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Tuition-Setting Authority and Broad-Based Merit Aid: The Effect of Policy Intersection on Pricing Strategies

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Abstract The notion of merit-aid is not a new development in higher education. Although previous researchers have demonstrated the impact of state-adopted merit-aid funding on student decision-making, fewer studies have examined institutional pricing responses to broad-based merit-aid policies. Using a generalized difference-in-difference approach, we extend previous empirical work by examining the impact of merit-aid on institutional pricing strategies while considering both the institution's tuition-setting authority and the relative strength of the merit-aid program. In this study, we find that colleges and universities with the authority to set their own tuition increased their in-state tuition and fees following broad-based merit-aid policy adoption; however, institutions with state-controlled tuition-setting authority respond to broad-based merit-aid policies by lowering their in-state tuition and fees. Our findings suggest that the incentives and dynamics of each state's policy environment are significant determinants of institutional responses to state-level policy adoptions.

Keywords Merit aid · Tuition decentralization · Pricing strategy · Policy interaction · Higher education finance · Financial aid

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Introduction

The notion of merit aid is not a new development in higher education. For many decades, private colleges and universities have used merit-based scholarships to recruit students with impressive grade point averages, standardized test scores, and other academic credentials (Geiger 2004). More recently, states have begun awarding merit-aid funding to public colleges and universities to incentivize high-achieving students to attend in-state institutions[1] (Zhang and Ness 2010) and prevent the migration of talented individuals to another state's workforce after college graduation (Heller 2002; Zhang and Ness 2010). Unlike need-based financial aid administered by the federal government, merit aid administered by the state does not appear to be focused on improving access for underprivileged students. Several scholars have contended that merit-based aid may be misplacing state resources by offering financial advantages to already-advantaged students who would have attended college in any event (Heller and Marin 2004; Baum and Lapovsky 2006).

Despite the well-documented criticisms of merit-based aid, previous studies have shown that merit-aid programs typically achieve their stated goals of increasing in-state enrollment (Dynarski 2002; Cornwell et al. 2006) and preventing talented students from pursuing higher education elsewhere (Zhang and Ness 2010). Less attention, however, has been paid to institutional pricing responses to merit-aid adoption.[2] Much of the literature on merit-aid policies has focused solely on the state of Georgia[3] (e.g., Bradbury and Campbell 2003; Cornwell et al. 2006; Long 2004), but additional studies are needed to offer a cross-state approach and examine whether institutional pricing responses to state-level merit-aid adoption can be explained by external factors. For example, public universities in most states do not have the unilateral authority to increase their in-state tuition (Zinth and Smith 2012), and the proportion of higher education funding allocated for merit-aid initiatives varies widely across states (Heller 2004).

Drawing on the Bennett Hypothesis (Bennett 1987) and building on prior merit-aid program typologies (Delaney and Ness 2013; Sjoquist and Winters 2015), we examined the effect of the intersection between broad-based[4] merit-aid program adoption and tuition-setting authority to address the following research questions: (1) to what extent does the adoption of a broad-based merit-aid policy impact pricing strategies (tuition-setting) at public 4-year institutions, and (2) to what extent are these strategic pricing responses to broad-based merit-aid policies impacted by the level of institutional autonomy to set their own tuition and fees?

In this study, we find concentrated increases for in-state tuition and fees among merit-aid adopting states with decentralized tuition-setting authority, but we show decreases for in-state tuition and fees among merit-aid adopting states with centralized tuition-setting authority. Our findings, which focus solely on states that adopt broad-based merit-aid policies with sizeable student subsidies and a large scope of student participants, offer

[1] Between 1993 and 2005, 14 states have offered merit aid to high-achieving resident students.

[2] Long (2004) found that four-year institutions throughout Georgia increased their costs for attendance after the adoption of Georgia's state-level merit-aid policy and effectively diluted the benefit of merit-aid. This study extends Long's work in several substantive ways, as outlined in this paper.

[3] Zhang (2011) and Zhang et al. (2013) include Florida in their analyses of the effect of merit-aid policies in higher education.

[4] As we discuss later, we define broad-based merit-aid as merit-aid policies that have large per-FTE subsidies and cover a substantial proportion of students enrolled at public 4-year institutions.

several implications for theory and policy. First, we find that the adoption of a broad-based merit-aid policy significantly impacts tuition-setting at public 4-year institutions. Second, the strategic pricing response is dependent on the agent with tuition-setting authority within a state. Our results demonstrate the importance of considering the environmental context when evaluating broad-based, state-level policy adoption.

Literature Review

Prior Research on Merit-Aid Policies

Given the increased interest in merit aid throughout higher education (Creech 1998), numerous researchers have attempted to quantify the benefits of state-adopted merit-aid programs. Previous studies evaluating the effects of merit-aid programs have isolated the effects of single-state adoption (e.g., Georgia's HOPE scholarship) rather than studying the impact of merit-aid policies across state contexts (Zhang and Ness 2010). Several scholars have found that merit-aid programs increase institutional prestige (Dynarski 2004), incentivize in-state postsecondary enrollment (Dynarski 2002; Hu et al. 2012), and prevent talented students from leaving the state to pursue higher education elsewhere (Dynarski 2004; Cornwell et al. 2006; Zhang and Ness 2010).

Dynarski (2004) observed a significant increase in the likelihood for Georgia residents to attend a postsecondary institution after policy adoption and noted a shift in enrollment toward elite 4-year institutions. Cornwell et al. (2006) found that the adoption of the Georgia HOPE scholarship program produced a 5.9% increase in statewide postsecondary enrollment as well as a similar shift in enrollment toward elite institutions. In addition, Zhang and Ness (2010) reported that the adoption of the Georgia HOPE scholarship program prevented talented students from attending college outside of the state of Georgia.

Scholars have also examined merit-aid programs in other individual states. Scott-Clayton (2011) evaluated West Virginia's PROMISE program and noted positive enrollment and completion effects related to accessing merit-aid funding. Bruce and Carruthers (2014) observed impacts associated with the Tennessee HOPE scholarship and found that resident students who meet the merit-aid requirements substitute away from community colleges in favor of 4-year institutions. Cohodes and Goodman (2014) noted that Massachusetts' Adams scholarship created an incentive for students to enroll at less prestigious in-state institutions rather than out-of-state institutions and ultimately decreased the probability that those students will graduate. Bettinger et al. (2016)found a positive relationship between long-term earnings and participation in California's Cal Grant, but the effect of the merit-aid program is concentrated among students at prestigious institutions who would have likely attended college in the absence of merit-aid awards. Finally, Harrington et al. (2016) discovered that effects of merit-aid policies—referring to Missouri's Bright flight program—also influenced participation in the labor market. Specifically, they found that participating in this program significantly increased the likelihood that graduates would remain within Missouri's labor force after graduation.

Similarly, critics have argued that merit-aid programs are regressive in nature and provide subsidies to students who would have attended college regardless, and merit-aid programs may actually reduce available funds for low-income and needier students (Creech 1998; Dynarski 2004; Heller and Rasmussen 2001). Heller and Rogers (2006) found that historically underrepresented students are the least likely to receive benefits

from state-adopted merit-aid programs, and that merit-aid actually increased postsecondary enrollment gaps between advantaged and disadvantaged students (Heller 2002). However, other research suggests that the benefits of merit-aid programs outweigh the costs for both students and the participating states (Doyle 2006; Dynarski 2000; Long 2004).

While the literature on student-based responses to merit-aid is extensive, few scholars have examined institutional or legislative responses to merit-aid adoption. Doyle (2010) examined the interplay between state-adopted merit-aid programs and state support for need-based aid and concluded that merit-aid programs produce no observable effect; need-based aid has changed incrementally within merit-aid states. Singell Jr et al. (2006) also found that merit-aid policy adoption is associated with accessing additional federal Pell Grant aid. However, McLendon et al. (2014) noted an inverse relationship between merit-aid spending and state appropriations, finding that increases in merit-aid expenditures were associated with declines in state appropriations. Finally, Griffith (2011) found that the adoption of a merit-aid policy significantly altered the admissions process at higher education institutions, as merit-aid adoption was associated with decreases in low-income and minority student enrollment particularly at selective public 4-year institutions.

