adult learners as a best practice (e.g., Cielinksi & Pham, 2017; Lumina Foundation, n.d.; Miller, 2016; Snyder & Fox, 2016). Today, approximately 17 states have these incentives in their public two-year college sectors (National Conference of State Legislatures, 2015; author's research).

Given concerns about colleges recruiting fewer students from traditionally underrepresented groups and the growth of equity provisions that seek to mitigate these concerns, it is important to examine whether PBF systems with equity provisions are effective in changing colleges' enrollment patterns. The only research to date on this topic is from the four-year sector, where there are some modest increases in underrepresented student enrollment among states with these provisions (Gándara & Rutherford, 2018; Kelchen, 2018a). Given that community colleges have a different set of mechanisms than four-year colleges that they can use to encourage lower-income, underrepresented minority, or adult students to enroll and primarily enroll students from a limited geographic area, it is important to examine whether community colleges appear to change their recruitment and enrollment practices in response to PBF systems both with and without equity provisions. This is a potential leading indicator for whether historically underrepresented students earn more certificates and associate degrees in the future.

In this paper, I focus on the distinction between PBF systems with and without these equity components in the community college sector to examine the following research questions:

(1) To what extent is there a relationship between a state having a performance-based funding (PBF) policy in place and the number of low-income, underrepresented minority, or adult students enrolled at two-year public colleges?

(2) To what extent is there a relationship between whether a state's PBF policy provides a bonus for serving underrepresented students and the number of low-income, underrepresented minority, or adult students enrolled at two-year public colleges?

Theoretical Framework

The logic model behind performance-based funding is underpinned by two main theories. The first theory is principal-agent theory (e.g., Spence & Zeckhauser, 1971), in which the principal (here, the state government) enacts a performance contract that the agent (the college) must implement. This sort of model requires that outcomes be observable and measurable, which generally means in higher education that easily quantifiable outcomes such as degree and certificate completions get prioritized over harder-to-measure outcomes such as teaching quality. Performance contracts have become increasingly commonplace in publicly-funded organizations as the public demands that taxpayer dollars be used wisely, even though these contracts generally generate at best modest improvements in outcomes (Gerrish, 2016).

The second theory underpinning PBF is resource dependency theory (Aldrich & Pfeffer, 1976), in which one organization is dependent on another for a key operational resource. Community and technical colleges have far lower per-student resources than public four-year institutions (Descrochers & Hurlburt, 2016) and are heavily dependent on state funding to help support their operations, with state support being a larger proportion of overall revenue than tuition dollars at the typical two-year college (State Higher Education Executive Officers, 2017).[i] Therefore, it is reasonable to expect that colleges may try to respond to incentives present in performance funding systems if they are reasonably well-aligned with their institutional goals.

Together, these two theories suggest that leaders of community colleges with limited financial resources have strong motivation to respond to the incentives present in PBF systems, such as prioritizing access and success, particularly for traditionally underrepresented students in states with explicit equity provisions. However, the theory of action behind PBF runs into two potential hurdles that could limit its effectiveness among community colleges.

The first reason why PBF policies may not generate the intended effects is that community colleges may already be using their current resources efficiently with a focus on student success. Community colleges already have a primary focus on instruction with relatively minimal spending on other activities, which is different than many four-year colleges that offer a broad range of student services and require faculty to conduct research as a requirement of tenure. Prior research suggests that public master's institutions—the group of four-year colleges that are perhaps the most similar to community colleges—already operate relatively efficiently (Titus, Vamosiu, & McClure, 2017). A number of qualitative studies have shown that both two-year and less-selective four-year colleges facing PBF have made student success a priority, with a key focus on academic advising and streamlining the process to completing a college credential (Dougherty et al., 2016; Dougherty & Reddy, 2011; Li & Zumeta, 2016). Yet the effectiveness of these practices is likely limited due to poorly-resourced institutional research offices, making data-driven processes such as predictive analytics difficult to implement without an infusion of additional funds (Dougherty & Natow, 2015; Hillman, 2016; Jones, 2014; Li & Zumeta, 2016).

Even if colleges have the resources to change their practices in responses to a PBF system, individuals may not be willing to do so. One challenge in higher education is the relative autonomy of individual faculty members; these 'street-level bureaucrats' (Weatherley & Lipsky, 1977) are accustomed to being able to influence (if not control) the teaching process. Research has generally shown that faculty are either barely aware of performance funding policies or are skeptical of the goals of these policies (e.g., Dougherty et al., 2016; Li, 2017b). Skepticism or opposition from key stakeholders may explain why quantitative analyses of colleges' expenditure patterns reveal only modest changes in functional expenditure categories among colleges subject to PBF (Kelchen & Stedrak, 2016; Rabovsky, 2012).

Literature Review

To this point, the body of rigorous scholarly research on the effectiveness of PBF systems in the community college sector has generally found no or very modest effects of these policies on college completions. Tandberg, Hillman, and Barakat (2014) used data from the Integrated Postsecondary Education Data System (IPEDS) from 1990 to 2010 and found no overall relationship between the presence of a PBF system and the number of associate degree completions. Four of the 19 states had statistically significant positive relationships (three of which later abandoned their systems), while six had negative relationships and nine others had insignificant relationships.

Li and Kennedy (2018) examined IPEDS data from 1990 to 2013 to see whether PBF systems were associated with changes in associate degrees, short-term certificates, or medium-term certificates. They generally found insignificant relationships between PBF and associate degrees and short-term certificates, while there were some significant increases in medium-term certificates among states with PBF systems that had been in existence at least six years. Hillman, Tandberg, & Fryar (2015) focused on Washington state's 2007 adoption of a PBF system in the community college sector using IPEDS data from 2002 to 2012. They found no significant effects on associate degrees, but did find a sharp increase in the number of short-term certificates awarded and a decrease in the number of long-term certificates. As both types of certificates received the same financial incentive from the state, they contended that colleges may be strategically responding to PBF systems. Finally, Hillman, Fryar, and Crespin-Trujillo (2018) examined community colleges in Tennessee and Ohio, showing a decrease in the number of associate degrees awarded while seeing an increase in certificates.

The question that is largely unanswered to this point is whether PBF policies with explicit equity provisions will generate different results than PBF policies without bonuses for successfully serving students from disadvantaged backgrounds. These bonuses, which are often around one to three percent of total state appropriations, may be too small to change institutional behaviors. Indiana's PBF system provides a $1,500 bonus for a certificate earned by an underrepresented student and $3,000 for an associate degree, which is smaller than the $2,500 and $5,000 bonuses for on-time completion (Indiana Commission for Higher Education, n.d.). McKinney and Hagedorn (2017) showed that Texas's PBF system, which gave bonus points for students who successfully completed remedial coursework, resulted in larger bonuses being earned by Asian students, traditional-age students, full-time enrollees, and Pell Grant recipients compared to other types of students. This painted a complicated picture of how equity-focused PBF could induce institutions to respond. Yet although equity bonuses may not always be large, they may still be sufficient to encourage colleges with a history of supporting access to higher education to incentivize recruiting historically underrepresented students, which would align with their missions and values.

