Evaluating the impact of performance funding in Ohio and Tennessee

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Abstract
Today, 35 states use performance based funding models tying appropriations directly to educational outcomes. Financial incentives should induce colleges to improve performance, but there are several well-documented reasons why this is unlikely to occur. We examine how two of the most robust performance funding states – Tennessee and Ohio – responded to the policy. Using a difference-in-differences design, findings point to null and negative effects where colleges responded by producing fewer associate's degrees or by not increasing bachelor's degree productivity. The only positive and robust effects were found among Tennessee community colleges that responded by producing significantly more certificates. Findings are consistent with performance management literature, where policy impacts are often muted or limited to a narrow range of outcomes.

Keywords
Accountability; Education finance; Education policy; Higher education; Performance

Today, 35 states tie at least a portion of higher education appropriations to performance funding policies. These policies place weights on various performance indicators, like retention and graduation rates, in order to allocate state funds to public colleges and universities. Colleges that are not performing on a given indicator will lose funds, while those that are performing well will receive greater funding. Proponents believe this pay-for-performance approach is a "game changer" that creates the conditions for colleges and universities to improve educational outcomes (Jones, 2015) and promote accountability by requiring colleges and universities to report and achieve progress on statewide educational goals. Failing to adopt this new approach means states will have "little financial incentive to help students complete degrees as efficiently as possible" (Snyder, 2016). Coupled with reductions in state funding and increased demand for college-educated labor, performance funding has become one of the most politically popular and rapidly spreading higher education reforms in recent decades (Dougherty & Natow, 2015).

The Bill and Melinda Gates Foundation and Lumina Foundation, which underwrite the advocacy organizations and consulting firms helping states adopt and sustain performance funding models, are two key organizations driving the proliferation of this policy (Gándara, Rippner, & Ness, 2017). These organizations have produced volumes of descriptive reports on the benefits of performance funding, claiming states "have demonstrated success in connecting funding to student outcomes" (Conklin, Snyder, Stanley, & Boelscher, 2016) and that performance funding has had "a positive impact on a range of student outcomes (Callahan, Meehan, & Shaw, 2017).

However, these conclusions are inconsistent with the growing body of research that finds states with performance funding policies rarely outperform states that never adopted the policy.

Instead, research often points to negative or null effects, which is more consistent with the broader performance management literature.

Advocates of performance funding policies argue that prior studies on the effects of performance funding examined older funding models that are no longer in operation, and they focused on states that tie relatively small amounts of money to performance funding (often between 1 to 8 percent of base budgets). Accordingly, the current study focuses on two states – Ohio and Tennessee – that stand out as exemplars since they both tie a significant amount of funds to performance and they adhere most closely to what have been described as design and implementation best practices (Snyder, 2015). If one were to find positive effects of performance funding regimes, they would most likely come from these two states, which is what we set out to examine in this paper.

We explore how certificate, associate, and bachelor's degree production has changed in these states since adopting new performance funding programs in 2009 (Ohio) and 2010 (Tennessee). Our guiding question is "*to what extent has the introduction of new performance funding affected certificate and degree production among Ohio and Tennessee colleges and universities*?" We employ a difference-in-differences regression analysis and test the robustness of our results against multiple comparison groups, ultimately finding few instances where these two states outperform others. There is one notable exception: community colleges produced significantly more certificates after the policy, but they also produced fewer associate's degrees. Neither state improved their bachelor's degree production, despite operating the new policy long enough for a full cohort of freshmen to have progressed to degree completion.

In addition to being the first paper to examine these two states, it also offers new perspectives into performance funding and policy implementation by drawing on literature from

outside of higher education. Literature from performance management, political science, and economics are often absent from higher education performance accountability debates, yet it is instructive for understanding the conditions under which performance regimes are likely to work. This literature reveals that performance regimes often yield little to no improvements in complex organizations that have multiple agents, complex and non-routine tasks, and where goals are either ambiguous or difficult to attain. While we cannot explain in this study exactly "why" these states do not outperform others, except in a few important instances, we draw on this literature to offer plausible explanations. Additionally, this paper helps us identify areas in need of further research to continue testing the efficacy of state policy reforms and the opportunity costs of pursuing policy agendas that yield little to no impacts.

Performance funding in Ohio and Tennessee

This study focuses on Ohio and Tennessee for two primary reasons. First, policy proponents often cite these two states as exemplars adhering most closely to best practices and promising design principles (Snyder, 2015). For example, both states have statewide college completion goals and place larger weights on degree completions than on any other performance outcome in their funding formulas. They also build performance funding into each college's base budget, differentiated by sector, rather than having funds be add-on or bonuses. A second reason to focus on these two states is because they have had a long enough duration of time to observe changes in degree production. In both sectors, we might not expect to observe performance changes until after a full cohort of new students has had enough time to go through college. For example, we might not expect Ohio to have immediate improvement in their first year of the policy simply because they have not had enough time to improve retention and graduation rates. By examining performance outcomes five to six years after policy adoption, we should begin to

see improvements in both the two-year and four-year sectors. By focusing on these two exemplar states that have had several years to improve their performance, results of this study should help determine whether even the best-designed performance funding policies improve educational outcomes.

Ohio has a robust public higher education system with 23 two-year colleges enrolling anywhere from 3,000 to 11,000 students per institution. The state's 13 four-year universities enroll anywhere from 2,000 to 57,000 students per institution. Since the mid-1990s, Ohio has operated a version of performance funding for four-year institutions, but this program did not adhere to today's best practices or design principles. It did not build performance funds into the base budget, nor did it emphasize degree completions or differentiate metrics within the sector. This changed in 2009, when the state adopted its new performance funding policy. The new policy built funds into each campus' base, rather than as bonuses, and it prioritized degree completion by allocating nearly all funds according to degree and certificate completion.

Among two-year colleges, "progress indicators" such as course and credential completions drive 100 percent of performance funds. Among four-year institutions, course and degree completion drives 80 percent of performance funds, with the remaining 20 percent allocated according to other performance goals like meeting state workforce needs and strategic initiatives around STEM education. Due to the high-stakes nature of their model, Ohio phased-in their program over time and included a stop-loss provision between the years 2009 and 2014 where campuses were protected from dropping below prior year's funding (Li & Zumeta, 2016).

Tennessee is home to 13 two-year colleges similar in size to Ohio's two-year colleges. Tennessee has 9 four-year universities that are typically smaller in size than Ohio's, ranging from 7,500 to 27,000 students. Tennessee operates the longest-running performance funding

regime in the country, which began in 1979. In 2010, the governor signed into law the Complete College Tennessee Act remodeling the original formula and now tying 85 percent of the state's higher education appropriations to performance outcomes and the remaining 15 percent to operations and maintenance (Snyder, 2015).[i] Prior to 2010, approximately 5 percent of the state's funds were tied to performance and – unlike the new model – the older model was not designed to prioritize or reward degree completion. Tennessee implemented their model immediately, but for three years provided additional funds to help prevent campuses from falling significantly behind prior-years' funding levels (Ness, Deupree, & Gándara, 2014).

Similar to Ohio, Tennessee's model prioritizes degree completions where completions carry the greatest weight in the funding formula. Each campus earns performance points based on a number of completion metrics including: transfer-out rate, credit completions, and certificates/degrees awarded. The formula also awards a premium to colleges that enroll and graduate more low-income and adult students (Dougherty, Natow, Jones et al., 2013; Snyder, 2015). The state's progress and completion metrics drive the majority of state funding to the institutions, with the remaining amount allocated according to university research and service output.

In both states, performance funding policies are the centerpiece of their respective higher education policy agendas. No other state policies were adopted in the same year that directly tie funding to performance outcomes. However, both states made significant changes to their dual enrollment policies that, in time, may positively affect college completions. By allowing more students to earn college credits in high school, it is possible for more graduating seniors to enter college as sophomores. In so doing, Ohio's "Seniors to Sophomores" policy and Tennessee's dual enrollment grants are designed to help improve access and time-to-degree. Researchers have

found dual enrollment policies can generate these outcomes (Allen & Dadgar, 2012; An, 2013), so it is possible for the effects of these policy changes to confound with performance funding. Ohio does not include dual enrollment in its funding formula, but Tennessee's model rewards community colleges for enrolling dual enrollment students. For most community colleges, the dual enrollment metric is least-heavily weighted since the highest weights are placed on degree completion metrics (Tennessee Higher Education Commission, 2017). Additionally, dual enrollment is voluntary and the state only covers $300 of tuition for no more than three college courses, and Tennessee has below-average dual enrollment participation rates (Karp, 2013; Tennessee Higher Education Commission, 2016). To the extent dual enrollment policy changes confound with the performance funding policy changes, they would only affect Tennessee's community colleges and the impact, if any, would be negligible.

