The Effects of State Merit Aid Programs on Attendance at Elite Colleges

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Abstract

State merit aid programs have been found to reduce the likelihood that students attend college out-of-state. Using the *U.S. News & World Report* (*USNWR*) rankings of colleges and universities to measure college quality and Integrated Postsecondary Education Data System data to measure enrollment, we explore how this reduction in out-of-state enrollment differs by the academic quality of the institution. Our difference-in-differences results suggest that state merit aid programs do not induce students to forgo attending top 15 ranked schools. However, state merit aid does induce some students to forgo attending out-of-state schools ranked below the top 15 and shifts them toward lower quality in-state schools, so that the net effect is a reduction in academic quality, as measured by *USNWR*. These effects may have long-term implications for students' degree completion rates and labor market earnings.

1. Introduction

Over the past 10 years a substantial number of papers have been published that explore the various effects of state funded student merit aid programs.[1] One of the early findings of this research is that merit aid reduces the probability that a student goes to college out-of-state. A question of interest and policy relevance is where these students would have gone to college in the absence of the merit aid program. A related stream of research has examined the determinants of college enrollment choices more generally, with enrollment at elite institutions receiving special attention, likely because, as we discuss below, of the considerable benefits to a student from attending an elite school and the important societal role that elite institutions play in educating some of the nation's greatest young minds. In this paper, we examine the effects of state merit-based student financial aid programs on out-of-state enrollment, looking separately at different sets of colleges and universities that vary in their level of prestige. Specifically, we consider whether out-of-state enrollment at elite institutions responds differently to state merit aid programs than enrollment at less prestigious schools. Understanding how merit aid alters students' enrollment choices is one piece of the bigger puzzle of the consequences of merit aid programs, and is significant given the important role that the quality of higher education institutions that students attend has. Despite the importance of this issue, it has received very little attention in previous research, and thus our research fills an important gap in the research literature. We also contribute to the broader literature on college choice since our results have implications regarding the price sensitivity of students in choosing between institutions.

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[1] Dynarski (2004) provides a discussion of how state-funded merit aid programs work. In general, merit aid is restricted to in-state students with a B or better GPA. The size of the aid ranges across states from a few hundred dollars to full tuition.

There are a few articles that provide estimates of the number of students who go to college in-state rather than out-of-state due to merit aid; see Dynarski (2000), Cornwell, Mustard, and Sridhar (2006), Zhang and Ness (2010), and Orsuwan and Heck (2009).[2] Knowing where students would have gone without merit aid is of considerable importance but much less explored. Goodman (2008) finds that the Massachusetts' Adams Scholarship merit aid program induced six percent of eligible students to switch from four-year private colleges to four-year public colleges. Goodman also explores heterogeneous effects by standardized test score percentiles and finds that the effect of merit aid on in-state public enrollment diminishes as ability increases and is statistically insignificant for students above the 90th percentile. Cohodes and Goodman (2014) further examine the effect of the Adams Scholarship on college switching and find that roughly half of such switches were to lower quality schools and that this reduction in college quality harmed students. However, studies of Georgia and Tennessee find positive effects of merit aid on college selectivity, for example, by students shifting students from two-year to four-year schools (Chakrabarti and Roy 2013; Bruce and Carruthers 2014).[3]

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[2] Dynarski (2000) conducted one of the first studies of the implications of student merit aid programs on enrollment profiles, focusing on Georgia's HOPE Scholarship program. To provide some notion of the size of the effect of HOPE on out-of-state enrollment, she considers two- and four-year colleges in states that border Georgia, and finds that in 1992 (pre-HOPE) 5,000 Georgian freshmen attended college in those states, while in 1998 (post-HOPE) that number had fallen to 4,500. Cornwell, Mustard, and Sridhar (2006) consider the same issue and find that Georgia's HOPE Scholarship program reduced the number of Georgians that go to an out-of-state four-year school by 560. Zhang and Ness (2010) use IPEDS data to estimate the effect of student merit aid on college enrollment in 10 states. In particular, they estimate that merit aid programs reduced out-of-state enrollment by nearly 9 percent, but with substantial differences across states. Orsuwan and Heck (2009) also use IPEDS data and consider the effect on student out-migration for all states that adopted merit aid programs. They find that the percentage of students going to college out-of-state was increasing prior to the adoption of merit aid but began to decline upon the adoption of merit aid; they do not provide any summary measure of the percentage change in the number of students going to college out-of-state. Other studies examining the effects of merit aid on in-state/out-of-state college enrollment include Binder and Ganderton (2004), Farrell and Kienzl (2009), Toutkoushian and Hillman (2012), and Hawley and Rork (2013). A few additional studies have also examined effects of merit aid on post-college retention in the state workforce (Sjoquist and Winters 2013, 2014; Leguizamon and Hammond 2015; Harrington et al. 2016).

[3] Chakrabarti and Roy (2013) first provide overall estimates for Georgia's HOPE Scholarship that include students switching from one in-state college to another and from out-of-state colleges to in-state colleges. However, their focus is to examine separate effects on in-state and out-of-state college enrollment. They find that Georgia resident freshmen enrolling in-state attended more selective schools post-HOPE and Georgia freshmen enrolling out-of-state also attended more selective schools post-HOPE. Bruce and Carruthers (2014) first show effects of Tennessee's

Of course, there are important differences between Massachusetts, Georgia, and Tennessee and their merit aid programs. Georgia's HOPE Scholarship is a large program that until recently covered full tuition and fees at in-state public institutions and was awarded very broadly; for example, in 1995-1996 HOPE was awarded to 70 percent of incoming freshmen at Georgia public colleges and universities (Sjoquist and Winters 2013). Tennessee's HOPE program is similar to Georgia's, though historically somewhat less generous. Massachusetts' Adams Scholarship covers in-state tuition but not fees, which are more substantial than tuition at Massachusetts public colleges and universities; the Adams Scholarship is also much more selectively targeted to a narrower group of high ability students. Finally, the public and private higher education options and pre-merit program enrollment patterns in the states differ, with Massachusetts having a higher percentage of students enrolled at private colleges and universities, both in-state and out-of-state.

For many state merit aid programs, keeping the state's "best and brightest" high school graduates in-state for college is an important goal. Thus, it is of interest to know if a merit aid program attracts the very best of the state's students to stay in-state or those who just marginally qualify for merit aid. With the exception of the few studies referenced above, research on the effects of merit aid on out-of-state enrollment has been unable to say much about the academic ability of the students who stay in-state for merit aid, other than that they qualify for merit aid. While it is not feasible to identify which in-state students would have gone to college out-of-state in the absence of merit aid, we can consider the change due to merit aid in out-of-state

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HOPE Scholarship on student shifting from two-year to four-year schools and then show general movement up the quality ladder of four-year public institutions in the state. Singell, Waddell, and Curs (2006) examine effects of Georgia's HOPE Scholarship on Pell and non-Pell enrollments and suggest that HOPE improved college access for needy students and did not crowd them out of selective institutions. However, Singell, Waddell, and Curs (2006) do not examine overall effects on college quality.

enrollment by the academic quality of the college. To the extent that students' academic ability is correlated with the academic quality of the college attended, we can infer something about the academic quality of the students by measuring how the change in enrollment differs by the academic quality of the college. In particular, we consider how enrollment of a state's students in elite colleges changes as a result of the adoption of a merit aid program.

A further concern regarding the effect of merit aid on college choice is that if students shift from out-of-state colleges that are of high academic quality to in-state schools that are of lower quality, the students' future earnings could suffer. Hoekstra (2009) finds that attending the most selective state university causes earnings to be approximately 20 percent higher for white men. Brewer, Eide and Ehrenberg (1999), Eide, Brewer and Ehrenberg (1998), Hoxby (1998), Hoxby and Long (1999), and Long (2008, 2010) obtain similar results for attendance at other elite institutions, although Dale and Krueger (2002) find effects from attending a higher tuition institution but not from attending a more selective one. Other benefits of attending an elite college have also been identified; see Hurwitz (2012) for a discussion. Furthermore, there may be societal benefits from having highly talented students educated at elite institutions, who then become leaders in science, business, and government.

Using a difference-in-differences approach we investigate how out-of-state enrollment in elite and in non-elite colleges changes as a result of state merit aid programs. We use *U.S. News & World Report* (*USNWR*) rankings of colleges and universities to measure college quality and Integrated Postsecondary Education Data System (IPEDS) data to measure enrollment at each institution by state of residence. We are especially interested in effects of merit aid on enrollment at the very top colleges and universities, which has not been explicitly considered in previous research. Our analysis also differs from previous single-state studies by examining nine states

with relatively large and generous merit aid programs rather than just one merit aid program. We find that merit aid significantly reduced the likelihood of enrolling at less prestigious out-of-state schools. However, our results suggest that state merit aid programs do not reduce the likelihood that a student attends a very top ranked school. This is a new result in this small but important literature and has considerable implications. We also consider how merit aid programs affect enrollment at in-state schools by rank and find a statistically significant increase in enrollment in *USNWR* national universities and colleges only for those that *USNWR* ranked in the fourth quartile.