The research on the effectiveness of equity provisions in PBF systems is currently limited to two recent studies, both of which focused on enrollment instead of completion due to the newness of many of these provisions and limited completion data on some outcomes of interest. These studies showed some modest benefits of equity provisions on enrollment, but with results differing across racial/ethnic groups (Gándara & Rutherford, 2018; Kelchen, 2018a). In this study, I expand the body of knowledge to consider enrollment levels of historically underrepresented students at public two-year colleges.

Data, Methods, and Sample

To explore whether the presence of performance-based funding systems (both with and without explicit bonuses for successfully serving underrepresented students) was associated with the number of traditionally underrepresented students enrolled, I constructed a dataset from the 2004-05 through 2014-15 academic years on the characteristics of PBF systems and underrepresented student enrollment and institution-level and state-level characteristics during the same period. The below section summarizes my data sources and analytic approach.

Data

I constructed two independent variables to capture the key characteristics of a state's performance funding system. The first variable is the typical measure used in the literature on PBF—a binary indicator for whether a college was subject to a PBF system in a given year. I constructed this measure based on prior reports and research on the topic (Dougherty & Natow, 2015; Gorbunov, 2013; Kelchen & Stedrak, 2016; National Conference of State Legislatures, 2015; Snyder & Fox, 2016) and analyzing states' performance funding documents and websites when these sources disagreed or were outdated.

The second independent variable, which represents one of the main contributions of this study, is a binary indicator for whether a college was subject to a PBF system with an incentive in place to serve underrepresented students. I constructed this metric by examining each state with PBF to see whether their system provided incentives to serve low-income, minority, and/or adult students, which are the most common equity components in state PBF systems (Cielinski & Pham, 2017). As Table 1 shows, only two of the nine states with PBF systems in place in the 2004-05 academic year had equity provisions in their models at the time (Indiana and

Tennessee). By 2015-16, 17 of the 29 states with PBF had equity provisions, with most of these provisions being adopted between 2011 and 2014.

[Insert Table 1 here]

My outcomes of interest all focused on the number of traditionally underrepresented students (including both full-time and part-time students) enrolled at public two-year colleges using IPEDS data. I focused on enrollment outcomes instead of completion outcomes for two reasons. First, many states' PBF systems provide bonuses to colleges based on key progression measures such as completing developmental education courses or crossing certain thresholds, in part because community college students often successfully transfer to four-year colleges before receiving associate degrees. For example, Ohio's system allocates 75% of PBF funds based on course completions and successful transitions out of developmental education, while only allocating 25% based on degree completions (Cielinski & Pham, 2017). Second, not all of the enrollment categories have corresponding graduation rate data in IPEDS and many equity provisions are too new to have sufficient data on completions. Therefore, enrollment is a more appropriate measure to use at this time.

The first enrollment measure is the number of students (both full-time and part-time) receiving Pell Grants, which was first collected in IPEDS in the 2007-08 academic year.[ii] For the majority of public two-year colleges operating on traditional semester calendars, this measure is based on undergraduate students who are enrolled at the beginning of the fall semester. However, for a relatively small percentage of technical colleges that report pricing and financial aid data to IPEDS by individual program, this measure includes all Pell recipients during a 12-month enrollment window. I then created a measure of the number of undergraduates not receiving Pell

Grants (as a proxy for higher-income students and/or those for whom colleges would not receive a bonus for serving) by subtracting Pell recipients from total undergraduate enrollment during the relevant period of time.

The second measure is the number of underrepresented minority undergraduate students enrolled in a given year. Due to changes in how IPEDS reported race/ethnicity, this included African-American, Hispanic, and Native American students prior to 2010-11 and added multiracial and native Hawaiian students as of that year. These enrollment figures cover all undergraduates enrolled during a 12-month period, which covers a much larger number of students than fall enrollment numbers at community colleges due to year-round start dates being common. Relatively few states appear to reward colleges explicitly based on race/ethnicity than other factors due to the political difficulty of doing so (e.g., Gándara, 2019), but many colleges will still try to recruit diverse classes because they value diversity. Additionally, because race and income are strongly correlated, colleges that recruit in areas with higher percentages of minority students will likely recruit more Pell recipients. As a comparison, I also examined the number of white and Asian undergraduate students enrolled, which have the highest graduation rates at community colleges (Ginder et al., 2017), by combing them to see if these enrollment numbers changed after PBF was implemented.

My final outcome measure is the number of undergraduate students enrolled at the beginning of the fall semester (or on October 15, in the case of colleges reporting data by program) who were age 25 or older. This is a commonly-used proxy for the number of nontraditional students, and it matches the definitions that states such as Ohio and Tennessee use in their PBF bonus metrics (National Conference of State Legislatures, 2015). Because IPEDS does not require colleges to report age data in even-numbered years, I interpolated using the

average of the two adjacent odd-numbered years for the approximately one-third of colleges that did not voluntarily report data. I then used the number of students age 24 or younger as a comparison metric.

I included a number of control variables in my model that prior studies have shown could plausibly affect enrollment levels separate from the implementation of PBF policies (Table 2). The first set of factors—state and local funding for higher education—has been shown to affect pricing levels (e.g., Delaney & Doyle, 2011; Koshal & Koshal, 2000), which could then affect student enrollment separate from a PBF system. I controlled for logged state and local appropriations per full-time equivalent student, assigning equal per-FTE appropriations across parent and child institutions (Jaquette & Parra, 2014) if financial data were reported in that manner.[iii] These metrics, along with all other financial metrics, were inflation-adjusted into 2014 dollars using the Consumer Price Index.

[Insert Table 2 here]

I also controlled for logged state grant aid per young adult between the ages of 18 and 24 living in the state using data from the National Association of State Student Grant and Aid Programs (NASSGAP) and the Census Bureau. I based the metric on the number of young adults because many of the largest state grant aid programs are restricted to students who attend full-time and/or enrolled soon after completing high school (Pingel & Sponsler, 2016); thus, controlling for this helps account for other factors that may encourage young adults to enroll in college. The NASSGAP survey also includes a measure of the percentage of state grant aid that is based on financial need, which is important because community colleges tend to serve a greater percentage of students with financial need.