Performance management and principal-agent theory

State policymakers often seek to use rewards and sanctions as a way to induce college and university leaders to more vigorously pursue their policy agendas. This approach is more common in states with Republican-controlled legislatures and those with less centralized higher education governance systems (McLendon, Hearn, & Deaton, 2006). Similarly, advocacy groups and the business community often encourage states to adopt performance funding policies as a way to hold colleges more accountable for statewide policy goals (Dougherty & Natow, 2015; Gándara, Rippner, & Ness, 2017). Sometimes states wait to see how their neighboring state fares under these new policy arrangements, suggesting states are learning from other states' experiences as these policies diffuse across the nation (Li, 2017).

In their various forms, states adopt performance funding models with the belief that rewards and sanctions will improve educational outcomes. Accordingly, principal-agent theory

serves as a lens to examine pay-for-performance in higher education. We can view state legislators, governors, and members of the state boards of regents as principals seeking to achieve various higher education policy goals. But they cannot achieve these goals on their own, so they must enlist agents – in this case public colleges and universities – to carry out the actions necessary to achieve them.

Professional expertise is a key factor in successful principal-agent relationships, where principals must perceive the agent as capable and qualified to carry out their contracts without shirking. Historically, policymakers in most states, acting as principals, established public colleges and engaged in indirect oversight through statutory regulations, statewide governing/coordinating boards, and appointed boards of regents. Instead of becoming involved in direct oversight and the regular administration of institutions, many legislatures engaged in efforts to structure the system in ways that would promote and protect legislative interests, a political control mechanism often called “hardwiring” or “deckstacking” (McCubbins, Noll & Weingast 1987; Gormley & Balla 2012). This approach, the more traditional role of state governance in higher education, establishes a system and relies on the expertise of leaders in public organizations to carry out the general mission as they see fit.

So why deviate from these long-standing systems of political control? Theory suggests that policymakers, over time, may become concerned with the effectiveness of traditional oversight. This may lead them to believe that organizations tasked with oversight will adopt the values of the institutions they are supposed to oversee, instead of the political principals to whom they should be accountable. This belief, often discussed as “capture theory” in the literature, is widely held, despite little evidence to support this belief (Frederickson, Smith, Larimer, and Licari 2015; Golden 2000; Wood and Waterman 1990). Once political principals shift their

thinking away from traditional models of control, the focus often moves to concerns over goal conflict and issues related to the structure of incentives.

In the case of performance in higher education, a state legislature may diagnose low or stagnant degree attainment rates as a policy problem and then use performance regimes to induce college presidents to improve their campus' educational outcomes. But it is important to note that this decision is actually a series of decisions common in principal-agent relationships. It is built on the assumption that principals and agents have goal conflict where agents, or college leaders in this case, place a higher priority on other goals over completions. It also assumes information asymmetry where agents have more information on the true priorities of the institution and their efforts to pursue those goals. This results in moral hazard where agents have an incentive to pursue their own goals that are not aligned with the goals of political principals (Wood and Waterman 1994; Gormley and Balla 2012). In short, the decision to move from traditional oversight to incentive-based models of political control are informed by this underlying theory of action.

This theory of action assumes incentives will motivate the behaviors of leaders of public organizations and create the conditions from which systematic change can occur. However, the underlying theory of action is not well developed in higher education and the same conditions that make performance funding policies effective can produce the undesirable results. For example, incentives may work well if they shift attention, priorities, and/or behaviors, but if college already prioritize degree completions then added incentives are unlikely to change behaviors. We lack strong evidence that college presidents do not already prioritize student success, so it is unclear how incentives might change their attitudes and behaviors. In fact, it is

possible that high-stakes incentives may crowd out existing intrinsic motivation, which in turn can mute efforts to improve performance (Weibel, Rost, & Osterloh 2009).

Incentives are also unlikely to induce change when agents do not have sufficient resources to implement the principal's desired agenda (Gilmour & Lewis 2008; Moynihan 2008; Rabovsky 2012). For example, a college may not have the infrastructure to collect, track, and analyze student success data. They may not have the financial resources to hire or train professionals to improve student retention and completion rates. To the extent this occurs, the agent may have aligned their priorities with the principal, yet not have the capacity to respond to the incentives. Agents may have the capacity to change but still fall short of performance goals if the task ahead of them is complex.

Pay-for-performance regimes work well with respect to lower-order rote tasks and relatively easy to control outcomes (Resh & Pitts, 2013; Pink, 2009). However, for higher-order tasks that require problem solving and non-routine patterns, it becomes more difficult to achieve desired or predictable results. When tasks are complex and financial stakes are high, it could lead agents to respond by strategically reporting the performance outcomes to maximize their performance rewards (Courty & Marschke, 2004). Agents may respond to incentives by manipulating performance data in ways that appear to have achieved greater performance, when in fact they simply changed how they count or measure performance indicators. Even if agents do not respond by gaming, they may only be able to achieve the lowest-order task. It would be much easier for a college to produce short-term credentials like certificates or associate's degrees, rather than bachelor's degrees, simply because these credentials are quicker and easier to produce. Because of these theoretical gaps, performance incentives may result in undesirable outcomes or outcomes that are only found in a narrow set of credential programs.

Literature review

Notwithstanding these theoretical limitations, public sector organizations are turning to New Public Management strategies to improve performance (Moynihan, 2008). In this review, we draw upon that literature to gain insights from other public sector organizations like hospitals and social services that have used "pay for performance" to change organizational outcomes. Across this literature, efforts to tie finances to outcomes has mixed results depending on the design of the incentive system, the complexity of the organization and its outputs, and even according to time.

In one of the most comprehensive reviews of the health literature, Petersen et al. (2006) found performance incentives lead to no and limited impacts and sometimes even negative impacts on patient's health outcomes. Care providers that operate under incentive-based funding models are more likely to avoid sicker patients due to adverse selection, experience misdiagnosis at higher rates, and deliver more expensive care (Shen, 2003; Dranove, Kessler, McClellan, & Satterthwaite, 2003; Wachter, Flanders, Fee, & Pronovost, 2008; Welker, Huston, & McCue, 2008). Ultimately, these unintended consequences can lead to wider health disparities that make it even more difficult for service providers to improve health outcomes (Werner & Asch, 2005). When positive outcomes are observed, they are often in response to relatively small (i.e., not "high stakes") financial incentives; however, these gains often disappear within a few years after implementation or are concentrated among providers that have the greatest capacity to perform in the first place (Bardach et al., 2013; Werner, Kolstad, Stuart, & Polsky, 2011). In health, positive outcomes appear to be the exception to the rule, where high-stakes incentives likely create "uncertain" or negative effects on health outcomes (Fung, Lim, Mattke, Damberg, & Shekelle, 2008; Jha, Joynt, Orav, & Epstein, 2012).

Similar conclusions have been drawn from other social service areas. In social welfare programs, correctional facilities, policing and even regional airports, there is evidence that incentive-based funding regimes generate no, small, or negative outcomes on performance outcomes (Cancian, Haveman, Meyer, & Wolfe, 2002; Heinrich, 2007; Moynihan, 2005; Wittman, 2014). In a recent meta-analysis including 49 high-quality studies from across public service organizations (i.e., education, job training, crime/policing, health, child support, etc.), Gerrish (2015) finds performance regimes tend to have small and often inconsequential effects. In education specifically, the effects are often not statistically different from zero. In the few cases where education interventions yield positive results, the effects are relatively small and of little practical significance. Due to the lack of conclusive evidence on the efficacy of incentive-based funding regimes, pay-for-performance policies may be a "triumph of hope over experience" where the hope of improving performance does not always translate into performance gains (Andrews & Moynihan, 2002).