As noted above, one objective of merit aid programs is to retain the "best and brightest" students in state for college. Given that merit aid programs do not cause students who go to the most elite out-of-state schools to shift to in-state schools, merit aid has not resulted in the very best and brightest to stay in state for college. This is not surprising given that none of the states with a significant merit aid program has a university or college ranked in the top 15 and there are likely large benefits from elite enrollment that elite students are unwilling to forego for lower quality in-state options. However, outside the top 15 schools, there is some reduction in total enrollment at schools in the top two quartiles of *USNWR* rankings, suggesting that merit aid is inducing some students to shift to lower quality in-state alternatives. This suggests that the net effect is a reduction in academic quality as measured by *USNWR*.

The remainder of the paper proceeds as follows. In the next section we present a simple conceptual framework for our analysis. Section 3 discusses the *U.S. News & World Report* college ranking, including a discussion of the studies that show that students (and which students) use *USNWR* rankings. Section 4 discusses our empirical approach and describes the

data we use, while Section 5 contains the results. A summary and conclusion section completes the paper.

2. Conceptual Framework

The bulk of the research on college enrollment focuses on the effect of tuition and student aid on aggregate enrollment rates or on the probability that a high school graduate attends college; see Heller (1997) and Ehrenberg (2004) for reviews of the literature. Additional research addresses the choice of which college to attend, which is relevant to our analysis. Fuller, Manski and Wise (1982), building off the work of Kohn, Manski, and Mundel (1976), provide one of the earliest studies of college choice.[4] Their framework, which is the standard framework for this literature, views a high school graduate as choosing from among a set of schooling and non-schooling options, where choice depends on factors such as tuition, scholarships, living expenses, the opportunity cost of schooling, college quality and student academic ability. While there are empirical studies of matriculation at specific colleges, for example Curs and Singell (2002), there are very few studies that consider student choices from among a large number of colleges. Besides Fuller, Manski, and Wise (1982), studies that explore the choice across multiple colleges were conducted by Weiler (1996) and Avery and Hoxby (2004), both of which focus on high ability students, and Long (2004), who explores how the importance of factors such as distance, tuition, and college quality have changed over time. As Nurnberg, Schapiro, and Zimmerman (2012) note, the literature is sparse; see Long (2007) for a review of this literature.

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[4] Manski and Wise (1983) provide a more extensive discussion of college choice, but the empirical analysis is the same as Fuller, Manski and Wise (1982).

The following is a simple framework, influenced by the college choice literature and the framework in Jacob, McCall and Stange (2013), in which to cast our empirical work. Consider a student who is choosing between two colleges, denoted by C_I and C_O, where C_I represents an in-state school and C_O an out-of-state college. We assume the colleges charge different prices (i.e., tuition and other fees net of financial aid), denoted by T_I and T_O, and differ in the set of attributes provided. These attributes include the academic quality of the college, the types of majors offered, consumption amenities such as spending on student activities, sports, and housing, the nature of the social life, etc. For the moment assume that the set of attributes can be represented by a one-dimensional variable denoted A_j, $j = I, O$. Assume that $T_I < T_O$ and $A_I < A_O$, in other words, the price of attributes is increasing. The student is assumed to choose the college that maximizes a preference function denoted $F(A_j, T_j)$, where $F^1 > 0$ and $F^2 < 0$.

Consider a student who, given prices and attributes, chooses C_O, the out-of-state college. Suppose now that T_I decreases due to the availability of a new merit-based student aid program. Under what conditions will the student now prefer C_I rather than C_O?

Whether C_I now becomes the preferred school depends on the student's substitutability between T and A, and the difference in A_I and A_O relative to the change in T_I. Given the substitutability, the smaller the difference between A_I and A_O, the more likely it is that the reduction in T_I will be sufficient for $F(A_I, T_I)$ to exceed $F(A_O, T_O)$, and thus that the student would attend college in state in the presence of the merit-based aid program. The greater the difference between A_I and A_O, the less likely it would be that the student's preferred college would change for a given change in T_I. The greater the substitutability, the smaller the difference between A_I and A_O has to be in order for the student to prefer C_I as result of the new aid program.

There are many characteristics of a college that a student might value, but for simplicity consider two categories of characteristics, namely consumption amenities and academic quality.[5] Consumption amenities include such things as ready access to ski slopes, strong athletic programs that win national titles, student activity programs, etc. Colleges differ in the extent to which they provide consumption amenities (Jacob, McCall and Stange 2013).

We assume that students differ in the relative value they place on consumption amenities and academic quality.[6] This assumption is consistent with Jacob, McCall and Stange (2013), who estimate a discrete choice model in which students care about net price, academic quality, consumption amenities, proximity, and peer composition, and find significant heterogeneity of preferences across students.

Consider a student who is of high academic ability and who places a high value on academic quality relative to consumption amenities.[7] Suppose that for this student C_O is one of the relatively small number of "elite" colleges and universities that offer a very high quality academic experience. Most states do not have an elite public college or university, and most merit aid programs do not extend merit aid eligibility to students in private in-state schools (or at least not the same level of aid as for public institutions). Thus, C_I for this student will be a college with a relatively lower academic quality. Thus, for this student we expect that the difference between A_I and A_O will be large, so that a small change in T_I will be insufficient to cause the student to now prefer C_I to C_O. Furthermore, if tuition at an elite school is high, the fact that the student chooses to attend the elite school suggests that he places great weight on quality.

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[5] Weiler (1996) finds that non-financial characteristics of colleges are highly significant determinants of college choice, and that students weigh non-academic and academic characteristics about the same.

[6] Fuller, Manski and Wise (1982) find that students prefer a college with an academic quality similar to the student's academic ability.

[7] Long (2004) finds that for high ability students, the effect of a college's academic quality on college choice is twice as large as for other students.

This is consistent with Jacob, McCall, and Stange (2013), who find that high achieving students have a greater willingness to pay for academic quality, and Long (2004); see also McDuff (2007) and Alter and Reback (2014). Thus, we do not expect that a new merit aid program would cause a student to switch from an elite out-of-state college to an in-state school.

If C_O provides a lower academic quality, it seems reasonable to assume that there would be in-state colleges with similar academic quality. Thus for students attending a lower academic quality out-of-state school, we expect that a decrease in T_I will be sufficient to cause at least some of these students to change their preferred school from C_O to C_I.

Consider now students who place a relatively higher value on consumption amenities. We assume that colleges compete for such students and offer a set of consumption amenities that attract their desired student body. Jacob, McCall and Stange (2013) note that there is substantial heterogeneity across colleges in their emphasis on consumption amenities and attribute this to heterogeneity on the demand side. Given the large number of colleges, we hypothesize that the willingness to pay for A_O over A_I for many students is not much larger than the pre-merit difference in T_O and T_I. Thus, we expect that a new merit aid program would cause several of the students who chose an out-of-state school because of these consumption amenities to switch from an out-of-state to an in-state college. Of course, an out-of-state college could offer a very unique consumption amenity that certain students highly desire so that a reduction in T_I would be insufficient to cause the student's choice of college to change.

3. *U.S. News & World Report* **Rankings**

To measure the quality of colleges and universities, we use the *U.S. News & World Report* rankings released in 1990 (*U.S. News & World Report* October 1990). The factors used to

construct the ranking for 1990 are: the selectivity of the student body; the degree to which the school financially supports a high-quality, full-time faculty; the overall financial resources; and student satisfaction.

There is a vast literature that criticizes college rankings in general and the *USNWR* rankings in particular; see Webster (2001) for a list of references. Concern is expressed that the rankings may not measure the quality of the education obtained by students, that the factors are subject to manipulation, and that the weights for the various factors are arbitrary and that small changes in the weights can lead to significant changes in rankings. Ehrenberg (2005) discusses many ways that colleges try to influence the ranking but that do not represent improvements in academic quality. For example, schools increasingly publicize their achievements to improve their score on academic reputation or take steps to increase the applicant pool so that their acceptance rates are lower. There are also reports that colleges misreport information; in 2012, Emory University reported that it had supplied false information to *USNWR* for more than a decade (Morse 2012).

The advantage of the *USNWR* ranking is that it combines substantial information into a single rank which proxies for the quality of the school. Despite criticisms of *USNWR* rankings, as Ehrenberg (2005) points out, most of the factors that are used in *USNWR* rankings are pieces of information that colleges actually include in their promotional materials.[8]

USNWR changes its methodology from time to time, and colleges do change over time, so we would expect some changes in the rankings over time. While the rankings among at least the top ranked schools do change from year to year, they do not change a lot. In 1990, *USNWR* ranked the top 25 national universities. Comparing the 1990 rankings to the 2015 rankings for

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[8] Webster (2001) conducted a principal component analysis of the *USNWR* rankings and concluded that the most significant ranking criterion is the average SAT score.

national universities, we found that of the top 25 national universities as of 1990, 6 increased their rank by more than 5 places and 5 decreased their rank by more than 5 places (including those who fell out of the top 25), but that no school moved more than 10 places. Of the 25 schools in the 1990 rankings, 22 were in the top 25 in 2015. So, while there are changes over time, the changes from year-to-year are small.

