**The Effects of HOPE on Post-College Retention in the Georgia Workforce**

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February 2013

Abstract

Research suggests that merit scholarship programs increase college enrollment in states that adopt them but post-college migration may limit the effect these programs have on the stock of college-educated labor in those states. In this paper we consider the effect of Georgia’s HOPE Scholarship program on post-college retention, estimating the effect in two ways. First, we use administrative data on student and employment records to examine the effects of the HOPE Scholarship on post-college retention rates in the Georgia workforce for students enrolled in the University System of Georgia (USG). Second, we use data from the census and ACS and a difference-in-difference model following the approach of Hickman (2009).

JEL Codes: I23, J24, R23

Keywords: HOPE; merit aid; employment; retention; brain drain

We thank Rob Watts from the Georgia Board of Regents and David Lee from the Georgia Student Finance Commission for their assistance in providing data, Lakshmi Pandey for technical assistance, and Barry Hirsch, Youngok Lim, Christopher Taber, and two anonymous referees for helpful comments. John Winters thanks the Charles Phelps Taft Research Center for financial support. The data used in this article are proprietary and cannot be made publicly available. Researchers interested in acquiring the data should contact the Georgia Board of Regents.

**I. Introduction**

In 1993, the state of Georgia launched its HOPE Scholarship program to provide merit-based financial aid for students pursuing a postsecondary academic degree.[[1]](#footnote-1) The HOPE Scholarship program is in many ways the model for other broad-based merit aid programs that have been introduced in a number of states since the early 1990s. Several objectives have been enumerated for these merit-based financial aid programs including: increasing academic achievement; increasing the percentage of high school students who attend college; increasing the percentage of the “best and brightest” students who stay in-state to go to college; and increasing the quality of the workforce, in part by retaining the “best and the brightest” after they graduate from college.

Several studies have investigated how HOPE and similar merit-based aid programs affect many of the outcomes associated with these objectives. For example, treating the adoption of HOPE as a natural experiment, Dynarski (2000, 2002, 2004, 2008) and Cornwell et al. (2006) show that HOPE increased the probability of enrollment, rate of degree completion, and the percentage of the “best and brightest” who go to college in-state.[[2]](#footnote-2) Sjoquist and Walker (2010) review the broader literature. This paper contributes to this literature by considering the effect of HOPE on another outcome; in particular we examine the effect of the HOPE Scholarship program on post-college retention in Georgia using two alternative approaches. For our first and primary approach we define treatment as having received a HOPE Scholarship and use administrative records to measure the effect on post-college retention in Georgia’s workforce for students enrolled in public colleges and universities in Georgia. For our second approach, we define treatment as having graduated from high school when HOPE was available and rely on census and American Community Survey data to measure the effect of HOPE on living in Georgia post college using a methodology similar to Hickman (2009).

Our paper also relates to the interest in understanding the effect of college on interstate mobility. Studies have shown that in general students are more likely to live in the state in which they attend college (Perry 2001).[[3]](#footnote-3) However, because students may choose a college location based on where they are considering their permanent residence, measuring the effect of attending college in a state on post-graduation retention requires controlling for the endogenous propensity of students to remain in the state. We identified three studies that attempt to measure the effect of graduating from college in a state on the probability of remaining in the state, controlling for such endogeneity.[[4]](#footnote-4)

Groen (2004) studied the effect of attending college in a particular state on the probability of locating in that state upon graduation, and finds modest effects once he controls for endogeneity. He treats the endogeneity issue as an omitted variable problem, and uses the student’s applications to college to control for heterogeneous location preferences. Using the National Longitudinal Study (NLS) of High School Class of 1972, he finds that 73 percent of the students that attend college in-state live in that state about 10 years after graduation, while 45 percent of those who attended out-of-state schools live in the original state-of-residence, a difference of 28 percentage points. However, after controlling for measures of the student’s propensity to live in another state and individual characteristics, he estimates that attending public college in-state increases the probability of living in-state by 15 percentage points.[[5]](#footnote-5)

Malamud and Wozniak (2012) address the question of post-college retention using variation in college attainment that is induced by variation in the risk of induction through the military draft to estimate casual effects of higher education on mobility. The estimates are based on the 1980 PUMS data, focusing only on men born between 1942 and 1953. They estimate that an additional year of college in a non-birth state increases the probability that an individual resides outside his birth state at mid-career by 7 percentage points.

Neither Groen (2004) nor Malamud and Wozniak (2012) consider the effect of a merit-based scholarship program on post-college retention. Hickman (2009) was the first to address the effect of a merit-based scholarship program on post-college retention. Hickman investigated the effect of the introduction of Florida’s merit-based scholarship program in 1997 on the post-graduation retention of students in Florida using the 2000 Census of Population and the American Community Survey for 2001 through 2006. To address the endogeneity issue he constructs a treatment group consisting of anyone born in Florida who was 18 years of age in 1997 or later, and thus are assumed to have been exposed to the treatment. The control group consists of individuals who were age 18 in 1996 or earlier. He considers individuals between 23 to 27 years of age who are not in school or the military.[[6]](#footnote-6)

Hickman’s dependent variable is whether the individual resides in Florida post-graduation. In his regression Hickman includes the treatment dummy and its interaction with a dummy measuring whether the individual has any post-secondary college education. The coefficient on the treatment dummy is not statistically significant, but the interaction term is. The result implies that that the introduction of the scholarship program increased the probability that a 23 to 27 year old with some college located in Florida by 3.4 percentage points.

From a policy perspective, states are concerned that many of the students who receive a HOPE-like scholarship may leave the state and work elsewhere once their undergraduate education is complete. There are several possible reasons why a state would want merit-aid scholars to work in the state once they finish their education. To the extent that these students do leave the state after attending college, the state’s return on its expenditure is reduced. While the increased earnings of those students who attend college because of HOPE is the most significant benefit from HOPE, this return is largely captured by the individual and does not depend on staying in the state after college. The other potential benefits of additional graduates staying in-state as a result of HOPE include the effect on economic development and public finances. It is believed that communities that are able to attract the best and the brightest will have higher economic growth rates (Glaeser and Saiz 2004; Moretti 2004; Florida et al. 2008) and a better quality of life (Shapiro 2006; Winters 2011a). In addition, higher educated workers pay more in taxes and impose less cost on the public sector for services (Trostel 2010). Thus, it is of interest to determine whether a HOPE scholarship affects post-college retention.

The current paper addresses this policy question, and while this analysis considers one policy, i.e., HOPE, the analysis is relevant to merit-based aid programs in other states and to other policies that affect the percentage of state high school graduates who decide to go to college in-state.

For our primary approach, we use administrative data to explore the effect of the HOPE Scholarship on the likelihood that a student will be employed in Georgia upon completing undergraduate studies in the state. In other words, we measure the effect of HOPE on post-college in-state retention (measured by whether the student is employed in the state) among students who enroll in a Georgia public college or university. This is not the same as asking the alternative question, what is the effect of HOPE among individuals who are eligible for HOPE? To address that question one has to consider two separate issues. First, since HOPE has been found to change the composition of the student body, it is necessary to first determine the effect of HOPE on who attends public post-secondary schools in Georgia. Second, once the adjusted student body is measured, one would then measure the effect of HOPE on the interstate mobility of these HOPE eligible students. As noted above, the first issue has been studied by several people, but those studies have not identified which specific students changed their enrollment behavior, and while we have a very rich data set, it cannot be used to address the first issue. Thus, we cannot address the alternative question using administrative data. Our primary approach is thus an analysis of individuals who enroll in college in Georgia, which is different from looking at a sample of high school graduates unconditional on whether and where they enroll in college.