Similar trends are emerging in the higher education literature, where a growing body of research, across multiple states and incorporating important variances in policy design, finds that states that have adopted performance based funding models often do not outperform other states. When they do, the effects are often small in magnitude or found only in a subset of the performance goals specified in the policy, mirroring the trends found in the above public sector examples. In a case study of Tennessee, Sanford and Hunter (2011) found that increasing the amount of funds tied to performance had no systematic effect on educational outcomes. Hillman, Tandberg, and Gross (2014) found public colleges subject to performance funding in Pennsylvania did not outperform similar colleges in other states that were not subject to similar policies. Similar findings emerged in a study of Washington state's policy, where community

colleges did not improve degree completion (on average) but instead increased the productivity of short-term certificates in response to the policy (Hillman, Tandberg, & Fryar, 2015). In Indiana, researchers have found that colleges respond to performance incentives not by improving graduation rates but by enrolling fewer under-represented students and becoming more selective (Umbricht, Fernandez, & Ortagus, 2015). These four examples – Tennessee, Pennsylvania, Washington, and Indiana – represent state policies designed to incorporate some of the "best practices" of performance management, raising questions about whether the limited influence of performance funding policies can be attributed to policy design.

When examining older performance funding policies that may not incorporate as many best practices into the policy design, findings mirror those described above. Shin (2010), Shin and Milton (2004), and Volkwein and Tandberg (2008) found that performance funding states did not significantly improve educational outcomes after adopting their policies. Tandberg and Hillman (2014) and Tandberg, Hillman, and Barakat (2014) found states operating performance funding between the years 1990 and 2010 had little to no average impact on performance (measured by associate and baccalaureate degree productivity). Rutherford and Rabovksy (2014) examined a similar time period and found performance funding generally had little to no impact on performance. There is some evidence that it takes time before impacts emerge, but even when this temporal dimension is added the effects are so small that they call into question their practical significance (Hillman, Tandberg, & Gross, 2014; Rutherford & Rabovsky, 2014; Tandberg & Hillman, 2014).

Literature on the implementation of performance funding in higher education can help us understand how campus officials respond to performance funding policies. Researchers have found that faculty, administrators, and staff within universities may be familiar with incentives

and goals associated with performance funding (Zumeta & Li, 2016). But if they are not involved in the design and continued improvement of the formula, they may lack buy-in and institutional support (Jones et al., 2017; Kaikkonen, 2016; Miller, 2016). Nevertheless, campus leaders may leverage this policy to help stimulate change on campuses (Jones, 2015). For example, after adopting performance funding, campuses have stimulated their efforts to reform developmental education, revisit transfer articulation agreements, and improve academic advising and student support services (K. J. Dougherty et al., 2016b, 2016a; Ness et al., 2014). However, this same research finds campuses vary widely with respect to their capacity to respond. Without adequate professional development opportunities, staffing, financial resources, or technological infrastructure, it is unlikely a campus will bring to scale evidence-based interventions and practices (K. J. Dougherty et al., 2016a). As a result, campuses may be aware of the new policy, but lack the capacity to respond effectively.

Data and analysis

The analytical sample includes public two-year and four-year U.S. colleges and universities, built from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS) for the academic years 2005-06 to 2014-15. This creates a 10-year balanced panel dataset with 839 two-year and 500 four-year institutions. Institutions that do not award undergraduate degrees or do not receive state appropriations are excluded from the analysis (e.g., military academies, medical colleges, etc.). Likewise, colleges that changed their degree-granting status, such as community colleges that began offering bachelor's degrees, are excluded because this compositional change could bias the estimated treatment effects (St. Clair & Cook, 2015). All finance data are CPI-adjusted to 2014 dollars. Since each of the two state

policies prioritize and reward certificate, associate, and bachelor's degree productivity, each of these outcomes are used in the analysis.

We use a difference-in-differences (DID) framework to evaluate performance funding's impact on degree production. This technique allows us to measure the trends of case study states relative to trends in other non-performance funding states, both before and after the policy intervention. Each state's adoption of performance funding is a plausible source of exogenous variation that induces public colleges and universities to respond. From here, we can observe whether states subjected to performance funding yielded different trends during the years exposed to the policy. To estimate these policy effects, we implement DID in the following regression model:

$$y_{it} = \alpha + \beta_1 (treat) + \beta_2 (post) + \beta_3 (treat \times post) + controls_{it} + \gamma_i + \eta_t + (state \times year) + \varepsilon_{it}$$

where y is the outcome variable measured as the logged value of the total number of certificates, associate's, or bachelor's degrees produced for each institution (i) in each year (t). The variable *treat* identifies the two treated states, Ohio and Tennessee, *post* identifies the implementation years for each state, and the interaction between them (*treat* x *post*) measures the average treatment effect: the change in slope after policy adoption.

We also add a broad set of observable *controls* that include: logged value of full-time equivalent undergraduate enrollments (FTE), percent of undergraduates enrolled part-time, percent of undergraduates who are white, logged values of published tuition and fees charged to full-time undergraduates, logged value of operating expenditures per FTE student, share of operating expenses covered by state appropriations, and county unemployment rates. We include institutional fixed effects (γ_i) and year fixed effects (η_t), and state-specific linear time trends *(state* x *year)* as strategies to improve internal validity. The institution fixed effects account for

unobserved institutional characteristics that are relatively stable over time, such as the institution's reputation, mission, and academic quality. The year fixed effects account for unobserved factors that affect all states in each year, such as changes in federal aid policies or recessions that impact states in similar ways. The linear state-specific trends allow degree completions to take different trajectories across the states during the pre-treatment period (Angrist & Pischke, 2015). The error term, $\varepsilon_{it,}$ represents the unobserved heterogeneity for each institution in each year that is not accounted for by the covariates in the models. To account for autocorrelation and panel heteroscedasticity that would downwardly bias standard errors, we cluster standard errors at the institution (Bertrand, Duflo, & Mullainathan, 2004).

Robustness checks. We utilize two strategies to test the robustness of our results. First, we extend beyond measuring the average treatment effects by exploring temporal heterogeneity within each model. The effectiveness of performance funding may vary depending on the number of years in operation. The first years of implementation may experience modest or even null to negative effects if there is an implementation lag, while later implementation years may experience stronger effects. Alternatively, the first years may experience early gains that eventually plateau or even decline if colleges respond by retroactively awarding credentials to former students. There is evidence of this practice in other states where colleges identify former students who have enough (or nearly enough) credits to graduate, but either did not file graduation paperwork or who were just short of earning the degree (Hillman, Tandberg, & Fryar, 2015). To account for these possibilities, where the policy could have stronger or weaker effects over time, we interact the treatment effect by the number of years in operation and report these as "years in operation" in our regression tables.

Our second strategy is to offer multiple comparison groups that compare the two states against various counterfactuals. The first counterfactual compares Ohio and Tennessee against other states in their respective geographic region, where Ohio colleges are compared against colleges from states in the Midwestern Higher Education Compact that did not adopt performance funding regimes during the period of this analysis: Iowa, Michigan, Minnesota, North Dakota, Nebraska, and Wisconsin. Tennessee is compared against colleges from Southern Region Education Board states that meet the same criteria: Alabama, Delaware, Florida, Kentucky, Maryland, South Carolina, and West Virginia. The second counterfactual removes the regional restriction and compares Ohio and Tennessee institutions against two-year and four-year colleges from any state nationwide that did not adopt performance funding during the analysis period. The third counterfactual compares the two states against colleges from other performance funding states nationwide to assess whether the adherence to best practices outperforms other performance funding designs. We use the Dougherty & Natow (2015) list of performance funding states and years to identify each comparison group.

Limitations

At least three notable limitations should be considered when interpreting these results. First, Tennessee and Ohio slowly phased their models in over time. In Tennessee, for example, the first year tied 40 percent of funding to performance measures and it eventually grew to 85 percent. While the states still provided larger incentives than any other state during their phase-in periods, the effects may become stronger over time as each state increases the “dosage” of the policy. We address this by examining annual effects, but we do not know whether these effects are driven by attention to performance metrics, financial incentives, or any other strategic

organizational response; therefore, we view performance funding as “treatment package” that requires additional research to fully understand the mechanisms driving any effects.

Second, each state adopted dual enrollment policy changes at the same time as performance funding. This could create a contamination effect upwardly-biasing our estimates, where performance funding’s effect includes the effects of dual enrollment policy changes. If this is the case, then we cannot disentangle the two effects. However, we believe the confounding would be negligible since dual enrollment targets a narrow set of high school seniors, participation is relatively low, and only Tennessee’s community colleges include dual enrollment in their funding formula. That positive effects are primarily found among certificate programs at community colleges, and these effects are large, we believe they are driven less by contamination and more by the strategic responses campuses made to funding incentives.