The *USNWR* ranking is consistent with an alternative ranking using an entirely different methodology. Avery et al. (2013) construct a ranking of undergraduate programs using an algorithm that relies on the choices students make among the schools to which they were accepted. We compared the top 25 universities on their list to the top 25 in the *USNWR* for 2004. Of the top 25 universities in the Avery et al. list, 21 are in the top 25 in the *USNWR* list.

There is evidence that the *USNWR* rankings are perceived as an indicator of quality. First, the *USNWR* issue containing college rankings is the magazine's best-selling issue and has become the "gold standard" of the college-ranking business (Ehrenberg 2005). The rankings are used in studies as a proxy for quality or reputation (see citations to relevant studies in Griffin and Rask (2007)).

Second, there are surveys that suggest that students consider college rankings in making their college choice, see McDonough et al. (1998), Machung (1998), Chang and Osborn (2005), and Clayton (2013). Third, there are studies that find that the rankings do in fact affect the choice of college; see Hazelkorn (2015) for a list of such studies. Monks and Ehrenberg (1999) find that a less favorable rank leads an institution to accept a greater percentage of its applicants, that a smaller percentage of its admitted applicants matriculate, and the resulting entering class is of lower quality, as measured by its average SAT scores. The Monks and Ehrenberg results were updated by Ren (2013), while Meredith (2004) and Bowman and Bastedo (2009) provide

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confirming results. See also Griffith and Rask (2007), who suggest that colleges will be unsuccessful using merit aid to attract high-income high-ability students away from the most prestigious and highly ranked institutions, a result that is consistent with the implication of our conceptual framework, and Alter and Reback (2014).

4. Empirical Approach and Data

We consider the effects of a state's merit aid program on out-of-state enrollment among college freshmen from the state in several sets of colleges and universities grouped by *USNWR* categories. Our interest is to examine whether the effects of state merit aid on out-of-state enrollment differ by the "eliteness" of higher education institutions. We implement a difference-in-differences regression framework, comparing elite enrollment pre- and post-adoption of merit aid and between states that did and did not adopt merit aid. The treatment group consists of cohorts who were exposed to a state merit-aid program, i.e., those who graduated from high school in a state with a merit aid program and after the program was implemented. The control group includes cohorts from states that did not adopt a merit-aid program and cohorts from merit-adopting states but who graduated high school before the merit program in their state was implemented. We estimate variants of the following regression:

$$lnE_{st} = \theta Merit_{st} + \beta X_{st} + \Gamma_s + \Pi_{st} + \varepsilon_{st}, \tag{1}$$

where lnE_{st} is the log of enrollment among recent first-time freshmen (who graduated high school in the past 12 months) from state *s* in year *t* in any of a set of out-of-state schools; *Merit* is an indicator variable equal to one if state *s* has a merit program in year *t* and zero otherwise; *X* is a set of control variables including the log of the state's population of 18 year olds, log of the state's median household income, state unemployment rate, and log of in-state tuition at the

state's public flagship universities; Γ_s are state fixed effects; Π_{st} are region-by-year dummies; and ε_{st} is an error term.

We measure lnE_{st} using bi-annual data from the Integrated Postsecondary Education Data System (IPEDS) Residence and Migration Survey for the period 1986 through 2012.[9] IPEDS reports for each college and university the number of recently graduated high school students who enroll in that college by state of residence.[10] We consider several alternative sets of colleges and universities as ranked by *U.S. News & World Report* in their October 15, 1990 issue. We use the 1990 rankings because we do not want the rankings to be affected by the adoption of state merit aid programs, which began in the early 1990s. The 1990 *USNWR* rankings in total include 204 "National Universities" (universities) and 141 "National Liberal Arts Colleges" (LACs). For universities and for LACs, *USNWR* provides individual rankings for the top 25, but reports only the ranking quartile for those outside the top 25. We divide the top 25 for each group into those in the top 15 and those ranked 16-25.[11] This gives us six ranking categories, namely, the top 15 ranked schools, the next 10 ranked schools, the rest of the top quartile, the second quartile, the third quartile, and the fourth quartile. We consider universities and LACs combined and separately, so that, for example, the top 15 universities and LACs consists of the top 15 universities plus the top 15 LACs. We also consider separate outcomes for

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[9] The Residence and Migration Survey has been administered to all U.S. colleges and universities in even-numbered years since 1986 except for 1990, which is excluded. Starting in 2001, a more limited sub-sample was surveyed in odd-numbered years on a voluntary basis. However, many institutions do not respond in the odd years, so we include only the even years in our analysis.

[10] Prior residence data are missing for a few schools for a few years. If the observations are missing at random, it will not bias our results. The results reported in the paper rely on this assumption, although it is hard to know *a priori* how random missing observations are. As an alternative, we imputed values for missing observations. The imputation procedure is based on a regression approach for state-institution flows that regresses observed flows (from origin states to individual institutions in non-missing years) on institution dummies and linear institution year trends, separately for merit and non-merit time periods. The regression results (see Online Appendix Table A-1) when we use this method are qualitatively similar to those reported in the tables in the paper.

[11] We also experiment with restricting the very top ranked group to just the top 10 (see Online Appendix Table A-2).

universities and LACs. In all, this gives 18 (= 6 ranking groups × 3 institution groupings)

enrollment outcome variables.[12] Our analysis focuses on out-of-state enrollment, so ranked

institutions within a state (both public and private) are excluded from our measures of that state's

outflows, but we conducted additional analysis for in-state enrollment as discussed below. The

table in Appendix 1 reports the schools in the top quartile.

Sjoquist and Winters (2014, 2015) identify 25 states that implemented a merit scholarship

program between 1991 and 2004; six more states implemented merit programs between 2005

and 2008. However, some of these state programs are relatively small and not likely to have a

sizable impact on student outcomes. Based on program characteristics including the dollar value

of awards and the percentage of students receiving the merit aid, Sjoquist and Winters (2014,

2015) classify nine states as having "strong" merit aid programs; the other merit states are

considered to have "weak" programs. We use their classification of strong merit aid states to

measure $Merit_{st}$. Table 1 lists the nine states and the year of adoption of their merit aid program.

Weak merit aid states receive only partial treatment and should be less affected than strong merit

aid states, but their partial treatment also makes them poorly suited for the control group. Weak

merit states are, therefore, excluded from both the treatment and control group in our primary

analysis.[13] Additional states have adopted weak merit aid programs since 2004 bringing the total

number of weak merit states to 22. The 22 states with weak merit aid programs are Alaska,

Arizona, Arkansas, California, Delaware, Hawaii, Idaho, Illinois, Maryland, Massachusetts,

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[12] The 1988 flow from West Virginia to LACs ranked 16-25 was zero; the missing log value was recoded to -1. Results below are robust to excluding this observation or treating the value as zero. All other flows for the 18 primary outcomes variables were greater than zero.
[13] In results not shown but discussed briefly below, we did examine potential merit aid effects in weak merit states relative to non-merit states.

Michigan, Mississippi, Missouri, Montana, New Jersey, New York, North Dakota, Oklahoma, South Dakota, Utah, Washington, and Wyoming.

The regression analysis includes a number of control variables. State fixed effects account for time-invariant differences across states and their inclusion means that the identifying variation comes from across cohorts within states. Region-by-year dummies account for temporal differences within Census regions with minimal parametric assumptions; their inclusion means that pre- and post-merit differences in merit aid states are compared to differences in non-merit states in the same region during the same time periods. This also means that states in other regions only affect the merit coefficient through their effects on the state control variables coefficients. Seven of the strong merit states are in the South region, while Nevada and New Mexico are in the West region. South region control states include Alabama, North Carolina, Virginia, and Texas. The West region control states are Colorado and Oregon.

The log of the state's population of 18 year olds is included to account for differences in out-flows across cohorts due to cohort size. Larger cohorts should send more people to colleges and universities both in-state and out-of-state. However, larger cohorts might disproportionately increase out-of-state enrollment if in-state institutions have constraints due to limited resources or capacity. Median household income and the unemployment rate in a state might affect both student financial capacity and student desires to leave their origin state. Higher in-state tuition, as measured by tuition at a state's flagship universities, is likely to increase out-of-state enrollment among the state's residents.[14] The cohort size data are obtained from the U.S. Census Bureau population estimates. Median household income is computed using the March Current

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[14] Avery and Hoxby (2004) find that the probability that a student attends a college, from among those to which the student was admitted decreases the higher the school's tuition. Long (2004) also finds that tuition negatively affects the probability of attending a particular college, but that the effect has declined over time.

Population Survey. State unemployment rates are obtained from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics (LAUS) database. In-state tuition values are obtained from IPEDS. Flagship universities are defined as in Rizzo and Ehrenberg (2004) and Winters (2012). Specifically, the set of flagships includes all public universities classified as Research I or II in the 1994 Carnegie Foundation Classification System plus the top public institution in a few states without a Carnegie Research I or II university. The tuition variable is the mean across flagship schools in a state. Summary statistics for the main enrollment outcome variables and the state control variables are reported in Table 2, separately for strong merit states and non-merit states.