The next set of state-level variables captured the extent to which a college can set its own tuition and fee levels, which has become increasingly important as community colleges' reliance on tuition dollars has risen in recent years and ties back into resource dependency theory (Desrochers & Hurlburt, 2016). This also affects the extent to which a college can make changes to its practices in order to enroll more students from traditionally underrepresented groups. I used a set of state-level surveys on tuition and fee policies conducted by the State Higher Education Executive Officers Association and given to state fiscal officers in the 2005-06, 2010-11, and 2012-13 academic years; in the intervening years, I used the most recent year of available data.[iv] I used variables for whether a state had a cap or curb on tuition and/or fees, as prior research has found that tuition caps lower tuition but are associated with higher fees, and fee caps have the same effect on tuition (Kelchen, 2016; Kim & Ko, 2015). I also controlled for whether the governor/legislature or a coordinating/system board, rather than an individual college, has the primary authority to set tuition given evidence in the four-year sector that colleges with this authority have higher prices than colleges that do not (Flores & Shepherd, 2014; Kim & Ko, 2015).

The final set of state-level variables includes other factors that could potentially affect either college pricing or enrollment levels. I used logged per-capita state income (from the Bureau of Economic Analysis), the percentage of state residents in poverty (from the Census Bureau), and unemployment rates (from the Bureau of Labor Statistics) for two main reasons. These economic characteristics both reflect a state's ability to support public higher education and serve as a proxy for the interest in attending community colleges given the pattern of strong enrollment levels during recessions and lower levels during economic booms (Delaney & Doyle, 2011; Hillman & Orians, 2013; Humphreys, 2000). Finally, I added measures for state partisan

control of the House, Senate, and governor's office using data from the National Conference of State Legislatures to account for the relationships between partisan control and college pricing and the likelihood of adopting a PBF system (e.g., Doyle, 2012; Li, 2017a; Tandberg, 2010; Weerts & Ronca, 2012).

Methods

I used generalized difference-in-difference panel regressions to answer my research questions, following the general structure of Belasco, Rosinger, and Hearn (2015) and Tandberg, Hillman, and Barakat (2014). For college *i* in year *t*, my analytic model was the following:

$$Y_{it} = \beta_0 + \beta_1(Treat * Post)_{it} + \beta_2 Approp_{it} + \beta_3 X_{it} + \lambda_i + \mu_t + \epsilon_{it}, \quad (1)$$

where Y represents the outcome variables—the number of Pell, underrepresented minority, or adult students enrolled in a given year as well as the number of non-Pell, white/Asian, and traditional-age students. The key coefficient of interest in this model is β_1, which reflects the difference-in-difference coefficient and allows for the treatment to take place across multiple time periods instead of in a single time period under a standard difference-in-difference model. In other terms, β_1 can be shown as the following:

$$\beta_1 = \left(Y_{Treat(post)} - Y_{Treat(pre)}\right) - \left(Y_{Comp(post)} - Y_{Comp(pre)}\right), \quad (2)$$

which reflects the difference across colleges in both the treatment and comparison conditions and across time. These two differences are captured by λ_i (institutional fixed effects representing differences between colleges in the treatment and comparison conditions) and μ_t (year fixed effects that reflect differences between the post-treatment and pre-treatment year).

I also controlled for prior state appropriations each college received ($Approp_{it}$), which could affect institutions' capacity to respond to PBF, and a vector of state-level characteristics (X_{it}) as described in Table 2 and in the previous section.[v] The error term ϵ_{it} was clustered at the state level to reflect how nearly every state subjected all of its institutions within a sector to a performance funding system (with a few exceptions, as noted in Table 1) and to address concerns with serially correlated error terms (Bertrand, Duflo, & Mullainathan, 2004). All dependent variables and financial characteristics were transformed using natural logarithms, reducing the influence of outliers and allowing the outcomes to be interpreted as percent changes.

I divided colleges into three groups based on their performance funding status: whether they were subject to a system that explicitly provided incentives for serving traditionally underrepresented students (equity PBF), whether they were subject to a PBF system that did not have these incentives (other PBF), and whether they were not subject to PBF (no PBF). This allowed me to make four different comparisons. The first comparison is the typical comparison used in PBF research (any PBF versus no PBF), while the other three comparisons (equity PBF versus no PBF, equity PBF versus other PBF, and other PBF versus no PBF) have not been examined in prior research. The equity versus other PBF comparison is of particular interest as more states adopt PBF and grapple with how to best design their system to meet their state's particular needs.

Because a PBF system may begin to affect a two-year college's actions very quickly due to flexible admissions and placement schedules, I ran models comparing the presence of PBF in a given year to enrollment levels in that same year as well as one and two years following the year in which PBF was measured. These lag periods allow more time for colleges to change their recruitment strategies, which is particularly relevant for traditional-age, full-time students who

may be starting their college search process at an earlier time than an adult student who is returning to college from the workforce. Because many states' PBF equity provisions are relatively new, I was unable to use longer lag periods in this analysis while still maintaining a sufficient number of colleges in the treatment group.

In order for the results from a difference-in-difference model to be plausible, the parallel trends assumption (requiring pre-treatment trends to be similar for both treatment and comparison colleges) must hold (Angrist & Pischke, 2009). I tested this by running a falsification test that compared the presence of PBF in a given year to enrollment levels one and two years prior to when PBF was measured (Appendix 1). The results using a two-year lead show concerns with white and Asian students for the any PBF versus no PBF and other PBF versus no PBF comparisons, as both the any and other PBF groups had fewer of these students than the no PBF group (both at $p<.05$). Using a one-year lead, there are more statistically significant differences. In addition to the white/Asian student differences that were present with a two-year lead, three of the four comparisons for adult students are negative and statistically significant at $p<.10$ and two of the Pell comparisons are significant at $p<.01$ (equity versus no PBF is positive and equity versus other PBF is negative). These results from one year prior to implementation may suggest that colleges began to respond to PBF incentives after the programs were announced but before they were funded. Nevertheless, the results for white and Asian students in particular should be interpreted with caution due to the parallel trends assumption being placed into question.

Sample

My sample consisted of 987 public two-year colleges in 49 states, following the convention in the higher education finance literature and omitting Nebraska institutions due to

the state's unicameral, officially nonpartisan legislature that makes it difficult to include state political conditions as a control variable. This sample excludes colleges that are primarily certificate-granting (mainly small technical institutes and career centers affiliated with local school districts), but includes two-year colleges that grant a limited number of baccalaureate degrees that are classified in the baccalaureate/associate granting Carnegie classification.

Table 3 contains a summary of colleges in the sample during the 2014-15 academic year, with separate columns for colleges subject to PBF with equity components, colleges subject to PBF without equity components, and colleges not subject to PBF. The rightmost column of the table indicates whether the three columns are jointly significantly different from each other using an F-test and a p-value of .05. Although only state unemployment rates were jointly significant across the three groups, it is clear that the three groups differ from each other in important ways. Colleges facing equity PBF have fairly high percentages of historically underrepresented students, are located in states with lower levels of appropriations, and are more likely than not to have Republicans controlling state government. Colleges subject to PBF policies without equity components tend to be smaller, less racially-diverse institutions with higher levels of appropriations, lower levels of state income, and are most likely under Republican state governance. Colleges in states without PBF, on the other hand, are primarily in states under Democratic control, are more racially diverse, and have higher state incomes and modest appropriations.