Third, each state has alternative outcomes that go unexamined in this analysis. It is possible that retention rates, transfer rates, graduation rates, STEM degrees, or research productivity changed after the policy, but these go unexamined here. While each of the case study states prioritize completions over other outcomes, these other outcomes could still be affected by the policy.

Results

Table 1 provides descriptive statistics on both the outcome and control variables used in the analysis. Between 2005 and 2014, Ohio and Tennessee two-year colleges produced an average of 329 and 294 certificates per year, respectively. Both states lagged below the national average on this outcome, but Tennessee’s two-year colleges were above the national average with respect to the average number of associates degrees produced annually (759). Ohio’s two-year colleges produced nearly the same number of associate’s degrees as the national average.

Public four-year universities in the two states produce more bachelor's degrees than the national average, 2,176 and 2,100, respectively in Ohio and Tennessee.

[Insert Table 1 about here]

These outcomes changed over time, as documented in Figure 1, where we compare degree production trends for Ohio on the left and Tennessee on the right. The top panel of Figure 1 displays how each state compares to all other performance funding and non-performance funding states with respect to certificate production. Here, we see that Ohio steadily grew the number of certificates over time, much like what was occurring in other states. It was not until the fourth and fifth years of implementation that Ohio began to outpace other states with certificate productivity. In Tennessee, we see a very different pattern where certificate productivity in community colleges was far below the national average and not rising at as steady of a pace prior to performance funding, but then certificate production immediately spiked in the years following the policy. After this immediate spike, certificate growth steadily declined, though was still considerably higher than the pre-treatment period.

[Insert Figure 1 about here]

In the middle panel of Figure 1, we see the trends in associate's degree productivity among community colleges, where Ohio colleges experienced a brief increase two years following the policy and then began to decline and flatten out. In Tennessee, colleges were on an upward trend prior to the policy and then appeared to level off while other states slowly continued to rise. A similar pattern holds in the lower panel, where the rate of bachelor's degree production increased soon after adoption in both Ohio and Tennessee, only to begin to level off in time. The comparison groups follow similar patterns in each panel, where there is growth for both non-performance funding and performance funding states on each of these measures. These

descriptive trends can help us anticipate the effects of performance funding in Ohio and Tennessee, but the figures alone cannot answer our research questions.

Turning to our regression results, now discuss the average treatment effects of adopting performance funding in the two states. Table 2 provides results for certificate production among community colleges, where the first three columns compare Ohio colleges to Midwestern states that never adopted performance funding, all states that never adopted performance funding, and then all other performance funding states. Across each comparison group, we detect a statistically significant difference in slope only when comparing Ohio two-year colleges against two-year colleges in the Midwest (i.e., the Treat x Post coefficient). This estimate is also economically significant: after the policy, Ohio two-year colleges increased certificate production by 32 percent when compared against other Midwestern two-year colleges. The bottom panel of Table 2 interacts the average treatment effect with the number of years in operation where zero is the start-year for performance funding. The difference in slopes is not statistically significant until the fourth and fifth years after implementation, when Ohio begins to outpace other community colleges in the Midwest (and in non-performance funding states) by 57 and 63 percent (43 and 50 percent), respectively. There are no discernable differences in certificate production between Ohio community colleges and community colleges in other performance funding states.

[Insert Table 2 about here]

Unlike Ohio, Tennessee community colleges experienced positive and significant gains in certificate production immediately following the state's adoption of performance funding. The magnitude of these average effects is quite large, ranging between 61 and 85 percent increase in certificate production in response to the policy. However, the magnitude of these effects

diminishes over time, as displayed both in Figure 1 and in the bottom panel of Table 2. Tennessee community colleges experienced the largest gains in the earlier years, doubling the number of certificates in a very short period. By the fourth year of implementation, these effects are still significantly different from zero and larger than the effects seen in Ohio. We will focus on this finding in the following section because impacts of this magnitude are rarely found in the research literature.

Shifting to the associate's degree production, Table 3 shows that Ohio community colleges experienced declines in associate degrees following the adoption of performance funding. The average treatment effects are negative and significant when compared against other community colleges in performance funding states. After the policy, Ohio community colleges produced an average of 16.2 percent fewer associate's degrees than other performance funding states (representing approximately 123 students). These effects appear to be getting larger over time, where the negative effect is estimated around 9 percent in the first years but rises past 25 percent in years four and five. As seen in Figure 1, associate's degrees plateaued in Ohio while they continued to rise in other states. In Tennessee, we see a very similar pattern, where the state's community colleges produced fewer associate's degrees than community colleges in other performance funding states. Tennessee produced 12 percent fewer degrees than other performance funding states, representing about 75 fewer recipients, on average. When comparing Tennessee to regional states or non-performance funding states, these effects are not distinguishable from zero.

[Insert Table 3 about here]

Finally, Table 4 displays the average treatment effects performance funding has on bachelor's degree completions. Across all models in both Ohio and Tennessee, four-year

colleges and universities did not, on average, outperform other colleges and universities around the country. In Ohio, colleges appear to have underperformed during the initial two years of the policy, though the parameter steadily approach zero and then become positive (though still not significant) by the fourth year. This lag effect has been examined in other studies and will be discussed in more detail later, though it is noteworthy all but one of the models for Tennessee's four-year institutions were statistically insignificant. In both states, the weight of evidence suggests bachelor's degree trends are not statistically different from the trends occurring in other non-performance funding or performance funding states.

[Insert Table 4 about here]

In summary, we find performance funding induced Tennessee community colleges to produce significantly more certificates immediately following the policy with these effects tapering off over time. These effects also emerged in Ohio, but only in two of the comparison groups and not immediately after implementation. In both states, community colleges produce significantly fewer associate's degrees than community colleges in other performance funding states. The magnitude of these effects gets larger over time, as both states appear to have plateaued at a time when other community colleges are producing more associates degrees. Finally, in neither Ohio nor Tennessee has performance funding induced four-year colleges and universities to produce more bachelor's degrees.

Taken together, these results support the earlier assertion that performance regimes are likely to induce immediate but short-lived effects on low-order outcomes that are easiest or quickest to improve (e.g., certificates). They also support the notion that performance regimes are likely ineffective at improving higher-order tasks that are less routine and that take more time to produce (e.g., associates and bachelor's degrees). In fact, there may even be degree

displacement if these two states are producing more certificates at the expense of associate's degrees. The following section will elaborate on these key findings while offering suggestions for further research in this important policy area.

Discussion and further research

These results, five to six years out from policy adoption, give insight into the progress these two states are making with their performance funding efforts. While it is possible that both states will eventually observe greater growth in associate's and bachelor's degree production, this analysis finds performance funding mostly induces colleges to produce more certificates than degrees. These results are concentrated among Tennessee community colleges, and are consistent with other studies where outcomes improve in only a narrow set of circumstances. While the results show some evidence of certificate growth, they largely conclude that these two states are not outperforming other states in most areas of degree productivity. This null finding suggests that states using traditional budget models (and states with less aggressive performance funding regimes) may be able to produce similar educational outcomes as those with robust performance funding models. There is even suggestive evidence that Ohio and Tennessee became less productive with respect to associate's degrees, suggesting the funding model may not induce colleges to change behaviors in ways policymakers might desire.

These findings stand in contrast to those produced by Callahan, Meehan, and Shaw (2017), who conclude performance funding in Tennessee caused "a positive impact on a range of student outcomes." They used a one-group interrupted time series (ITS) analysis and found, for example, that Tennessee universities produced 380 more bachelor's degrees after the policy was in effect. But degree production was on the rise nationwide, making it unclear that Tennessee's growth was due to the policy and not secular trends. We overcame this threat to validity by

employing a difference-in-differences strategy comparing trends in Tennessee colleges and universities to those in other (non-treated) colleges and universities. Doing so addressed a key threat to internal validity found to "render most one-group ITS designs causally problematic" in social science (St. Clair, Cook, & Hallberg, 2014, p. 312). By following the comparison group approach, we see that Tennessee's growth in bachelor's degrees, while positive, was not statistically different from the growth experienced in other states.