Prior Literature on Postsecondary Pricing Strategies

Previous researchers have explored the forces associated with changes in tuition, but this is a challenging area of higher education scholarship. Hauptman (1990) claimed that there is "no overarching explanation" for understanding tuition and fee increases and labeled tuition-setting practices as the "tuition dilemma" (p. vii). Other researchers have referred to similar misunderstandings as the "tuition puzzle" (Wellman 1999), the "paradox of college tuition" (Heller 2001), and "the paradox of college prices" (Mumper 2001). Various empirical studies have examined the potential for irrational behavior by tuition-setting agents. Rothschild and White (1995) argue that, contrary to core economic theories, colleges and universities do not engage in the maximization of net revenues and thereby act inconsistently with what they described as a set of competitive equilibrium predictors. Hoxby (1997) extended prior work to describe the role of peer effects and information asymmetries when explaining variations in the higher education marketplace. However, a growing body of literature has focused upon the influence of the political environment (Doyle 2012), economic conditions (Paulsen 1991), and the external stakeholders (Doyle 2012) on tuition-setting practices.

Earlier work by Rusk and Leslie (1978) and St. John (1992) found that individual state conditions and decisions relating to state appropriations have a direct impact on tuition and fees for both in-state and out-of-state students. Paulsen (1991) noted that tuition and fee levels are negatively related to enrollment levels, grants, and state appropriations. Titus et al. (2015) discussed institutional pressures to enroll out-of-state students to increase tuition-based revenues and demonstrated that out-of-state, non-resident tuition levels are converging at a national average. Finally, Doyle (2012) found that the ideological positions of state policymakers play an important role in tuition-setting decisions—for both in-state and out-of-state students.

A smaller literature base on tuition-pricing strategies includes analyses of state higher education governance structures (McLendon et al. 2013) and the potential impacts of statewide environmental pressures (Hoxby 1997). Previous studies have found little evidence connecting autonomous postsecondary governance structures with increases in tuition and fees (Rizzo and Ehrenberg 2004; McLendon et al. 2013). Additionally, public 4-year institutions that have the authority to set their own tuition and fees typically increase

their total costs more than comparable institutions whose tuition-setting authority rests with a state agency (Lowry 2001), particularly among public doctoral institutions that enroll the largest number of students (Lyall and Sell 2006). Breneman and Finney (1997) described an indirect relationship between decentralization and price, as states that provided tuition-setting authority to their public 4-year institutions often reduced their overall public funding for higher education, which may facilitate increases in tuition and fees to replace lost revenues in state-level support.

Intersection of Financial Aid Policies and Tuition and Fees

The majority of previous scholarship on institutional pricing strategies has focused on institutional responses to state and federal financial aid programs (Curs and Dar 2010; Singell and Stone 2007) and declining state appropriations (Hearn et al. 1996; McLendon et al. 2013; Rizzo and Ehrenberg 2004). Turner (2012) found that institutions did not raise tuition and fees relative to increases in state aid, but colleges and universities did reduce the amount of institutional aid to students as a result. Rizzo and Ehrenberg (2004) found no relationship between increases in state-administrated aid and increases in either in-state or out-of-state tuition at public institutions. Lan and Winters (2011) also found no evidence that enrolling students with state-based financial aid packages increased the tuition and fees for out-of-state students.

While there is a growing literature base connecting state aid programs and pricing strategies, a larger body of literature connects federal financial aid programs with institutional pricing responses. Curs and Dar (2010) reported that need-based aid (e.g., Pell Grant) increases led to increases in net price and a decrease in average institutional discounts. Additional studies have shown that public 4-year institutions (and state flagships) increased their tuition in response to increases in need-based aid (Rizzo and Ehrenberg 2004). Singell and Stone (2007) found that responses to increases in federal student aid amounted to an almost one-to-one increase in out-of-state tuition at private institutions and public 4-year colleges and universities. In other words, the authors suggested that every dollar increase in federal aid was linked to a nearly one-dollar increase in tuition and fees. However, this relationship did not hold for in-state tuition and fees at public 4-year institutions. Cellini and Goldin (2014) noted a similar one-to-one relationship between federal aid and tuition setting at for-profit institutions. Finally, Turner (2012) found that federal tax-based incentives and aid packages do little to decrease the cost of attendance for enrolling students.

Although the majority of the literature on both state and federal programs has focused on need-based aid programs, far less is known regarding the connection between merit-based financial aid and institutional pricing strategies. Studies examining the connection between merit-based aid and tuition-setting practices is primarily limited to prior work by Dynarski (2004) and Long (2004), who analyzed the impact of the adoption of the Georgia HOPE scholarship program on tuition and fees. Dynarski (2004) found evidence of tuition increases following merit-aid adoption. Long (2004) found that public institutions did not appear to have the legislative flexibility to raise tuition, but these institutions raised other non-mandatory fees for students (e.g., room and board). Specifically, Long reported that public institutions "recouped 10 percent of the value of the scholarship by raising room and board fees" (p. 1053), finding that institutions with the largest number of merit-aid recipients responded with proportionally larger increases in other non-mandatory fees. Our study extends previous work by examining multiple adoptions of merit-aid policies and considering tuition-setting authority to examine institutional pricing strategies.

The Bennett Hypothesis

In 1987, the United States Secretary of Education at the time, William Bennett, argued that "increases in financial aid in recent years have enabled colleges and universities blithely to raise their tuitions, confident that Federal loan subsidies would help cushion the increase" (Bennett 1987). Although Bennett was only referencing the impact of federal loan subsidies on increases in tuition, the Bennett Hypothesis can also be used to better understand the relationship between state-level merit aid and tuition increases by colleges and universities. The underlying logic of the Bennett Hypothesis suggests that increases in financial aid lead to increases in student demand for enrollment. Colleges and universities subsequently respond to this increased demand by raising their tuition to offset any increases in financial aid. This institutional response appears to be rational in a competitive environment but antithetical to the intent of financial aid policies crafted to improve access and affordability in higher education. However, the Bennett Hypothesis can only be used to explain pricing responses at colleges and universities that have tuition-setting authority. If tuition-setting authority belongs to the state and not the individual institution, the Bennett Hypothesis cannot be used to explain tuition responses.

Our review of empirical studies on merit-aid in higher education reveals several areas in which this paper advances scholarship. First, this study adds to both the merit-aid and policy adoption literature bases by examining the intersection between state-funded merit-aid policies and tuition-setting authority when examining institutional pricing responses. Previous studies exploring the topic of institutional responses to changes in state-level financial aid have yet to consider whether the individual institutions or the state have the authority to set prices. Second, this paper will consider the relative strength of the state-level merit-aid policy as a contributing factor for strategic pricing responses post merit-aid adoption. Given that the proportion of higher education funding allocated toward merit-aid initiatives varies widely across states (Heller 2004), this study focuses only on the merit-aid programs that provide full in-state tuition and fee subsidies to qualified students or that have been classified as broad-based merit-aid programs (see Table 1).[5]

Hypotheses

Hypothesis #1 For institutions with tuition-setting authority, the adoption of a broad-based merit-aid policy will lead to significant increases in their published tuition and fees.

Building on the tenets of the Bennett Hypothesis, we hypothesize that colleges and universities that receive broad-based merit-aid funding and have the authority to set their own tuition and fees will respond by increasing their tuition and fees. As reflected in previous work by Ehrenberg (2002), who found that institutions increase their tuition and fees as a proportional response to increases in federal aid, we speculate that institutions will do the same in response to the subsidies provided by a broad-based merit-aid policy.

Hypothesis #2 For institutions located within a state that possesses a centralized tuition-setting authority, the adoption of a broad merit-aid policy will lead to significant decreases in their published tuition and fees.

[5] We follow the prior work of Delaney and Ness (2013) and Sjoquist and Winters (2015) to identify the broad-based merit-aid policies for this study. A more detailed description of how policies were identified can be found in the methods section of this manuscript.