[Insert Table 3 here]

Limitations

One of the strengths of this analysis is that states with performance funding systems are broken down into two groups: those with components to encourage colleges to serve historically underrepresented students and those without such components. Although this represents an advance in the literature in the topic, this simple binary indicator is still a crude summary of the features of state PBF systems. Critics of the scholarly literature on the effectiveness of PBF systems (e.g., Snyder, 2016) have rightly noted the rudimentary nature of many PBF indicators, but a more nuanced measure of the percentage of funds tied to various metrics has been exceedingly difficult to construct for three reasons.

The first reason is that it is extremely difficult to collect accurate data going back several years on the exact metrics in state PBF systems and the amount of funds tied to each of these metrics. Researchers and analysts have struggled to agree upon whether certain states even had a PBF system in the 2000s, so a simple binary measure is likely the best possible variable until significant support is provided for researchers to develop and cross-check a detailed PBF database over a period of several years. Second, some PBF systems allow colleges to choose some of their performance metrics or to place additional weights on various metrics. Indiana's system, for example, allowed for an institution-defined metric in the 2013-15 and 2015-17 budget cycles that counted for five percent of the overall PBF allowance (Indiana Commission for Higher Education, n.d.). Finally, colleges may be aware that they will be subject to PBF in a given year, but the amount of money at stake may change due to state fiscal conditions or the whims of policymakers.

A significant limitation of the study is that two of the three sets of outcome measures (Pell/non-Pell students and adult/non-adult students) are only captured in IPEDS data for the fall semester at the majority of colleges in the sample. Comparing the race/ethnicity measures (which

capture all students) to the other two categories of measures suggests that the Pell and adult student measures include approximately 70% of all students. It is unclear whether students who do not enroll in the fall but appear at some other point in the 12-month cycle have similar characteristics to fall enrollees; however, as long as any differences are similar across colleges facing different PBF systems over time, the difference-in-difference framework helps to alleviate these concerns. However, the differences in student demographics between colleges facing non-equity-focused PBF systems and the other two conditions could bias estimates if coverage rates across conditions are different. The Pell enrollment measure should also be interpreted as an underestimate of the number of low-income students due to relatively low FAFSA filing rates, particularly in the community college sector (Kantrowitz, 2015; Kofoed, 2017). But since states reward colleges based on Pell recipients, this is a reasonable measure for this study.[vi]

I am also unable to include two other important metrics reflecting historically underrepresented students. Some states include first-generation students and those enrolled in developmental education in their equity formulas (Cielinski & Pham, 2017; McKinney & Hagedorn, 2017), but those metrics are not available in federal data and states' definitions of these terms may also differ.[vii] However, in reviews of current PBF systems, it does not appear that states with equity bonuses only have them for these two measures. This means that states are still classified as having equity provisions in my dataset if they have at least one component that I can measure using IPEDS data. I also cannot examine the number of completions for underrepresented students at this point for two reasons. First, while completions are available by race and ethnicity, they are not currently available by age and were first released for Pell Grant recipients in 2017. Second, because many of the PBF systems with equity components are

relatively new, not enough time has yet passed for students to complete their credentials and to have enough years operating under PBF to support a difference-in-difference regression.

Results

I began by conducting the typical analysis comparing enrollment levels of traditionally underrepresented and other students between colleges operating under any performance funding and those not operating under a performance funding system (the any PBF versus no PBF comparison in the top left of Table 4). Using any of the three lag periods (no lag, a one-year lag, or a two-year lag), there were no statistically significant differences for Pell recipients, underrepresented minority students, or adult students. The coefficients also remained relatively similar over the three years, suggesting that colleges did not change their actions regarding underrepresented student recruitment or retention after being subject to PBF. Colleges facing any PBF system did have approximately three percent lower levels of enrolling white/Asian and younger students, but these results are very similar to the pre-treatment trends shown in Appendix 1. As such, it is unclear whether these trends are a result of PBF or some other trend at these institutions.

[Insert Table 4 here]

The equity PBF versus no PBF comparison (the top right of Table 4) shows positive and marginally significant coefficients ($p<.10$) of around five percentage points for the number of Pell recipients, potentially suggesting that colleges may have responded to incentives to some extent. This comparison was statistically significant at $p<.01$ the year prior to PBF but not significant two years prior, which raises the possibility that some of the observed relationship may actually be due to PBF. The other two underrepresented groups (adults and

underrepresented minority students) were again not statistically significant. The white/Asian comparison was negative and significant at $p<.05$ using one-year and two-year lags, but this was also generally similar to the pre-treatment trend.

Turning to the equity PBF versus other PBF comparison (the bottom left of Table 4), the estimated decrease in Pell recipients associated with an equity system was large and negative (nearly nine percentage points) using no lag before tapering off to zero using a two-year lag. This coefficient was large and negative before PBF took effect, so it is possible that colleges pre-emptively responded to discussions of PBF before changing their practices after the details of a system were finalized. Alternatively, it could be unobserved pre-treatment differences. But in either case, the coefficients approaching zero for Pell recipients and being consistently insignificant for underrepresented minority students and adults suggest that PBF system design did not substantially influence colleges' enrollment patterns of underrepresented students over the long term. Again, there were negative and marginally significant coefficients ($p<.10$) for white/Asian and younger students, but those became insignificant two years after PBF was measured.

Finally, I compared colleges subject to a PBF policy without equity components to those not subject to any PBF policy (the other PBF versus no PBF comparison in the bottom right of Table 4). All of these coefficients were relatively small and none were statistically significant at $p<.05$, suggesting that PBF policies without equity components did relatively little to incentivize or disincentivize enrolling particular types of students.

Discussion and Future Work

Colleges and universities are facing stronger accountability pressures today than they have in the past amid frustration with student outcomes (Kelchen, 2018b). Performance-based or outcomes-based funding systems have grown rapidly in popularity as a result, with the goal that tying a portion of state funding to student outcome would incentivize colleges to improve their performance. Although PBF has generally had little to no impact on college completion numbers to this point, some prior quantitative and qualitative research has raised the possibility that even two-year colleges may be dissuaded from serving historically underrepresented students as a result of the incentives present in many systems (e.g., Dougherty et al., 2016; Kelchen & Stedrak, 2016; McKinney & Hagedorn, 2017).

In this study, I examined whether PBF systems with bonuses for serving historically underrepresented students in higher education are effective in increasing underrepresented student enrollment. My analyses do not support this hypothesis, as there are few statistically significant differences in underrepresented student enrollment between either of the types of PBF programs and those colleges that are not subject to PBF. This suggests that community colleges are likely not engaging in widespread practices to try to recruit more-advantaged students, which matches the modest relationships between PBF adoption and financial aid practices at community colleges found by Kelchen and Stedrak (2016).

