Examining the Impact of State Level Merit-Aid Policies on Advanced Placement Participation

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ABSTRACT

This study examines the impact of merit-aid programs on secondary course taking patterns. Specifically, this study uses difference-in-differences to analyze state-level Advanced

Placement (AP) participation and examination data pre and post merit-aid adoption. Results indicate increases in AP participation and number of total examinations after the adoption for merit-aid program who initial eligibility requirements are solely high school performance rather than a combined initial eligibility of high school GPA and standardized test performance. Findings illustrate the potential rationality of student decisions as they take high school courses that not only maximize their admittance into college, but also increase probability of achieving the necessary GPA to receive the merit-aid scholarship.

INTRODUCTION

Over the past two decades there has been tremendous growth both in the number of secondary students seeking more rigorous high school courses as well as state policy-makers adopting policies aimed at ensuring these academically gifted students remain in-state for their postsecondary education. The most popular options for expanding secondary course rigor has been the Advanced Placement (AP) program (Attewell and Domina 2008), while state policy makers had tended to adopt merit-aid scholarships as a mechanism to increase in-state retention and postsecondary success (Cornwell, Mustard, and Sridhar 2001).

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Despite the growth of both AP course and merit-aid policies, little is known regarding the intersection between incentives postsecondary policies may play in facilitating rigorous secondary course completion. For example, as merit-aid policies are adopted, do students utilize AP course to increase their probabilities of achieving the necessary eligibly requirements for the scholarship or do they shy away from rigorous high school courses in a risk adverse mentality? Alternatively, do merit-aid programs that possess a finite number of the postsecondary credit support or facilitate an extra incentive for students to enroll in college with postsecondary credits already in hand? Currently, neither empirical evidence nor theory exists in the literature to explain how secondary students are leveraging AP course completion or participation in response to merit-aid policy adoption. This paper attempts to fill this gap in the literature by examining empirical evidence through a quasi-experimental design as well as expand theoretical explanation of student course selection.

The primary focus of this study is to examine both the level of the participation and depth of participation in AP exams post adoption of a merit-aid policy. Certainly there are confounding factors when evaluating the impact of the merit-aid policy on AP program participation—program access, level of merit-aid funding, and eligibility criteria to name a few. This paper develops a quasi-experimental difference-in-difference model to account for these confounding factors on state-level outcomes. Estimates from the difference-in-difference model indicate that student participation in AP courses differs post-adoption of merit-aid program based on the initial eligibility criteria.

LITERATURE REVIEW

Despite the recent push for increasing course standards, scholars have long studied the connection between the completion of rigorous courses and secondary and postsecondary achievement. To this end, scholars have identified a strong link between academic success and the completion of the rigorous curriculum (Attewell and Domina 2008; Byrk, Lee, and Smith 1990; Rock and Pollack 1995; Schneider et al. 1998). This push for rigorous courses has manifested itself in schools through the inclusion of AP—or similar—programs.

Advanced Placement History and Trends

Developed in 1951, the AP program is the most widespread advanced secondary course option with 2.1 million students taking AP courses (College Board 2012). Specifically in 2012, 2.1 million high school students completed almost 3.7 million exams across 34 different AP subjects spanning the curriculum including

music theory, calculus, Chinese language and culture, and human geography (College Board 2012). Unlike traditional secondary classes, at the conclusion of an AP class, students may take an end-of-course AP exam. To receive college credit for the completed AP course, a student must score at least a three out of a possible five (College Board 2003).

Between 1987 and 2012, the number of students participating in the AP program increased 682%, from 258,442 in 1987 to 2,022,722 in 2012. This increase coincided with an increase in high school enrollment of only 22.3%. Figure 1 illustrates the growth in both AP student participation and the number of the AP examinations completed each year. Since 1987, the AP program's prominence has experienced a sharp increase annually.

Secondary Course Taking

While the AP program is the most popular option for secondary students seeking advanced and rigorous courses, scholars are have long attempted to explain by students engage in courses that requirement additional time and effort. In general, students benefit from taking these higher level classes because they offer more rigorous material and assignments than typical high school classes (Long, Conger, and Iatarola 2012), and the courses signal college preparation to admission offices (Geiser and Santelices 2004). Kim (2012) utilized human capital theory to frame the weighing of costs and benefits for each student choosing to participate in rigorous secondary courses. Zocco (2009) used risk

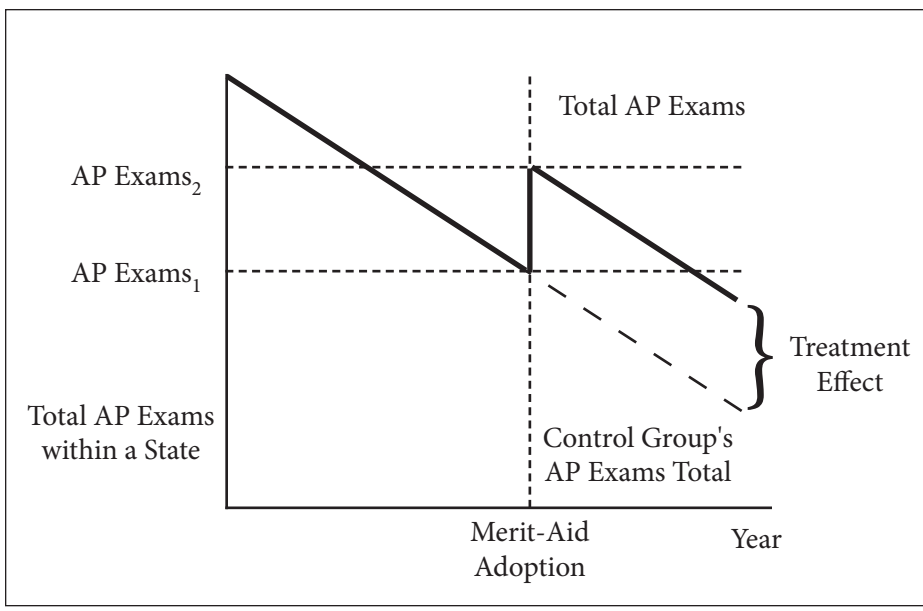

Figure 1. Difference-in-Difference Design

theory to explore college students' course selection, indicating that "students enroll in a course hoping for a positive outcome but realizing that the outcome is not certain" (p. 13). Individual students have different educational expectations, such as grade, subject matter, and the course's relevance to future career. Factors influencing their expectations can be academic and/or personal. However, one course may not satisfy all these different needs, so students face risks in choosing courses.