5. Results

Table 3 presents the basic results. Standard errors are clustered by origin state to account for potential serial correlation within states.[15] In these regressions, we exclude states with weak merit aid programs from the analysis. In general the results are consistent with our priors. The coefficients on strong merit aid for the top 15 schools are negative but small and statistically insignificant, whether we consider just the top 15 universities, the top 15 liberal arts colleges (LACs), or the combined set. Limiting elite schools to just the Top 10 yields results that are very similar to those in column 1 of Table 3 (see Online Appendix Table A-2). The results imply that

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[15] Clustered standard errors can be biased when the number of clusters is small (Bertrand, Duflo, and Mullainathan 2004). Our main analysis includes 28 states in total, which should be sufficiently large to avoid considerable standard error bias but not enough to eliminate concerns entirely. In results not shown, we also estimated two alternative inference procedures. The first is a standard block-bootstrap that resamples entire states instead of individual state-year observations. The second is based on a related inference procedure for differences-in-differences suggested by Conley and Taber (2011) that is especially useful when there are a small number of policy changes and a large number of control groups. The inferences using both alternative procedures are very similar to using the clustered standard errors reported. No outcomes go from statistically significant with clustered standard errors to insignificant with the alternatives. One outcome (Panel C, Column 6) goes from statistically insignificant with clustered standard errors (p-value = 0.137) to statistically significant at the ten percent level using both alternatives. The coefficients for enrollment at top 15 schools remain statistically insignificant in all three panels for both alternative inference procedures.

the adoption of merit aid in the students' home state does not reduce the number of students attending top ranked out-of-state schools. This seems plausible, since it suggests that free tuition at in-state institutions is not a sufficient incentive for students to give up attending a top 15 school in order to attend a state public college or university. The results imply that students are price insensitive when choosing between elite and non-elite institutions, which is consistent with the literature noted above suggesting that the benefits of attending an elite institution are substantial. This finding also has implications for suggestions that merit aid programs help states retain the "best and brightest" students in-state. Strictly speaking, students capable of attending top 15 schools have the most legitimate claim to the title of "best and brightest" and their enrollment decisions appear unaltered by merit aid. The results also have implications for the debate over the market power of elite colleges and universities.[16]

All of the coefficients in Table 3 are negative. The absolute values of the coefficients on strong merit aid are larger for schools ranked below the top 15, and are statistically significant in all but one case (Panel C Column 6). The coefficients outside the top 15 range from -0.137 to -0.369. The results warrant careful interpretation. Since the dependent variable is measured in logs, a coefficient of -0.239 (Panel A Column 2) implies that adoption of a merit aid program reduces the number of students from a merit-aid state who go to an out-of-state college or university ranked 16th to 25th by roughly 23.9 percent. This percentage reduction in out-of-state enrollment is relative to pre-merit cohorts within the same state (because of state fixed effects), while accounting for common time differences across states in the same census region (via

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[16] Alternatively, it is also possible that some elite-level students are affected by state merit aid programs but top-ranked schools are committed to maintaining geographic diversity and thus take steps, such as providing more financial aid or admitting more students from merit aid states, in order to achieve that objective. We are unable to provide any evidence for or against this possibility but it seems unlikely to be the main explanation for the null effects on out-of-state enrollment at Top 15 schools.

region-year dummies). Furthermore, we cannot directly use the 23.9 percent reduction in out-of-state enrollment at 16-25 ranked schools to make inferences about effects on in-state enrollment.[17] We discuss in-state enrollment effects later.

The effects in Table 3 are typically larger for universities than for LACs and tend to increase as the rank falls. The results for universities are consistent with our expectations, since we expect that the incentive provided by merit aid would have a larger effect the lower the rank of the school. The smaller effect of merit aid for LACs than for universities suggest that students have greater attachment to out-of-state LACs than out-of-state universities, i.e., merit-adopting states may have better in-state substitutes for non-top ranked national universities than for non-top ranked national LACs. However, the size and statistical significance of the coefficients across the sets of LACs do not follow a consistent trend pattern by college rank. The lower level of significance relative to universities further suggests that the attachment to LACs is different than the attachment to universities. These results are consistent with the possibility that LACs are less homogeneous than universities so there is less substitutability among LACs, and that in choosing a liberal arts college students weigh non-academic factors more heavily than students attending a university. It is also possible that LACs are especially committed to maintaining geographic diversity.

To provide a visual summary of our results, Figure 1 illustrates how mean log enrollment in the top 15 and the 4th quartile out-of-state schools by students from merit-aid states reacted to the adoption of merit aid. The vertical axis is the mean of the log of the number of merit-aid state students who go to an out-of-state college in each ranking category. The x-axis measures the

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[17] For example, most students attend college in-state and only a subset attend schools within given ranking categories, so base levels vary across categories. Also, it is possible that merit aid reduces enrollment overall. However, this latter concern is unlikely based on theoretical expectations via the law of demand and prior research literature (Dynarski 2004); we tested this possibility and discuss results below.

number of years before and after the adoption of merit aid. Since the year of adoption of a merit aid program differs by state, event time is defined so that the first year of merit aid adoption is zero for all merit aid states. Since the IPEDS Residence and Migration Survey was conducted every two years, event time is constructed using two-year windows. Georgia is excluded from the figure because it adopted its merit aid program in 1993, but the IPEDS survey was not conducted in 1990, which prevents us from observing Georgia in event time -3; including Georgia in the figure in the other years would unbalance the sample. Consistent with the results in Table 3, we see that enrollment of students in merit aid states in the top 15 colleges and universities was similar pre- and post-merit aid, while enrollment in the 4th quartile colleges and universities was increasing prior to the adoption of merit aid, but decreased subsequent to the adoption of the merit aid program.

Table 4 explores whether the effects differ by public and private institutions. Since almost all of the top 25 schools and most of the top quartile are private schools, we estimated the regressions for all schools in the 1st quartile, as well as for the 2nd, 3rd, and 4th quartiles. We expect the effect of merit aid will be greater for out-of-state public institutions than for private institutions for at least two reasons. First, merit-adopting states may have better in-state substitutes for out-of-state public institutions than for private ones, similarly to what was suggested above for national universities relative to LACs. Second, merit aid will generally represent a much larger percentage change in relative tuition between the home state and out-of-state public schools than for out-of-state private schools. As expected, we find that the effect is larger for public than for private schools. The coefficients also again somewhat increase in magnitude as rank diminishes.

It is also of interest to explore the effect of merit aid on in-state enrollment. Table 5 repeats the analysis of Table 3, but rather than considering enrollment of students in out-of-state schools, it considers enrollment in in-state schools. None of the merit aid states has a top 25 school or a top quartile LAC, and thus we have no results for those categories. Furthermore, there are only 6 universities in merit aid states in the first quartile, and no LACs. The signs on the coefficients are mixed, but only the coefficients for the fourth quartile are statistically significant, and they are positive. The effect of merit aid on the type of in-state enrollment is jointly due to the effect of merit aid on reducing out-of-state enrollment as shown in Table 3, the effect on the probability of enrolling in college at all, and the effect on the choice of college among those enrolling in-state regardless of merit aid (see, for example, Dynarski 2000). Our results suggest that merit aid increased enrollment in only the fourth quartile among *USNWR* national universities and LACs. In results not shown, we also estimated the effects of strong merit aid programs on 1) log total in-state enrollment at all colleges and universities in a state and 2) log in-state enrollment in public flagship universities defined as in Rizzo and Ehrenberg (2004) and Winters (2012). The former regression yields a modest positive coefficient (0.034) that is statistically insignificant at conventional levels, while the latter yields a positive coefficient of 0.120 that is significant at the ten percent level.

In Table 6, we consider effects of strong merit aid on total enrollment of students in both in-state and out-of-state colleges by *USNWR* category. This essentially combines Table 3 and Table 5, though coefficients are not strictly addable because enrollment totals for Table 6 are summed first and then logged and because many states have no in-state schools in particular categories while other states do. For example, columns (1) and (2) of Table 6 differ from those in Table 5 since the control states have in-state elite schools. As in Table 3, the effect of merit aid

on enrollment in Top 15 schools is statistically insignificant. Other than the fourth quartile, the coefficients for the other 4 categories are negative though not always statistically significant, as is the case in Table 3. The coefficients for the fourth quartile are of mixed sign but statistically insignificant. This reflects the decrease in out-of-state enrollment in fourth quartile schools (Table 3) and increase in in-state enrollment in fourth quartile schools (Table 5). While merit aid does not push students out of elite (Top 15) schools, it does appear to push them out of national universities and LACs in the top three quartiles of *USNWR* rankings, even when including in-state schools. Thus, merit aid likely reduces the quality of college attended for a large number of high ability students, consistent with results for Massachusetts found in Goodman (2008) and Cohodes and Goodman (2014).