Table 1 Merit-aid adopting states *Sources* Dynarski (2004), Delaney and Ness (2013), Heller (2004), Hawley and Rork (2013), Sjoquist and Winters (2015), the Brookings Institution, and state agency web sites

State	Program name	Year of implementation (removal)
Broad-based merit-aid programs		
Georgia	Georgia HOPE scholarship	1993
Florida	Florida bright futures scholarship	1997
New Mexico	New Mexico lottery success scholarship	1997
Louisiana	Louisiana TOPS scholarship	1998
South Carolina	South Carolina LIFE scholarship	1998
Kentucky	Kentucky educational excellence scholarship	2000
Nevada	Nevada millennium scholarship	2000
West Virginia	West Virginia PROMISE scholarship	2002
Tennessee	Tennessee HOPE scholarship	2005
Narrow merit-aid programs		
Alaska	Alaska scholars	1999
Arkansas	Arkansas academic challenge scholarship	1991
Idaho	Robert R. Lee PROMISE scholarship	2001
Illinois	Illinois merit recognition scholarship	1999 (2004)
Maryland	Maryland HOPE scholarship	2002 (2005)
Michigan	Michigan Merit & PROMISE scholarship	2000 (2008)
Mississippi	Mississippi TAG and ESG	1996
Missouri	Missouri bright flight scholarship	1997
New Jersey	New Jersey OSRP (STARS)	1997 (2004)
New York	NY scholarships for academic excellence	1997
Oklahoma	Oklahoma PROMISE scholarship	1996
South Dakota	South Dakota opportunity scholarship	2004
Washington	Washington PROMISE scholarship	1999 (2006)

Scholarships programs within California, Indiana, Massachusetts, North Dakota, Utah, and Wyoming were not included as merit-aid programs because the states did not report undergraduate student aid program expenditures based solely on merit within 2009 NASSGAP survey

While the Bennett Hypothesis can explain institutional pricing responses to changes in financial aid, states operate under different financial pressures than colleges and universities (Ringquist and Garand 1999). More specifically, states face political constraints in which external stakeholders pressure state legislators to minimize the price of higher education for their constituents (Mumper 2001). Long (2004) analyzed institutional fiscal responses within the state of Georgia, a centralized tuition-setting state, and found that the adoption of a merit-aid policy led to decreases in in-state tuition and fees. Because Georgia

implemented a broad-based merit-aid policy (Dynarski 2004), we expect to produce similar results for states that possess a centralized tuition-setting authority.

Hypothesis #3 Increases in tuition and fees in response to merit-aid policy adoption will be concentrated primarily within in-state tuition and fees.

Given Hypotheses #1 and #2, we also hypothesize that the effect of broad-based merit-aid policy adoption will be concentrated within in-state, and not out-of-state, tuition and fees. The merit-aid policies examined are intended to benefit in-state students and do not provide subsidies to out-of-state students (Heller 2002). Following the logic of the Bennett Hypothesis, any policy-related increases in price would likely focus on the student populations receiving the increased financial aid (Bennett 1987).

Data and Methods

Data Sources and Variables

To examine the role of merit-aid policies in institutional pricing strategies, we created a unique institution-level panel dataset from numerous sources. This study began with 573 Title IV–participating public 4-year institutions, but we removed 73 institutions[6] that were not in existence during the full period of our analytical sample (1988–2009) and 15 institutions missing key information.[7] Our final sample includes 450 public four-year universities.[8] In line with recommendations outlined by Jaquette and Parra (2014), we created a panel dataset using the integrated postsecondary education data system (IPEDS) and state-level information from a variety of prior studies. Data pertaining to in-state and out-of-state tuition became available in 1988, and data from Tandberg (2013) on the state-level coordination of higher education was collected until 2009, which explains the time period of our analytical sample (1988–2009). This period coincides with the rising popularity of merit-aid adoption, which began in 1993 with the Georgia HOPE scholarship and concluded with a Massachusetts program in 2005 (Cohodes and Goodman 2014).

Dependent Variables

Given that previous researchers have established a relationship between state-adopted merit-aid programs and both student enrollment and persistence (Henry et al. 2004), we aim to examine institutional pricing responses to the adoption of state-funded merit-aid programs by addressing both (1) in-state tuition and fees (inflation-adjusted and logged), and (2) out-of-state tuition and fees (inflation-adjusted and logged). Meyer (1995) argued that estimates can be sensitive to the selected functional form. Specifically, Meyer suggested that, in certain cases, estimates can actually change their sign if a nonlinear

[6] The majority of institutions removed were community colleges that were reclassified as public 4-year institutions due to their awarding of bachelor's degrees. See Fulton (2015) for information on states implementing community college baccalaureate policies during our analytical period.

[7] Missing data were concentrated primarily in institutions that have zero tuition reliance (i.e., service academies) and public 4-year institutions that reported no state appropriation revenue or FTE enrollment in a given year.

[8] We omitted private institutions from our analysis because not all state merit-aid programs provide incentives for enrollment at private 4-year institutions. All state-adopted merit-aid programs provide financial support to qualified in-state students attending a public 4-year institution.

transformation, such as a logged transformation, is applied to the dependent variable. To account for this potential limitation, we ran model specifications that include our dependent variables in current and constant dollars. Results from these tests indicate that they are not dependent on our functional form choice, so we follow the recommendation of Wooldridge (2009) and log transform our dependent variables for efficiency and ease of interpretation.

Our selection of published in-state and out-of-state tuition and fees, rather than net tuition revenue, is purposeful. Given our research questions, we are primarily interested in the ways in which broad-based merit-aid policies may change the public signals of pricing (published tuition and fees) rather than the actual amount the average student pays. Additionally, prior literature has demonstrated that merit-aid policy adoption is linked to changes in institutional grant aid and discounting (Griffith 2011). Using published tuition and fees allows us to examine pricing strategies independently of changes in institutional aid relative to broad-based merit-aid policy adoption. Finally, current data limitations do not allow us to analyze differences in net costs for in-state or out-of-state students.

Control Variables

We also include a series of covariates within the generalized difference-in-differences model to ensure appropriate comparisons among institutions. While these control variables are not listed within the results tables—due to space limitations—we present a complete list of summary statistics in Table 2 and provide complete point estimates for each covariate within our models in Appendix A. We control for state economic characteristics, such as per capita income, state unemployment rate, and the state gross domestic product. Additionally, we account for the institution's size, the proportion of undergraduate students, and the level of institutional expenditures for education-related activities. We also include an institution and year fixed effects to account for unobserved heterogeneity and any impacts due to year-specific factors.

To determine the impact of the covariates, we have run the model without the presence of any control variables. The addition of the vector of controls increases the explanatory power of the analysis while not increasing the bias in parameter estimates. Previous models included a larger subset of institutional and state-level controls; however, these inclusions introduced redundancy into the model and did not significantly impact the results. In pursuit of a more efficient and parsimonious model, we have opted to include only the controls outlined previously.

Merit-Aid Adoption Identification

Table 1 provides each state that adopted a merit-aid policy and shows the first year of policy implementation. Merit-aid policies are not homogenous as many of the merit-aid programs include differences in the level of financial support provided, initial student eligibility requirements, and length of scholarships (Delaney and Ness 2013).

To address many of these distinctions across programs, we use the classification provided by previous scholarship (Dynarski 2004; Delaney and Ness 2013; Heller 2004; Sjoquist and Winters 2015) on the relative strength of the merit-aid program. Given the number of students receiving subsidies from merit-aid programs, the classification of the merit-aid adopting states is not always consistent. To this end, we collected a holistic list of states that have each been identified as a merit-aid adopter by reviewing both state policy documents and empirical literature. Next, we took our initial list of state-adopted merit-aid