State Merit-Aid Adoption Research

The mission of merit-aid programs is to promote large tuition subsidies for academically successful in-state students. This mission resonates with a wide variety of stakeholders as a way to counteract the constant increases in college costs. In particular, middle to high income individuals—who would not qualify for any need-based aid—has served as strong advocates for the adoption of these programs (McCrary and Condrey 1998). However, in many merit-aid programs, especially those funded through state lottery revenues, low-income families shoulder a large portion of the burden and expend a large percentage of their annual income on playing the lottery. Hearn (2002) detailed how lottery-funded programs act as a regressive tax on low-income families—a topic this study will discuss later in this paper.

While the literature on the outcomes of state merit-aid programs is expansive, research on factors influencing the adoption of these programs is somewhat limited. Much of the work has rested on the theoretical assumption of policy innovation and regional diffusion—the effect of the geographical neighboring states on the adoption of similar policies. Two studies—Doyle's (2006) and Cohen-Vogel et al.'s (2008)—have directly examined the idea of policy innovation and diffusion of state funded merit-aid programs. These studies illustrate not only the complexity of understanding policy adoption but also the diverse results that can come from the use of various methodological approaches.

Few researchers have conducted studies on the adoption of merit-aid programs; these studies have illuminated the complexities associated with understanding the policy process. One might assume that examining the outcome effects of merit-aid programs would produce more definitive results; however, this is not the case. The following provides an overview of the various outcomes associated with merit-aid programs. Despite the larger volume, this area of research produces similar results, demonstrating the clear lack of positive impact of merit-aid programs.

Merit-Aid and Secondary Achievement

Much research exists connecting merit-aid programs and postsecondary decision making. However, considerably less evidence exists regarding the relationship between merit-aid programs and student achievement in secondary schools. Henry and Rubenstein (2002) demonstrated that the proportion of Georgia secondary graduates with a 3.0 or higher GPA increased faster in Georgia under the HOPE scholarship than before program implementation. Henry and Rubenstein argued that this increase represented a meaningful improvement in secondary student effort and achievement, noting that the association between student GPA and academic achievement (as measured by SAT scores) remained consistent in Georgia over this period. Pallais (2009) found evidence of similar positive academic achievement effects for the Tennessee Education Lottery Scholarship. These findings lend credence to the idea that merit-aid programs motivate secondary student effort. However, since both of these studies drew data from surveys accompanying college entrance exams, their findings may not apply beyond the self-selecting group of college-bound students who take these exams. No study connects postsecondary merit-aid adoption with AP participation and success, hence the rationale for this study.

Higher educational institutions respond more to students' academic ability than their needs, so the perception of merit aid is mixed, and research on its influence has produced inconsistent results (Doyle 2010). Supporting evidence has shown that broad-based merit-aid programs have increased college-going rates and expanded access (Toutkoushian and Hillman 2012). Stater's (2009) study also indicated that a merit-aid program has a larger positive effect on students' GPA than need-based aid does:

> A $1,000 increase in need-based or merit-based aid is predicted to increase first-year GPA by 0.10 or 0.19 points, respectively. In the second through fourth years, a $1,000 increase in need-based or merit-based aid is predicted to increase cumulative GPA by 0.04 and 0.21 points, respectively (pp. 803).

Similarly, South Carolina's Legislative Incentives for Future Excellence (LIFE) program increased students' college GPAs by 0.101. However, the researcher observed a relationship between merit aid and GPA only among male students (Hernández-Julián 2009). Merit-aid programs can influence high school students' decisions and performance as well. In their study, Orsuwan and Heck (2009) found that students tended to attend an in-state institution to obtain state merit-based aid. Ness and Tucker (2008) discovered that due to the support of merit aid, low-income students and African American students in Tennessee regarded themselves as more eligible for higher education. Moreover, because merit aid offers financial aid access based on students' academic preparation,

high school students are motivated to enhance their performance and college readiness (Betts 1997). Georgia's HOPE program has improved the quality of secondary education and reduced the performance disparity among racial groups (Henry and Rubenstein 2002). Research has affirmed that Florida's Bright Futures program has encouraged high school students to take more advanced courses and to attend in-state institutions, especially for low SES and minority students. The overall percentage taking the required college preparatory courses grew from 54% to 67% between 1997 and 2001 (Harkreader, Hughes, Tozzi, and Vanlandingham 2008; Hickman 2009).

Other researchers have asserted that merit aid is unwise because it actually limits the higher education access of low SES students and minority students, defraying expenses for students who could have accessed higher education without merit aid (Baum and Schwartz 1988; Dynarski 2000; Griffith 2011; Long and Riley 2007; Sridhar 2001). Hurwitz (2012) claimed that merit aid is a "potential misallocation of resources," to which the higher SES students who do not need to the subsidy to attend college receive the greatest proportion of aid (p. 7). DeFrank-Cole, Cole, and Garbutt (2009) assessed West Virginia's PROMISE program in the Honors College at West Virginia University. Although they discovered that the program led to increased enrollment and decreased graduation time, fewer low-income students enrolled in the college after PROMISE's implementation. While the Kentucky Education Excellence Scholarship (KEES) aims to expand access, increase retention, and keep the brightest students in the state, its impact turns out to be regressive: A disproportional amount of funds flow to students that are high SES, White, or female (Kash and Lasley 2009). Monks (2009) reached a similar conclusion in his study, asserting that merit aid "has a statistically significant but inelastic effect on enrollment of extremely high ability students" (p. 99). In their study, Stanley and French (2009) even identified a non-significant relationship between merit aid and student enrollment. After comparing enrollment of states that implemented merit-based programs and enrollment of states that did not, researchers have suggested that the main reason for growing enrollment is the rising population of the state rather than the effect of merit aid.

Theoretical Intersections of Merit-aid Policies and Rigorous Secondary Course Taking

While traditionally not intersected within the academic literature, both rigorous secondary course taking and state merit-aid policy adoptions share theoretical assumptions. The reason students engage in rigorous secondary courses is numerous. Specifically, students engaging in AP courses have heightened academic achievement (Long, Conger, and Iatarola 2012), increase likelihood of

postsecondary success (Hoekstra 2009), and generating credits to increase time-to-degree (Babcock and Marks 2011). Similarly, states adopt merit-aid polices as a mechanism to increase their institutional prestige (Doyle 2010), maximize revenues (Monks 2009), and retain the most academically gifted in-state students (Cornwell, Mustard, and Sridhar 2001). In both cases, actors engage in prestige seeking behaviors aimed at increasing individual (or state) prominence within their respective environments.