Table 7 explores potential heterogeneous effects of merit aid on log out-of-state enrollment over time. Rather than a single merit-aid dummy, we created a set of merit aid-by-year dummy variables and estimated the model for the combined set of universities and colleges. The results are consistent with those in Table 3 in that the coefficients on the merit aid variable are smaller and statistically insignificant for the Top 15 schools, and the effect of merit aid is larger the lower the rank of the set of schools. We note that the magnitude of the coefficients increased for years around the Great Recession, as one would anticipate since we would expect students to be more sensitive to the availability of merit aid during tougher economic times.

We ran several other alternative regressions to explore the sensitivity of the results to alternative assumptions. First, the regressions in Table 3 consider all even numbered years over a relatively long time period. To explore the effects of merit aid around the year of adoption of the merit aid program, we estimate the regressions using only observations within six years pre- and

post-merit aid adoption in merit-aid states.[18] These results, which are presented in Table 8, are very similar to those in Table 3, although the effects are slightly smaller in magnitude (less negative) in Table 8.[19] The reduction using the narrow time window is consistent with estimates in Table 7 suggesting that effects were larger in magnitude during and after the Great Recession since the 6-year window closes prior to 2008 for all but Tennessee. We also estimated the regressions after completely removing the Northeast and Midwest regions from the analysis, and also by replacing the region-by-year dummies with national year dummies that include all non-merit states in the control group. The results from these two alternatives are qualitatively robust to what is reported in the tables (see Online Appendix Tables A-4 and A-5). Finally, instead of using the 1990 *USNWR* rankings, we repeated the analysis using the 2010 *USNWR* rankings for the highest ranked 25 colleges and 25 universities. Given the small change in rankings that we noted above, it is not surprising that the results are very similar for the two sets of rankings; the effects using the 2010 rankings are a little larger for the Top 15 and smaller for the schools ranked 16-25, but the pattern is the same as with the 1990 rankings.

We considered several other alternatives, and since they are consistent with the results presented in Table 3, we do not include them in a table in the paper. We first estimated the regression equation using weak merit aid states as treatment states and excluding strong merit aid states from the analysis. As expected, the coefficients on *MERIT* are generally negative (with one estimate just above zero) but are smaller in magnitude than those for strong merit states and are less consistently statistically significant (see Online Appendix Table A-6). Given that the merit

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[18] For example, for this exercise states with strong merit programs adopted in 1997 would potentially include IPEDS observations from 1991-1996 in the pre-merit control group and observations from 1997-2002 in the post-merit treatment group. However, because the data is limited to even years, the actual control group years for such states would be 1992, 1994, and 1996, while the actual treatment group years would be 1998, 2000, and 2002. Non-merit states are included in the control group for the full period.

[19] Results not shown are very similar if we use a four-year pre- and post-merit window (see Online Appendix Table A-3).

aid programs in these states are not as generous, we expected that the effects would be smaller, and perhaps hard to detect. We next added the weak merit aid states to the control states, even though this is conceptually undesirable since students in those states did receive partial treatment (see Online Appendix Table A-7). The results are consistent with those in Table 3, although the magnitudes of the coefficients are moderately smaller. Third, we compared the enrollment rates and income levels of the strong merit aid states and the remaining control states and deleted three control states that appear different from merit aid states. Thus, in addition to excluding states in the Northeast and Midwest, we dropped Colorado, Virginia, and Oregon (see Online Appendix Table A-4). For pooled enrollment in national universities and LAC's, we find no qualitative effect on the results when we remove Colorado and Virginia. Further removing Oregon results in the coefficient for Other Top Quartile becoming smaller and not statistically significant. However, the main result still holds, the coefficient for Top 15 (elite) enrollment is very small and not significant while the coefficient is quite large for the other groups. Fourth, we considered heterogeneous effects by distance. The likelihood of attending an out-of-state school may be negatively related to the distance from the home state to the out-of-state school.[20] Thus, we restricted the schools in the set of ranked schools to those located within 500 miles of the population center of the state. For a few states there are no top ranked schools within 500 miles, and so these states were not included in this alternative analysis. However, the results were consistent with those reported in Table 3 (see Online Appendix Table A-8). Since it is possible that in-state flagship tuition in a state is related to whether the state has adopted a merit aid program, there is concern that this control variable is endogenous. We therefore estimated the

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[20] Long (2004) finds that over time the importance of distance in selecting a college has declined, which is consistent with the findings of Hoxby (1997) regarding the changing market structure of U.S. higher education. Alm and Winters (2009) and Lowe and Viterito (1989) find that the deterrent effect of distance declines with institutional quality.

regressions excluding this control variable (see Online Appendix Table A-9). The results are essentially the same as those in Table 3, although there is a slight decrease in precision. We also examined using institutional expenditures and graduation rates reported in IPEDS as alternatives to *USNWR* to measure quality. However, there are some concerns with these, so we relegate these results to Online Appendix Tables A-10, A-11, and A-12.[21]

A significant number of freshmen enroll in college out-of-state. In 1992, 18.6 percent of recent first-time freshmen from the 9 states with strong merit aid programs enrolled out-of-state. Table 9 addresses the question of how large is the number of students who out-migrate to top schools. In 1992, 1,873 students from the 9 states attended a top 15 ranked school, and 4,943 students attended a top quartile schools. For the 9 states, 6.0 percent of student out-migrants went to a top 15 college and 15.9 percent went to a top quartile college. These are not inconsequential magnitudes. Furthermore, these are very high ability students and their enrollment decisions are likely especially important.

6. Summary and Conclusion

In this paper we explore how the effects of state merit aid programs on students' decisions to attend college out-of-state differ by the "eliteness" of the out-of-state college. Using

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[21] We computed both current and instructional expenditures in 1990 divided by total enrollment and obtained six-year graduation rates for the 1996 cohort and summed these across *USNWR* categories. There are concerns with these data. For example, there are dozens of lesser known schools with 100 percent graduation rates, which may be due to reporting error or lack of rigor. Instructional expenditures do not separate undergraduate and graduate instruction and it is also unlikely that consistent rules are applied for allocating faculty salaries to instruction versus other activities such as research. That said, the means of these alternative quality measures across *USNWR* categories are consistent with expectations, but there is considerable overlap across *USNWR* categories; see Online Appendix Table A-10. We also then divided institutions into quality categories based on graduation rates (Online Appendix Table A-11) and instructional expenditures per pupil (Online Appendix Table A-12) and estimated regressions for log enrollment by these quality categories similar to our main results. The results are noisy, as expected, but broadly consistent with our main results using *USNWR* quality categories. Specifically, the negative effects on out-of-state enrollment are larger for more moderate quality institutions than very high quality ones and the effects on overall enrollment suggest a shift from higher quality out-of-state institutions to lower quality in-state ones.

U.S. News & World Report rankings of colleges and universities to measure "eliteness" and IPEDS data to measure freshmen enrollment by school and home state, we find that merit aid programs have a small negative, but statistically insignificant effect on out-of-state enrollment in the top ranked 15 schools. However, as the school rank falls, the negative effect on out-of-state enrollment increases in magnitude and becomes statistically significant. We also find larger average effects for public institutions than private institutions and larger effects for national universities than for national liberal arts colleges outside the top quartile. The results are not sensitive to alternative specifications.

The differing effects by the quality of institutions have implications for state merit aid programs and highlight more general differences between elite and less elite institutions. Merit aid programs were adopted in part in order to retain top students in state. Strong merit aid programs did result in a substantial percentage reduction in the number of students going to college out-of-state, including many who would have instead gone to colleges and universities ranked in the top two quartiles by *USNWR*. This implies that state merit aid programs can help keep many very good students in-state for college. However, our results suggest that merit aid programs did not incentivize students with the academic ability to attend top ranked national colleges and universities to attend school in state. Thus, merit aid may influence many better and brighter students to stay in-state, but it appears unlikely to influence the college choice decisions of the very best and brightest students from the state.

Merit-eligible in-state colleges and universities are frequently lower ranked than the out-of-state institutions that would have been chosen absent merit aid. Therefore, the net effect of merit aid on total enrollment (including in-state and out-of-state) by *USWNR* category is to

reduce the number of students attending high quality (but not elite) schools and therefore likely reducing the quality of higher education that they receive.

The implications regarding elite enrollment are also important. Our results imply that students do not view a merit scholarship at an in-state institution as a sufficient incentive to give up attending a very top school. Thus, students appear to be very price insensitive when choosing between elite and non-elite colleges and universities. This is consistent with popular perceptions and empirical research suggesting that students receive considerable benefits from attending an elite higher education institution.

References

Alm, James, and John V. Winters. 2009. Distance and intrastate college student migration. *Economics of Education Review* 28(6): 728-738.

Alter, Molly, and Randall Reback. 2014. True for your school? How changing reputations alter demand for selective U.S. colleges. *Educational Evaluation and Policy Analysis* 36(3): 346-370.