On the other hand, equity provisions are not inducing community colleges to recruit more students from historically underrepresented groups with more effort than other community colleges not facing PBF. These results are somewhat less promising than similar equity provisions in the four-year sector, which have shown some positive relationships with underrepresented student enrollments (Gándara & Rutherford, 2018; Kelchen, 2018a). But since most states with equity provisions in the two-year sector also have them in the four-year sector, it

is worth noting that any increases in the four-year sector do not appear to be at the expense of community college enrollments.

The null findings may be a result of many state PBF programs still being relatively small and new, limiting the attention that colleges have to pay to these systems at this point. This generally matches the findings in the broader (non-equity-focused) body of literature on PBF with respect to degree and certificate completions at community colleges (e.g., Hillman et al., 2015; Hillman et al., 2018; Li & Kennedy, 2018; Tandberg et al., 2018). Only a small percentage of colleges have more than five percent of their overall budget tied to performance metrics, and the presence of "stop loss" provisions that limit the amount of money colleges can lose in a given year (National Conference of State Legislatures, 2015). Colleges may also be remembering the performance funding systems of the 1990s, which were adopted with vigor but abandoned during the early 2000s recession (Dougherty & Natow, 2015).

Researchers and policymakers alike need to closely monitor the effectiveness of new and increasingly higher-stakes PBF systems that seek to improve college completion rates while attempting to prevent unintended consequences regarding access and equity. It is possible that a consistent pattern of effects (either positive or negative) could emerge in the future as colleges may adjust to operating under PBF. These questions must be examined on a regular basis in the coming years, particularly as data on completions by race/ethnicity and Pell receipt become available for students who entered college under PBF systems with equity provisions. Policymakers need to be willing to hold systems constant for a period of time (instead of consistently tinkering with systems) in order to examine whether the program is truly effective, while also being willing to make changes when high-quality qualitative and quantitative research raises concerns.

Much more research is needed on the effects and implications of state performance funding systems for community and technical colleges. First, more needs to be done to understand institutions' capacity to respond to PBF systems and to make the types of changes needed to improve student outcomes. There is a particular need for research to determine the price tag for strengthening institutional research, academic advising, and other programs necessary to allow colleges to meet performance funding goals. This is especially important as research suggests that minority-serving institutions are adversely affected by PBF policies, which has important implications for equity (Hillman & Corral, 2018). Policymakers and researchers alike also need to listen to institutional officials' concerns when designing and evaluating PBF systems, as people working on responding to PBF on the ground have important insights that are often neglected.

There is a great need for better data on the characteristics of each state's performance funding systems that would allow for more nuanced comparisons. A longitudinal data source on the amount of funds at stake for each college, whether that amount changed from what was initially proposed, and the weights given to each performance measure would greatly enhance the body of research on PBF. Additional data on student outcomes by demographic group (such as for adult students and Pell recipients) would help test for whether equity-based PBF components are affecting outcomes as well as enrollment levels. Finally, future research should examine enrollment levels at the program level by student characteristic to see whether PBF programs have equity implications across different types of programs.

References

Aldrich, H. E., & Pfeffer, J. (1976). Environments of organizations. *Annual Review of Sociology, 2*, 79-105. https://doi.org/10.1146/annurev.so.02.080176.000455.

Angrist, J. D., & Pischke, J-S. (2009). *Mostly harmless econometrics: An empiricist's companion.* Princeton, NJ: Princeton University Press.

Belasco, A. S., Rosinger, K. O., & Hearn, J. C. (2015). The test-optional movement at America's selective liberal arts colleges: A boon for equity or something else? *Educational Evaluation and Policy Analysis, 37*(2), 206-223. https://doi.org/10.3102/0162373714537350.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics*, *119*(1), 249-275. https://doi.org/10.1162/003355304772839588.

Bill and Melinda Gates Foundation (2016, September). *Postsecondary success advocacy priorities*. Accessed 12 April 2019 from http://postsecondary.gatesfoundation.org/wp-content/uploads/2015/03/PS-ADV-Priorities-V1.pdf.

Carey, J. (2014). *State share of instruction report.* Columbus, OH: University System of Ohio.

Cielinski, A., & Pham, D. (2017). *Equity measures in state outcomes-based funding: Incentives for public colleges to support low-income and underprepared students.* Washington, DC: Center for Law and Social Policy.

Complete College America (2014a). *Alliance of states.* Accessed 12 April 2019 from https://web.archive.org/web/20171123145948/http://completecollege.org/the-alliance-of-states/.

Complete College America (2014b). *Four-year myth.* Indianapolis, IN: Author.

Cook, B., & Pullaro, N. (2010). *College graduation rates: Behind the numbers.* Washington, DC: American Council on Education.

Delaney, J. A., & Doyle, W. R. (2011). State spending on higher education: Testing the balance wheel over time. *Journal of Education Finance, 36*(4), 343-368.

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

Dougherty, K. J., Jones, S. M., Lahr, H., Natow, R. S., Pheatt, L., & Reddy, V. (2016). Looking inside the black box of performance funding for higher education: Policy instruments, organizational obstacles, and intended and unintended impacts. *RSF: The Russell Sage Foundation Journal of the Social Sciences, 2*(1), 147-173. doi: 10.7758/rsf.2016.2.1.07.

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

Dougherty, K. J., Natow, R. S., & Vega, B. E. (2012). Popular but unstable: Explaining why state performance funding systems in the United States often do not persist. *Teachers College Record, 113*(3), 1-41.

Dougherty, K. J., & Reddy, V. (2011). *The impacts of state performance funding systems of higher education institutions: Research literature review and policy implications.* New York, NY: Community College Research Center Working Paper No. 37.

Doyle, W.R. (2012). The politics of public college tuition and state financial aid. *The Journal of Higher Education, 83*(5), 617-647. https://doi.org/10.1353/jhe.2012.0033.

Fain, P. (2011, December 14). Behind the billboards. *Inside Higher Ed*. Accessed 12 April 2019 from https://www.insidehighered.com/news/2011/12/14/texas-business-groups-billboard-campaign-completion-rates.

Flores, S. M., & Shepherd, J. C. (2014). Pricing out the disadvantaged? The effect of tuition deregulation in Texas public four-year institutions. *The ANNALS of the American Academy of Political and Social Science, 655*, 99-122. https://doi.org/10.1177/0002716214539096.

Gándara, D. (2019). Does evidence matter? An analysis of evidence use in performance-funding policy design. *The Review of Higher Education, 42*(3), 991-1022. https://doi.org/10.1353/rhe.2019.0027.

Gándara, D., Rippner, J. A., & Ness, E. C. (2017). Exploring the 'how' in policy diffusion: National intermediary organizations' roles in facilitating the spread of performance-based funding policies in the states. *The Journal of Higher Education, 88*(5), 701-725. https://doi.org/10.1080/00221546.2016.1272089.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. doi: 10.1007/s11162-017-9483-x.

Gerrish, E. (2016). The impact of performance management on performance in public organizations: A meta-analysis. *Public Administration Review, 76*(1), 48-66. https://doi.org/10.1111/puar.12433.