Furthermore, students in merit-aid states must balance the potential trade-offs associated with taking more difficult secondary courses with increased risk of not reaching the eligibility criteria for the merit-aid scholarship. This internal trade-off is further complicated by the need for secondary students to maximize the likelihood of being admitted to an in-state postsecondary institution—of which successful completion of the AP courses increases. This study attempts to the expand the theoretical assumptions of Dynarski and Scott-Clayton (2006) who articulated that students view postsecondary education as an investment and balance opportunity costs (sacrifices), such as cost of attendance, forgone earnings, and time to study, with the delayed benefits of college education—higher wage earnings, more prestigious employment, and increased social status.

Recently, scholars have called into the question the appropriateness of applying rational choice principles to secondary students (Zietz and Joshi 2005). This study attempts to utilize state-level data to test rational choice models for students connecting AP course participation and merit-aid program adoption. Leveraging variations in initial eligibility criteria and merit-aid award coverage results provide empirical evidence to the potential rationality of secondary student decisions.

Variation in AP Inclusion within Merit-aid Eligibility

A potential confounding factor impacting the potential connection between merit-aid policies and AP program participation is the level of the inclusion of additional course weighting in the eligibility criteria. Table 1 provides an overview of the inclusion of the AP courses within merit-aid policies. Overall, the vast majority of the merit-aid states include provisions for weighting AP courses more than traditional high school courses. In total, eight states have provisions to include AP credits; three of which have a specified list of approved AP courses or provide authority to the local secondary school to decide which courses should be included. The remaining five provide expansive and statewide list of approved AP courses.

Table 1. State Merit Scholarship Programs Requirements and AP/IB Course Inclusion

State	Initial Eligibility Requirements	AP Course Inclusion in Initial Eligibility	Weighted GPA Scale	Merit-Aid Award Amount ($)
Georgia	HS GPA	Yes - Statewide	5.0	Full tuition and fees at a GA public institution plus $300, or up to $3,000 at a GA private institution
Mississippi	HS GPA and SAT/ACT	Yes - HS Specific	4.0	$2,500 at a MS public or private institution
Florida	HS GPA and SAT/ACT	Yes - Statewide	4.5	Up to full tuition and fees at a FL public institution plus $300, or a comparable amount at a FL private institution
Missouri	SAT / ACT	No	--	$2,000 at a MO public or private institution
New Mexico	College GPA	No	--	Full tuition and fees at a NM public institution
Louisiana	HS GPA and ACT	Yes - Specified Courses	5.0	Full tuition and fees at a LA public institution plus up to $800, or a comparable amount at a LA private institution
South Carolina	GPA, SAT/ACT, and Class Rank	Yes - Statewide	5.00	Up to $6,700 at a public SC institution; comparable amount at a SC private institution (award amount cannot exceed tuition charges)
Kentucky	Level 1:HS GPA Level 2: HA GPA & SAT/ ACT	Yes - Statewide	5.00	Up to $1,000 per year at a KY public or private institution
Michigan	State Secondary Assessment	No	--	One-time award up to $2,500 at a MI public or private institution; $1,000 out of state
Nevada	HS GPA	Yes - HS Specific	5.0	$80 per credit hour at a NV four-year public or private institution or $40/$60 per credit hour (lower division/upper division) at a NV community college
West Virginia	HS GPA and SAT/ACT	Yes - Statewide	5.00	Full tuition at a WV public institution or comparable amount at a WV private institution
Tennessee	HS GPA or SAT/ ACT	Yes - Statewide	5.00	Up to $4,000 at a TN four-year public or private institution and $2,500 at a TN two-year institution (see Table 1-2 for more information).[1]
Massachusetts	State Secondary Assessment	No	--	Tuition (but not mandatory fees) at any public institution in Massachusetts

Sources: (Heller, 2002;Krueger, 2001; Selingo, 2001), and state program websites

1: TN initially did not award points for AP / IB course. GPA calculation was changed in 2005

RESEARCH DESIGN AND DATA

To examine the impact of merit-aid programs on participation in rigorous secondary course completion, this study created a unique dataset merging information from multiple sources. In particular, this study drew data from the College Board, which provides information on state-level AP participation and AP exams completed. This study gathered data for 1976 through 2013—the most recent available public data on AP participation and covariates. Since our dataset includes state-level data, and all 50 states participated in AP programs for each of the sample years, this dataset presents as efficient and effective mechanism with which to evaluate policy adoption. In total, this study had 1,901 observations within the dataset.

Dependent Variables

Since the state goals for merit-aid programs are to ensure the best and brightest students complete their postsecondary education within their resident state through large merit subsides for academic performance (primarily high school GPA and SAT/ACT performance), there exists the potential for students to select courses that maximize the likelihood of a high GPA. The variability across high school courses and the difficulty in gaining standardized course data make the evaluation of individual student course profiles difficult. The use of AP exams and student participation creates a standardized outcomes variable and assessment across the United States. For these reasons, this study focused on the following outcomes:

1. Advanced Placement (AP) participations; and
2. Advanced Placement (AP) exams

Because there is theoretically no limit to the number of AP exams or courses a student could take, this study wanted to examine the depth (number of exams) and breadth of the participation (number of students) to gain a holistic view of how merit-aid programs impact AP course participation. In both cases, this study uses logged transformed dependent variables. The use of logged or percentage-based dependent variables increases the efficiency of the model and model fit through the reduction of outliers. An additional benefit of a logged or percentage-based dependent variable is that it allows for the interpretation of results in elasticities. Woolridge (2009) stated that when predictors and/or dependent variables are expressed in percentage form, their original form is efficient in estimating an elastic relationship. Specifically, this allows the model to estimate the percentage impact of adopting a merit-aid policy on AP program participation.

Table 2. Merit-Aid Adopting States

State	Year of Adoption (Beginning)
Georgia	1993
Mississippi	1996
Florida	1997
Missouri	1997
New Mexico	1997
Louisiana	1998
South Carolina	1998
Alaska	1999
Kentucky	2000
Michigan	2000
Nevada	2000
West Virginia	2002
Tennessee	2004
Massachusetts	2005

Control Variables

To address the variations among each state's educational and economic profiles, this study included a series of covariates (control variables) in our models. While this study displays the impacts of these covariates within our results, they are not discussed within the results section. Table 2 provides the descriptive statistics for each the covariates, pre- and post-treatment for each adopting state. Within each model, this study controlled for the number of schools participating in the AP program (Jackson 2010), total high school enrollment (Klopfenstein, 2004), the performance on the NAEP assessments in combined reading and mathematics (Klopfenstein and Thomas 2009), economic condition (i.e., state GDP), and spending per FTE on education (Jackson 2010). As discussed later, this study also included state-level fixed-effects and year (time) fixed-effects models to account for any unobserved heterogeneity within the analyses.