For this first approach, which we refer to as the USG-approach, we combine administrative data on student and employment records from the University System of Georgia (USG), the Georgia Student Finance Commission, and the Georgia Department of Labor. We measure retention by whether a student is employed in Georgia X years after first enrolling in college (where X takes on several different values) and use several approaches to examine the effects of HOPE on post-college retention rates in the Georgia workforce.[[7]](#footnote-7)

Our second approach uses methodology similar to Hickman (2009). This second approach, which we refer to as the Hickman-approach, fundamentally differs from the use of administrative records in several important ways.[[8]](#footnote-8) First, the Hickman-approach examines the post-college residential retention in Georgia of college-educated persons born in Georgia regardless of whether they attended college in Georgia, while our first approach examines the post-college employment retention in Georgia of persons who enrolled in the USG. Therefore, the first approach measures post-college retention by employment in Georgia conditional on enrollment in the USG, while the Hickman-approach measures an unconditional retention by residing in Georgia. Second, the first analysis speaks more directly to the objective of increasing post-college, in-state employment. Another difference is that with the Hickman-approach we do not know whether a student actually received a merit scholarship, only that the student graduated from high school when the program was in existence. With the first approach we are able to identify and track students who received a HOPE Scholarship. Finally, both approaches suffer from the effect of HOPE on college enrollment, so that any pre- and post-HOPE comparisons are affected by changes in the composition of the student body; for example, HOPE may have caused an increase in enrollment of students who in the absence of HOPE would not have gone to college or would have gone to college out-of-state, but who might have propensities to remain in Georgia that differ from those of students whose college attendance was not affected by HOPE.

To preview our results, using administrative data we find evidence that HOPE had little long run effect on post-college retention rates for lower ability students, but did reduce retention rates among the best HOPE eligible students, many of whom would likely have gone to college out-of-state without the HOPE program. While this may initially seem surprising, it is consistent with our conceptual framework we present in Section III and with the findings of Dynarski (2002) and Cornwell et al. (2006). They find that HOPE attracted students who in the absence of HOPE would have gone to college out-of-state. Our analysis suggests that the decrease in post-college retention is driven by the predisposition of these students to move out-of-state after college. For the Hickman-approach, the results differ depending on the definition of the control group. However, the results from our preferred model suggest that HOPE had no effect on post-college retention.

The remainder of the paper proceeds as follows. In the next section we briefly describe the HOPE program. Section III presents a framework for decomposing changes in retention. Section IV discusses the construction of the administrative data used in the first approach, and Section V presents the empirical results using those data. Section VI discusses the Hickman-approach and the data used, while the results of that analysis are presented in Section VII. A final section concludes.

**II. Background on HOPE[[9]](#footnote-9)**

HOPE (Helping Outstanding Pupils Educationally) is a universal merit-based post-secondary scholarship and grant program for Georgia students enrolled in college or a technical school who have a B average. Funded by the Georgia lottery, these programs have served thousands of students since 1993.[[10]](#footnote-10) Between 1993 and 2010, the number of HOPE recipients increased from 42,796 to 256,484, while the value of the awards increased from $21.4 million to $748.2 million (Georgia Student Finance Commission 2011). In fall 1999, 81.6 percent of freshmen entering Georgia public colleges had a HOPE Scholarship, while in 2009 it was 49.4 percent; the decrease is the result of changes in 2000 in how the grade point average (GPA) that determines HOPE eligibility is calculated.

 To be eligible a student must be a U.S. citizen or eligible non-citizen, a Georgia resident, enrolled in an eligible institution (either full or part time), and maintain a 3.0 GPA. Students who lose (or were not eligible for) HOPE can regain (or gain) it by increasing their cumulative GPA to 3.0.

 The first HOPE Scholarship was awarded in September 1993. The initial HOPE Scholarship paid full tuition at public colleges and universities, net of any Pell award (students were required to apply for Pell), for only two years of schooling. Eligibility was restricted to high school graduates in 1993 or later who graduated with at least a B average and came from families with income of $66,000 or less. There was no income cap for students attending private colleges. Eligible students attending private colleges were given $500 scholarships for each of the first two years of college; this has been increased several times and is now $4,000.

 Many changes to the program have been made since 1993, the most significant of which are the following:

* In 1994, HOPE Scholarship was expanded to cover 4 years of college and the income cap was increased to $100,000 for students attending public colleges.
* In 1995, students who lost the HOPE Scholarship after the freshman year were given the opportunity to regain HOPE if they increased their overall GPA to 3.0, nontraditional students (i.e., those who graduated before 1993) were made eligible, and the income cap was completely removed.
* In 1998, home schooled students became eligible.
* In 2000, the Pell offset was removed.

In the 2011 session of the Georgia General Assembly, several changes were made to HOPE. In particular, HOPE will no longer cover full tuition except for students with a GPA of 3.7. In addition there is no longer a book allowance and fees are no longer covered. These changes were made because lottery revenue was not keeping pace with the increase in HOPE scholarships and grants.

**III. Decomposing Changes in Retention**

In this section we discuss how HOPE might affect post-college retention. We first consider the USG-approach in which treatment is defined as having received a HOPE Scholarship, so we are considering whether the HOPE Scholarship program affected the post-college retention of students enrolled in the USG. For the USG-approach retention refers to a student being employed in Georgia after completing college education, while for the Hickman-approach retention refers to a student who resides in Georgia after completing college education.

HOPE could affect the USG-approach retention rate in two ways. First, HOPE might increase (or decrease) the retention rate of HOPE students who would have gone to college in Georgia even without HOPE. We are unable to develop what we consider strong arguments for why HOPE might affect retention of such students. There are no HOPE-related financial incentives or requirements to remain in state after completing college; for example, HOPE does not require students to work in the state upon graduation from college. However, some HOPE students who might otherwise have moved out-of-state may feel some obligation to remain in the state upon completing their college education, or receiving a HOPE scholarship may have a halo effect that increases the possibility of obtaining a good job in Georgia. Since HOPE reduces the amount a student or his family must pay or borrow for college, there is a potential wealth effect of the HOPE Scholarship, which could affect the student’s post-college location decision.[[11]](#footnote-11) We are unable to isolate this direct effect of HOPE on such students, but our prior is that HOPE will not affect the retention rate from these students.

Second, HOPE could have an indirect effect on retention due to its effect on the composition of the student body. For example, Dynarski (2000, 2002, 2004) and Cornwell et al. (2006) find that HOPE increases the percentage of Georgia high school graduates who go to college, that HOPE increases the percentage of HOPE-eligible students who enroll in four-year schools rather than two-year colleges, and that HOPE causes some students who would have gone to college out-of-state to attend in-state schools instead.[[12]](#footnote-12) These students might have different propensities to remain in-state upon graduation than do other students. In particular, if HOPE increases the share of in-state college enrollment among students who have a higher than average propensity to live in another state, the retention rate will fall. We cannot identify those HOPE Scholars who in the absence of the HOPE program would have gone to college out of state. Thus, we measure the effect of HOPE on the retention rate, where the change in the retention rate consists of the change in the direct effect of HOPE and the indirect effect due to the change in the composition of the student body due to HOPE.[[13]](#footnote-13)

The following is a more formal discussion and presents an accounting framework to decompose possible changes in retention due to Georgia’s HOPE program. Consider two time periods: *t* = 1, 2, for pre- and post-HOPE cohorts, respectively. For each time period let there be three groups of potential USG students: *i* = 1, 2, 3. The first group consists of students who would enroll in the USG after graduating from high school, regardless of the HOPE program; i.e., HOPE has no effect on the enrollment of group 1. Group 1 likely represents the bulk of USG students both before and after HOPE.

Group 2 consists of recent high school graduates who would not enroll in the USG if there was no HOPE program but are enticed by the merit scholarship to enroll in the USG if it exists. These “HOPE stayers” who attend the USG because of HOPE but would not have done so otherwise have generated considerable interest from researchers. Dynarski (2000) estimates that such students comprised 20 percent of the freshman class; the estimate of Cornwell et al. (2006) is 15 percent. To be more precise, group 2 actually consists of three subgroups who attend the USG because of HOPE: students who would have gone to college out of state, students who would have attended a private college or university in Georgia, and students who would not have gone to college. To keep things simpler, we refer to these three subgroups collectively as group 2.