Ginder, S. A., Kelly-Reid, J. E., & Mann, F. B. (2017). *Graduation rates for selected cohorts, 2008-13; outcome measures for cohort year 2008; student financial aid, academic year 2015-16; and admissions in postsecondary institutions, fall 2016.* Washington, DC: National Center for Education Statistics Report 2017-150rev.

Gorbunov, A. V. (2013). *Performance funding in public higher education: Determinants of policy shifts.* Unpublished doctoral dissertation, Vanderbilt University.

Hillman, N. W. (2016). *Why performance-based college funding doesn't work.* New York, NY: The Century Foundation.

Hillman, N. W., & Corral, D. (2018). The equity implications of paying for performance in higher education. *American Behavioral Scientist, 61*(14), 1757-1772. https://doi.org/10.1177/0002764217744834.

Hillman, N. W., Fryar, A. H., & Crespin-Trujillo, V. (2018). Evaluating the impact of performance funding in Ohio and Tennessee. *American Educational Research Journal, 55*(1), 144-170. https://doi.org/10.3102/0002831217732951.

Hillman, N. W., & Orians, E. L. (2013). Community colleges and labor market conditions: How does enrollment demand change relative to local unemployment rates? *Research in Higher Education, 54*(7), 765-780. https://doi.org/10.1007/s11162-013-9294-7.

Hillman, N. W., Tandberg, D. A., & Fryar, A. H. (2015). Evaluating the impacts of "new" performance funding in higher education. *Educational Evaluation and Policy Analysis, 37*(4), 501-519. https://doi.org/10.3102/0162373714560224.

Humphreys, B. R. (2000). Do business cycles affect state appropriations to higher education? *Southern Economic Journal, 67*(2), 398-413. doi: 10.2307/1061477.

Indiana Commission for Higher Education (n.d.). *Performance-based funding for public colleges and universities: Frequently asked questions.* Accessed 12 April 2019 from https://www.in.gov/che/files/Performance_Funding_FAQ_FINAL.pdf.

Jaquette, O., & Parra, E. E. (2014). Using IPEDS data for panel analyses: Core concepts, data challenges, and empirical applications. P. 467-533 in M. B. Paulsen (Ed.), *Higher education: Handbook of theory and research (Vol. 29)*. Dordrecht, the Netherlands: Springer.

Jones, T. (2014). *Performance funding at MSIs: Considerations and possible measures for public minority-serving institutions.* Atlanta, GA: Southern Education Foundation.

Kantrowitz, M. (2015). *Leaving money on the table.* Las Vegas, NV: Edvisors.

Kelchen, R. (2016). An analysis of student fees: The roles of states and institutions. *The Review of Higher Education, 39*(4), 597-619. https://doi.org/10.1353/rhe.2016.0027.

Kelchen, R. (2018a). Do performance-based funding policies affect underrepresented student enrollment? *The Journal of Higher Education, 89*(5), 702-727. https://doi.org/10.1080/00221546.2018.1434282.

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

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

Kim, M. M., & Ko, J. (2015). The impacts of state control policies on college tuition increase. *Educational Policy, 29*(5), 815-838. https://doi.org/10.1177/0895904813518100.

Kofoed, M. S. (2017). To apply or not to apply: FAFSA completion and financial aid gaps. *Research in Higher Education, 58*(1), 1-39. https://doi.org/10.1007/s11162-016-9418-y.

Koshal, R. K., & Koshal, M. (2000). State appropriation and higher education tuition: What is the relationship? *Education Economics, 8*(1), 81-89. https://doi.org/10.1080/096452900110319.

Layzell, D. T. (1999). Linking performance to funding outcomes at the state level for public institutions of higher education: Past, present, and future. *Research in Higher Education, 40*(2), 233-246. https://doi.org/10.1023/A:1018790815103.

Li, A. Y. (2017a). Covet thy neighbor or "reverse policy diffusion"? State adoption of performance funding 2.0. *Research in Higher Education, 58*(7), 746-771 https://doi.org/10.1007/s11162-016-9444-9.

Li, A. Y. (2017b). The point of the point: Washington's student achievement initiative through the looking glass of a community college. *Community College Journal of Research and Practice, 41*(3), 183-202.

Li, A. Y., & Kennedy, A. I. (2018). Performance funding policy effects on community college outcomes: Are short-term certificates on the rise? *Community College Review*, *46*(1), 3-39. https://doi.org/10.1080/10668926.2016.1179601.

Li, A. Y., & Zumeta, W. (2016). *Performance funding on the ground: Campus responses and perspectives in two states.* New York, NY: TIAA Institute.

Lumina Foundation (n.d.). *Frequently asked questions: Outcomes-based funding.* Accessed 12 April 2019 from https://www.luminafoundation.org/outcomes-based-funding-faq.

McKinney, L., & Hagedorn, L. S. (2017). Performance-based funding for community colleges in Texas: Are colleges disadvantaged by serving the most disadvantaged students? *The Journal of Higher Education*, *88*(2), 159-182. https://doi.org/10.1080/00221546.2016.1243948.

Miller, G. N. S., & Morphew, C. C. (2017). Merchants of optimism: Agenda-setting organizations and the framing of performance-based funding for higher education. *The Journal of Higher Education*, *88*(5), 754-784. https://doi.org/10.1080/00221546.2017.1313084.

Miller, T. (2016). *Higher education outcomes-based funding models and academic quality*. Indianapolis, IN: Lumina Foundation.

Murray, V. E. (2011). *10 questions state legislators should ask about higher education*. Washington, DC: American Legislative Exchange Council.

National Conference of State Legislatures (2015, July 31). *Performance-based funding for higher education*. Accessed 12 April 2019 from

https://web.archive.org/web/20180709174718/http://www.ncsl.org/research/education/performance-funding.aspx.

Pingel, S., & Sponsler, B. A. (2016). *Redesigning state financial aid: Principles to guide state aid policymaking.* Boulder, CO: Education Commission of the States.

Rabovsky, T. M. (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.

Selingo, J. J., & Van Der Werf, M. (2016). *Linking appropriations for the Texas State Technical College System to student employment outcomes.* Indianapolis, IN: Lumina Foundation.

Snyder, M. (2016, April 18). Jumping to conclusions. *Inside Higher Ed*. Accessed 12 April 2019 from https://www.insidehighered.com/views/2016/04/18/essay-challenging-academic-studies-states-performance-funding-formulas.

Snyder, M., & Fox, B. (2016). *Driving better outcomes: Fiscal year 2016 state status & typology update*. Washington, DC: HCM Strategists.

Snyder, T. D., de Brey, C., & Dillow, S. A. (2016). *Digest of education statistics, 2015.* Washington, DC: National Center for Education Statistics.

Spence, M., & Zeckhauser, R. (1971). Insurance, information, and individual action. *The American Economic Review, 61*(2), 380-387.