Analytical Technique

This study adapts methodological approaches similar to Dynarksi (2000), Long (2004) and Cornwell, Mustard, and Sridhar (2001) who each used a combination of the traditional OLS fixed effects regression parameters and difference-in-differences (DiD) approach to study high school student AP course participation responses and merit-aid programs. Unlike previous work on merit-aid policy adoption, this study takes a national perspective and utilizes states that have not

adopted merit-aid programs as the control group within the quasi-experimental model—rather than limiting to a region—and tests the pre- and post- adoption effects using the DiD approach for all adopting states. Specifically, this study focuses on: 1) number of students participating in the AP program and 2) total number of AP exams completed.

Equation (1) articulates the traditional DiD approach to the analyzing the impact of the merit-aid program adoption. Equation (1) is specified as:

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

where Y_{st}, the outcome of interest (i.e. student participation and exam completion) for state *s* in year *t*. *Treatment* is a dummy variable indicating state adoption of a merit-aid program. X_{st} is a vector of covariates thought to influence access, availability, and completion of AP programs derived from the academic literature. These include: number of high schools within the state who participated in the AP program, total student enrollment within state high schools, combined NAEP scale score on both mathematics and English language arts. Additionally, state-level financial controls are included to control for the economic condition of each state. These include: secondary education expenditures per FTE and the state gross domestic product.

In terms of the treatment effect, Cameron and Trividi (2006) articulate an inherent assumption using difference-in-difference estimation that requires a common time-effect across both the treatment and control group. In this manner the *Year* denotes a series of dummy variables for each academic year except for the first year of merit-aid program adoption. This specification also includes interaction terms between *Treatment* and each *Year*, except the excluded year; thus, β identifies how AP program participation and exam completion in merit-aid adopting states differed from AP program participation and exam completion in control states (similar non-merit aid states) immediately prior to the introduction of the merit aid program—thus providing a comparative baseline. The interaction term—displayed as *Treatment*Year*—estimates how the merit state outcomes in each year vary from the baseline difference identified by β. A near zero coefficient on the interaction terms suggests no difference.

The difference-in-difference interaction between the pre-policy adoption (pre-treatment) and post-policy (post-treatment) time periods can be expressed as:

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

The model is enhanced by the use of the aforementioned covariates which control for differences that existed prior to the adoption of the merit-aid policy.

While the traditional difference-in-difference approach rests on the

assumption of a common treatment period; this study advances the merit-aid adoption literature by employing a quasi- experimental framework flexible for the varying adoption nature of merit-aid polices. Following the work of Belasco, Rosinger, and Hearn (2014), this study specifies a model that account for variations in the duration of policy adoption by implementing a two-way fixed model—year and state fixed-effects (Bertrand, Duflo, and Mullainathan 2004; Dynarksi 2004). The pooled model for this study is fully specified as such:

$$Y_{st} = \delta_1 MA_{st} + \lambda X_{st} + \alpha S_s + \beta Ty + \varepsilon_{st} \qquad (3)$$

Where $\delta_1 MA_{st}$ is the coefficient of interest which is equaled to "1" in any academic year post adoption of a merit-aid program. λX_{st} is a vector of controls that includes state-level financial and academic predictors αS_s is the institutional-level fixed-effects and βTy is the year fixed-effects. Finally, ε_{st} is the idiosyncratic error term fluctuating both over time and across units. This study followed the process of Hillman and Orianas (2013) to account for the potential error associated with a panel model. Within any application of a panel (repeated time series) approach is the potential for the error terms to be serially correlated between panel years in adjacent years. This serial correlation is a violation of the panel regression models and the independence of the error term. Serially correlated error terms produce imprecise standard errors, t values, and confidence intervals. A Wooldridge test (Drukker 2003) was conducted to assess whether the state-level error term was serially correlated over time. The test indicated the presence of serial correlation. To adjust of this presence and heteroskedasticity across panels, this study followed the recommendations of for Greene (2011) and utilized Prais-Winsten estimation parameters within the final model. Panel adjusted standard errors are reported within the results.

Robustness Checks

The difficulty in any quasi-experimental design is in the identification of the counterfactual in the absence of a policy adoption. The use of a difference-in-difference design allows this study to approximate the impact of non-adoption in the adopting states using 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 the this counterfactual approach is that treatment and control units following 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 adopted techniques to test the parallel; assumption. First, this study utilized added a state-specific trend to the set of covariates (Belasco, Rosinger, and Hearn 2014; Angrist and Pischke

2009). This inclusion controls for the potential that merit-aid adopting states may have experienced differences in the outcomes of interest prior to the adoption of a merit-aid policy. To do, state trend variables were created by regressing dummy time variables for the years 1988–1993 (years in which no merit-aid polices were adopted) on each of the dependent variables and multiplying the resulting coefficient by year to create a unique state trend variable. An appropriately created state trend variable should not impact the magnitude or directionality of the results.

A major concern with the difference-in-difference approach is the untangling the policy effect with a potential corresponding time effect. To do this this study used a placebo test. To this end, this study created artificially adoptions of the merit-aid program one and two years prior to the actual adoption of the policy (Belasco, Rosinger, and Hearn 2014). Significant results signal that the estimates impact on AP courses and student participation was a product not of the policy adoption, but rather a time-effect that happen to coincide with the adoption of merit-aid policies.

Limitations

The present study is limited in a number of ways. First, the adoption of the merit-aid policy may be simultaneously implemented with other policies or economic considerations that may have influenced other state decisions. However, it is highly unlikely that simultaneous policy impact would exists across each of the adopting states and not be attributable to the merit-aid policy.

Second, despite the variances explained within each model, there exists the potential that additional time variant factors, which influence the outcomes, are missing from the analysis. The fixed-effects approach accounts for institutional factors that are consistent and immeasurable but does not account for covariates that vary across time.