Often overlooked is the third group of students, which consists of “HOPE leavers.” These are students who would have attended a USG institution in the absence of the HOPE program but do not to do so after HOPE. This group is likely the smallest of the three but could still be important. HOPE might cause some students to “leave” the USG because of HOPE’s increased selectivity in admissions. Merit scholarships like HOPE often lead to increased competition for enrollment at top public universities such as the University of Georgia and Georgia Institute of Technology. Some students who would have gained admission to and enrolled in the top universities in the absence of a merit program are likely to be crowded out of the top universities due to merit-induced rising standards. Many of these students will attend a less prestigious USG institution and still be part of group 1. But some students crowded out of the top universities may instead attend college at nearby institutions outside the USG, such as Auburn University, Clemson University, the University of Alabama, and the University of Mississippi. Thus, HOPE could possibly have increased total enrollment in the USG more than it did if the capacity at the top institutions had expanded sufficiently such that the credentials of the marginal admitted student were the same before and after HOPE.

The retention rate of group $i$ from period $t$, $ρ\_{it}$, is defined as the ratio of the number of USG students of group $i$ from period $t$ retained in the state years after high school, $N\_{it}$, to the number of students of group $i$ from period $t$ enrolled in the USG immediately after high school, $E\_{it}$:

$ρ\_{it}= N\_{it}/E\_{it} $ (1)

The overall retention rate in period $t$ is defined similarly:

$ρ\_{t}= N\_{t}/E\_{t} $, (2)

where $N\_{t}=\sum\_{i}^{}N\_{it}$ and $E\_{t}=\sum\_{i}^{}E\_{it}$. With some rearranging and noting that $N\_{21}=N\_{32}=0$ by definition[[14]](#footnote-14), we can write the overall retention rate for each period as:

$ρ\_{1}= θ\_{11}ρ\_{11}+ \left(1-θ\_{11}\right)ρ\_{31}$ (3a)

$ρ\_{2}= θ\_{12}ρ\_{12}+ (1-θ\_{12})ρ\_{22}$ , (3b)

where $θ\_{1t}=E\_{1t}/E\_{t}$ is group 1’s share of enrollment in period $t$. The overall retention rate for a given period is, therefore, the weighted average of the retention rates of the relevant student groups for that period.

We can define the change in the overall retention rate between the pre- and post-HOPE periods as $∆ρ=ρ\_{2}-ρ\_{1}$. We can add ($ρ\_{11}-ρ\_{11})$ and ($ρ\_{12}-ρ\_{12})$ to $∆ρ$ and rearrange to obtain:

$∆ρ=\left(1-θ\_{11}\right)\left(ρ\_{11}-ρ\_{31}\right)-\left(1-θ\_{12}\right)\left(ρ\_{12}-ρ\_{22}\right)+(ρ\_{12}-ρ\_{11})$ (4)

The sign of $∆ρ$ will depend on the relationships between the various parameters in equation (4). Signing $∆ρ$ is further complicated by the fact that group 2 actually consists of the three subgroups of HOPE stayers discussed above, which we refer to as groups 2a, 2b, and 2c, respectively, so that $ρ\_{22}=(θ\_{2a2}ρ\_{2a2}+θ\_{2b2}ρ\_{2b2}+θ\_{2c2}ρ\_{2c2})/(1-θ\_{12})$. These subgroups likely have different retention probabilities, which makes the change in the overall retention rate, $∆ρ$, harder to predict. However, Cornwell, Mustard and Sridhar (2006) suggest that two-thirds of the increased enrollment from HOPE is due to fewer students leaving the state, so we expect this subgroup to dominate the overall retention rate of group 2.

Our prior is that the change in the overall retention rate will be negative. The change in the retention rate will be negative if $θ\_{11}>θ\_{12}$ and $ρ\_{11}=ρ\_{12}>ρ\_{31}\geq ρ\_{22}$.[[15]](#footnote-15) Previous studies have shown that HOPE increased USG enrollment, i.e., HOPE caused more students to “stay” than “leave”, so assuming that $θ\_{11}>θ\_{12}$ is quite reasonable. The hypothesized relationships between the group-period retention rates seem fairly reasonable as well. First, $ρ\_{11}=ρ\_{12}$ says that HOPE did not affect the post-college retention rate of group 1, the group of students who would have enrolled in the USG regardless of the HOPE program. The sufficient condition also says that group 1 students have higher retention rates than group 2 and 3 students. That is, it assumes that students who would attend the USG regardless of HOPE have a greater attachment to living and working in Georgia than students whose college decisions depend on HOPE. Finally, $ρ\_{31}\geq ρ\_{22}$ says that “HOPE stayers” do not have higher retention rates than “HOPE leavers”, i.e., those who enroll in the USG because of HOPE do not have a stronger attachment to living and working in Georgia than those who would have enrolled in the USG in the absence of HOPE but are pushed out by HOPE. Again, we expect group 2 to be dominated by students who would have gone to college out of state but enroll in the USG because of HOPE. These students are likely to have the weakest attachment to staying in the state after college.

 As a special case, one might consider the change in the overall retention rate if $E\_{31}=0$, that is, if there are no students pushed out by HOPE and group 3 is empty. In that case, $θ\_{11}=1$ and equation (4) becomes:

$∆ρ=-\left(1-θ\_{12}\right)\left(ρ\_{12}-ρ\_{22}\right)+(ρ\_{12}-ρ\_{11})$, (5)

which is negative if $ρ\_{11}=ρ\_{12}>ρ\_{22}$.

 While we are unable to separately estimate all of the parameters discussed in this section, we can estimate the change in the overall retention rate, $∆ρ$. We suspect that a decrease in the overall retention rate would most likely be driven primarily by students who would have gone to college out of state but enroll in the USG because of HOPE. In other words, a decrease in the overall retention rate because of HOPE likely suggests that this particular group of HOPE stayers is considerably less likely to remain in the state after college than students who would have enrolled in the USG regardless of HOPE. Because this group of HOPE stayers represents two-thirds of the increased enrollment due to HOPE, low post-college retention for this group raises important questions about the overall success of HOPE in building an educated workforce for Georgia. If these students are very likely to leave the state after college and cause the overall retention rate to decrease, the goal of building an educated workforce might be better achieved by making college more affordable for students who are likely to stay in the state after college.

 The accounting differs for the Hickman-approach because all college attendees are included in the PUMS analysis regardless of where they attended college. However, HOPE could still alter the composition of the sample if it affected whether individuals attended college anywhere. The definitions for the three groups are now based on whether HOPE affected their decision to attend college and not whether HOPE affected where they attend college. The first group includes persons who would have attended college (somewhere) regardless of HOPE, the second group includes persons who attend college because of HOPE but would not have attended college without HOPE, and the third group consists of people who would have attended college without HOPE but decide not to because of HOPE. The third group is likely to be very small. If the third group is empty and we define retention rates similarly as above for the PUMS analysis, the change in the overall retention rate (equation 5) will depend on the size of group 2, how the retention rate of group 2 compares to the retention rate of group 1, and how the retention rate of group 1 is affected by HOPE. Marginal college attendees are likely to be lower quality students and less mobile than persons who would have gone to college with or without HOPE so we expect that $ρ\_{22}>ρ\_{12}$. HOPE encouraged many of the students in group 1 to go to college in Georgia and if this increases their attachment to the state we might expect $ρ\_{12}\geq ρ\_{11}$. If $ρ\_{22}>ρ\_{12}\geq ρ\_{11}$, then $∆ρ$ will be positive for the PUMS analysis. However, if group 2 is empty ($θ\_{22}=0)$ and $ρ\_{12}=ρ\_{11}$, then $∆ρ=0$; in other words, if HOPE does not affect whether individuals attend college and does not affect the retention rate of college attendees, there will be no change in the overall retention rate in the PUMS analysis.