The findings presented in our study are useful for developing both an evidence base and a theory base from which to inform future state higher education policy developments. We frame this discussion around our earlier overview regarding the challenges of using pay-for-performance in complex public organizations like college and university settings. Namely, that performance regimes are most likely to yield desired outcomes only when the tasks are relatively simple/routine, they are easily measured, and when agents are have the capacity to meet the principal's goals but are likely to shirk. The production of a certificate credential requires far fewer resources than the production of an associate's or bachelor's degree, both in terms of time and money. Colleges can more quickly and inexpensively produce a certificate, and that process is far less complex than any other higher-order credential. This is likely the reason why the only positive results found in this study are within two-year colleges' improvement of certificates.

The growth in certificates may be deemed a policy success, but there are three important caveats to consider. First, certificates generate only modest and temporary economic returns in the labor market. These returns tend to be higher for longer programs, and they vary considerably across state, gender, and field of study (Belfield & Bailey, 2017). Using administrative wage data from Ohio, Bettinger and Soliz (2016) find that men entering law enforcement and women entering health-related fields generate the largest returns. However,

they also find the majority of programs (e.g., agriculture, natural resources, personal and culinary services, education, engineering technologies, etc.) did not generate higher earnings for certificate holders. Second, literature on the returns to college consistently finds associate's degrees generate larger returns than certificate programs (Belfield & Bailey, 2017). Community colleges in both Ohio and Tennessee began producing more certificates and fewer associate's degrees after the introduction of performance funding. Campus leaders in Tennessee have raised concerns about this finding, "where students may stop pursuing their associate's degree after receiving a certificate" (Ness, Deupree, & Gándara, 2014, p. 36). Our analysis cannot say with certainty that certificates and associates are substitutes, but the findings presented here raise questions about the potential trade-off, which could result in the unintended consequence of weakening the labor market outcomes of college graduates.

Third, unlike degree programs, colleges can create certificates with relatively little oversight, making them flexible credentials for institutions to produce (Johnson & Yanagiura, 2016). This flexibility may also make it easier for college to game the performance funding system. For example, Ness, Deupree, and Gándara (2014) found that Tennessee community colleges began automatically granting credentials as soon as students earned sufficient credit hours toward a certificate program, even if students were unaware they had met the program qualifications. This flexibility allowed Tennessee's community colleges to rapidly develop or expand certificate programs with little state oversight (Tennessee Board of Regents, 2015). Ohio is similarly decentralized, where colleges are only required to notify the state board when implementing new long-term certificates; however, short-term certificate programs require no such notification (Ohio Board of Regents, 2015). The combination of Ohio's three-year phase-in of performance funding, in conjunction with the approval process required for long-term

certificates, may explain why we observe delayed effects in Ohio. Tennessee's rapid implementation of performance funding, in conjunction with its more decentralized approval process for certificates, can help explain why their effects were more immediate than Ohio's. Both states have since refined their formulas to guard against the proliferation of short-term certificates (Carey, 2014; Johnson & Yanagiura, 2016).

Shifting attention to baccalaureate degree production, we fail to reject the null hypothesis that universities in the two states improve degree completion after the introduction of performance funding. The consistent non-findings for each bachelor's degree model (both the average treatment effects and changes over time) can illustrate the limitations of underlying pay-for-performance theory of action. The production of a bachelor's degree is a complex process that is shaped by students own academic progress, engagement with their campus, and financial circumstances, among other factors (Kuh, Kinzie, Schuh, Whit, et al, 2010; Pascarella & Terenzini, 2005; Tinto, 2012). Degree completion is also a function of the campus' own capacity to meet students' needs, where campuses with the most financial resources are in the best position of retaining and graduating students (Bound, Lovenheim, & Turner, 2012; Deming & Walters, 2017). For example, promising interventions like expanding need-based financial aid, mandating intensive advising, and developing holistic support services will likely help improve student success (Bettinger & Baker, 2014; Castleman & Goodman, 2016; Castleman & Long, 2016; Scrivener et al., 2015), but campuses may not have the capacity to bring these interventions to scale without additional staffing, financial, or technological resources.

Furthermore, there are many agents involved in the production process, meaning that any single agent (e.g., faculty member, financial aid administrator, academic advisor, etc.) does not have direct or unambiguous control over the entire task of producing a college graduate.

Performance regimes are most suitable for routine and predictable tasks and not inherently complex ones, so this finding may help policymakers and researchers understand why incentives may be too blunt of a policy instrument for inducing the desired change.

Additionally, the capacity constraints of public colleges and universities – both two-year and four-year – can help us understand why performance regimes may underperform. Dougherty's research consistently finds that capacity constraints are among the most significant barriers for campus administrators and faculty members implementing performance funding (Dougherty & Reddy, 2013). In Florida, for example, limitations in institutional research staff and data systems were identified as critical obstacles faced by smaller, less selective institutions (Dougherty & Hong, 2006), issues that were echoed by leaders in other states (Dougherty & Reddy, 2013). What may appear to be shirking could in fact be a capacity constraint where agents have a willingness but not capacity to comply with the principal's goals.

There are a number of ways to motivate agents to behave according to a principal's goals, and high-stakes financial incentives may actually crowd out the agents' willingness and ability to perform (Weibel, Rost, & Osterloh 2009). Public management literature often finds that public employees (in this case, college and university faculty and staff) are motivated by intrinsic rewards and the desire to serve others, be public stewards, and achieve other non-monetary objectives. Using financial incentives to penalize or reward these agents may be misaligned with what we know about public sector motivation. There may be other ways beyond "carrots and sticks" to motivate agents, but the performance funding literature has yet to fully explore the range of possible alternatives. For example, it could be that capacity constraints and crowding-out effects shape institutional performance outcomes, which is a line of inquiry worthy of further research. Similarly, it is possible that different campuses respond differently to these incentives

depending on the institutional mission, leadership commitment, or organized channels to learn from performance data, so further research could explore this heterogeneity.

States often learn from others and design new policies according to their own and others' past experiences. Many state policymakers may look to Ohio and Tennessee for guidance on how best to design performance policies that adhere to proponents' best practices. If a state were to improve educational outcomes because of performance funding, then it would most likely be in these two; however, results show limited evidence of this occurrence. The evidence presented here suggests the exemplar performance funding states have not yet out-performed other states except with respect to certificate programs. Considering the low returns to certificate programs, where graduates' earnings are often not higher than high school graduates, this outcome may work against other state policy goals related to economic mobility and workforce development. These results are consistent with both theory and evidence from both within and outside of higher education, suggesting even the most advanced performance funding states have not yet outperformed those without this funding model.

References

Allen, D., & Dadgar, M. (2012). Does dual enrollment increase students' success in college? Evidence from a quasi-experimental analysis of dual enrollment in New York City. *New Directions for Higher Education, 2012*(158), 11–19. https://doi.org/10.1002/he.20010

An, B. P. (2013). The Impact of Dual Enrollment on College Degree Attainment: Do Low-SES Students Benefit? *Educational Evaluation and Policy Analysis*, *35*(1), 57–75. https://doi.org/10.3102/0162373712461933

Andrews, M. & Moynihan, D. (2002). "Why Reforms Do Not Always Have to 'Work' to Succeed: A Tale of Two Managed Competition Initiatives." *Public Performance & Management Review* 25 (3): 282–97.

Angrist, J., & Pischke, J. (2015). *Mastering 'Metrics: The Path from Cause to Effect*. Princeton ; Oxford: Princeton University Press.

Bardach, N. S., Wang, J. J., De Leon, S. F., Shih, S. C., Boscardin, W. J., Goldman, L. E., & Dudley, R. A. (2013). Effect of pay-for-performance incentives on quality of care in small practices with electronic health records: a randomized trial. *JAMA*, *310*(10), 1051–1059.

Belfield, C., & Bailey, T. (2017). *The Labor Market Returns to Sub-Baccalaureate College: A Review*. New York, NY: Center for Analysis of Postsecondary Education and Employment. Retrieved from http://capseecenter.org/labor-market-returns-sub-baccalaureate-college-review/

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.

Bettinger, E., & Baker, R. (2014). The Effects of Student Coaching An Evaluation of a Randomized Experiment in Student Advising. *Educational Evaluation and Policy Analysis*, *36*(1), 3–19. https://doi.org/10.3102/0162373713500523

Bettinger, E., & Soliz, A. (2016). Returns to vocational credentials: Evidence from Ohio's community and technical colleges. *Center for Analysis of Postsecondary Education and Employment Working Paper Series*.