Avery, Christopher, Mark Glickman, Caroline M. Hoxby, and Andrew Metrick. 2013. A revealed preference ranking of U.S. colleges and universities. *Quarterly Journal of Economics* 128(1): 425-467.

Avery, Christopher, and Caroline M. Hoxby. 2004. Do and should financial aid packages affect students' college choice? In *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*, edited by Caroline M. Hoxby. Chicago, IL: University of Chicago Press, pp. 239-299.

Bertrand, Marianne, Ester Duflo, and Sendhil Mullainathan. 2004. How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics* 119(1): 249-275.

Binder, Melissa, and Philip T. Ganderton. 2004. The New Mexico Lottery Scholarship: Does it help minority and low-income students? In *State Merit Scholarship Programs and Racial Inequality*, edited by Donald E. Heller and Patricia Marin. Cambridge, MA: Civil Rights Project at Harvard University, pp.101–22.

Bowman, Nicholas A., and Michael N. Bastedo. 2009. Getting on the front page: Organizational reputation, status signals, and the impact of U.S. News and World Report on student decisions. *Research in Higher Education* 50(5): 415-436.

Brewer, Dominic J., Eric R. Eide and Ronald G. Ehrenberg. 1999. Does it pay to attend an elite private college? Cross-cohort effects of college type on earnings. *Journal of Human Resources* 34: 104-123.

Bruce, Donald J., and Celeste K. Carruthers. 2014. Jackpot? The impact of lottery scholarships on enrollment in Tennessee. *Journal of Urban Economics* 81: 30-44.

Chakrabarti, Rajashri, and Joydeep Roy. 2013. Merit aid, student mobility, and the role of college selectivity. FRB of New York Staff Report No. 641.

Chang, Gordon C., and J.R. Osborn. 2005. Spectacular colleges and spectacular rankings: The U.S. News Rankings of American 'Best' colleges. *Journal of Consumer Culture 5*(3): 338-364.

Clayton, Dana D. 2013. Factors and influences contributing to the college selection decision of high achieving high school seniors. Ph.D. dissertation, Educational Leadership Doctoral Program, Western Kentucky University, Bowling Green, Kentucky. Available at http://digitalcommons.wku.edu/diss/49

Cohodes, Sarah R., and Joshua S. Goodman. 2014. Merit aid, college quality, and college completion: Massachusetts' Adams Scholarship as an in-kind subsidy. *American Economic Journal: Applied Economics* 6(4): 251-285.

Conley, Timothy G., and Christopher R. Taber. 2011. Inference with "difference in differences" with a small number of policy changes. *Review of Economics and Statistics* 93(1): 113-25.

Cornwell, Christopher M., David B. Mustard, and Deepa J. Sridhar. 2006. The enrollment effects of merit-based financial aid: Evidence from Georgia's HOPE Program. *Journal of Labor Economics* 24(4): 761-86.

Curs, Bradley, and Larry D. Singell, Jr. 2002. An analysis of the application and enrollment process for in-state and out-of-state students at a large public university. *Economics of Education Review* 21(2): 111-24.

Dale, Stacy B., and Alan B. Krueger. 2002. Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables. *Quarterly Journal of Economics* 117: 1491-1527.

Dynarski, Susan, 2000. Hope for whom? Financial aid for the middle class and its impact on college attendance. *National Tax Journal* Part 2 53(3): 629-61.

Dynarski, Susan, 2004. The new merit aid. In *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*, edited by Caroline M. Hoxby. Chicago: University of Chicago Press, pp. 63-97

Ehrenberg, Ronald G. 2004. Econometric studies of higher education. *Journal of Econometrics* 121(1-2): 19-37.

Ehrenberg, Ronald G. 2005. Method or madness? Inside the *U.S. News and World Report* college rankings. *Journal of College Admission* 189: 29-35.

Eide, Eric R., Dominic J. Brewer and Ronald G. Ehrenberg. 1998. Does it pay to attend an elite private college: Evidence on the effects of undergraduate college quality on graduate school attendance. *Economics of Education Review* 17(4): 371-376.

Farrell, Patricia L., and Gregory S. Kienzl. 2009. Are state non-need, merit-based scholarship programs impacting college enrollment? *Education Finance and Policy* 4(2): 150-174.

Fuller, Winship C., Charles F. Manski, and David A. Wise. 1982. New evidence on the economic determinants of postsecondary schooling choices. *Journal of Human Resources* 17(4): 476-498.

Goodman, Joshua. 2008. Who merits financial aid? Massachusetts' Adams Scholarship. *Journal of Public Economics* 92(10): 2121-2131.

Griffith, Amanda and Kevin Rask. 2007. The influence of US News and World Report collegiate rankings on the matriculation decision of high-ability students: 1995-2004. *Economics of Education Review* 26(2): 244-255.

Harrington, James R., José Munoz, Bradley R. Curs, and Mark Ehlert. 2016. Examining the impact of a highly targeted state administered merit aid program on brain drain: Evidence from a regression discontinuity analysis of Missouri's Bright Flight Program. *Research in Higher Education* DOI: 10.1007/s11162-015-9392-9.

Hawley, Zackary B., and Jonatan C. Rork. 2013. The case of state funded higher education scholarship plans and interstate brain drain. *Regional Science and Urban Economics* 43(2): 242-249.

Hazelkorn, Ellen. 2015. The effects of rankings on student choices and institutional selection. In *Access and Expansion Post-Massification: Opportunities and Barriers to Further Growth in Higher Education Participation,* edited by Ben W. A. Jongbloed and Hans Vossensteyn. London: Routledge, pp 107-128.

Heller, Donald E. 1997. Student price response in higher education: An Update to Leslie and Brinkman. *The Journal of Higher Education* 68(6): 624-659.

Hoekstra, Mark. 2009. The effect of attending the flagship state university on earnings: A discontinuity-based approach. *Review of Economics and Statistics* 91(4): 717-724.

Hoxby, Caroline M. 1997. How the changing market structure of U.S. higher education explains college tuition. NBER Working Paper No. 6323.

Hoxby Caroline M. 1998. The return to attending a more selective college: 1960 to the present. Harvard Economics Department Working Paper.

Hoxby Caroline M., and Bridget Terry Long. 1999. Explaining rising income and wage inequality among the college educated. NBER Working Paper No. 6873.

Hurwitz, Michael. 2012. The impact of institutional grant aid on college choice. *Educational Evaluation and Policy Analysis* 34(3): 344-363.

Jacob, Brian, Brian McCall, and Kevin M. Stange. 2013. College as country club: Do colleges cater to students' preferences for consumption? NBER Working Paper No. 18745.

Kohn, Meir G., Charles Manski, and David Mundel. 1976. An empirical investigation of factors influencing college-going behavior. *Annals of Economic and Social Measurement* 5(4): 391-419.

Leguizamon, J. Sebastian, and George W. Hammond. 2015. Merit-based college tuition assistance and the conditional probability of in-state work. *Papers in Regional Science* 94(1): 197-218.

Long, Bridget Terry. 2004. How have college decisions changed over time? An application of the conditional logistic choice model. *Journal of Econometrics* 121: 271-296.

Long, Bridget Terry. 2007. The contributions of economics to the study of college access and success. *The Teachers College Record* 109(10): 2367-2443.

Long, Mark C. 2008. College quality and early adult outcomes. *Economics of Education Review* 27(5): 588-602.

Long, Mark C. 2010. Changes in the returns to education and college quality. *Economics of Education Review* 29(3): 338-347.

Lowe, John C., and Arthur Viterito. 1989. Differential spatial attraction of private colleges and universities in the United States. *Economic Geography* 65(3): 208-215.

Machung, Anne. 1998. Playing the rankings game. *Change* July/August: 12-16.

Manski, Charles F., and David A. Wise. 1983. *College Choice in America*. Cambridge, MA: Harvard University Press.

McDonough, Patricia M., Anthony Lising Antonio, MaryBeth Walpole, and Leonor Xóchitl Pérez. 1998. College rankings: Democratized college knowledge for whom? *Research in Higher Education* 39(5): 513-537.

McDuff, DeForest. 2007. Quality, tuition, and applications to in-state public colleges. *Economics of Education Review* 26(4): 433-449.

Meredith, Marc. 2004. Why do universities compete in the ratings game? An empirical analysis of the effects of the *U.S. News and World Report* college rankings. *Research in Higher Education* 45(5): 443-461.

Monks, James, and Ronald G. Ehrenberg. 1999. The impact of US News and World Report college rankings on admission outcomes and pricing decisions at selective private institutions. NBER Working Paper No. 7227.

Morse, Bob. 2012. Emory University misreported admissions data. U.S. News & World Report, blog of August 17, 2012, Accessed August 8, 2015. Available at http://www.usnews.com/education/blogs/college-rankings-blog/2012/08/17/emory-university-misreported-admissions-data.

Nurnberg, Peter, Morton Schapiro, and David Zimmerman. 2012. Students choosing colleges: Understanding the matriculation decision at a highly selective private institution. *Economics of Education Review* 31(1): 1-8.