**IV. USG Data**

This section discusses the construction of the University System of Georgia (USG) Sample that we use to examine differences in retention in Georgia for students in the USG before and after HOPE. The USG is a statewide system of all 35 public higher education institutions including two- and four-year colleges and universities in Georgia. For Fall 1990 the USG accounted for 72 percent of total college enrollment in Georgia (NCES 1995).[[16]](#footnote-16) From the USG Board of Regents we obtained data on four cohorts of entering students to the USG. The four cohorts include all students who graduated from a Georgia high school during the years 1990, 1991, 1995 and 1996 and enrolled in the USG in the same year (i.e., students who enrolled in the summer or fall terms immediately after graduating high school). The 1995 and 1996 cohorts were chosen because these were the first students for which HOPE Scholarship eligibility was not subject to an income cap. The 1992 cohort of students was avoided out of concern that some of these students might have anticipated the passage of HOPE and altered their behavior in response. The 1990-1991 cohorts are therefore the pre-HOPE control group and the 1995-1996 cohorts are the post-HOPE treatment group. The USG sample is also restricted to Georgia residents who graduated high school in Georgia because non-residents and graduates of schools outside of Georgia were not eligible for HOPE. Our main USG sample includes all recent Georgia high school graduates who enroll in the USG regardless of whether they ever earn a degree from a USG institution, but we also separately consider the effects of HOPE on the retention of just college graduates.

 We combine the USG data with data from the Georgia Student Finance Commission (GSFC) and the Georgia Department of Labor (GDoL) ES-202 records. The GSFC data indicate which students in the post-HOPE cohorts received a HOPE Scholarship during their first year enrolled in the USG but provide no information on the pre-HOPE cohorts. The HOPE variable equals one if a student received a HOPE Scholarship upon matriculating as a freshman, and zero otherwise. We refer to this as the freshman HOPE dummy. The GDoL records report whether an individual had positive wage and salary earnings in Georgia for a given period of time.[[17]](#footnote-17) We use these employment records to measure retention (employment) in the Georgia several years after graduating high school. We measure retention starting four years after graduating high school and for each year until 12 years after high school. Students are defined as employed in Georgia X years after high school if they had positive earnings in Georgia during the calendar year X years after the year in which they graduated high school. For example, an individual graduating high school in 1990 is considered employed in Georgia six years later if they had positive earnings in Georgia at any time during the 1996 calendar year. Measuring employment by calendar year has the disadvantage of including individuals who work in the state in the early months of the year but leave later in the year.

**V. Empirical Results for USG Analysis**

The USG-approach to estimating the effect of HOPE on retention that would probably provide the strongest test would be to estimate a difference-in-difference regression in which we used a student’s high school GPA to determine which students in the 1990 and 1991 cohorts would have been eligible for HOPE. Unfortunately, as discussed in more detail below, HOPE eligibility relies on a specially calculated high school GPA that does not exist for 1990 and 1991. Thus, we use a number of alternative methods to examine the effects of HOPE on post-college retention.

*Pre- and Post-HOPE Differences in Retention*

We begin by examining differences in the means of several academic and demographic characteristics of the pre- and post-HOPE USG cohorts (Table 1). Consistent with earlier studies by Henry and Rubenstein (2002) and Cornwell and Mustard (2006), the data suggest a considerable increase in high school grade point average (GPA) in core courses and SAT scores after HOPE was implemented.[[18]](#footnote-18) According to previous researchers, the increases in GPAs and SAT scores suggest that HOPE increased incentives to devote greater effort to secondary schooling. Our estimates suggest that 70 percent of recent Georgia high school graduates in the post-HOPE sample received the HOPE Scholarship during their first year of study. This percentage might seem high given the mean GPA of 2.87, but HOPE eligibility was based on total GPA (including electives) while the high school GPA reported in the USG data was only for core courses. We examined the data more closely and found that many students with a core GPA below 3.0 were still eligible for HOPE because of total GPAs above the cutoff.[[19]](#footnote-19) Table 1 also reports that students in the post-HOPE USG cohorts were more likely to be female and less likely to be white, which is a reflection of a longer-term trend in USG enrollment.

Table 1 also shows that USG enrollment of recent Georgia high school graduates increased by nearly 14 percent between the pre- and post-HOPE cohorts. This is even more impressive given that National Center for Education Statistics estimates in the *Digest of Education Statistics* report that the number of Georgia high school graduates during these years actually decreased by four percentage points (NCES various years). The increase in enrollment is likely attributable to at least three sources. First, HOPE caused some students to enroll in the USG who would have gone to college out-of-state. Second, HOPE caused some students to enroll in the USG who would have enrolled at private colleges and universities in Georgia. Third, HOPE caused some students to enroll in the USG who would not have attended college at all or would have delayed attending college. Our data do not allow us to sort out these possible causes, but Dynarski (2000, 2002, 2004) and Cornwell et al. (2006) find that HOPE increased the percentage of Georgia high school graduates who go to college and caused some students who would have gone to college out-of-state to attend in-state schools instead.

Turning to retention rates, we first look at mean retention rates before and after HOPE for all recent Georgia high school graduates regardless of their actual or potential HOPE eligibility.[[20]](#footnote-20) Given that 70 percent of the post-HOPE sample received the HOPE Scholarship, we might expect that meaningful effects of HOPE on retention would create differences in the mean retention rates of the pre- and post-HOPE cohorts. Table 2a reports mean retention rates in Georgia for several years after high school for all recent Georgia high school graduates in the pre- and post-HOPE USG cohorts, regardless of HOPE eligibility, current enrollment status, or degree completion. For both groups retention rates are just shy of 82 percent four years after high school, but retention rates decline with the number of years after high school, likely because nontrivial numbers of students leave the state after finishing schooling and the cumulative share that has left the state grows over time. By twelve years after high school, the share employed in the state falls below 70 percent for both groups.

More important for our purposes is the difference in retention rates before and after HOPE. Table 2a suggests relatively small differences (less than 3.5 percentage points) in retention rates for the pre- and post-HOPE USG cohorts, with the retention rates being smaller for the 1995-1996 cohorts.[[21]](#footnote-21) The differences are statistically significant except for the 4-year and 12-year differences. The differences are largest between seven and nine years after high school, with differences of 0.03 or larger. However, the differences fade out after 11 and 12 years.

Researchers have suggested that college education increases geographic mobility (Bound and Holzer 2000; Chen and Rosenthal 2008; Wozniak 2010; Groen 2011). If college graduates do have different retention rates than non-graduates, then one mechanism by which HOPE might affect retention in Georgia is through the effect of HOPE on college graduation rates. Henry, Rubenstein and Bugler (2004) conduct a regression discontinuity study and find that HOPE recipients enrolled in USG institutions just above the GPA cutoff are significantly more likely to graduate within four years than counterparts just below the GPA cutoff. Dynarksi (2008) uses the 2000 Census 1% Public Use Microdata Sample (PUMS) to suggest more generally that merit scholarship programs in Arkansas and Georgia increased degree completion for persons born in those states. Sjoquist and Winters (2012a), however, suggest that Dynarski’s (2008) results are not robust to using a similar sample (the 5% PUMS) or improved inference techniques.[[22]](#footnote-22)

We use the USG sample to consider whether bachelor’s degree completion rates several years after high school changed as a result of HOPE. Similarly to how retention is measured, an individual is defined as a college graduate X years after high school if they had earned a bachelor’s degree within the calendar year X years after graduating high school. For example, a student graduating high school in 1990 would be defined as having completed a bachelor’s within six years of high school if they earned a degree anytime during or before December 1996. As seen in Table 2b, bachelor’s degree completion rates were statistically significantly higher after HOPE by more than two percentage points for all except four years after high school. For example, within twelve years after high school 45.8 percent of the post-HOPE USG cohort had completed a bachelor’s degree in the USG but only 43.3 percent of the pre-HOPE USG cohort had done so.

Given that HOPE appears to have increased the percentage of students who graduate, as well as the fact that policymakers are likely to be especially interested in retaining college graduates, we consider the effects of HOPE on retention in Georgia for just those who have earned a bachelor’s degree at a USG institution. Table 2c is equivalent to Tables 2a, but restricts the USG sample to individuals who have completed a bachelor’s degree within X years after high school. As seen in Table 2c the retention rates are actually larger for college graduates than for all attendees for both groups. Furthermore, the differences in retention rates are somewhat larger than those reported in Table 2a, and again are statistically significant.