Bound, J., Lovenheim, M., & Turner, S. (2012). Increasing time to baccalaureate degree in the United States. *Education Finance and Policy*, *7*(4), 375–424.

Callahan, K., Meehan, K., & Shaw, K. (2017). *Summary of OBF Impact on Student Outcomes in Tennessee and Indiana*. Philadelphia, PA: Research for Action. Retrieved from https://www.researchforaction.org/publications/summary-obf-impact-student-outcomes-tennessee-indiana/

Cancian, M., Haveman, R., Meyer, D, & Wolfe, B. (2002). Before and After TANF: The Economic Well-Being of Women Leaving Welfare. *Social Service Review*, *76*(4), 603–641.

Carey, J. (2014). *State Share of Instruction Report*. Ohio Board of Regents: Columbus, OH. https://www.ohiohighered.org/sites/ohiohighered.org/files/uploads/financial/ssi/SSI_Performance-Based-Funding-Evaluation-Report_Dec2014.pdf

Castleman, B., & Goodman, J. (2016). Intensive College Counseling and the Enrollment and Persistence of Low Income Students. *Education Finance and Policy*. Retrieved from http://www.mitpressjournals.org/doi/abs/10.1162/EDFP_a_00204

Castleman, B. L., & Long, B. T. (2016). Looking beyond Enrollment: The Causal Effect of Need-Based Grants on College Access, Persistence, and Graduation. *Journal of Labor Economics*, *34*(4), 1023–1073. https://doi.org/10.1086/686643

Conklin, K., Snyder, M., Stanley, J., & Boelscher, S. (2016). *Rowing Together: Aligning state and federal investments in talent to common outcomes*. Denver, CO: Education Commission of the States. Retrieved from http://www.ecs.org/rowing-together-aligning-state-and-federal-investments-in-talent-to-common-outcomes/

Dadgar, M., & Weiss, M. (2012). Labor Market Returns to Sub-Baccalaureate Credentials: How Much Does a Community College Degree or Certificate Pay? CCRC Working Paper No. 45. *Community College Research Center, Columbia University*.

Deming, D., & Walters, C. (2017). The impacts of price and spending subsidies on US postsecondary attainment. *Working Paper*.

Dougherty, K., Jones, S., Lahr, H., Natow, R. S., Pheatt, L., & Reddy, V. (2016a). 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.

Dougherty, K., Jones, S. M., Lahr, H., Natow, R. S., Pheatt, L., & Reddy, V. (2016b). *Performance Funding for Higher Education*. Baltimore, Maryland: Johns Hopkins University Press.

Dougherty, K., & Hong, E. (2006). Performance accountability as imperfect panacea: The community college experience. In T. Bailey & V. S. Morest (Eds.), *Defending the community college agenda* (pp 51-86). Baltimore, MD: Johns Hopkins University Press.

Dougherty, K., Jones, S., Lahr, H., Natow, R. S., Pheatt, L., & Reddy, V. (2014). Performance Funding for Higher Education Forms, Origins, Impacts, and Futures. *The ANNALS of the American Academy of Political and Social Science*, *655*(1), 163–184.

Dougherty, K., & Natow, R. (2015). *The Politics of Performance Funding for Higher Education: Origins, Discontinuations, and Transformations*. Baltimore: Johns Hopkins University Press.

Dougherty, K., & Reddy, V. (2013). Performance Funding for Higher Education: What Are the Mechanisms What Are the Impacts? *ASHE Higher Education Report*, *39*(2).

Dranove, D., Kessler, D., McClellan, M., & Satterthwaite, M. (2003). Is more information better? The effects of "Report Cards" on health Care providers. *Journal of Political Economy*, *111*(3), 555–588.

Frederickson, H., Smith, K., Larimer, C., & Licari, M. J. (2015). *The Public Administration Theory Primer*. Boulder, CA: Westview Press. 3rd edition.

Fung, C., Lim, Y., Mattke, S., Damberg, C., & Shekelle, P. (2008). The evidence that publishing patient care performance data improves Quality of care. *Annals of Internal Medicine*, *148*(2), 111–123.

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*, 1–25.

Gerrish, E. (2015). The Impact of Performance Management on Performance in Public Organizations: A Meta-Analysis. *Public Administration Review*.

Golden, M. (2000). *What Motivates Bureaucrats?: Politics and Administration During the Reagan Years.* New York: Columbia University Press.

Gormley, W. T. & Balla, S. J. (2012). *Bureaucracy and Democracy: Accountability and Performance*. Los Angeles, CA: CQ Press. 3rd edition.

Heinrich, C. (2007). False or fitting recognition? The use of high performance bonuses in motivating organizational achievements. *Journal of Policy Analysis and Management, 26*(2), 281–304.

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

Hillman, N., Tandberg, D., & Gross, J. (2014). Performance funding in higher education: do financial incentives impact college completions? *Journal of Higher Education, 85*(6), 826–857.

Jepsen, C., Troske, K., & Coomes, P. (2014). The labor-market returns to community college degrees, diplomas, and certificates. *Journal of Labor Economics, 32*(1), 95–121.

Jha, A. K., Joynt, K. E., Orav, E. J., & Epstein, A. M. (2012). The long-term effect of premier pay for performance on patient outcomes. *New England Journal of Medicine*, *366*(17), 1606–1615.

Johnson, N., & Yanagiura, T. (2016). *Early Results of Outcomes-Based Funding in Tennessee*. Washington, DC: Lumina Foundation. Retrieved from https://www.luminafoundation.org/resources/early-results-of-outcomes-based-funding-in-tennessee

Jones, S. (2015). The Game Changers: Strategies to Boost College Completion and Close Attainment Gaps. *Change: The Magazine of Higher Learning*, *47*(2), 24–29.

Jones, T., Jones, S., Elliott, K. C., Russell Owens, L., Assalone, A. E., & Gándara, D. (2017). *Outcomes Based Funding and Race in Higher Education*. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-49436-4

Kaikkonen, D. (2016). Shifting from Enrollment- to Performance-Based Funding in Higher Education: What Can We Learn from Washington's Experience? *Education Finance and Policy*, *11*(4), 482–498. https://doi.org/10.1162/EDFP_a_00190

Karp, M. M. (2013). Dual enrollment for college completion: Policy recommendations for Tennessee. *New York, NY: Columbia University, Teachers College, Community College Research Center. Retrieved May*, *18*, 2015.

Kuh, G.D., Kinzie, J., Schuh, J.C., Whitt, E.J., and Associates. (2010). *Student Success in College: Creating Conditions that Matter.* San Francisco, CA: Jossey-Bass.

Li, A. Y. (2017). Covet Thy Neighbor or "Reverse Policy Diffusion"? State Adoption of Performance Funding 2.0. *Research in Higher Education*, 1–26. https://doi.org/10.1007/s11162-016-9444-9

McCubbins, M. D., Noll, R. G., & Weingast, B. R. (1987). Administrative Procedures as Instruments of Political Control. *Journal of Law, Economics, and Organization. 3*(Fall): 243-277.

McLendon, M., Hearn, J., & Deaton, R. (2006). Called to account: Analyzing the origins and spread of state performance-accountability policies for higher education. *Educational Evaluation and Policy Analysis*, *28*(1), 1–24.

Miller, T. (2016). *Higher education outcomes-based funding models and academic quality*. Indianapolis, IN: Lumina Foundation. Retrieved from https://www.luminafoundation.org/files/resources/ensuring-quality-1.pdf

Moynihan, D., & Krull, A. (2014). *Performance Management Routines that Work? An Early Assessment of the GPRA Modernization Act* (LaFollette School Working Paper No. 2014-005). Madison, WI.

Moynihan, D. P. (2005). Managing for Results in an Impossible Job: Solution or Symbol? Abstract. *International Journal of Public Administration*, *28*(3-4), 213–231.