ESTIMATION RESULTS

Figure 2 illustrate the changes in AP program participation over the past 25 years of both adopting and non-adopting merit-aid states. Prior to any state adoption of merit-aid programs in 1987 non-adopting and future adopting merit-aid states exhibited similar participation rates—2.7% and 2.5% of total high school student respectively. By the end of the analytical sample the gap between merit-aid and non-merit-aid states participation increased to 2.35%—21.30 and 18.95% respectively. It is clear that regardless of merit-aid adoption, AP program participation within the U.S. experienced tremendous growth.

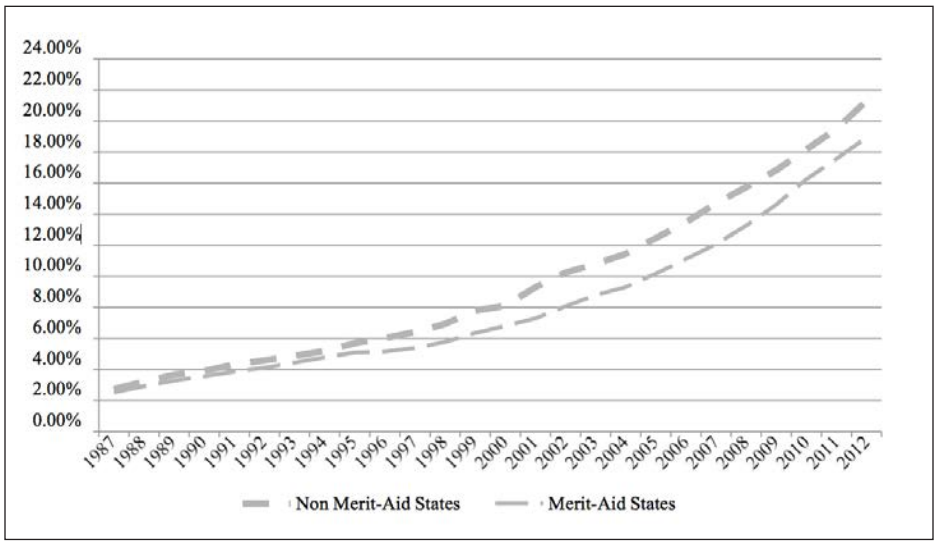

Figure 2. Trend in AP Program Participation over Time (Merit-Aid States vs Non-Merit-Aid States)

While Figure 2 illustrates a potential negative relationship between merit-aid program adoption and AP program participation, the relationship cannot be definitively expressed. This is due in part of the other factors that may impact secondary student participation in AP programs. Factors such as the economic condition of a given state, the total enrollment in secondary schools, and AP program access all mediate the potential relationship between merit-aid policies and AP participation.

The descriptive statistics, as presented in Table 3, provide insight into growth on other state, academic and financial indicators that may have influenced the gap in AP participation. Across each of the independent variables, there appears to be similar growth pre- and post-adoption for both merit and non-merit-aid states. In generally, non-adopting merit-aid states appear to possess slightly higher state economic conditions, most academically successful students, and larger secondary student population—consistent with previously research on factors impacting merit-aid policy adoption (Doyle 2006).

Difference-in-Differences Estimation

Table 4 presents the effects of adopting merit-aid policies on participation in the AP program. Results do not appear to confirm a statistical difference in AP participation post-adoption for all merit-aid states, but rather for specific merit-aid states. When controlling for unobserved heterogeneity—through the two-way fixed effects—as well other covariates that impact AP participation varying

Table 3. Means and Standard Deviations

	Minimum	Maximum	Merit-Aid States (1992)	Merit-Aid States (2011)	Non-Merit-Aid States (1992)	Non-Merit-Aid States (2011)
Dependent Variables						
AP Examinations per FTE	0.00	0.52	0.04 (0.021)	0.18 (0.096)	0.05 (0.029)	0.20 (0.094)
AP Student Participation (%)	0.30	30.25	2.78 (1.336)	10.50 (5.194)	3.13 (1.767)	11.45 (5.073)
Independent Variables						
AP High Schools (100)	0.05	17.32	1.83 (1.117)	3.11 (2.069)	1.96 (2.119)	3.44 (3.910)
HS Enrollment FTE (10,000)	1.35	201.37	21.67 (13.048)	28.10 (20.050)	22.76 (27.373)	30.07 (39.250)
Secondary Expenditures per FTE ($100)	45.33	223.39	72.64 (13.448)	101.65 (17.954)	85.22 (21.605)	118.61 (34.363)
State Gross Domestic Product ($10,000)	1.88	210.25	18.32 (12.842)	27.07 (19.481)	21.14 (27.137)	32.22 (41.074)
States (N)	--	--	13	13	37	37

Note: expenditures and financial variables are adjusted for inflation and in 2010 constant dollars; FTE = full-time equivalents enrollment

across time, the adoption of merit-aid policies failed to produce a significant change in AP program participation or exams completed.

For each of the two outcomes, model (1) represents the pooled estimates of the impact of merit-aid adoption on AP program participation. While the directionality of the coefficient is negative—2.1% for AP exams and 0.9% for AP students, this study observed no statistically significant differences in AP student participation post adoption of a merit-aid policy. The heteroskedastic and autocorrelated adjusted difference-in-differences models accounted for greater than 95% of the variance explained. This explanatory power is enhanced by the inclusion of mediating factors such as number of schools with an AP program, total number of high school enrollments, and the state's economic condition – all significantly impacting AP program participation.

Column (2) represented the individual state estimates pre- and post-adoption of a merit-aid policy. Merit-aid policies significantly impacted the number of AP exams in five states. Results are presented are logged transformed rather than actual exams take. Georgia (26.5%; $p<0.001$) and Nevada (20.5%; $p<0.001$) experienced a significant increase in the number of AP exams. South Carolina (-22.1%; $p<0.001$), Louisiana (-13.9%; $p<0.01$), and Massachusetts (-8.6%; $p<0.05$), experienced a significant decrease in the AP exams taken post-adoption.