Tables 2a and 2c suggests that HOPE had a modest and negative effect on average retention rates in Georgia of recent Georgia high school graduates. However, these results are not causal inferences and do not control for differences in economic conditions faced by the two cohorts. Thus, we next consider differences in retention based on the likelihood that a student would receive HOPE.

*DD Effects Based on Predicted HOPE*

Instead of considering the differences in average retention rates across USG cohorts, an alternative approach to examining the effects of HOPE on retention in Georgia would be to use the high school GPA in the USG data to predict HOPE eligibility for the pre-HOPE cohorts. However, as discussed above, the USG data report the core GPA while HOPE eligibility was based on total GPA which is not available for the pre-HOPE cohorts. However, we can estimate the probability of HOPE eligibility for the pre-HOPE cohorts using the core GPA and the relationship between core GPA and HOPE receipt for the post-HOPE cohorts. However, average GPAs rose over the period, and if this increase was the result of grade inflation, estimating the probability of HOPE eligibility for the pre-HOPE cohorts using high school core GPA will result in biased estimates. In particular, grade inflation will reduce the estimated probability that a student of given quality will be HOPE eligible in 1990-1991. Henry and Rubenstein (2002) suggest that the relationship between high school GPA and SAT scores was stable before and after HOPE was established and that HOPE did not lead to grade inflation, but they only examine a small portion of the GPA distribution. We consider post-HOPE grade inflation more generally by examining changes in average SAT scores by GPA level (rounded to one decimal) before and after HOPE for recent Georgia high school graduates enrolled in the USG. Results are reported in Table 3.

The results in Table 3 suggest that although average SAT scores increased after HOPE for the total population of recent Georgia high school graduates enrolled in the USG, average SAT scores were statistically significantly lower within most GPA levels for the post-HOPE cohorts. This suggests that part of the increase in high school GPAs post-HOPE was due to grade inflation.[[23]](#footnote-23) The major exception is for students with a 4.0 GPA, who experienced a very large and significant increase in mean SAT scores of 64 points. This considerable increase in student quality among the very best students suggests that HOPE did help keep more of the best and brightest in the state for college.

Another approach to examine grade inflation is to look at the distribution of high school GPAs before and after HOPE. Table 4 reports the decile cutoffs for high school GPAs for the pre- and post-HOPE USG cohorts. Between 1990-91 and 1995-96, the GPA increased at each decile cutoff. Changes over time are smallest at the top and bottom decile cutoffs, with differences of 0.15 and 0.16, respectively. Changes over time are largest in the middle of the distribution, with a 0.30 increase in median GPA after HOPE. High school GPAs increased throughout the distribution providing additional evidence of grade inflation.

Despite the evidence of grade inflation, and since we do not have the appropriate GPA to determine HOPE eligibility in 1990-1991, we use available post-HOPE information to predict whether a student in 1990-1991 would have been eligible for HOPE. We then use the predicted HOPE eligibility to estimate a difference in differences regression. We first estimate Linear Probability Models (LPM) based on the 1995 and 1996 cohorts using four different specifications.[[24]](#footnote-24) The dependent variable is the freshman HOPE dummy, that is, whether the student received a HOPE Scholarship as a freshman. The first specification includes race and gender dummies, 437 high school dummies, and 19 SAT score group dummies. The second specification adds 29 high school GPA group dummies; the third specification adds 33 USG institution dummies but excludes the GPA dummies, and the fourth specification includes all of the predictors. GPAs are potentially influenced by grade inflation and HOPE may have affected which institutions students chose to attend, so the first specification is our preferred one.[[25]](#footnote-25)

The resulting equations are used to predict HOPE for both the pre- and post-HOPE cohorts. We then estimate “difference in differences” regressions of the form[[26]](#footnote-26):

$Y=β\_{0}+β\_{1}\hat{HOPE}+β\_{2}AFTER+β\_{3}\hat{HOPE}×AFTER+ε$,

where Y measures employment in Georgia several years after high school, $\hat{HOPE}$ is the predicted probability of receiving a HOPE Scholarship, $AFTER$ is an indicator variable equal to one for the post-HOPE USG cohort, and $\hat{HOPE}×AFTER$ is an interaction term. The $\hat{HOPE}$ variable controls for the common effect that the HOPE predictors have on the likelihood of post-college employment in Georgia. The $AFTER$ variable controls for overall differences in employment due to the different labor market conditions faced by the 1990-91 and 1995-96 cohorts. The coefficient on the interaction term, $β\_{3}$, is the parameter of interest since it tells us the effect of HOPE on the post-college retention of HOPE eligible students. This procedure attempts to estimate the effects of HOPE on retention of students who have a high probability of receiving HOPE by using students from the same cohort but have a low probability of receiving HOPE as a comparison group. Results for $β\_{3}$ are reported in Table 5. It should be noted that the standard errors are from an OLS regression and thus may be downwardly biased due to within group correlation. Unfortunately, robust inference procedures such as suggested by Conley and Taber (2011) are not available because we have only one state and only four cohorts of incoming freshmen.

As can be seen in Table 5, $β\_{3}$ is negative in almost all cases, but generally not statistically significantly different from zero (based on OLS standard errors) between four and seven years after high school. However, as the number of years after high school increases, we do find a consistently negative and statistically significant value for $β\_{3}$, suggesting that HOPE reduced retention rates among those eligible for HOPE. The magnitudes of these effects are usually largest for the specification that excludes GPA and institution dummies from the HOPE probability equation; coefficients were between -0.023 and -0.036 for the longer run estimates between eight and twelve years after high school. Adding GPA and institution dummies as HOPE predictors does not greatly affect the results. Overall the values of $β\_{3}$ are fairly similar to the differences found in Table 2a. Recall that the $AFTER$ variable controls for aggregate differences in labor market conditions faced by the 1990-91 and 1995-96 cohorts, so that the $β\_{3}$ coefficient for the interaction between $\hat{HOPE}$ and $AFTER$ is not affected by aggregate labor market differences. These results, therefore, suggest that HOPE reduced post-college retention rates.

We repeated this analysis but replaced the dependent variable in the equation predicting HOPE eligibility with the number of years the student had a HOPE Scholarship, and a dummy variable equal to one if the student had a HOPE Scholarship for all four years, which we refer to as the four-year HOPE dummy. (We do not present these results.) For the difference in differences using the number of years a student had a HOPE Scholarship, the pattern of results are similar to those using the freshman HOPE dummy, although the magnitudes of $β\_{3}$ are substantially smaller (generally by a factor of about five) in absolute value. Note that this approach assumes that the effect of the number of years that a student has a HOPE Scholarship is linear, an assumption that is likely to be false. Using the four-year HOPE dummy yields signs on $β\_{3 }$that are negative and somewhat smaller than for the freshman HOPE dummy, but few (9) of the 36 coefficients are statistically significant. Using the four-year dummy means that the control group includes those students who received a HOPE Scholarship for less than four-years, so these results should be interpreted with care.

*Differences in Retention Rates by Ability Decile*

The next method we use compares the difference in mean retention rates between the 1990-1991 and 1995-1996 cohorts sorted by ability. We rank the students within both cohorts by ability decile, where ability is equal to a student’s combined (Verbal plus Math) SAT score plus 400 times their high school GPA on a four point scale.[[27]](#footnote-27) (Results are similar measuring ability by just GPA percentiles or just SAT percentiles). The first column of numbers in Table 6 reports for each ability decile the share of students in the 1995-1996 cohorts who received HOPE Scholarships. The share increases across the ability deciles but is more than zero and less than one for even the bottom and top deciles. Table 6 then reports the post-college mean retention rates in Georgia for 4 through 12 years after high school by decile for both the pre- and post-HOPE cohorts and the difference in retention rates. The retention rates are generally lowest for the highest ability deciles, suggesting that the most able students are the ones most likely to leave the state after college. This is not surprising given the finding in the literature that better educated individuals are more geographically mobile.