State Higher Education Executive Officers (2017). *State higher education finance FY2016.* Boulder, CO: Author.

Tandberg, D. A. (2010). Politics, interest groups and state funding of public higher education. *Research in Higher Education, 51*(5), 416-450. https://doi.org/10.1007/s11162-010-9164-5.

Tandberg, D. A., Hillman, N. W., & Barakat, M. (2014). State higher education performance funding for community colleges: Diverse effects and policy implications. *Teachers College Record, 116*(12), 1-31.

Titus, M. A., Vamosiu, A., & McClure, K. R. (2017). Are public master's institutions cost efficient? A stochastic frontier and spatial analysis. *Research in Higher Education, 58*(5), 469-496. https://doi.org/10.1007/s11162-016-9434-y.

Weatherley, R., & Lipsky, M. (1977). Street-level bureaucrats and institutional innovation: Implementing special-education reform. *Harvard Educational Review, 47*(2), 171-197. https://doi.org/10.17763/haer.47.2.v870r1v16786270x.

Weerts, D. J., & Ronca, J. M. (2012). Understanding differences in state support for higher education across states, sectors, and institutions: A longitudinal study. *The Journal of Higher Education, 83*(2), 155-185. https://doi.org/10.1353/jhe.2012.0012.

Table 1: Summary of 2-year PBF policies by state and year, 2004-05 to 2015-16.

State	Any PBF (years)	Equity provisions (years)
Arkansas	2007-09, 2012--	2013--
Colorado	2004-06, 2011--	
Florida	2013--	2013--
Georgia	2006-08, 2015--	
Hawaii	2011--	2011--
Illinois	2011--	2011--
Indiana	2004--	2004--
Kansas	2004-2008, 2011--	
Louisiana	2014--	
Maine	2013--	2014--
Massachusetts	2011--	2014--
Michigan	2012--	2014--
Minnesota	2007-08, 2011--	2011--
Missouri	2013--	2013--
Montana	2013--	
Nevada	2013--	
New Mexico	2004--	2012--
New York	2004-06, 2015-- (all), 2007-14 (2-year CUNY)	2015-- (all)
North Carolina	2004-08, 2012--	
North Dakota	2013--	
Ohio	2004--	2008--
Oklahoma	2004--	2012--
Tennessee	2004--	2004--
Texas	2007--	2007--
Utah	2013--	
Virginia	2005--	2014--
Washington	2008--	
Wisconsin	2013-- (WTCS)	
Wyoming	2012--	

Sources: Author's research; Dougherty & Natow, 2015; Gorbunov, 2013; National Conference of State Legislatures, 2015; Synder & Fox, 2016; Tandberg & Hillman, 2014.

Note: The year listed refers to the fall of the academic year (i.e., 2012 for 2012-13).

Table 2: Summary statistics of the institutions in the dataset (2014-15 academic year).

Characteristic	Mean	(SE)	Source
Performance-based funding system			
Any PBF in place (pct)	56.3	(10.0)	See Table 1
Years subject to PBF	4.2	(0.8)	See Table 1
Equity PBF in place (pct)	34.5	(9.4)	See Table 1
Years subject to equity PBF	1.6	(0.6)	See Table 1
Student characteristics (number of undergraduates)			
Pell recipients	2,744	(238)	IPEDS (2007-08 on)
Non-Pell recipients	4,531	(660)	IPEDS (2007-08 on)
Underrepresented minority	4,205	(839)	IPEDS
White/Asian students	5,854	(415)	IPEDS
Students age 25 or older	2,626	(309)	IPEDS
Students age 24 or younger	4,605	(554)	IPEDS
State characteristics			
Per-FTE state/local appropriations ($)	6,116	(324)	IPEDS
Grant aid per 18-24 year old ($)	320	(32)	NASSGAP, Census
State grant aid based on need (pct)	78.6	(5.6)	NASSGAP
State tuition cap or curb (pct)	55.4	(9.7)	SHEEO surveys
State fee cap or curb (pct)	28.1	(8.6)	SHEEO surveys
Gov/legislature sets tuition (pct)	23.7	(10.7)	SHEEO surveys
Coordinating board sets tuition (pct)	75.5	(7.7)	SHEEO surveys
Per-capita state income ($)	45,708	(1,182)	BEA
State poverty rate (pct)	14.9	(0.5)	Census Bureau
State unemployment rate (pct)	6.1	(0.2)	BLS
Population age 18-44 (1,000s)	4,612	(1,256)	Census Bureau
Republican governor (pct)	54.2	(10.2)	Carl Klarner, NCSL
Republican Senate control (pct)	55.8	(10.2)	Carl Klarner, NCSL
Republican House control (pct)	56.5	(10.2)	Carl Klarner, NCSL
Number of observations	987		

Notes:

(1) The acronyms are the following: IPEDS=Integrated Postsecondary Education Data System, NASSGAP=National Association of State Student Grant Aid Programs, SHEEO=State Higher Education Executive Officers, BEA=Bureau of Economic Analysis, BLS=Bureau of Labor Statistics, NCSL=National Conference of State Legislatures.

(2) Standard errors are clustered at the state level.

Table 3: Comparison of colleges based on PBF status (2014-15 academic year).

Characteristic	Equity PBF	Other PBF	No PBF	Diff?
Student characteristics (number of undergraduates)				
Pell recipients	2,975	2,231	2,844	
Non-Pell recipients	4,724	3,371	5,045	
Underrepresented minority	4,679	2,533	4,742	
White/Asian students	6,326	5,041	5,997	
Students age 25 or older	2,791	2,090	2,796	
Students age 24 or younger	4,912	3,461	5,023	
State characteristics				
Per-FTE state/local appropriations ($)	5,694	6,887	5,911	
Grant aid per 18-24 year old ($)	291	281	372	
State grant aid based on need (pct)	75.4	86.0	77.1	
State tuition cap or curb (pct)	34.6	76.6	57.1	
State fee cap or curb (pct)	19.9	50.6	20.4	
Gov/legislature sets tuition (pct)	21.4	20.9	25.8	
Coordinating board sets tuition (pct)	64.8	76.2	79.4	
Per-capita state income ($)	45,242	44,524	46,977	
State poverty rate (pct)	14.9	14.2	14.9	
State unemployment rate (pct)	5.7	5.9	6.6	Yes
Population age 18-44 (1,000s)	4,471	2,505	5,800	
Republican governor (pct)	57.2	68.6	40.8	
Republican Senate control (pct)	63.3	74.5	42.0	
Republican House control (pct)	63.3	74.5	43.6	
Number of observations	341	239	431	

Sources: See Table 2.
Notes:

(1) "Diff" tests for differences across all three categories using a F-test, with "yes" indicating that the p-value was below .05.

(2) "Other PBF" refers to a college subject to a PBF system without a provision for enrolling or graduating historically underrepresented students.