National Conference of State Legislatures. (2015). *Performance-based funding for higher education*. Denver, CO: National Conference of State Legislatures. Retrieved from http://www.ncsl.org/research/education/performance-funding.aspx

Ness, E., Deupree, M., & Gándara, D. (2014). *Campus Responses to Outcomes-Based Funding in Tennessee: Robust, Aligned, and Contested*. Nashville, TN: Tennessee Higher Education Commission. Retrieved from https://www.tn.gov/assets/entities/thec/attachments/FordFoundationPaper.pdf

Ohio Board of Regents (2015). *Guidelines and Procedures for Academic Program Review*. Columbus, OH: Ohio Board of Regents. Retrieved from: https://www.ohiohighered.org/sites/ohiohighered.org/files/Academic-Program-Review-Guidelines_FINAL_042915.pdf

Pascarella, E.T. & Terenzini, P.T. (2005). *How College Affects Students: A Third Decade of Research.* San Francisco, CA: Jossey-Bass.

Petersen, L. A., Woodard, L. D., Urech, T., Daw, C., & Sookanan, S. (2006). Does pay-for-performance improve the quality of health care? *Annals of Internal Medicine*, *145*(4), 265–272.

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

Sanford, T., & Hunter, J. M. (2011). Impact of performance-funding on retention and graduation rates. *Education Policy Analysis Archives*, *19*(33), 1–30.

Scrivener, S., Weiss, M. J., Ratledge, A., Rudd, T., Sommo, C., & Fresques, H. (2015). *Doubling Graduation Rates: Three-Year Effects of CUNY's Accelerated Study in Associate*

Programs (ASAP) for Developmental Education Students. Washington, DC: MDRC. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2571456

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Boston, MA: Houghton Mifflin.

Shen, Y. (2003). Selection incentives in a performance-based contracting system. *Health Services Research*, *38*(2), 535–552.

Shin, J. C. (2010). Impacts of performance-based accountability on institutional performance in the US. *Higher Education*, *60*(1), 47–68.

Shin, J.-C., & Milton, S. (2004). The Effects of Performance Budgeting and Funding Programs on Graduation Rate in Public Four-Year Colleges and Universities. *Education Policy Analysis Archives*, *12*(22), n22.

Snyder, M. (2015). *Driving Better Outcomes: Typology and Principles to Inform Outcomes-Based Funding Models*. Washington, D.C.: HCM Strategists.

St.Clair, T., Cook, T. D., & Hallberg, K. (2014). Examining the internal validity and statistical precision of the comparative interrupted time series design by comparison with a randomized experiment. *American Journal of Evaluation*, *35*(3), 311–327. https://doi.org/10.1177/1098214014527337

St. Clair, T., & Cook, T. D. (2015). Difference-in-differences methods in public finance. *National Tax Journal*, *68*(2), 319–338.

State Higher Education Executive Officers. (2015). State Higher Education Finance. Boulder, CO. Retrieved June 5, 2015, from http://www.sheeo.org/projects/shef-%E2%80%94-state-higher-education-finance

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

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

Tennessee Board of Regents. (2015). *Approval of Academic Programs, Units, and Modifications*. Nashville, TN: Tennessee Board of Regents. Retrieved from https://policies.tbr.edu/policies/approval-academic-programs-units-and-modifications

Tennessee Higher Education Commission. (2016). *Profiles and Trends in Tennessee Higher Education*. Nashville, TN: Tennessee Higher Education Commission. Retrieved from https://www.tn.gov/assets/entities/thec/attachments/Profiles-Trends-2016.pdf

Tennessee Higher Education Commission. (2017). *Formula Weighted Outcomes Calculation*. Nashville, TN: Tennessee Higher Education Commission. Retrieved from https://www.tn.gov/thec/article/2015-20-funding-formula

Tinto, V. (2012). *Completing College: Rethinking Institutional Action.* Chicago, IL: University of Chicago Press.

Titus, M. A. (2009). The production of bachelor's degrees and financial aspects of state higher education policy: A dynamic analysis. *The Journal of Higher Education*, *80*(4), 439–468.

Volkwein, J. F., & Tandberg, D. A. (2008). Measuring up: Examining the connections among state structural characteristics, regulatory practices, and performance. *Research in Higher Education*, *49*(2), 180–197.

Wachter, R. M., Flanders, S. A., Fee, C., & Pronovost, P. J. (2008). Public Reporting of Antibiotic Timing in Patients with Pneumonia: Lessons from a Flawed Performance Measure. *Annals of Internal Medicine*, *149*(1), 29–32.

Welker, J. A., Huston, M., & McCue, J. D. (2008). Antibiotic timing and errors in diagnosing pneumonia. *Archives of Internal Medicine*, *168*(4), 351–356.

Werner, R. M., & Asch, D. A. (2005). The unintended consequences of publicly reporting quality information. *Journal of the American Medical Association*, *293*(10), 1239–1244.

Werner, R. M., Kolstad, J. T., Stuart, E. A., & Polsky, D. (2011). The effect of pay-for-performance in hospitals: lessons for quality improvement. *Health Affairs*, *30*(4), 690–698.

Wittman, M. D. (2014). Public funding of airport incentives in the United States: The efficacy of the Small Community Air Service Development Grant program. *Transport Policy*, *35*, 220–228.

Wood, B.D. & Waterman, R. W. (1994). *Bureaucratic Dynamics: The Role of Bureaucracy in a Democracy*. Boulder, CA: Westview Press.

Zumeta, W., & Li, A. Y. (2016). *Assessing the underpinnings of performance funding 2.0: Will this dog hunt*. New York, NY: TIAA Institute. Retrieved from https://www.tiaainstitute.org/sites/default/files/presentations/2017-02/ti_assessing_the_underpinnings_of_performance_funding_2.pdf

End Notes:

[i] Some reports claim Tennessee allocates 100% of its funding according to performance, but technically 15% of state funds are appropriated based on campus' fixed costs and the Quality Assurance program funds (TN SB NO. 7006, 2010; Dougherty, Natow, Jones et al., 2013).

Table 1:

Means (standard deviations) of variables used in analysis, pooled 2005-2014

	Two-year colleges			Four-year colleges		
	OH	TN	US	OH	TN	US
Certificates awarded	328.7	293.5	390.9	-	-	-
	(517.3)	(392.9)	(491.7)			
Associates degrees awarded	758.5	618.4	621.9	-	-	-
	(611.7)	(217.5)	(589.4)			
Bachelor's degrees awarded	-	-	-	2176.2	2100	2004.2
				(2400.3)	(1152.0)	(1902.7)
FTE enrollment (logged)	8.1	8.3	8	8.7	9.2	8.8
	(0.9)	(0.4)	(0.9)	(1.2)	(0.4)	(0.9)
Percent enrolled part-time	57.1	51.6	57.8	19	17	21
	(11.0)	(6.1)	(13.1)	(11.3)	(6.6)	(14.6)
Percent white enrollment	79.5	78.1	61.1	75	68.4	62.1
	(11.5)	(16.1)	(23.5)	(19.1)	(21.4)	(24.7)
Tuition and fees (logged)	8.2	8.1	7.9	9	8.7	8.7
	(0.1)	(0.1)	(0.6)	(0.3)	(0.2)	(0.4)
Operating cost per FTE (logged)	8.7	8.1	8.4	9.6	9.4	9.6
	(0.3)	(0.2)	(0.5)	(0.7)	(0.6)	(0.7)
Share of operating cost from state	68	94.5	73.9	40.1	61.3	56.2
	(16.6)	(12.4)	(29.6)	(15.5)	(16.8)	(26.9)
County unemployment rate	7.7	7.3	7.2	7.5	7	6.6
	(2.2)	(2.3)	(2.9)	(2.0)	(2.1)	(2.5)
Institutions	20	13	806	19	9	472

Figure 1:

Trends in average degree completion pre and post policy adoption

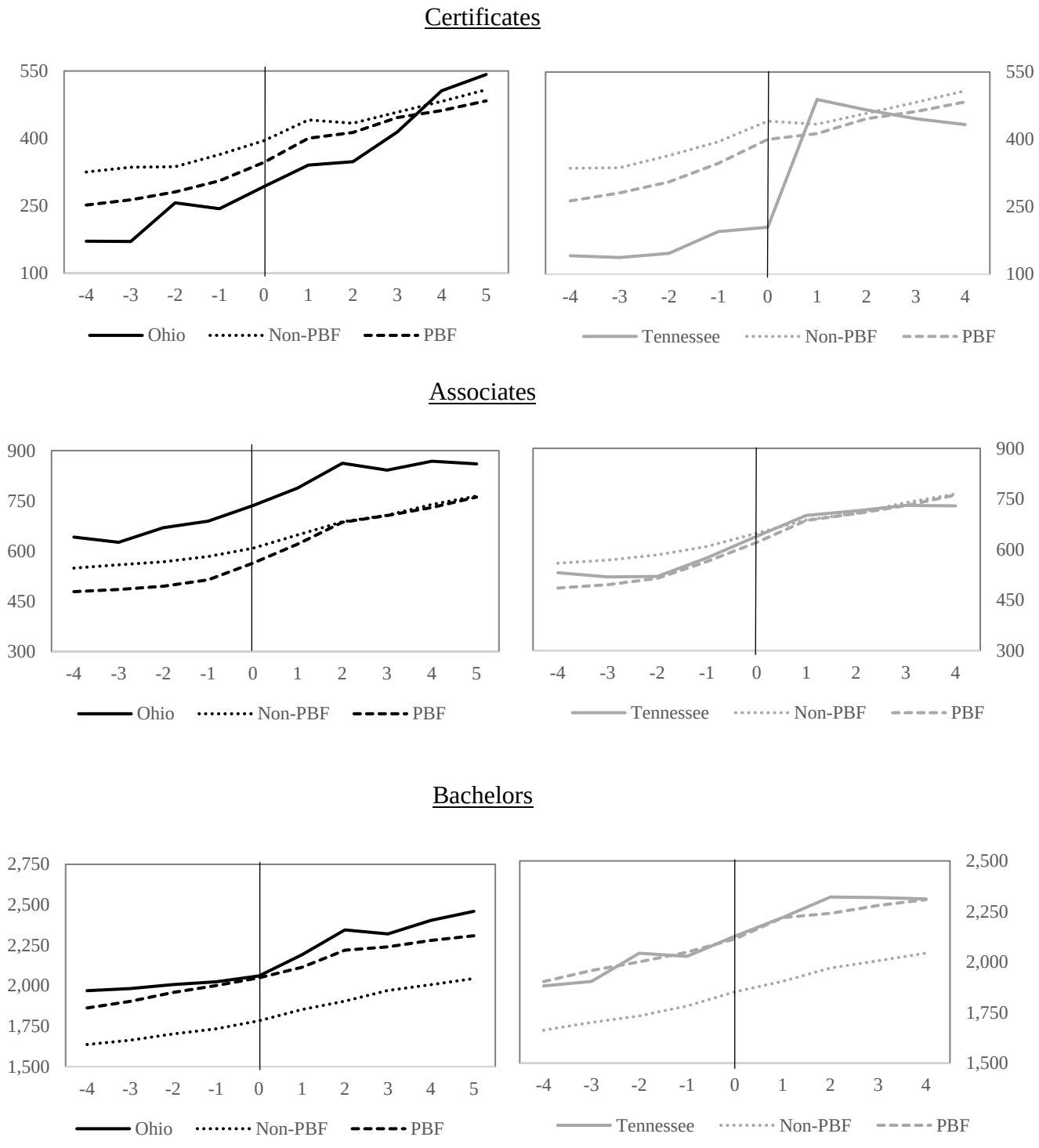

Table 2:

Effects of performance funding on certificate production among two-year colleges

	Ohio			Tennessee		
	Region	Non-PBF	PBF	Region	Non-PBF	PBF
Treat x Post	0.322**	0.199	-0.042	0.749***	0.854***	0.610**
	(0.116)	(0.117)	(0.114)	(0.176)	(0.179)	(0.187)
Year in Operation						
0	0.030	-0.027	-0.127	0.06	0.142	-0.008
	(0.093)	(0.079)	(0.085)	(0.125)	(0.121)	(0.128)
1	0.153	0.080	-0.038	0.915***	0.994***	0.805***
	(0.111)	(0.101)	(0.105)	(0.200)	(0.199)	(0.209)
2	0.210	0.112	-0.076	1.037***	1.105***	0.813**
	(0.118)	(0.115)	(0.120)	(0.240)	(0.234)	(0.247)
3	0.285	0.163	-0.18	0.963***	1.025***	0.747**
	(0.193)	(0.182)	(0.188)	(0.231)	(0.227)	(0.234)
4	0.570**	0.434*	0.090	0.952***	1.052***	0.758**
	(0.214)	(0.219)	(0.223)	(0.256)	(0.250)	(0.254)
5	0.626**	0.495*	0.130	-	-	-
	(0.201)	(0.215)	(0.222)	-	-	-
Observations	950	4140	1510	1080	4050	1420
Institutions	95	414	151	108	405	142
Institution fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
State time trend	yes	yes	yes	yes	yes	yes
Controls	yes	yes	yes	yes	yes	yes
R^2 (treat x post)	0.15	0.18	0.32	0.37	0.21	0.40

*Note: Clustered standard errors in parentheses, p-value: ***<0.001, **<0.01, *<.05*

Table 3:

Effects of performance funding on associates degree production among two-year colleges

	Ohio			Tennessee		
	Region	Non-PBF	PBF	Region	Non-PBF	PBF
Treat x Post	-0.054	-0.028	-0.162***	-0.035	0.042	-0.122***
	(0.033)	(0.027)	(0.026)	(0.043)	(0.028)	(0.033)
Year in Operation						
0	-0.075*	-0.042	-0.097**	-0.039	0.011	-0.069*
	(0.036)	(0.028)	(0.031)	(0.039)	(0.024)	(0.027)
1	-0.102**	-0.057*	-0.095***	-0.029	0.049*	-0.082**
	(0.033)	(0.029)	(0.026)	(0.039)	(0.024)	(0.028)
2	-0.048	-0.017	-0.115***	-0.024	0.047	-0.128**
	(0.033)	(0.027)	(0.025)	(0.049)	(0.033)	(0.042)
3	-0.036	-0.008	-0.186***	-0.025	0.069	-0.151**
	(0.041)	(0.036)	(0.035)	(0.058)	(0.039)	(0.050)
4	-0.057	-0.018	-0.253***	-0.063	0.038	-0.192***
	(0.049)	(0.044)	(0.046)	(0.065)	(0.044)	(0.051)
5	-0.023	-0.026	-0.280***	-	-	-
	(0.051)	(0.043)	(0.047)	-	-	-
Observations	960	4280	1530	1160	4210	1460
Institutions	96	428	153	116	421	146
Institution fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
State time trend	yes	yes	yes	yes	yes	yes
Controls	yes	yes	yes	yes	yes	yes
R^2 (treat x post)	0.53	0.51	0.66	0.57	0.51	0.67

*Note: Clustered standard errors in parentheses, p-value: ***<0.001, **<0.01, *<.05*

Table 4:

Effects of performance funding on bachelors degree production among four-year colleges

	Ohio			Tennessee		
	Region	Non-PBF	PBF	Region	Non-PBF	PBF
Treat x Post	0.036	-0.013	0.001	0.019	-0.014	0.033
	(0.052)	(0.054)	(0.053)	(0.029)	(0.024)	(0.028)
Year in Operation						
0	-0.024	-0.071*	-0.040	0.019	-0.021	0.021
	(0.028)	(0.031)	(0.023)	(0.021)	(0.016)	(0.018)
1	-0.048	-0.099**	-0.040	-0.001	-0.029	0.002
	(0.051)	(0.032)	(0.033)	(0.026)	(0.021)	(0.021)
2	0.001	-0.021	-0.018	0.06	0.022	0.064*
	(0.040)	(0.038)	(0.040)	(0.031)	(0.022)	(0.030)
3	-0.013	-0.02	-0.016	0.012	-0.013	0.048
	(0.087)	(0.100)	(0.115)	(0.050)	(0.043)	(0.050)
4	0.079	0.047	0.063	0.013	-0.027	0.041
	(0.069)	(0.087)	(0.103)	(0.047)	(0.039)	(0.044)
5	0.113	0.100	0.106	-	-	-
	(0.079)	(0.093)	(0.105)	-	-	-
Observations	630	2730	800	790	2630	700
Institutions	63	273	80	79	263	70
Institution fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
State time trend	yes	yes	yes	yes	yes	yes
Controls	yes	yes	yes	yes	yes	yes
R^2 (treat x post)	0.33	0.47	0.36	0.55	0.54	0.63

*Note: Clustered standard errors in parentheses, p-value: ***<0.001, **<0.01, *<.05*