More important for our purposes are the differences in post-college retention rates before and after HOPE. Measured four years after high school graduation, the differences are only statistically significant based on OLS standard errors at the 10 percent level for one ability decile. Five years after high school, the differences are now significant for three of the four highest ability deciles and the differences are more than three percentage points for the top two deciles. For 6 to 9 years after high school graduation, we find negative and statistically significant differences in the pre- and post-HOPE retention rates for nearly all ability deciles. These years correspond to the largest average differences in Table 2a and may be influenced by differing macroeconomic conditions faced by the pre- and post-HOPE cohorts that affect employment rates for individuals of all abilities.

 For 10 to 12 years after high school, the differences in retention rates for the four highest ability deciles are negative and statistically significant in all but one case suggesting that HOPE reduced retention rates for the best students. Furthermore, the negative effects of HOPE on retention are largest for the very top decile, with decreases greater than four percentage points between 10 and 12 years after high school. In contrast, the pre- and post-HOPE differences for the six lowest ability deciles for 10 to 12 years after high school are typically small and are statistically significant in only three cases, one of which is negative and two of which are positive. This suggests that while HOPE reduced the post-college retention rates for high ability students it did not for low and medium ability students.

*Summary of USG Results*

The empirical results presented above using the USG-approach tell an interesting story. The results in Table 2a and 2c suggest that HOPE had a small negative effect on the average post-college employment retention rates of students. Likewise, Table 5 suggests that a higher probability of HOPE receipt did reduce the retention rates of students actually eligible for HOPE after eight or more years since high school. Table 6 reports that the highest ability students in the USG experienced significant decreases in retention rates for nearly all numbers of years since high school, but the lowest ability students did not experience decreased retention rates in the most recent years (10-12 years after high school). Together, these results suggest that HOPE reduced the conditional retention rates of the very best and brightest students but had a sufficiently small (maybe even positive) effect on the retention rates of students in lower ability deciles so that the average effect on retention rates is generally small.

We suggest that the decreased retention rates for the highest ability groups are largely due to the effect of HOPE on the changing composition of the student body. HOPE encouraged many students to enroll in the USG who otherwise would have gone to college out-of-state. These students are likely to be less attached to the state and less likely to remain in the state after college than are students who would have attended the USG regardless of HOPE.

**VI. Empirical Framework for PUMS Analysis**

We turn now to consideration of the alternative definition of treatment and the use of the Hickman-approach. For this approach we use decennial census and American Community Survey (ACS) Public Use Microdata Samples (PUMS) to examine the effects of HOPE on the probability of living in Georgia post-college for all persons born in the state who have attended at least some college. The PUMS data do not tell us where an individual attended college, only that they attended college somewhere. Like Hickman we assume that individuals attend college in their state of birth. Similarly to Hickman’s merit program treatment variable for Florida, we define a HOPE treatment dummy equal to one if an individual was born in Georgia and turned 18 in 1993 or later and zero otherwise. Year age 18 is based on the survey year and age at the time of the survey. Data are drawn from the 1990 and 2000 decennial censuses and the 2001-2010 ACS all available at IPUMS (Ruggles et al. 2010) and we use census provided weights to give each survey year roughly equal weight. The sample is limited to persons who are not in school or the military and have un-imputed information for age, education, and state of birth.

We first employ an empirical approach that is very similar to Hickman (2009). We limit the sample to persons ages 23-27 who were born in Georgia and also exclude military veterans. We estimate the following linear probability model (LPM):

$P\left(Y\_{it}=1\right)=α+βHOPE\_{it}+γCollege\_{it}+δ\left(HOPE\_{it}\*College\_{it}\right)+ΘX\_{it}+Φ\_{t}+ε\_{it}$,

where $Y\_{it}$ equals one if individual $i$ lives in Georgia in year $t$, $HOPE$ is a dummy equal to one for persons turning 18 after 1993, $College$ is a dummy equal to one if the person has attended at least some college, $X$ controls for individual characteristics including a linear term for age and dummies for whether the individual is female, black, Asian, or Hispanic, and $Φ\_{t}$ includes a full set of survey year dummies. We refer to this first PUMS specification as our Hickman specification. This specification differs from Hickman’s in only four aspects: 1) we examine Georgia instead of Florida, 2) we include more years than Hickman, 3) we use a linear probability model (LPM) while Hickman used probit, and 4) we use weights while Hickman is silent on the issue. We use more years because more information is preferred to less and using more years allows us to produce more precise estimates.[[28]](#footnote-28) The LPM is chosen for simplicity and ease of exposition but results are robust to using probit. Weights are used because the early years of the ACS (2001-2004) were relatively small samples but we want each survey year to be treated equally.

Hickman argues that persons who do not attend college should be unaffected by merit programs and are a useful control group for persons who do attend college. The primary variable of interest in the Hickman specification is the interaction between $HOPE$ and $College$. The $δ$ coefficient is intended to measure the effects of the merit scholarship on the post-college location decisions of individuals who attended some college, i.e., it measures the effect of the treatment on the treated.

We next estimate a modified-Hickman specification that makes a few minor, but we believe reasonable changes. This specification is presented primarily to serve as a bridge to our third specification. First, the modified-Hickman specification expands the age range to 23-35 years because including a larger age group increases the precision of the estimates. The second modification is that we include in the sample veterans who are not currently on active-duty. Third, we use a full set of age dummies instead of a linear age term to allow for a non-parametric effect of age. Finally, we include a dummy variable for whether an individual’s race/ethnicity is “Other non-white”. The last three modifications are expected to have very minor effects but expanding the age range could alter the estimates if effects differ by age.

Our third and fourth PUMS specifications follow the basic procedure outlined in Sjoquist and Winters (2012b). Sjoquist and Winters (2012b) argue that persons not attending college are a poor control group for college attendees, and suggest that a more relevant control group for a difference in difference specification is college attendees in other states. Our Sjoquist-Winters specification limits the sample to persons who have attended at least some college but includes persons born in control states.[[29]](#footnote-29) The control states for our third specification include the 25 states plus D.C. listed in Sjoquist and Winters (2012b) that did not adopt a merit-based financial aid program between 1991 and 2004. The fourth specification is identical to the third except it limits the set of control states to non-merit states in the southern census region. The Sjoquist-Winters specification estimates the following equation:

$P\left(Y\_{ist}=1\right)=α+δHOPE\_{st}+Γ\_{s}+Π\_{t}+βX\_{ist}+ε\_{ist}$,

where $Y\_{ist}$ equals one if individual $i$ lives in their state of birth $s$ in year $t$, $HOPE$ is a dummy equal to one for persons born in Georgia who turn 18 after 1993, $Γ\_{s}$ consists of state of birth fixed effects, $Π\_{t}$ consists of year of birth fixed effects, and $X$ includes the same individual characteristics as in the modified Hickman specification. State and year of birth fixed effects allow the equation to be interpreted as a difference in differences model identified based on differences across birth states and across birth cohorts within birth states. Since the Sjoquist-Winters specification sample is restricted to those with at least some college, we do not include a $College$ dummy or an interaction term between $HOPE$ and $College$ since these would be collinear with the constant and the $HOPE$ dummy. The variable of interest is now the HOPE dummy and $δ$ is again the coefficient of interest; it measures the effects of HOPE on whether individuals who attended some college live in Georgia after college, i.e., the effect of the treatment on the treated.

**VII. Empirical Results for PUMS Analysis**

 The empirical results for our Census/ACS analysis are presented in Table 7. We only report the results for the $HOPE$ and $HOPE\*College$ variables but the results for the other variables are available by request. Results for the Hickman specification and modified Hickman specification are presented in the first two columns and results for the Sjoquist-Winters specifications are presented in the last two columns.