Table 2 Mean (SD) of key outcomes and covariates

	Strong merit-aid adopters	Non-adopters controls			
		National	Regional	Border states	IPW control
Dependent variables (outcomes)					
In-state tuition and fees (constant dollars)	2134.62 (1536.95)	2697.07 (1961.16)	2268.15 (1641.33)	2555.76 (1914.01)	2573.37 (1845.95)
Out-of-state tuition and fees (constant dollars)	6075.99 (4209.54)	6789.80 (4548.24)	6702.08 (4614.33)	6772.19 (4601.98)	6525.67 (4330.14)
State-level covariates (controls)					
State GDP (constant dollars)	137,593.80 (133,752.20)	262,589.70 (315,374.10)	296,840.80 (392,608.70)	298,311.60 (353,372.30)	261,308.90 (310,690.90)
State per capita income (constant dollars)	18,911.24 (8591.80)	21,847.68 (10,268.83)	20,996.13 (9949.38)	21,013.96 (9749.83)	21,525.74 (10,057.13)
State unemployment rate (%)	5.98 (1.71)	5.35 (1.43	5.53 (1.47)	5.52 (1.37)	5.35 (1.42)
State high school graduates (#)	47,097.08 (28,049.10)	91,769.86 (81,606.00)	103,155.70 (105,039.00)	107,399.80 (92,386.43)	92,506.31 (81,174.07)
Higher education coordinating board (%)	0.43 (0.49)	0.27 (0.44)	0.27 (0.45)	0.18 (0.38)	0.29 (0.46)
State expenditures need-based aid (constant dollars)	25,962.25 (47,842.99)	147,807.20 (214,030.60)	110,564.90 (194,536.50)	137,285.10 (188,283.00)	142,989.70 (207,512.10)
Governor democrat	0.59 (0.49)	0.46 (0.50)	0.49 (0.50)	0.49 (0.50)	0.46 (0.50)
Institutional-level covariates (controls)					
Tuition reliance (%)	23.09 (9.25)	25.71 (10.37)	22.86 (10.19)	25.27 (10.57)	24.6 (10.20)
State appropriations per FTE (constant dollars)	4533.15 (2762.93)	4619.89 (2600.19)	4869.87 (2724.84)	4630.20 (2525.92)	4878.87 (2791.36)
Total FTE enrollment (#)	9943.59 (9128.63)	11,371.01 (13,899.93)	10,851.05 (12,298.39)	11,664.93 (12,991.98)	10,914.98 (15,495.28)
Percentage of enrollment undergraduate (%)	85.26 (9.19)	84.19 (10.70)	83.26 (11.45)	83.41 (11.12)	83.96 (10.96)

programs and removed states that did not report any undergraduate student aid expenditures based solely on merit for the 2009 NASSGAP Survey—the final year of our analytical sample. This led to the exclusion of merit-aid programs in California, Indiana, Massachusetts, North Dakota, Utah, and Wyoming because these states did not report financial aid allocations based solely on merit criteria.[9]

Next, we borrowed the prior classification of Delaney and Ness (2013) and Sjoquist and Winters (2015) to identify our broad-based merit-aid policies. Both studies classified state-adopted merit-aid policies based on the relative size of the financial award and the scope of student participation in the merit-aid program. In order to be included as a state with a broad-based merit-aid policy, a state had to be listed as both a "large" merit-aid policy within Delaney and Ness (2013) work and a "strong" merit-aid policy within the work of Sjoquist and Winters (2015). Only the State of Michigan was listed within Delaney and Ness (2013) and not Sjoquist and Winters (2015).

Our decision to limit our sample to broad-based merit-aid programs was purposeful and rooted in the empirical literature (Fitzpatrick and Jones 2016; Sjoquist and Winters 2014, 2015). First, there is a considerable difference between broad-based and narrow merit-aid programs based on the number of students receiving the award. Additionally, the tuition-based subsidy provided to students within broad-based merit-aid programs is consistently large and has less variability than the subsidy within programs identified as narrow. The potential heterogeneity among all merit-aid policies is diminished when examining only those with large tuition subsidies and a significant number of participating students. To this end, we expect that possible tuition-setting responses will be more consistent with the subset of broad-based merit-aid programs than it would be with the universe of merit-aid adopters. Finally, the estimates reflecting the effect of broad-based merit-aid policies represent more conservative estimates. Given that we are capitalizing on the adoption of various state broad-based merit-aid policies, our treatment effects will be influences by the policy with the smallest subsidy and level of participation, thus under estimating the average effects of large broad-based programs such as the Georgia HOPE scholarship.

Tuition Decentralization

To further analyze the role of the policy environment when studying institutional pricing responses to merit-aid policy adoption, we have included an indicator for tuition-setting authority. Building on the work of Deaton (2006) and Warne (2008), we have used institutional information from the annual SHEEO Tuition and Financial Aid surveys. These surveys collect information on state tuition and fees and financial aid policies, as well as institutional authority to establish levels for tuition and fees. Within our sample and analytic time period, 19 states allocated tuition-setting authority to their individual institutions.

[9] The practice of using the NASSGAP Survey to identify merit-aid policy adopters is rooted within the academic literature. Specifically, Doyle (2006) used it to classify adopters for his event history analysis as well as Fitzpatrick and Jones (2012) in their analysis of multi-state merit-aid adoption on student migration. Additionally, none of these states met the criteria for broad-based merit-aid policies, and thus would not impact our point estimates.

Empirical Strategy

This study adapts methodological approaches used by Dynarski (2000), Long (2004), and Cornwell et al. (2006), each of whom used a combination of the traditional OLS fixed-effects regression parameters and a difference-in-differences (DiD) approach to study demand responses to merit-aid programs. Unlike previous work on merit-aid policy adoption, our study takes a national perspective and uses non-adopting states as the control group within the quasi-experimental model rather than limiting the analysis to a region. In addition, we test the pre- and post-adoption effects using a generalized DiD approach to allow the adoption period to vary by the individual state. This study, much like Long's (2004) prior analysis, expands the financial aid literature by considering the institution-level effects of merit-aid policies.

In a hypothetical setting where all states adopt a merit-aid program within a single year (single policy shock), we could have estimated the policy impact through a traditional difference-in-differences (DiD) approach:

$$Y_{it} = \alpha + \beta Treat_i + \gamma Year_{it} + \delta(Treat_i * Post_{it}) + \lambda X_{it} + \varepsilon_{st}. \quad (1)$$

The logic of a DiD approach is that casual estimates are generated by comparing the pre- and post-policy outcome means for both adopting and non-adopting states: Eq. 2. This assumption is predicated on the premise that adopters and non-adopters follow similar outcome trends prior to the adoption of a given policy and thus would follow similar trends if the policy had not been adopted. The results difference in the trend line post-adoption is our causal policy effect.

$$\delta_1 = \left(\gamma_{treatment(post)} - \gamma_{treatment(pre)}\right) - \left(\gamma_{control(post)} - \gamma_{control\,(pre)}\right) \quad (2)$$

However, we do not have a single year in which all broad-based merit-aid states adopted their policies simultaneously, and thus we need to implement an analytical strategy that accounts for variation in the adoption year. This study advances the merit-aid adoption literature by implementing a quasi-experimental framework that allows for a varying adoption period—a generalized difference-in-differences (GDiD). Following the work of Belasco et al. (2015), this study specifies a model that accounts for variations in the adoption year of the policy by implementing a two-way, fixed-effects model addressing both year and institutional fixed effects (Bertrand et al. 2004; Dynarski 2004).

$$Y_{it} = \delta_1 MA_{it} + \lambda X_{it} + \alpha S_i + \beta T_t + \varepsilon_{st} \quad (3)$$

where $\delta_1 MA_{it}$ is the coefficient of interest, which is equal to one in years in which the state has a merit-aid program and zero otherwise. λX_{it} is a vector of controls that includes both state and institutional economic and academic predictors. αS_i represents the institutional-level fixed effects, and βT_t indicates the year fixed effects. Finally, ε_{st} is the state-clustered robust standard error term. Since merit-aid policies are adopted at the state level, the decision to cluster standard errors at the state level seems to be appropriate and accounts for the state-level policy. In addition to clustering standard errors at the state level, we also ran model specifications that included corrections for serial correlations (Drukker 2003) and heteroskedasticity (Stock and Watson 2008). These corrections did not yield significant changes in the point estimates or significance levels. The inclusion of the state-clustered standard errors produce conservative estimates for our tests of significance.