Orsuwan, Meechai, and Ronald H. Heck. 2009. Merit-based student aid and freshman interstate college migration: Testing a dynamic model of policy change. *Research in Higher Education* 50(1): 24-51.

Ren, Siyuan. 2013. The impact of U.S. News & World Report college rankings: An update to Monks and Ehrenberg. M.A. thesis, College of Education, Pennsylvania State University.

Rizzo, Michael J., and Ronald E. Ehrenberg. 2004. Resident and nonresident tuition and enrollment at flagship state universities. In *College Choices: The Economics of Where to Go, When to Go, and How to Pay for It*, edited by Caroline Hoxby. Chicago: University of Chicago Press pp. 303–349.

Singell, Larry D. Jr., Glen R. Waddell, and Bradley R. Curs. 2006. HOPE for the Pell? Institutional effects in the intersection of merit-based and need-based aid. *Southern Economic Journal* 73(1): 79-99.

Sjoquist, David L., and John V. Winters. 2013. The effects of HOPE on post-college retention in the Georgia workforce. *Regional Science and Urban Economics* 43(3): 479-490.

Sjoquist, David L., and John V. Winters. 2014. Merit aid and post-college retention in the state. *Journal of Urban Economics* 80: 39-50.

Sjoquist, David L., and John V. Winters. 2015. State merit-based financial aid programs and college attainment. *Journal of Regional Science* 55(3): 364-390.

Toutkoushian, Robert K., and Nicholas W. Hillman. 2012. The impact of state appropriations and grants on access to higher education and outmigration. *Review of Higher Education* 36(1): 51-90.

Webster, Thomas J. 2001. A principal component analysis of the *U.S. News & World Report* tier rankings of colleges and universities. *Economics of Education Review* 20(3): 235-244.

Weiler, William C. 1996. Factors influencing the matriculation choices of high ability students. *Economics of Education Review* 15(1): 23-36.

Winters, John V. 2012. Cohort crowding and nonresident college enrollment. *Economics of Education Review* 31(3): 30-40.

Zhang, Liang, and Erik C. Ness. 2010. Does state merit-based aid stem brain drain? *Educational Evaluation and Policy Analysis* 32(2): 143-165.

Table 1: States with Strong Merit Aid Programs

State	Year Enacted	Program Name
Florida	1997	Florida Bright Futures Scholarship
Georgia	1993	Georgia HOPE Scholarship
Kentucky	1999	Kentucky Educational Excellence Scholarship
Louisiana	1998	Louisiana TOPS Scholarship
Nevada	2000	Nevada Millennium Scholarship
New Mexico	1997	New Mexico Lottery Success Scholarship
South Carolina	1998	South Carolina LIFE Scholarship and HOPE Scholarship
Tennessee	2003	Tennessee HOPE Scholarship
West Virginia	2002	West Virginia PROMISE Scholarship

Sources: Sjoquist and Winters (2014, 2015).

Table 2: Summary Statistics for Main Variables

	Strong Merit States		Non-Merit States	
	Mean	Std. Dev.	Mean	Std. Dev.
Log Recent FTF Out-of-State Enrollment Measures				
Top 15 - Universities and Colleges	4.945	0.868	5.389	0.848
Top 15 - National Universities	4.557	0.918	4.978	0.905
Top 15 - National LACs	3.751	0.828	4.243	0.797
16-25 - Universities and Colleges	4.479	0.840	4.951	0.809
16-25 - National Universities	4.302	0.881	4.514	0.925
16-25 - National LACs	2.467	0.941	3.639	0.989
Other Top Quartile - Universities and Colleges	5.350	0.778	5.666	0.894
Other Top Quartile - National Universities	5.269	0.802	5.496	0.912
Other Top Quartile - National LACs	2.556	0.883	3.514	1.108
Second Quartile - Universities and Colleges	5.817	0.750	6.381	0.765
Second Quartile - National Universities	5.567	0.731	6.107	0.858
Second Quartile - National LACs	4.228	0.968	4.809	0.667
Third Quartile - Universities and Colleges	5.992	0.875	6.230	0.742
Third Quartile - National Universities	5.837	0.959	6.039	0.778
Third Quartile - National LACs	3.783	0.638	4.341	0.756
Fourth Quartile - Universities and Colleges	4.660	0.752	5.432	1.029
Fourth Quartile - National Universities	4.373	0.816	5.028	1.164
Fourth Quartile - National LACs	2.962	0.960	4.134	0.906
State Control Variables				
Log population age 18	10.945	0.700	10.864	0.902
Unemployment rate	6.484	2.116	5.274	1.797
Log median household income	10.405	0.282	10.570	0.300
Log in-state tuition at public flagships	8.065	0.601	8.407	0.643
Observations	117		247	

Notes: The 13 years of data are for even years 1986-2012 excluding 1990.
The 1988 flow for West Virginia to LACs ranked 16-25 was zero; the missing log value was recoded to equal -1. All other out-migration flows considered were greater than zero.

Table 3: Effects of Strong Merit Aid on Log Recent FTF Enrollment Out-Migration by Type of Institution

Institution Type:	(1) Top 15	(2) Ranks 16-25	(3) Other Top Quartile	(4) Second Quartile	(5) Third Quartile	(6) Fourth Quartile
A. Universities and Colleges						
Strong Merit	-0.027	-0.239	-0.212	-0.239	-0.346	-0.327
	(0.037)	(0.063)***	(0.089)**	(0.064)***	(0.061)***	(0.064)***
B. National Universities						
Strong Merit	-0.016	-0.240	-0.212	-0.268	-0.368	-0.369
	(0.034)	(0.071)***	(0.093)**	(0.072)***	(0.065)***	(0.076)***
C. National LACs						
Strong Merit	-0.029	-0.184	-0.332	-0.137	-0.202	-0.167
	(0.042)	(0.081)**	(0.076)***	(0.072)*	(0.113)*	(0.109)

Note: Standard errors in parentheses are clustered by state of origin. Weak merit states are excluded from the control group. All regressions include 364 state-year observations. All regressions include state fixed effects, year fixed effects, region-by-year fixed effects, and state control variables.

*Significant at 10% level based on clustered standard errors; **Significant at 5% level; ***Significant at 1% level.

Table 4: Effects of Strong Merit Aid on Enrollment - Separately for Public and Private Institutions

	(1)	(2)	(3)	(4)
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
Institution Type:				
A. Public Universities and Colleges				
Strong Merit	-0.270	-0.264	-0.404	-0.325
	(0.101)**	(0.085)***	(0.076)***	(0.080)***
B. Private Universities and Colleges				
Strong Merit	-0.085	-0.189	-0.131	-0.232
	(0.043)*	(0.038)***	(0.068)*	(0.071)***

Note: Standard errors in parentheses are clustered by state of origin. Weak merit states are excluded from the control group. All regressions include state fixed effects, year fixed effects, region-by-year fixed effects, and state control variables.
*Significant at 10% level based on clustered standard errors; **Significant at 5% level; ***Significant at 1% level.

Table 5: Effects of Strong Merit Aid on Log In-State Recent FTF Enrollment by *USNWR* Category

Institution Type:	(1) Top 15	(2) Ranks 16-25	(3) Other Top Quartile	(4) Second Quartile	(5) Third Quartile	(6) Fourth Quartile
A. Universities and Colleges						
Strong Merit	N/A	N/A	-0.040	0.030	-0.097	0.187
			(0.091)	(0.081)	(0.072)	(0.092)*
B. National Universities						
Strong Merit	N/A	N/A	-0.032	0.060	-0.113	0.197
			(0.088)	(0.092)	(0.076)	(0.110)*
C. National LACs						
Strong Merit	N/A	N/A	N/A	-0.022	0.042	0.367
				(0.126)	(0.170)	(0.159)**

Note: Standard errors in parentheses are clustered by state of origin. Weak merit states are excluded from the control group. All regressions include state fixed effects, year fixed effects, region-by-year fixed effects, and state control variables. Results exclude states with no in-state institution in the relevant category.
*Significant at 10% level based on clustered standard errors; **Significant at 5% level; ***Significant at 1% level.

Table 6: Effects of Strong Merit Aid on Log Recent FTF Enrollment at In-state and Out-of-State Schools

Institution Type:	(1) Top 15	(2) Ranks 16-25	(3) Other Top Quartile	(4) Second Quartile	(5) Third Quartile	(6) Fourth Quartile
A. Universities and Colleges						
Strong Merit	0.016	-0.183	-0.183	-0.135	-0.176	0.123
	(0.041)	(0.067)**	(0.061)***	(0.095)	(0.065)**	(0.099)
B. National Universities						
Strong Merit	0.041	-0.176	-0.210	-0.145	-0.186	-0.040
	(0.044)	(0.075)**	(0.071)***	(0.106)	(0.065)***	(0.141)
C. National LACs						
Strong Merit	-0.019	-0.183	-0.278	-0.121	-0.093	0.139
	(0.046)	(0.079)**	(0.078)***	(0.068)*	(0.110)	(0.131)
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region*Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State control variables	Yes	Yes	Yes	Yes	Yes	Yes

Note: Standard errors in parentheses are clustered by state of origin. Weak merit states are excluded from the control group. All regressions include 364 state-year observations. Data exclude schools not ranked by USNWR.
*Significant at 10% level based on clustered standard errors; **Significant at 5% level; ***Significant at 1% level.