The results in the first two columns are very similar. The $HOPE$ coefficients of -0.0131 in the first column and -0.0102 in the second column measure the effects of HOPE on the post-college in-state retention of persons who never attended college. The magnitudes of the coefficients are relatively small as expected because this measures the effect of HOPE on those who did not attend college and hence could not have had a HOPE Scholarship. More interesting in the first two columns are the coefficients for the interaction term, which measure the effects of the treatment on the treated. These coefficients are nearly identical at 0.0358 in the first column and 0.0356 in the second column, implying that HOPE increased retention by 3.6 percentage points. These coefficients are also quite similar to Hickman’s coefficient estimate of 0.0339 for Florida. All four of the coefficients for the Hickman and modified Hickman specifications are statistically significant at the 1 percent level using standard errors clustered by year of birth.

The results for the Sjoquist-Winters specifications in the third and fourth columns are quite different from the results for the two Hickman specifications. Recall that the sample is now limited to persons attending at least some college, so the coefficient on the $HOPE$ dummy now measures the effect of the treatment on the treated. The specification in the third column has a coefficient of -0.0013 which is very small and not distinguishable from zero. The fourth column, which limits the control states to the southern region, has a coefficient of 0.0068 that is also not statistically significant. Thus the PUMS results for the effects of the Georgia HOPE Scholarship on post-college in-state retention meaningfully differ between the Hickman specification and the Sjoquist-Winters specification. The Hickman specification suggests a significantly positive effect while the Sjoquist-Winters specification suggests a small and insignificant effect.[[30]](#footnote-30)

Our preferred specification is the Sjoquist-Winters specification. Persons who never attend college are not a good control group for persons who do attend college. These two groups have very different labor market prospects and very different migration propensities. Furthermore, the decline in migration rates over the past three decades was much larger for high school graduates as compared to those with more than a high school degree (Molloy et al. 2011). Thus, our preferred control group for college attendees born in Georgia is college attendees born in other states. Our preferred specification suggests that HOPE had no effect on post-college retention, measured by whether a student lives in Georgia after completing college education.

**VIII. Conclusion**

Previous researchers have examined the effects of merit scholarship programs including Georgia’s HOPE Scholarship on a number of important variables, but the effects on post-college retention have been largely overlooked. Merit scholarship programs such as HOPE alter the composition of college students in the state and are likely to affect the percentage of students who remain in the state after finishing college. We estimate the effect of HOPE on post-college retention using two different approaches. First, we consider the case in which treatment is defined by whether the student received a HOPE Scholarship. For this case we combine data from several sources including administrative data from the University System of Georgia and the Georgia Department of Labor for pre- and post-HOPE cohorts of freshmen to examine changes in post-college retention due to HOPE. We define retention in Georgia by employment in the state several years after high school. Since the GPA calculation that would determine eligibility for the pre-HOPE cohort that would allow us to do a traditional difference in differences regression does not exist, we adopt several approaches to measuring the effect of HOPE on post-college retention.

A comparison of mean retention rates between pre- and post-HOPE cohorts suggest that HOPE reduced the overall retention rate of USG students by a relatively small amount. When we use SAT scores, core high school GPA, and other variables to predict the probability that students would be eligible for HOPE if it were available, we find that post-college retention rates for students who were actually eligible for HOPE and attended college in Georgia were reduced by as much as 3.7 percentage points. We also look at pre- and post-HOPE differences in retention by ability deciles and find that the post-HOPE reduction in retention rates was largest for the highest ability students. Given that HOPE altered the composition of students enrolled in the USG, our results suggest that students who enrolled in the USG because of the HOPE Scholarship are less attached to living and working in the state after college than students who would have attended the USG regardless of HOPE.

Our second approach considers the case in which treatment is defined by whether the student graduated from high school when the HOPE Scholarship was available. For this case we follow the approach used by Hickman (2009) in his analysis of retention and by others such as Dynarski (2008) who measure other effects of merit-aid, employing census and American Community Survey data. Using non-college students as part of the control group suggests that retention increased by 3.36 percentage points due to HOPE. However, our preferred specification, which only considers students with at least some college living in non-merit aid states as the control group yields a small coefficient that is not statistically significant.

Together our two sets of results suggest that HOPE kept many students in-state for college, but the students who attended college in Georgia because of HOPE were less attached to the state and more likely to leave after college. As a result, Georgia’s HOPE Scholarship Program did not increase the percentage of the state’s college-bound high school students who remain in the state after college. These results have policy implications for Georgia and other states that have adopted or considered adopting merit-based financial aid programs since the public benefits to states of investing in students are largely contingent on keeping them in the state’s workforce after college.

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| Table 1: Means of Selected Variables for Recent Georgia High School Graduates |  |
|   | 1995-1996 | 1990-1991 | Difference |
| High School GPA | 2.866 | 2.671 | 0.195\*\*\* |
| SAT (Verbal + Math) | 982.5 | 960.1 | 22.4\*\*\* |
| HOPE Scholarship Recipient | 0.700 | N/A | N/A |
| Female | 0.563 | 0.537 | 0.026\*\*\* |
| Black | 0.250 | 0.207 | 0.043\*\*\* |
| Hispanic | 0.013 | 0.008 | 0.005\*\*\* |
| Asian | 0.024 | 0.020 | 0.004\*\*\* |
| Native American | 0.002 | 0.002 | 0.000 |
| Number of Observations | 49,741 | 43,642 | 6,099 |
| Notes: Recent Georgia High School Graduates refers to students who graduate high school and begin enrollment in the University System of Georgia during the same year. HOPE Receipt is measured at matriculation. High School GPA is missing for 660 observations in 1995-1996 and 296 observations in 1990-1991. SAT is missing for 2934 observations in 1995-1996 and 1851 observations in 1990-1991. |
| \*\*\* Significant at 1%. |