We also examine the impact of the interaction of merit-aid adoption with tuition-setting authority. Prior research (Kim and Stange 2016; McLendon et al. 2013; Rizzo and Ehrenberg 2004) has established that institutions with authority over their own tuition and fee levels set significantly higher tuition levels; we hypothesize that institutions with tuition-setting authority will respond differently to merit-aid adoption than those without tuition-setting authority. To this end, we extend Eq. 4 to include both a dichotomous indicator for decentralized tuition-setting authority (TD_{st}) and the interaction between merit-aid adoption and decentralized tuition-setting authority ($MA_{st} * TD_{st}$). In this calculation, TD_{st} is equal to one when a given state provides tuition-setting authority to its individual institutions and each year thereafter and zero otherwise. Our interaction term ($MA_{st} * TD_{st}$) is equal to one when an institution is within a merit aid–adopting state that has also provided tuition-setting authority to institutions and zero otherwise. Our final estimation—Eq. 4—includes the same vector of state- and institution-level covariates as well as year and institution fixed effects.

$$Y_{it} = \delta_1 MA_{st} + \delta_2 TD_{st} + \delta_3 (MA_{st} * TD_{st}) + \lambda X_{it} + \alpha S_i + \beta T_t + \varepsilon_{st} \quad (4)$$

Robustness Checks

The difficulty of any quasi-experimental design is in the identification of the counterfactual in the absence of policy adoption. The use of a GDiD design allows this study to approximate the impact of non-adoption by using institutions in non-adopting states as controls. This produces estimates of what could have occurred within the outcomes if the merit-aid policy had not been adopted. The assumption of this counterfactual approach is that treatment and control units follow similar (or parallel) patterns pre-policy, and the resulting variations in the outcome can be attributed to policy adoption. While this assumption is difficult to test, this study has adopted two techniques to test and account for the parallel assumption. First, this study added institution- and state-specific trends to our set of covariates (Angrist and Pischke 2008). This inclusion controls for the potential that institutions in merit-aid adopting states may have experienced differences in the outcomes of interest prior to the adoption of a merit-aid policy. To do this, state and institutional trend variables were created by regressing dummy time variables for the years 1988–1993 (prior years in which no merit-aid policies were adopted) on each of the dependent variables and multiplying the resulting coefficient by the year to create a unique state- and institutional-trend variable.[10]

Control Groups

In addition to ensuring parallel trends prior to the adoption of a broad-based merit-aid policy, we ran models using four different comparison groups (Meyer 1995) to ensure that our estimates are not sensitive to the compositional effects of selecting institutions from non-adopting states. We describe each of our four comparison groups below.

Group 1: National Comparison (National) Our analysis begins with the most general control group—institutions within states that have not adopted a merit-aid policy—and then narrows down to states with pre-policy characteristics. Within the national

[10] Figure 1 provides the pre- and post-adoption trends for each of our identified broad-based merit-aid states. Across each of our identified adopters, institutions within merit-aid states followed similar pre-adoption trends compared to institutions in non-adopting states.

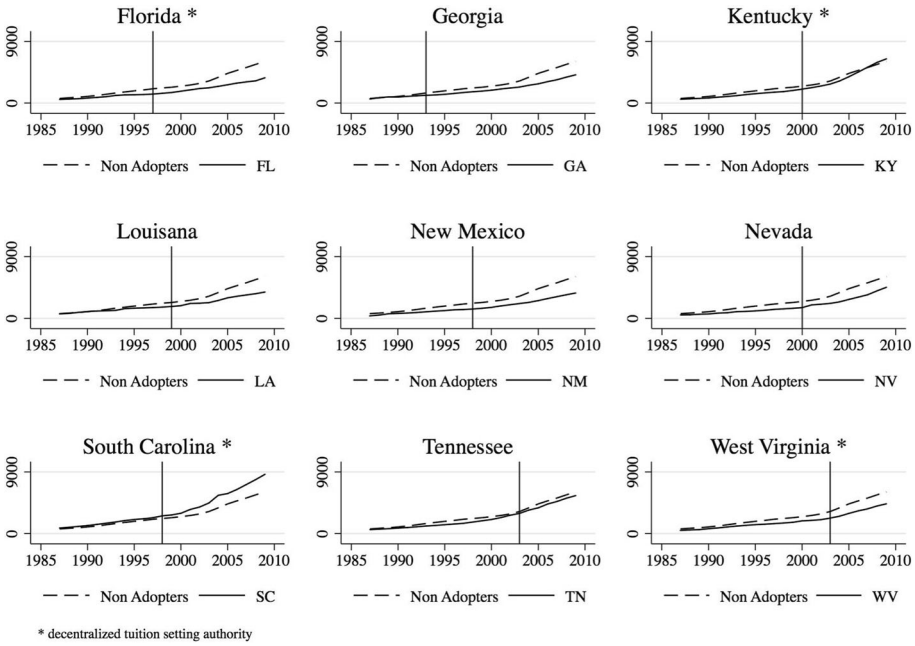

Fig. 1 In-state tuition and fee for strong merit-aid adopters and non-adopters pre and post adoption (constant dollars)

comparison, we include public 4-year institutions located within 41 non-adopting states. States identified in Table 1 as having narrow merit-aid policies are excluded from the analysis.[11] However, as a robustness check, we include states that adopted "narrow" merit-aid programs as additions to our control groups and achieve similar results.

Group 2: Regional Association (Region) In addition to using our non-adopting states as a control group, we limit our sample to regions where states have adopted merit-aid policies to account for any region-based tuition reciprocity agreements (DesJardins et al. 2006; Cornwell et al. 2006) or any other policy-relevant set of counterfactuals. In limiting our sample to regional association, our comparison group includes 186 distinct institutions from 20 non-adopting states, for a total of 4274 control observations.

Group 3: Border States (Border) As is common with difference-in-differences approaches, we use geographic boundaries to specify two of our control groups (Dynarski 2000; Zhang and Ness 2010). Specifically, we leverage geographic proximity to include states that share a physical border with adopting states. These "border states" also share similar demographics and regional characteristics as adopting states. Our border state comparison groups include 233 unique institutions from 19 non-adopting states, for a total of 5352 control observations.

Group 4: Pre-Policy Similar Institutions (Weighted) In addition to our geographically based control groups, we have created a control group of institutions that share pre-policy characteristics with institutions within non-adopting states. To construct each of the

[11] See our methodological discussion on how we used the prior work of Delaney and Ness (2013) and Sjoquist and Winters (2014) to classify the identified merit-aid policies.

additional samples, institutions are matched across treatment and control groups using data from 1992 (immediately prior to any state adopting a merit-aid policy). Specifically, we use inverse probability weighting on institutions in untreated states and estimate the probability of the treatment in 1992 by calculating a propensity score for each institution using state- and institution-level predictors. We use a logit model to predict the probability of adopting a merit-aid policy, specified as follows:

$$logit(meritaidstate = 1) = \beta_0 + \beta_1(x_i) + \beta_2(x_s) \quad (5)$$

where x_i represents a vector of individual values of predictors for institution-level covariates, and x_s represents a vector of individual values of predictors for state-level covariates on the likelihood of receiving treatment through a merit-aid policy. Shadish et al. (2008) stated that using multi-level covariates in a matching approach more closely approximates estimates from a randomized control trial, but it is not necessary to conduct a multi-level match to achieve balance.

After calculating the propensity scores, we generate weights to calculate the average treatment on treated (ATT) effect. We have chosen the ATT effect, rather than the average treatment effect (ATE), because we are primarily interested in estimating the impact of merit-aid adoption on those institutions within adopting states. In weighting ATT, treated units (institutions within adopting states) are given a weight equal to one, and control units are given a weight equal to $p/(1-p)$. Control units with low weights will count less in the statistical analysis as these units are not similar to the treated institutions prior to the introduction of merit-aid policies. Institutions with propensities of less than 0.01 or greater than 0.99 are dropped from the analysis. Dropping units at the tails of the distribution will remove units with very low and large weights. This decision to trim propensities ensures overlap between treated and untreated units. The benefits of a weighted approach, as opposed to a matching approach, is that all non-adopting units remain within our sample.

Given our focus on broad-based merit-aid policies, the counterfactual may be dependent on the inclusion of the non-broad-based merit-aid states. To this end, we ran model specifications to include and exclude non-broad-based merit-aid states as a control group. Results across each specification were statistically similar in magnitude, directionality, and statistical significance. The estimates with the non-broad-based merit-aid policies had slightly more power; however, we have chosen to retain our conservative estimates and not include them as a non-adopting control.

Timing

First, we use falsification tests (Cook and Campbell 1986) to overcome a major concern with quasi-experimental approaches by untangling the policy effect from a potential corresponding time effect. To this end, we artificially create the adoption of a merit-aid program a number of years prior to the actual adoption. This approach allows the results to be viewed in context. Significant results prior to the actual adoption signal that the estimated impact on our dependent variable is not a product of the merit-aid policy adoption but rather a time effect that happens to coincide with the adoption.

Results

Figure 1 shows the in-state tuition and fees for merit aid–adopting states compared to non-adopting states before and after merit-aid adoption. As displayed in Fig. 1, institutions in each of the nine merit aid–adopting states demonstrate similar changes in their in-state tuition and fees prior to the introduction of the policy. Of the nine merit-aid adopting states included in this study, four states provide their institutions with the authority to set their own tuition and fee levels. States that adopt merit-aid programs and provide institutions with the authority to set their own tuition and fee levels experience significant departures in post-adoption trends regarding in-state tuition and fees.