The results for the number of students participating in the AP program followed similar estimates as those for the number of AP exams. Specifically,

Table 4. Effects of Merit-aid Adoption on AP Exams and Student Participation

	AP Exams (logged)			AP Students (Logged)		
	Full Model (1)	**State Specific Adoption Terms (2)**	**Placebo Check (3)**	**Full Model (1)**	**State Specific Adoption Terms (2)**	**Falsification Checks (3)**
Post x Adopting State	**-0.021**		**Yes(-)**	**-0.009**		**Yes(-)**
	(0.019)			**(0.018)**		
GA x Adoption	--	0.265***	No	--	0.259***	No
	--	(0.071)		--	(0.067)	
MS x Adoption	--	-0.094	No	--	-0.088	No
	--	(0.061)		--	(0.059)	
FL x Adoption	--	0.012	No	--	-0.010	No
	--	(0.035)		--	(0.035)	
LA x Adoption	--	-0.139**	Yes(-)	--	-0.125**	Yes(-)
	--	(0.053)		--	(0.033)	
SC x Adoption	--	-0.221***	No	--	-0.206***	No
	--	(0.066)		--	(0.064)	
KY x Adoption	--	0.061	Yes(-)	--	0.100	Yes(-)
	--	(0.071)		--	(0.070)	
TN x Adoption	--	-0.090	Yes(-)	--	-0.082*	No
	--	(0.046)		--	(0.041)	
MA x Adoption	--	-0.086*	No	--	-0.082*	No
	--	(0.039)		--	(0.052)	
MI x Adoption	--	-0.068	No	--	-0.034	No
	--	(0.041)		--	(0.036)	
MO x Adoption	--	0.008	No	--	0.038	No
	--	(0.034)		--	(0.030)	
NV x Adoption	--	0.205***	No	--	0.206***	No
	--	(0.056)		--	(0.058)	
NM x Adoption	--	-0.128	No	--	-0.076	No
	--	(0.075)		--	(0.064)	
WV x Adoption	--	-0.020	No	--	-0.009	No
	--	(0.096)		--	(0.096)	
# of AP Schools (100)	**0.188*** **	**0.197*** **		**0.183*** **	**0.192*** **	
	(0.018)	**(0.017)**		**(0.0170)**	**(0.016)**	
High School	**0.010*** **	**0.010*** **		**0.009*** **	**0.009*** **	
Enrollment (10,000)	**(0.002)**	**(0.002)**		**(0.002)**	**(0.002)**	
	0.001	**0.001** **		**0.001**	**0.001** **	
NAEP Scale Score	**(0.000)**	**(0.001)**		**(0.000)**	**(0.000)**	
Secondary Expenditures	**-0.020***	**-0.016***		**-0.016***	**-0.017***	
Per FTE ($1,000)	**(0.001)**	**(0.001)**		**(0.007)**	**(0.001)**	
State Gross Domestic	**-0.016*** **	**-0.017*** **		**-0.015*** **	**-0.016*** **	
Product ($10,000)	**(0.005)**	**(0.002)**		**(0.002)**	**(0.002)**	
# of Observations	1,275	1,275	1,275	1,275	1,275	1,275
# of Groups (institutions)	50	50	50	50	50	50
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State-Specific Trend	Yes	Yes	Yes	Yes	Yes	Yes
Model R^2	0.9883	0.9889	0.9883	0.9883	0.9889	0.9883

*Note: Panel corrected standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001; Coefficients are adjusted using an AR1 process.*

Georgia (25.9%; *p<0.001*) and Nevada (20.6%; *p<0.001*) experienced a significant increase in the number of student participating in the AP program. Louisiana (-12.5%; (*p<0.01),* South Carolina (-20.6%; *p<0.001*), Tennessee (-8.2%; *p<0.05*), and Massachusetts (-8.2 %; *p<0.05*) experienced a significant post-adoption decrease in the number of the students participating in the AP program.

Finally, to ensure that the estimated increases or decreases in AP program participation are related to the adoption of a merit-aid policy, this study implemented a placebo check to confirm the results. If the results described above were actually a product of the adopted merit-aid policy, the placebo check would yield insignificant results for each state. Column (3) provides the notation of significance and directionality. Results from the placebo check indicate that the increases in both Georgia and Nevada have actual results attributable to the adoption of the merit-aid policy due to the lack of significance from the placebo check. States who experienced a decrease in their AP participation that was not attributed to any time related variable are South Carolina and Massachusetts.

In an attempt to further demonstrate robustness of results, this study estimated the effect size using the underlying data within the difference-in-differences models. Note that the values associated with Cohen's *d* are positive if the mean difference is in the predicted direction, and, therefore, the representation of the effect size is adjusted to illustrate such a relationship. Table 5 provides a summary of the Cohen *d* effect size and corresponding *eta-sq* values for each of the dependent variables of the model.

Table 5. Effect Size of the Dependent Variables

	Cohen d	**Effect Size r**
Total AP Examinations	0.794	0.369
AP Student Participation	0.813	0.377

Across both dependent variables, the calculated Cohen's *d* is large. Both outcomes have a coefficient of approximately 0.80. With a Cohen's *d* of 0.8, 79% of the treatment group will be above the mean of the non-treated states, 69% of the treated and untreated groups will overlap, and there is a 71% greater chance that a state selected randomly from the treatment group will experience an increase in

AP participation than a state selected randomly from the control group (probability of superiority). Large effect sizes represent the stability of the estimates and the robustness of the results. The placebo check combined with effect size estimates illustrate that results of this study are robust and the impact of merit-aid policy on AP participation is state-dependent.

CONCLUSIONS

States' desire to increase their in-state enrollment has manifested in the adoption of merit-aid programs. Consistent state-level experimentation with financial aid policies is primarily motivated by a desire to increase access and institutional efficiency. However, the adoption of these postsecondary policies oftentimes has unintended effects. Few scholars have examined the effect postsecondary policies have on student decisions at the secondary level. This study attempted to codify the impact of postsecondary financial incentives on secondary decisions. The presence of merit-aid policies oftentimes increases the necessity of academic success in high school. In many adopting states, students have not only admission and enrollment incentives to succeed academically but also additional financial incentives.

The results of this study indicate that adopting merit-aid in states where the initial qualifying requirement is high school GPA and AP performance is weighted greater than that in traditional secondary courses experienced an increase in their AP program participation. States where the merit-aid programs' initial requirements were SAT/ACT performance or postsecondary performance did not significantly increase their AP program participation. This is particularly true for states that provide students with a full-point increase in weight for AP courses (5.0 vs. 4.0). This result appears to support Flowers (2008), who affirmed that students who participated in AP courses achieved significantly higher high school GPAs than students who did not.