Table 4: Difference-in-difference estimates of the relationship between PBF and historically underrepresented student enrollment.

	Any PBF vs. no PBF			Equity PBF vs. no PBF		
Characteristic (pct change)	No lag	1-yr lag	2-yr lag	No lag	1-yr lag	2-yr lag
Pell recipients	0.5	0.1	-0.2	5.1*	5.3	4.9*
	(2.3)	(2.0)	(2.3)	(2.5)	(3.2)	(2.7)
Non-Pell recipients	-0.1	0.3	-0.1	-1.5	-3.0	-2.9
	(1.7)	(1.5)	(1.7)	(2.4)	(1.9)	(2.3)
Underrepresented minority	3.6	3.8	3.2	5.7	2.2	-0.6
	(4.5)	(3.9)	(3.6)	(10.7)	(8.8)	(7.2)
White/Asian students	-3.3*	-2.9*	-2.6*	-3.9	-4.3**	-5.5***
	(1.7)	(1.5)	(1.4)	(2.5)	(1.8)	(1.6)
Age 25 or older	-2.2	-1.0	-1.3	-2.1	0.0	1.2
	(2.0)	(1.8)	(1.7)	(4.5)	(3.2)	(1.6)
Age 24 or younger	-3.2**	-2.8**	-1.7	-2.8*	-2.2	-1.7
	(1.3)	(1.3)	(1.1)	(1.6)	(1.5)	(1.5)
Maximum number of colleges		986			961	

	Equity PBF vs. other PBF			Other PBF vs. no PBF		
Characteristic (pct change)	No lag	1-yr lag	2-yr lag	No lag	1-yr lag	2-yr lag
Pell recipients	-8.6***	-4.1	-0.3	-0.7	-2.7	-1.9
	(2.7)	(3.4)	(3.9)	(2.7)	(2.0)	(2.7)
Non-Pell recipients	1.4	1.0	-3.2	-0.2	1.1	0.4
	(1.7)	(3.9)	(3.5)	(1.9)	(1.7)	(1.9)
Underrepresented minority	1.7	1.4	3.2	1.2	3.2	3.8
	(3.8)	(4.6)	(4.8)	(1.9)	(2.6)	(3.3)
White/Asian students	-3.9*	-5.9*	-3.6	-2.5	-2.4	-1.8
	(2.2)	(3.2)	(3.7)	(2.0)	(1.9)	(1.9)
Age 25 or older	-3.7	-3.5	-3.3	-2.1	-2.0	-2.5
	(3.5)	(3.5)	(3.2)	(1.8)	(1.9)	(2.3)
Age 24 or younger	-6.2**	-5.6*	-4.9	-2.4	-2.7*	-1.6
	(2.7)	(2.8)	(3.1)	(1.6)	(1.5)	(1.3)
Maximum number of colleges		647			970	

Sources and years covered: See Table 2.

Notes:

(1) Standard errors (clustered at the state level) are below the point estimates.

(2) * signifies p<.10, ** signifies p<.05, and *** signifies p<.01.

(3) Each coefficient is the result of a separate regression.

(4) "Other PBF" refers to a college subject to a PBF system without a provision for enrolling or graduating historically underrepresented students.

Appendix 1: Falsification tests for the relationship between PBF historically underrepresented student enrollment.

2-year lead Characteristic (pct change)	Any PBF vs. no PBF	Equity vs. no PBF	Equity vs. other PBF	Other PBF vs. no PBF
Pell recipients	2.4	3.6	-7.7*	4.3
	(2.4)	(3.1)	(4.2)	(2.8)
Non-Pell recipients	-2.2	-1.1	-2.8	-2.1
	(2.0)	(2.8)	(3.3)	(2.6)
Underrepresented minority	-0.1	3.7	3.9	-2.5*
	(4.1)	(11.2)	(4.3)	(1.5)
White/Asian students	-4.4***	-5.3	-0.3	-2.8**
	(1.6)	(3.7)	(2.0)	(1.3)
Age 25 or older	-1.7	-4.1	-3.1	-0.7
	(1.9)	(3.9)	(6.2)	(2.1)
Age 24 or younger	-2.5	-3.5	-8.1	-1.4
	(1.6)	(2.4)	(6.1)	(1.9)

1-year lead Characteristic (pct change)	Any PBF vs. no PBF	Equity vs. no PBF	Equity vs. other PBF	Other PBF vs. no PBF
Pell recipients	1.3	6.4***	-12.6***	1.0
	(2.8)	(2.4)	(3.6)	(3.4)
Non-Pell recipients	-0.8	-1.6	-0.6	-0.6
	(2.4)	(2.8)	(2.5)	(3.0)
Underrepresented minority	3.0	9.3	4.7	-1.2
	(5.1)	(13.4)	(3.1)	(1.5)
White/Asian students	-4.8***	-6.4**	-1.8	-3.1*
	(1.7)	(3.0)	(2.0)	(1.6)
Age 25 or older	-2.1	-4.2	-6.3	-1.4
	(1.9)	(4.5)	(5.2)	(1.4)
Age 24 or younger	-3.1**	-3.8*	-8.7*	-2.1
	(1.3)	(2.1)	(5.1)	(1.4)
Maximum number of colleges	986	961	647	970

Notes:

(1) The falsification test uses enrollment two years and one year before PBF status was measured, a pre-treatment observation.
(2) Standard errors (clustered at the state level) are below the point estimates.
(3) * signifies p<.10, ** signifies p<.05, and *** signifies p<.01.

(4) "All others" includes colleges subject to a PBF system without an equity component, as well as colleges that are not subject to PBF.
(5) Each coefficient is the result of a separate regression.

[i] Local funds represent another portion of community colleges' operating budgets, but the importance of local funds varies substantially across states and is not the focus of this paper.
[ii] Prior to 2007-08, there was a measure of the number of first-time, full-time students receiving any federal grant aid in IPEDS. Although this is almost perfectly correlated with the number of first-time, full-time students receiving Pell Grants in later years, I excluded this measure because of the low percentage of students in this cohort at many community and technical colleges.
[iii] I added 1 to values of all variables before logging in order for the smallest possible value to be 0 after logging in the case of a zero value on appropriations or any other metrics.
[iv] Not every state participated in each wave, with the number of states ranging from 35 in 2012-13 to all 50 in 2005-06.
[v] I ran models with fewer state characteristics and the results were substantively similar, although the standard errors were much larger in many cases. These results are available upon request from the author.
[vi] One exception is Ohio, which rewards colleges based on the number of Pell-eligible students. This means that students who filed the FAFSA and had a sufficiently low EFC would be included, even if they ended up not receiving a Pell Grant for some reason (Carey, 2014). But since this still requires FAFSA filing, the overcount of Pell students relative to other states should be both modest and consistent across time.
[vii] The College Scorecard does contain a measure of the percentage of FAFSA filers who are first-generation students, but there is insufficient information to obtain the number of first-generation students from that dataset.