Table 2 provides the descriptive statistics for our merit aid–adopting states and various control groups on several key mediating factors.

Table 3 provides trends in pricing (in-state and out-of-state) for the year prior to the adoption of any merit-aid programs (1992) and the final year in our analytical sample (2009). Prior to any merit-aid adoption, the difference in in-state tuition and fees between institutions within adopting states and institutions within non-adopting states was approximately $251. By the end of our analytical sample, this gap between in-state tuition and fees had increased to $1229. Changes in out-of-state tuition and fees did not follow the same trend as the gap between institutions in adopting states and institutions in non-adopting states was $586 in 1992 and declined to $540 by 2009. Descriptively, this would appear to suggest that merit-aid policies may impact in-state and out-of-state price setting differently. However, political factors surrounding raising in-state tuition compared to raising student fees may influence this widening gap.

Tables 4 and 5 provide our generalized difference-in-differences regression results for the average treatment effect of merit-aid adoption. In order to test for robustness, Tables 4 and 5 are disaggregated by our four comparison groups as outlined previously: (a) national, (b) regional, (c) border states, and (d) weighted. Across these four groups, we attempt to illustrate consistently emerging patterns not influenced by the selection of a particular control group. Each control group provides its own strength, and it is not our goal to generate the "ideal" control group but rather to examine the extent to which our estimation patterns are consistent across multiple counterfactuals.[12] Tables 4 and 5 also provide two model specifications. Model 1 is equivalent to Eq. 3 in which the impact of the merit-aid policy adoption is isolated. Model 2 is equivalent to Eq. 4 in which merit-aid policy adoption fully interacts with tuition decentralization. Each of our model specifications includes control variables at both the institutional and state levels with both institution and year fixed effects.

Effects on In-State Tuition and Fees

Given that all state-adopted merit-aid programs provide in-state students with significant tuition support, we began our investigation with an examination of in-state tuition and fees. Table 4 (Model 1) provides our points estimates for the effect of merit-aid adoption

[12] We borrow from Hillman et al. (2014) when discussing robustness across multiple comparison groups: (a) one comparison group yields a statistically significant result and equals "limited" evidence, (b) two or three groups equals stronger evidence, and (c) all four comparison groups yield statistically significant results, which is the strongest evidence possible. Alternatively, if our estimates have no significant patterns across all four comparison groups, then we conclude that the policy had null effects on that particular outcome.

Table 3 Differences in pre and post outcomes

	Pre-adoption (1992) (in constant 2009 dollars)			Post-adoption (2009) (in constant 2009 dollars)		
	Non-adopters	Adopters	Difference	Non-adopters	Adopters	Difference
In-state tuition and fees	$1313.94 (496.2)	$1063.23 (233.3)	−$250.71	$6225.03 (2007.3)	$4995.70 (1817.9)	−$1229.33
Out-of-state tuition and fees	$3412.66 (1193.1)	$2826.22 (578.6)	−$586.44	$14,612.00 (4890.5)	$14,071.79 (4084.5)	−$540.21

Mean coefficients; standard deviations in parentheses

Table 4 In-state published tuition and fees (logged)

	Model (1)				Model (2)			
	National	Region	Border	Weighted	National	Region	Border	Weighted
Strong merit-aid	−0.021	−0.0338*	−0.016	−0.0312^{+}	−0.0491**	−0.0534**	−0.0425**	−0.0593***
	(0.0154)	(0.0152)	(0.0154)	(0.0168)	(0.0161)	(0.0163)	(0.0158)	(0.0170)
Tuition decentralization					0.0375***	0.0327*	0.0360*	0.0476***
					(0.0112)	(0.0163)	(0.0150)	(0.0128)
Strong merit-aid * tuition decentralization					0.0615*	0.0537^{+}	0.0531^{+}	0.0559*
					(0.0255)	(0.0178)	(0.0274)	(0.0279)
Number of observations	10,079	6024	7105	10,032	10,079	6024	7105	10,032
Number of Groups	450	268	315	446	450	268	315	446
R-squared (within)	0.936	0.927	0.932	0.934	0.937	0.928	0.932	0.935
Weighted control institutions	No	No	No	Yes	No	No	No	Yes
State-level time varying covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution-level time varying covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

State clustered robust standard errors in parentheses

$^{+}$ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5 Out-of-state published tuition and fees (logged)

	Model (1)				Model (2)			
	National	Region	Border	Weighted	National	Region	Border	Weighted
Strong merit-aid	0.0815***	0.0210	0.0565***	0.0756***	0.0512**	−0.0085	0.0179	0.0426*
	(0.0158)	(0.0169)	(0.0167)	(0.0163)	(0.0186)	(0.0187)	(0.0191)	(0.0188)
Tuition decentralization					−0.0198	−0.0996***	−0.0761***	−0.0394**
					(0.0134)	(0.0173)	(0.0157)	(0.0150)
Strong merit-aid * tuition decentralization					0.0969***	0.1510***	0.156***	0.1150***
					(0.0252)	(0.0266)	(0.0256)	(0.0265)
Number of observations	10,081	6023	7105	10,034	10,081	6023	7105	10,034
Number of groups	450	268	315	446	450	268	315	446
R-squared (within)	0.909	0.913	0.915	0.907	0.910	0.915	0.916	0.908
Weighted control institutions	No	No	No	Yes	No	No	No	Yes
State-level time varying covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution-level time varying covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Institution fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

State clustered robust standard errors in parentheses

$^{+}$ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

without the consideration of tuition-setting authority. We find suggestive evidence that the adoption of a merit-aid program has a negative impact on in-state tuition and fees. Across each comparison group, our GDiD coefficient is negative but only statistically significant when comparing adopters to non-adopters within the same region (−3.4%) and our weighted similar institutions analysis (−3.1%). When we consider tuition-setting authority (Model 2), we find robust results across all four comparison groups regarding the impact of the adoption of a broad-based merit-aid policy on in-state tuition and fees. When holding tuition-setting authority constant, broad-based merit-aid adoption decreases in-state tuition and fees between 4.3 and 5.9% in states where tuition-setting authority is centralized. We also find, consistent with prior literature, that institutions that are able to set their own tuition levels without having a broad-based merit-aid policy in place have significantly higher in-state tuition and fees (between 3.3 and 4.8%).[13]

The interaction between merit-aid adoption and tuition-setting authority yields several meaningful results. For the weighted model, the combined effect of the two main effect parameters and the interaction term is 0.051 and statistically significant. In respect to the main effects, while broad-based merit-aid states have a negative relationship with increases in in-state tuition, when mediated by policies that promote institutional control over tuition setting, the effect reverses at a similar magnitude.

Effects on Out-of-State Tuition and Fees

Table 5 displays the following results regarding the impact of merit-aid adoption on out-of-state tuition and fees. Model 1 provides point estimates for the adoption of a broad-based merit-aid program without considering tuition-setting authority. We find generally consistent and significant results indicating that merit-aid adoption—without considering tuition-setting authority—produces an increase in out-of-state tuition and fees by approximately 5.6 and 8.2%. However, when we consider tuition-setting authority (Model 2), only the national and weighted samples produce significant results regarding the impact of merit-aid adoption on out-of-state tuition and fees for institutions whose state set tuition and fees—a 5.1% increase and 4.3% increase, respectively. Our estimates for states that have decentralized tuition-setting authority align with prior research in finding that institutions with the ability to set tuition, regardless of the presence of a broad-based merit-aid policy, had significantly lower in-state tuition and fees relative to institutions in states with centralized tuition-setting authority.

Similar to our findings for in-state tuition and fees, we find a dynamic interlock between tuition decentralization and broad-based merit-aid policies. Institutions located within a broad-based merit-aid policy-adopting state, that also have the ability to set their own tuition, responded in a significantly different manner than institutions operating under a broad-based merit-aid policy located within a state where tuition-setting authority is centralized. Specifically, broad-based merit-aid adopters with the authority to set their own tuition increased their out-of-state tuition and fees between 4.3 and 12.8%, depending on the control group. This is in contrast to the broad-based merit aid adopters in centralized tuition-setting states who increased their out-of-state tuition and fees between 1.8 and 5.1%.

[13] Over the course of our analytical sample, 82 institutions were under a broad-based merit-aid program, 195 institutions were afforded the authority to set their own tuition, and 38 institutions operated both under a broad-based merit-aid policy and decentralized tuition-setting authority.