Table 7: Effects of Strong Merit Aid on Log Recent FTF Enrollment Out-Migration by Year

Institution Type:	(1) Top 15	(2) Ranks 16-25	(3) Other Top Quartile	(4) Second Quartile	(5) Third Quartile	(6) Fourth Quartile
Universities and Colleges						
Strong Merit*Year1994	0.041	-0.011	0.033	-0.153	-0.202	-0.144
	(0.041)	(0.054)	(0.058)	(0.049)***	(0.057)***	(0.107)
Strong Merit*Year1996	0.030	-0.233	-0.066	-0.220	-0.425	-0.374
	(0.047)	(0.083)***	(0.074)	(0.052)***	(0.069)***	(0.119)***
Strong Merit*Year1998	0.053	-0.139	-0.037	-0.060	-0.170	-0.084
	(0.055)	(0.079)*	(0.100)	(0.083)	(0.081)**	(0.134)
Strong Merit*Year2000	-0.028	-0.191	-0.163	-0.250	-0.223	-0.293
	(0.071)	(0.082)**	(0.095)*	(0.083)***	(0.098)**	(0.125)**
Strong Merit*Year2002	-0.042	-0.251	-0.197	-0.232	-0.338	-0.307
	(0.057)	(0.084)***	(0.082)**	(0.088)**	(0.100)***	(0.138)**
Strong Merit*Year2004	-0.044	-0.177	-0.202	-0.235	-0.412	-0.495
	(0.059)	(0.105)	(0.083)**	(0.081)***	(0.098)***	(0.245)*
Strong Merit*Year2006	0.025	-0.269	-0.257	-0.235	-0.276	-0.393
	(0.066)	(0.100)**	(0.112)**	(0.070)***	(0.086)***	(0.113)***
Strong Merit*Year2008	-0.087	-0.270	-0.387	-0.352	-0.437	-0.376
	(0.053)	(0.110)**	(0.139)***	(0.104)***	(0.097)***	(0.103)***
Strong Merit*Year2010	-0.116	-0.455	-0.373	-0.353	-0.474	-0.365
	(0.096)	(0.112)***	(0.147)**	(0.112)***	(0.089)***	(0.118)***
Strong Merit*Year2012	-0.035	-0.260	-0.259	-0.263	-0.521	-0.413
	(0.111)	(0.098)**	(0.158)	(0.126)**	(0.113)***	(0.129)***

Note: Standard errors in parentheses are clustered by state of origin. Weak merit states are excluded from the control group. All regressions include state fixed effects, year fixed effects, region-by-year fixed effects, and state control variables.
*Significant at 10% level based on clustered standard errors; **Significant at 5% level; ***Significant at 1% level.

Table 8: Effects of Strong Merit Aid - Restricted to 6 Years Before and After Adoption in Merit States

Institution Type:	(1) Top 15	(2) Ranks 16-25	(3) Other Top Quartile	(4) Second Quartile	(5) Third Quartile	(6) Fourth Quartile
A. Universities and Colleges						
Strong Merit	0.004	-0.146	-0.128	-0.167	-0.263	-0.298
	(0.026)	(0.054)**	(0.059)*	(0.043)***	(0.045)***	(0.064)***
B. National Universities						
Strong Merit	0.032	-0.144	-0.119	-0.212	-0.272	-0.359
	(0.024)	(0.059)**	(0.062)*	(0.050)***	(0.047)***	(0.091)***
C. National LACs						
Strong Merit	-0.033	-0.141	-0.360	-0.018	-0.164	-0.055
	(0.046)	(0.098)	(0.085)***	(0.048)	(0.089)*	(0.101)

Note: Standard errors in parentheses are clustered by state of origin. Weak merit states are excluded from the control group. All regressions include state fixed effects, year fixed effects, region-by-year fixed effects, and state control variables.

*Significant at 10% level based on clustered standard errors; **Significant at 5% level; ***Significant at 1% level.

Table 9: 1992 Elite Enrollment for Strong Merit States

	Top 15 Out-Migration		Top Quartile Out-Migration	
	Total Flow[a]	Share of Out-Migration[b]	Total Flow[a]	Share of Out-Migration[b]
Florida	711	0.081	1839	0.209
Georgia	366	0.054	879	0.131
Kentucky	106	0.047	360	0.161
Louisiana	111	0.040	284	0.103
Nevada	39	0.032	96	0.079
New Mexico	90	0.056	216	0.133
South Carolina	168	0.066	456	0.179
Tennessee	212	0.058	590	0.161
West Virginia	70	0.046	223	0.146
All	1873	0.060	4943	0.159

Notes: a. Total out-migration of recent first-time freshmen (FTF) of state residents to out-of-state institutions.

b. Total Flow divided by the total enrollment of recent FTF in all out-of-state institutions.
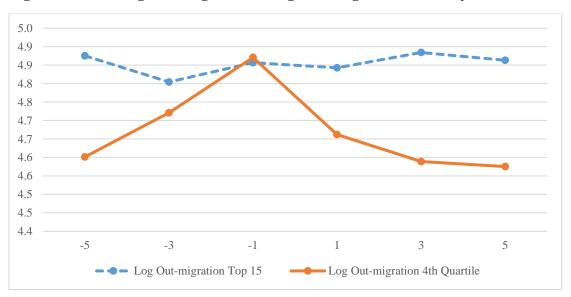
Figure 1: Mean Log Out-Migration in Eight Strong Merit States by Event Time

Note: Georgia is excluded; see text for discussion.

Appendix 1: Top Quartile Institutions by Category, Based on 1990 US News & World Report ranking

Nation Universities	Rank Category	National Liberal Arts Colleges	Rank Category
Brown University	Top 15	Amherst College	Top 15
California Institute of Technology	Top 15	Bowdoin College	Top 15
Columbia University	Top 15	Carleton College	Top 15
Cornell University	Top 15	Claremont McKenna College	Top 15
Dartmouth College	Top 15	Davidson College	Top 15
Duke University	Top 15	Middlebury College	Top 15
Harvard University	Top 15	Oberlin College	Top 15
Johns Hopkins University	Top 15	Pomona College	Top 15
Massachusetts Institute of Technology	Top 15	Smith College	Top 15
Princeton University	Top 15	Swarthmore College	Top 15
Stanford University	Top 15	Vassar College	Top 15
University of California-Berkeley	Top 15	Washington and Lee University	Top 15
University of Chicago	Top 15	Wellesley College	Top 15
University of Pennsylvania	Top 15	Wesleyan College (CT)	Top 15
Yale University	Top 15	Williams College	Top 15
Carnegie Mellon University	16-25	Barnard College	16-25
Georgetown University	16-25	Bates College	16-25
Northwestern University	16-25	Bryn Mawr College	16-25
Rice University	16-25	Colby College	16-25
University of California-Los Angeles	16-25	Colgate University	16-25
University of Michigan-Ann Arbor	16-25	Grinnell College	16-25
University of North Carolina-Chapel Hill	16-25	Hamilton College	16-25
University of Rochester	16-25	Haverford College	16-25
University of Virginia	16-25	Mount Holyoke College	16-25
Washington University in St. Louis	16-25	Occidental College	16-25
Brandeis University	Other top quart.	Bucknell University	Other top quart.
Case Western Reserve University	Other top quart.	College of the Holy Cross	Other top quart.
College of William and Mary	Other top quart.	Colorado College	Other top quart.
Emory University*	Other top quart.	Dickinson College	Other top quart.
Georgia Institute of Technology*	Other top quart.	Franklin and Marshall College	Other top quart.
Lehigh University	Other top quart.	Gettysburg College	Other top quart.
New York University	Other top quart.	Kenyon College	Other top quart.
Pennsylvania State University	Other top quart.	Lafayette College	Other top quart.
Purdue University-West Lafayette	Other top quart.	Scripps College	Other top quart.
Rensselaer Polytechnic Institute	Other top quart.	Trinity College	Other top quart.
Rutgers University-New Brunswick	Other top quart.	Union College	Other top quart.
Tufts University	Other top quart.		
Tulane University*	Other top quart.		
University of California-Davis	Other top quart.		
University of California-Irvine	Other top quart.		
University of California-San Diego	Other top quart.		
University of Connecticut-Storrs	Other top quart.		
University of Georgia*	Other top quart.		
University of Illinois Urbana-Champaign	Other top quart.		
University of Miami*	Other top quart.		
University of Notre Dame	Other top quart.		
University of Southern California	Other top quart.		
University of Washington	Other top quart.		
University of Wisconsin-Madison	Other top quart.		
Vanderbilt University*	Other top quart.		
Virginia Tech	Other top quart.		

Note: * denotes a school located in a state with a strong merit-aid program.