Georgia and Nevada, the two states with significant increases in AP participation, have consistent initial merit-aid scholarship requirements that rest solely on students' performance in their secondary courses. Additionally, both states provide statewide and an expansive list of the AP courses that count towards the initial eligibility criteria—both states provide an additional grade-point for completing an AP course and exam in their calculation of merit-aid eligibility. The fact that Georgia was an early adopter (1993) and Nevada a late adopter (2000) provide additional evidence that the effects are a not a product of time, but rather, the incentives within the specific merit-aid policy. The decline in AP performance in Massachusetts is understandable as access to the merit-aid scholarship is tied directly to state secondary assessments rather than secondary GPA. Since AP courses are not aligned to the secondary assessments in Massachusetts, engaging in unaligned rigorous AP courses could potentially decrease the likelihood of qualifying for the merit-aid scholarship.

Our findings confirm the rationality of students' engaging in rigorous courses when incentives to reduce the financial cost of higher education are solely rooted in their high school course performance. This increase in probability of taking rigorous AP courses seems to be concentrated in states where a full additional

grade point is given for AP courses—the largest positive adjustment.

The lack of a significant increase in states utilizing state or national assessments as their eligibility criteria provide additional evidence to the rationality of students and their understanding of how to maximize their likelihood of achieving a merit-aid scholarship. Since students across all states face the same pressures associated with postsecondary admittance, one can reasonably assume that across all adopting states (and non-adopting states), high school students experience similar incentives to enroll in AP courses to enhance their college application; however, states like Georgia and Nevada place a financial premium on secondary course success and thus further incentive participation.

This study is one of the first attempts to codify the effects of postsecondary policy adoption on decisions made by students while in high school. The effectiveness of merit-aid policies' creating access and supporting student success in a postsecondary environment is well-documented in the literature (Ness & Tucker 2008). Additionally, the literature provides robust evidence of the positive impact of AP program participation on college readiness and postsecondary success (Cooney et al. 2013). The results of this study yield additional areas of focus. Specifically, an exploration of different responses based on student and school demographics would be interesting. Unpacking non-significant impacts in states with dual initial eligibility requirements would provide further insight into student motivations in states like Georgia, Nevada, and Kentucky.

Future researchers utilizing student-level data could codify the connections among merit-aid policies, their initial eligibility requirements, and participation in AP courses/exams. Our study illustrates the first estimates connecting merit-aid policies and rigorous course completion in high school. As students engaged in the academically and financially competitive postsecondary admission process, they appeared to leverage rigorous high school courses when doing so provided the largest benefits to reducing postsecondary fiscal barriers.

References

ACT, Inc. (2013). *The condition of college and career readiness 2013*. Iowa City, IA: ACT, Inc.

An, B. P. (2013). The influence of dual enrollment on academic performance and college readiness: Differences by socioeconomic status. *Research in Higher Education*, *54*, 407-432.

Attewell, P., & Domina, T. (2008). Raising the bar: Curricular intensity and academic performance. *Educational Evaluation and Policy Analysis*, 30(1), 51–71

Babad, E., & Tayeb, A. (2003). Experimental analysis of students' course selection. *British Journal of Educational Psychology*, *73*, 373-393.

Bandura, A. (1986). *Social foundations of thought and action: A sociocognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Barnard-Brak, L., McGaha-Garnett, V., & Burley, H. (2011). Advanced Placement course enrollment and school-level characteristics. *NASSP Bulletin*, *95*(3), 165-174. doi: 10.1177/0192636511418640

Baum, S. R., & Schwartz, S. (1988). Merit aid to college students. *Economics of Education Review*, *7*(1), 127-134.

Betts, J. R. (1997). *Do grading standards affect the incentive to learn?* San Diego, CA: University ofCalifornia at San Diego.

Cohen-Vogel, L., Ingle, W. K., Levine, A. A., & Spence, M. (2008). The "spread" of merit-based college aid: Politics,policy consortia, and interstate competition. *Educational Policy*, 22(3), 339-362

College Board. (2014). "AP." Retrieved from http://professionals.collegeboard.com/testing/ap.

College Entrance Examination Board. (1962). *Advanced Placement Program: Course descriptions*. NewYork, NY: College Entrance Examination Board.

Conley, D. T. (2007). *Toward a more comprehensive conception of college readiness*. Eugene, OR: Educational Policy Improvement Center.

Contreras, F. (2011). Strengthening the bridge to higher education for academically promising underrepresented students. *Journal of Advanced Academics*, *22*(3), 500-526.

Cooney, S. M., McKillip, M. E. M., & Smith, K. (2013). *An investigation of college students' perceptions of Advanced Placement courses* (Research Report No. 2013-2). Retrieved from College Board website: http://research.collegeboard.org/sites/default/files/publications/2013/4/researchnote-2013-2-college-students-ap-perceptions.pdf

Davenport, E. C., Jr., Davison, M. L., Kuang, H., Ding, S., Kim, S., & Kwak, N. (1998). High school mathematics course-taking by gender and ethnicity. *American Educational Research Journal*, *35*(3), 497-514.

DeFrank-Cole, L., Cole, R., & Garbutt, K. (2009). Does broad-based merit aid affect socioeconomic diversity in Honors? *Journal of the National Collegiate Honors Council*, *10*(1), 61-64.

Doyle, W. R. (2010). Does Merit-Based Aid "Crowd Out" Need-Based Aid? *Research in Higher Education*, *51*(5), 397–415.

Doyle, W. R. (2010). Changes in institutional aid, 1992–2003: The evolving role of merit aid. *Research in Higher Education*, *51*, 789-810.

Dynarski, S. (2000). Hope for whom? Financial aid for the middle class and its impact on college attendance. *National Tax Journal*, 53(3), 629- 661.

Duffy, J., Gunther, G., & Walters, L. (1997). Gender and mathematical problem solving. *Sex Roles*, *37*(7-8), 477-494.

Graff, C. G. (2011). Course selection theory and college transition seminars: An adaptation of college choice models to explain first-year students' course enrollment behavior [Doctoral dissertation]. Retrieved from ProQuest. UMI No.: 3473180

Griffith, A. L. (2011). Keeping up with the Joneses: Institutional changes following the adoption of a merit aid policy. *Economics of Education Review*, *30*, 1022–1033.

Hansen, K., Reeve, S., Gonzalez, J., Sudweeks, R. R., Hatch, G. L., Esplin, P., & Bradshaw, W. S. (2006). Are Advanced Placement English and first-year college composition equivalent? A comparison of outcomes in the writing of three groups of sophomore college students. *Research in the Teaching of English*, *40*(4), 461-501.

Harkreader, S., Hughes, J., Tozzi, M. H., & Vanlandingham, G. (2008). The impact of Florida's Bright Futures Scholarship programs on high school performance and college enrollment. *NASFAA Journal of Student Financial Aid*, *38*(1), 5-16.