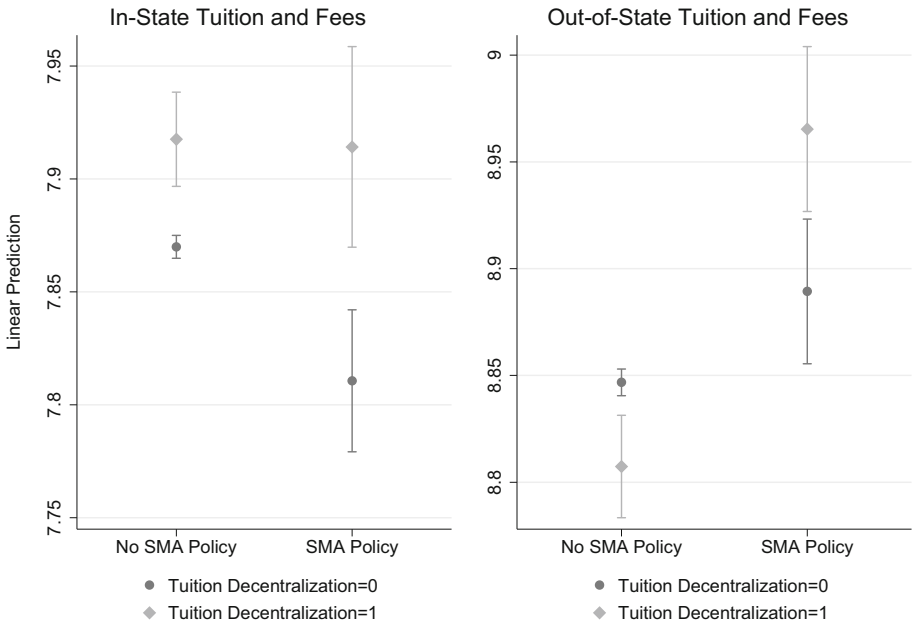

Fig. 2 Interaction terms

For the purposes of comparison of relative effects sizes, Fig. 2 plots the margins for the main and combined effects with 95% confidence intervals for the results of the interacted, weighted model. For in-state tuition and fees, the movement from centralized to decentralized tuition-setting authority carries with it a 5% increase in tuition and fees; however, that effect doubles to a 10% increase in the presence of a broad-based merit-aid policy. For out-of-state tuition and fees, we see a predicted decrease of 4% when a state decentralizes its tuition-setting authority. However, again in the presence of broad-based merit-aid policies, that effect increases by nearly 8%.

Limitations

This study is limited in a number of ways. First, the adoption of the merit-aid policy may have been simultaneously implemented with other policies or economic considerations that may have influenced state and institutional decisions. The GDiD approach relaxes this concern to some degree, as the variations in the broad-based merit-aid adoption year make it highly unlikely that this simultaneous policy impact would exist across all multiple adopting states.

Second, despite the variances explained within each model, additional time variant factors could potentially impact the outcomes that are missing from the analysis. The fixed-effects approach accounts for institutional factors that are consistent and immeasurable, but this approach does not account for covariates varying across time. The heterogeneous nature of broad-based merit-aid policies may suggest that our results should be interpreted with caution. Although we feel that we have addressed many of these heterogeneous effects through sample restriction and the inclusion of covariates, heterogeneous policy implementations have the potential to bias our estimates. Finally, our results are

generalizable only to institutional pricing response to the adoption of broad-based merit-aid policies and not merit-aid policies in general.

Discussion and Conclusions

Prior to the early 1990s, the use of merit-based financial aid was largely limited to individual institutions' recruitment and retention of academically gifted students (Geiger 2004). Doyle (2006) stated that adoption of systematic state-level merit-aid programs "represents one of the most pronounced policy shifts in higher education in the last 20 years" (p. 256). The vast majority of these programs are aimed at increasing in-state enrollment (Dynarski 2000; Heller 2002) and reducing student migration to neighboring states (Rogers and Heller 2003). Prior work on merit-aid policy adoption has produced compelling evidence regarding the impact of the regressive nature of aid access (Heller 2002), the impact on student major choice (Zhang 2011), and the impact on student migration and retention (Zhang and Ness 2010). Few scholars have examined the role of merit-aid policy adoption in institutional responses, but Long's (2004) study of the impact of the Georgia HOPE scholarship on institutions' pricing response demonstrated that Georgia's four-year institutions reduced their tuition and fees after the adoption of the HOPE scholarship program.

Our study contributes to both the merit-aid and broader policy-adoption literature bases by considering the intersection of a financial aid policy and institutional tuition-setting authority. Specifically, we leverage the interaction between state-level broad-based merit-aid policy adoption and tuition-setting authority to investigate pricing strategies following merit-aid policy adoption. In our non-interacted model, which examines solely the adoption of a broad-based merit-aid policy, our estimates are similar to those of Long (2004). Broad-based merit-aid adoption is associated with decreases in published in-state tuition and fees. Additionally, our results confirm previous work on the role of tuition decentralization in producing increases in levels of tuition and fees (Kim and Stange 2016).

Our most interesting results occur when we examine the interaction effect between broad-based merit-aid adoption and tuition-setting authority. If we assume that state policymakers seek to keep the price of postsecondary education low for their citizens (Mumper 2001) and avoid policy cost overruns, then states would aim to keep tuition and fees as low as possible (Bell et al. 2011). Since most merit-aid policies are lottery-funded (Ness 2010), only a finite amount of external resources are available, and broad-based merit-aid policies may act as a possible deterrent to increasing in-state tuition and fees for states with centralized tuition-setting authority. Any policy cost overruns faced by individual states would likely need to be covered by discretionary state funds in which the sector of higher education is often regarded as a low priority (Delaney and Doyle 2011).

Colleges and universities do not face the same cost-containment external pressures as states. In line with the Bennett Hypothesis (Bennett 1987), autonomous institutions raise their tuition and fees because their prospective students are less price-sensitive after receiving their merit-aid tuition subsidy. This is particularly true regarding broad-based merit-aid policies that cover a large proportion of in-state tuition and fees. We note that this finding confirms analogous work by Curs and Dar (2010) and Cellini and Goldin (2014), who found that institutions increase tuition and fees in response to increases in federal student aid. These dynamics help to explain the underlying logic between our divergent results related to the impact of merit-aid adoption when we consider the level of tuition-setting authority given by the state.

Contrary to our findings pertaining to in-state tuition and fees, out-of-state tuition and fees increased after broad-based merit-aid adoption for states with both centralized and decentralized tuition-setting authority. However, institutions with the authority to set their own tuition increased their out-of-state tuition and fees at approximately twice the rate of institutions within broad-based merit-aid–adopting states where states have the authority to set tuition and fees. We postulate that two potential mechanisms are in play for centralized tuition-setting and broad-based merit-aid policy adopters. First, out-of-state tuition levels are more sensitive to the presence of financial aid changes (Singell and Stone 2007), and any estimated increases in out-of-state tuition may be in direct response to the reduction in tuition revenue associated with lower in-state tuition and fees (Rizzo and Ehrenberg 2004). Second, the muted effect in centralized tuition-setting states is a product of the fact that states must set tuition and fees for a wide range of institutions in terms of their enrollments, selectivity, and financial support. Some of these institutions (e.g., non-selective public 4-years) receive very few students as a result of merit-aid policy (Heller 2002). Although the actions of decentralized tuition-setting states that adopted merit-aid policies appear to be congruent with the principles of revenue maximization, future research should explore the mechanisms influencing increases in out-of-state tuition and fees.

Implications

In addition to advancing scholarship on institutional pricing strategies in response to broad-based merit-aid policy adoption, this paper demonstrates the importance of considering the intersection of various postsecondary policies when evaluating a policy effect. Given that the pricing strategy of in-state tuition and fees for broad-based merit-aid-adopting states was dependent on the level of tuition-setting autonomy, an analysis without considering tuition-setting authority would have likely led to biased estimates. Specifically, had this study examined broad-based merit-aid adoption without considering tuition-setting authority, we would have concluded that the adoption of broad-based merit-aid policies is associated with general decreases in published in-state tuition and fees—confirming the prior work of Long (2004)—and increases in published out-of-state tuition and fees.

By considering both the adoption of a broad-based merit-aid policy and tuition-setting authority, we add nuance related to conversations surrounding the impact of state-level policy adoption. In addition, this study informs higher education administrators and policymakers by showing that general discussions of the effects of merit-aid policies on tuition and fees may offer little value without considering external dynamics, such as the incentives of the entity that has tuition-setting authority. Future investigations can build on this study by employing quasi-experimental approaches to examine the intersection of other state-level policies (e.g., performance-based funding, enrollment caps, and pre-paid tuition) and individual state contexts. To ensure the adoption of effective state-level postsecondary policies in future years, higher education stakeholders require a greater understanding of the extent to which policy initiatives and environmental factors impact one another.

Appendix

See Tables 6 and 7.

Table 6 In-state published tuition and fees (logged) with covariate point estimates

	Model (1)				Model (2)			
	National	Region	Border	Weighted	National	Region	Border	Weighted
Strong merit-aid	−0.021	−0.0338*	−0.016	−0.0312^{+}	−0.0491**	−0.0534**	−0.0425**	−0.0593***
	(0.0154)	(0.0152)	(0.0154)	(0.0168)	(0.0161)	(0.0163)	(0.0158)	(0.017)
Tuition decentralization					0.0375***	0.0327*	0.0360*	0.0476***
					(0.0112)	(0.0163)	(0.015)	(0.0128)
Strong merit-aid * tuition decentralization					0.0615*	0.5371^{+}	0.0531^{+}	0.0559*
					(0.0255)	(0.0178)	(0.0274)	(0.0279)
State-level controls								
State GDP (logged)	−0.004	−0.286***	−0.137^{+}	0.080	−0.000	−0.280***	−0.133^{+}	0.070
	(0.067)	(0.082)	(0.081)	(0.080)	(0.065)	(0.081)	(0.077)	(0.077)
Per-capital income (logged)	−0.337**	−0.308^{+}	−0.367*	−0.379*	−0.343**	−0.297^{+}	−0.335*	−0.383*
	(0.127)	(0.172)	(0.160)	(0.155)	(0.122)	(0.169)	(0.157)	(0.151)
Unemployment rate (%)	0.019***	0.016***	0.014***	0.014***	0.018***	0.016***	0.014***	0.013***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)
High school graduates (lagged and logged)	0.106**	0.223***	0.227***	0.137**	0.119**	0.229***	0.237***	0.146**
	(0.039)	(0.054)	(0.050)	(0.047)	(0.039)	(0.055)	(0.051)	(0.047)
Governance structure (Y/N)	−0.012	−0.032*	−0.020	−0.022	−0.021	−0.052***	−0.044**	−0.032^{+}
	(0.017)	(0.016)	(0.016)	(0.019)	(0.017)	(0.015)	(0.014)	(0.018)
State need-based aid expenditures (logged)	0.028***	0.037***	0.040***	0.031***	0.023***	0.030***	0.032***	0.023***
	(0.004)	(0.005)	(0.006)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)
Democratic governor (Y/N)	0.005	0.023***	0.021***	0.001	0.004	0.022**	0.021***	−0.000
	(0.005)	(0.007)	(0.006)	(0.006)	(0.005)	(0.007)	(0.006)	(0.006)
Institution-level controls								
Tuition reliance (%)	0.009***	0.009***	0.009***	0.010***	0.009***	0.009***	0.009***	0.010***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)

Table 6 continued

	Model (1)				Model (2)			
	National	Region	Border	Weighted	National	Region	Border	Weighted
State appropriations per FTE (logged)	−0.033	−0.041^{+}	−0.027	−0.022	−0.024	−0.033	−0.019	−0.014
	(0.022)	(0.024)	(0.022)	(0.026)	(0.022)	(0.024)	(0.023)	(0.026)
Total E&R expenditures (logged)	0.179***	0.230***	0.226***	0.196***	0.167***	0.217***	0.211***	0.182***
	(0.034)	(0.045)	(0.041)	(0.035)	(0.033)	(0.044)	(0.039)	(0.034)
Total FTE (logged)	−0.263***	−0.304***	−0.315***	−0.251***	−0.250***	−0.293***	−0.300***	−0.238***
	(0.046)	(0.057)	(0.053)	(0.066)	(0.046)	(0.056)	(0.053)	(0.065)
Enrollment proportion undergraduate (%)	0.001	0.002	0.002^{+}	0.002	0.001	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	10,079	6024	7105	10,032	10,079	6024	7105	10,032
Number of groups	450	268	315	446	450	268	315	446
R-squared (within)	0.936	0.927	0.932	0.934	0.937	0.928	0.932	0.935
Weighted control institutions	No	No	No	Yes	No	No	No	Yes
Institution fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

State clustered robust standard errors in parentheses

$^{+}$ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 7 Out-of-state published tuition and fees (logged) with covariate point estimates

	Model (1)				Model (2)			
	National	Region	Border	Weighted	National	Region	Border	Weighted
Strong merit-aid	0.082***	0.021	0.057***	0.076***	0.051**	−0.009	0.018	0.043*
	(0.016)	(0.017)	(0.017)	(0.016)	(0.019)	(0.019)	(0.019)	(0.019)
Tuition decentralization					−0.020	−0.100***	−0.076***	−0.039**
					(0.013)	(0.017)	(0.016)	(0.015)
Strong merit-aid * tuition decentralization					0.097***	0.151***	0.156***	0.115***
					(0.025)	(0.027)	(0.026)	(0.026)
State-level controls								
State GDP (logged)	−0.030	−0.179*	−0.101	−0.073	−0.006	−0.104	−0.038	−0.031
	(0.063)	(0.078)	(0.073)	(0.074)	(0.062)	(0.074)	(0.070)	(0.072)
Per-capital income (logged)	0.004	−0.262	0.048	0.015	0.016	−0.257^{+}	−0.003	0.023
	(0.139)	(0.161)	(0.163)	(0.150)	(0.138)	(0.153)	(0.158)	(0.148)
Unemployment rate (%)	0.019***	0.018***	0.022***	0.018***	0.020***	0.021***	0.024***	0.020***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
High school graduates (lagged & logged)	−0.007	−0.063	0.017	−0.022	0.006	−0.045	0.031	−0.008
	(0.043)	(0.058)	(0.055)	(0.048)	(0.043)	(0.056)	(0.054)	(0.048)
Governance structure (Y/N)	−0.008	−0.030	0.002	−0.003	−0.017	−0.036	−0.016	−0.011
	(0.028)	(0.028)	(0.028)	(0.027)	(0.029)	(0.027)	(0.027)	(0.028)
State need-based aid expenditures (logged)	−0.001	−0.021***	−0.020***	−0.003	−0.002	−0.012*	−0.016**	−0.003
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)
Democratic governor (Y/N)	−0.021***	−0.029***	−0.032***	−0.022***	−0.021***	−0.027***	−0.031***	−0.021***
	(0.005)	(0.007)	(0.006)	(0.006)	(0.005)	(0.007)	(0.006)	(0.006)
Institution-level controls								
Tuition reliance (%)	0.006***	0.006***	0.006***	0.007***	0.006***	0.006***	0.005***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Table 7 continued

	Model (1)				Model (2)			
	National	Region	Border	Weighted	National	Region	Border	Weighted
State appropriations per FTE (logged)	−0.016	−0.014	−0.003	−0.009	−0.012	−0.017	−0.002	−0.007
	(0.022)	(0.022)	(0.019)	(0.023)	(0.021)	(0.021)	(0.018)	(0.022)
Total E&R expenditures (logged)	0.187***	0.172***	0.175***	0.165***	0.187***	0.202***	0.193***	0.169***
	(0.038)	(0.045)	(0.042)	(0.039)	(0.037)	(0.044)	(0.041)	(0.038)
Total FTE (logged)	−0.208***	−0.210***	−0.204***	−0.201***	−0.207***	−0.230***	−0.221***	−0.203***
	(0.046)	(0.051)	(0.047)	(0.051)	(0.045)	(0.049)	(0.045)	(0.051)
Enrollment proportion undergraduate (%)	−0.001	−0.001	−0.002	−0.001	−0.001	−0.001	−0.002^{+}	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	10,081	6023	7105	10,034	10,081	6023	7105	10,034
Number of groups	450	268	315	446	450	268	315	446
R-squared (within)	0.909	0.913	0.915	0.907	0.910	0.915	0.916	0.908
Weighted control institutions	No	No	No	Yes	No	No	No	Yes
Institution fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

State clustered robust standard errors in parentheses

$^{+}$ $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

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