Henry, G. T., & Rubenstein, R. (2002). Paying for grades: Impact of merit-based financial aid on educational quality. *Journal of Policy Analysis and Management*, *21*(1), 93-109.

Hernández-Julián, R. (2009). Merit-based scholarships and student effort. *Education Finance and Policy*, *5*(1), 14-35.

Hickman, D. C. (2009). The effects of higher education policy on the location decision of individuals: Evidence from Florida's Bright Futures Scholarship Program. *Regional Science and Urban Economics*, *39*, 553-562

Hoffman, N., Vargas, J., & Kazis, R. (2004). *Double the numbers: increasing postsecondary credentials for underrepresented youth.* Cambridge, MA: Harvard Education Press.

Hurwitz, M. (2012). *How does institutional grant aid impact college choice?* Retrieved from College Board website: http://advocacy.collegeboard.org/sites/default/files/11b_4821_GrantAid_ ResearchBrief_ WEB_120607.pdf

Jackson, C. K. (2010). A little now for a lot later: A look at a Texas Advanced Placement Incentive Program. *Journal of Human Resources*, 45 (3), 591–639.

Jeong, D. W. (2009). Student participation and performance on Advanced Placement Exams: Do state-sponsored incentives make a difference? *Educational Evaluation and Policy Analysis*, *31*(4), 346-366.

Jones, B. L. (2009). *A grounded theory of the course-choosing experiences of African American high school students and their families related to advanced-level course* [Doctoral dissertation]. Retrieved from ProQuest. UMI No.: 3387653

Kash, J. P., & Lasley, S. (2009). Defining merit: The impact of award structure on the distribution of merit aid. *Journal of Student Financial Aid*, *39*(1), 30-40.

Kim, J. (2012). Exploring the relationship between state financial aid policy and postsecondary enrollment choices: A focus on income and race differences. *Research in Higher Education*, *53*, 123-151.

Klopfenstein, K. (2004). Advanced Placement: Do minorities have equal opportunity? *Economics of Education Review*, 23 (2),115–131.

Klopfenstein, K., & Thomas, K. M. (2009). The LINK between Advanced Placement experience and early college success. *The Southern Economic Journal*, 75 (3), 873- 891.

Leonard, R. A. (2009). *High school students' course selection decisions in South Carolina: The influence of education professionals, parents, peers, and academic performance* [Doctoral dissertation]. Retrieved from ProQuest. UMI No.: 3421346

Long, B. T. (2004). How do financial aid policies affect colleges? *Journal of Human Resources 39*(4), 1045-1066.

Long, B. T., & Riley, E. (2007). Financial aid: A broken bridge to college access? *Harvard Educational Review*, *77*(1), 39-63.

Mattern, K. D., Marini, J. P., & Shaw, E. J. (2013). *Are AP students more likely to graduate from college on time* (Research Report No. 2013-5)? Retrieved from College Board website: http://research.collegeboard.org/sites/default/files/publications/2014/1/research-report-2013-5-are-ap-students-more-likely-graduate-college.pdf

Mattern, K. D., Shaw, E. J., & Ewing, M. (2011). *Advanced Placement exam participation: Is AP exam participation and performance related to choice of college major* (Research Report No. 2011-6)? Retrieved from College Board website: http://research.collegeboard.org/publications/content/2012/05/info-go-summary-ap- exam-participation-and-performance-related-choice

Mattern, K. D., Shaw, E. J., & Xiong, X. (2009). *The relationship between AP exam performance and college outcomes* (Research Report No. 2009-4). Retrieved from College Board website: https://research.collegeboard.org/sites/default/files/publications/2012/7/researchreport-2009-4-relationship-between-ap-exam-performance-college-outcomes.pdf

McLendon, M.K.,Hearn, J.C.,& Lacy, T.A. (2010, April).Gambling on merit aid: An event history analysis of the rise and spread of merit-aid programs. Paper presented at the annual meeting of the Midwest Political Science Association, Chicago

Monks, J. (2009). The impact of merit-based financial aid on college enrollment: A field experiment. *Economics of Education Review*, *28*, 99–106.

Moore, G., & Slate, J. R. (2010). Advanced Placement courses and American Indian performance. *American Secondary Education*, *28*(2), 73-94.

Murphy, D., & Dodd, B. (2009). *A comparison of college performance of matched AP and Non-AP student groups* (Research Report No. 2009-6). Retrieved from College Board website: https://research.collegeboard.org/sites/default/files/publications/2012/7/researchreport-2009-6-comparision-college-performance-matched-ap-non-ap-student-groups.pdf

Ness, E. C., & Tucker, R. (2008). Eligibility effects on college access: Under-represented student perceptions of Tennessee's merit aid program. *Research in Higher Education*, *49*, 569-588. Orsuwan, M., & Heck, R. H. (2009). Merit-based student aid and freshman interstate college migration: Testing a dynamic model of policy change. *Research in Higher Education*, *50*, 24-51. Pallais, A. (2009). Taking a chance on College: Is the Tennessee Education Lottery Scholarship Program a Winner? *The Journal of Human Resources, 44*(1), 199-222Sciarra, D. T. (2010). Predictive factors in intensive Math course-taking in high school. *Professional School Counseling*, *13*(3), 196-207.

Spade, J. Z., Columba, L., & Vanfossen, B. E. (1998). Tracking in mathematics and science: Courses and course-selection procedures. *Sociology of Education*, *70*(2), 108-127.

Sridhar, D. J. (2001). *Postsecondary enrollment effects of merit-based financial aid: Evidence from Georgia's HOPE scholarship program* [Doctoral dissertation]. Retrieved from ProQuest. UMI No.: 3025399

Stanley, R. E., & French, P. E. (2009). Evaluating increased enrollment levels in institutions of higher education: A look at merit-based scholarship program. *Public Administration Quarterly, 33*(1), 4-36.

Stater, M. (2009). The impact of financial aid on college GPA at three flagship public institutions. *American Educational Research Journal*, *46*(3), 782-815

Sterns, E., Potochmick, S., Moller, S., & Southworth, S. (2010). High school course-taking and post-secondary institutional selectivity. *Research in Higher Education*, *51*, 366-395

Thompson, T., & Rust, J. O. (2007). Follow-up of advanced placement students in college. *College Student Journal*, *41*(2), 416-422.

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

Zocco, D. (2009). Risk theory and student course selection. *Research in Higher Education*, *3*, 1–29.