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| Table 2a: Share of USG Enrollees Employed in Georgia Years after High School |
|   | 1995-1996 | 1990-1991 | Difference |
| Four Years after HS | 0.817 | 0.818 | 0.000 |
| Five Years after HS | 0.805 | 0.818 | -0.013\*\*\* |
| Six Years after HS | 0.784 | 0.805 | -0.022\*\*\* |
| Seven Years after HS | 0.762 | 0.792 | -0.030\*\*\* |
| Eight Years after HS | 0.742 | 0.775 | -0.033\*\*\* |
| Nine Years after HS | 0.729 | 0.759 | -0.031\*\*\* |
| Ten Years after HS | 0.716 | 0.736 | -0.020\*\*\* |
| Eleven Years after HS | 0.702 | 0.712 | -0.009\*\*\* |
| Twelve Years after HS | 0.689 | 0.693 | -0.005 |
| Multi-year mean |   |   | -0.018\*\*\* |
|  |  |  |  |
| Table 2b: Bachelor's Degree Completion Rates for Recent Georgia HS Graduates |
|   | 1995-1996 | 1990-1991 | Difference |
| By Four Years after HS | 0.266 | 0.249 | 0.017\*\*\* |
| By Five Years after HS | 0.355 | 0.334 | 0.021\*\*\* |
| By Six Years after HS | 0.395 | 0.374 | 0.021\*\*\* |
| By Seven Years after HS | 0.417 | 0.395 | 0.022\*\*\* |
| By Eight Years after HS | 0.430 | 0.409 | 0.021\*\*\* |
| By Nine Years after HS | 0.441 | 0.418 | 0.023\*\*\* |
| By Ten Years after HS | 0.448 | 0.424 | 0.024\*\*\* |
| By Eleven Years after HS | 0.454 | 0.429 | 0.025\*\*\* |
| By Twelve Years after HS | 0.458 | 0.433 | 0.026\*\*\* |
| Multi-year mean |   |   | 0.022\*\*\* |
|  |  |  |  |
| Table 2c: Share of USG Graduates Employed in Georgia Years after High School |
|   | 1995-1996 | 1990-1991 | Difference |
| Four Years after HS | 0.822 | 0.822 | 0.000 |
| Five Years after HS | 0.824 | 0.851 | -0.027\*\*\* |
| Six Years after HS | 0.806 | 0.839 | -0.033\*\*\* |
| Seven Years after HS | 0.786 | 0.822 | -0.036\*\*\* |
| Eight Years after HS | 0.769 | 0.805 | -0.036\*\*\* |
| Nine Years after HS | 0.755 | 0.791 | -0.036\*\*\* |
| Ten Years after HS | 0.739 | 0.762 | -0.023\*\*\* |
| Eleven Years after HS | 0.724 | 0.738 | -0.015\*\*\* |
| Twelve Years after HS | 0.707 | 0.719 | -0.012\*\*\* |
| Multi-year mean |   |   | -0.024\*\*\* |
| Notes: Employment or degree completion X years after HS for the USG sample is defined for the calendar year X years after the year the individual graduated high school. \*\*\* Significant at 1%. |
| Table 3: Mean SAT Scores by High School GPA Group |
|   | Mean Combined SAT Scores |
|   | 1995-1996 | 1990-1991 | Difference |
| Total | 982.5 | 960.1 | 22.4\*\*\* |
|  |  |  |  |
| GPA unknown | 886.1 | 895.4 | -9.3 |
| GPA<1.5 | 790.2 | 815.3 | -25.0\*\*\* |
| GPA=1.6 | 816.7 | 844.4 | -27.7\*\*\* |
| GPA=1.7 | 820.7 | 850.4 | -29.6\*\*\* |
| GPA=1.8 | 828.6 | 843.0 | -14.5\* |
| GPA=1.9 | 840.5 | 856.6 | -16.1\*\* |
| GPA=2.0 | 840.3 | 870.3 | -30.0\*\*\* |
| GPA=2.1 | 862.9 | 867.9 | -4.9 |
| GPA=2.2 | 871.7 | 876.8 | -5.0 |
| GPA=2.3 | 878.9 | 888.4 | -9.5\*\* |
| GPA=2.4 | 889.4 | 907.6 | -18.2\*\*\* |
| GPA=2.5 | 908.3 | 917.4 | -9.2\*\* |
| GPA=2.6 | 925.2 | 936.3 | -11.1\*\* |
| GPA=2.7 | 938.0 | 945.4 | -7.4\* |
| GPA=2.8 | 951.4 | 970.9 | -19.5\*\*\* |
| GPA=2.9 | 972.7 | 978.3 | -5.6 |
| GPA=3.0 | 988.8 | 997.6 | -8.8\*\* |
| GPA=3.1 | 1003.7 | 1013.4 | -9.7\*\* |
| GPA=3.2 | 1024.6 | 1034.6 | -10.0\*\* |
| GPA=3.3 | 1046.3 | 1045.6 | 0.8 |
| GPA=3.4 | 1057.3 | 1065.5 | -8.2 |
| GPA=3.5 | 1072.4 | 1079.2 | -6.9 |
| GPA=3.6 | 1099.4 | 1098.3 | 1.1 |
| GPA=3.7 | 1123.6 | 1121.6 | 2.0 |
| GPA=3.8 | 1145.4 | 1139.0 | 6.5 |
| GPA=3.9 | 1178.6 | 1170.3 | 8.3 |
| GPA=4.0 | 1244.6 | 1180.7 | 63.9\*\*\* |
| \* Significant at 10%; \*\* Significant at 5%; \*\*\* Significant at 1%. |

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| Table 4: High School GPA by Decile Cutoffs |
|   | 1995-1996 | 1990-1991 | Difference |
| 10th Percentile | 2.00 | 1.84 | 0.16 |
| 20th Percentile | 2.30 | 2.10 | 0.20 |
| 30th Percentile | 2.50 | 2.30 | 0.20 |
| 40th Percentile | 2.70 | 2.47 | 0.23 |
| 50th Percentile | 2.90 | 2.60 | 0.30 |
| 60th Percentile | 3.06 | 2.80 | 0.26 |
| 70th Percentile | 3.26 | 3.00 | 0.26 |
| 80th Percentile | 3.50 | 3.30 | 0.20 |
| 90th Percentile | 3.75 | 3.60 | 0.15 |

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| Table 5. DD Effects for Interaction of Predicted HOPE and Post-HOPE Dummy |
| First Stage |   |   |   |   |
| Race and Gender Dummies | Yes | Yes | Yes | Yes |
| High School Dummies | Yes | Yes | Yes | Yes |
| SAT Dummies | Yes | Yes | Yes | Yes |
| High School GPA Dummies | No | Yes | No | Yes |
| USG Institution Dummies | No | No | Yes | Yes |
| Adjusted R2 | 0.223 | 0.405 | 0.259 | 0.423 |
|  |  |  |  |  |
| DD Results |  |  |  |  |
| Four Years after HS | -0.020\* | -0.001 | -0.012 | 0.000 |
|  | (0.011) | (0.008) | (0.011) | (0.008) |
| Five Years after HS | -0.037\*\*\* | -0.014\* | -0.028\*\* | -0.013 |
|  | (0.012) | (0.008) | (0.011) | (0.008) |
| Six Years after HS | -0.014 | -0.004 | -0.012 | -0.005 |
|  | (0.012) | (0.009) | (0.011) | (0.008) |
| Seven Years after HS | -0.017 | -0.004 | -0.014 | -0.003 |
|  | (0.012) | (0.009) | (0.011) | (0.009) |
| Eight Years after HS | -0.025\* | -0.010 | -0.023\*\* | -0.010 |
|  | (0.013) | (0.009) | (0.012) | (0.009) |
| Nine Years after HS | -0.033\*\* | -0.019\*\* | -0.029\*\* | -0.016\* |
|  | (0.013) | (0.009) | (0.012) | (0.009) |
| Ten Years after HS | -0.029\*\* | -0.018\* | -0.024\*\* | -0.016\* |
|  | (0.013) | (0.010) | (0.012) | (0.009) |
| Eleven Years after HS | -0.036\*\*\* | -0.034\*\*\* | -0.028\*\* | -0.031\*\*\* |
|  | (0.013) | (0.010) | (0.013) | (0.010) |
| Twelve Years after HS | -0.023\* | -0.029\*\*\* | -0.020 | -0.025\*\* |
|   | (0.014) | (0.010) | (0.013) | (0.010) |
| Notes: OLS Standard errors in parentheses. |  |  |
| \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%. |  |

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| Table 6. HOPE Receipt and Retention Rates in Georgia by Ability Decile |  |  |  |  |  |
|  HOPE Receipt | Employed in GA 10 Years after HS | Employed in GA 11 Years after HS | Employed in GA 12 Years after HS |
|   | 1995-1996 | 1995-1996 | 1990-1991 | Difference | 1995-1996 | 1990-1991 | Difference | 1995-1996 | 1990-1991 | Difference |
| Bottom Decile | 0.117 | 0.741 | 0.746 | -0.005 | 0.730 | 0.729 | 0.001 | 0.715 | 0.711 | 0.004 |
| Second Decile | 0.369 | 0.738 | 0.760 | -0.022\*\* | 0.730 | 0.727 | 0.003 | 0.717 | 0.713 | 0.005 |
| Third Decile | 0.593 | 0.741 | 0.742 | -0.001 | 0.734 | 0.712 | 0.022\*\* | 0.714 | 0.698 | 0.017\* |
| Fourth Decile | 0.733 | 0.744 | 0.750 | -0.006 | 0.732 | 0.726 | 0.006 | 0.718 | 0.704 | 0.014 |
| Fifth Decile | 0.814 | 0.742 | 0.753 | -0.011 | 0.719 | 0.729 | -0.010 | 0.708 | 0.712 | -0.004 |
| Sixth Decile | 0.877 | 0.722 | 0.738 | -0.015 | 0.709 | 0.714 | -0.005 | 0.696 | 0.687 | 0.009 |
| Seventh Decile | 0.901 | 0.725 | 0.749 | -0.023\*\*  | 0.702 | 0.728 | -0.025\*\*\* | 0.691 | 0.711 | -0.020\*\* |
| Eight Decile | 0.924 | 0.697 | 0.729 | -0.031\*\*\* | 0.690 | 0.709 | -0.018\* | 0.680 | 0.688 | -0.008 |
| Ninth Decile | 0.936 | 0.682 | 0.717 | -0.035\*\*\* | 0.664 | 0.693 | -0.028\*\*\* | 0.650 | 0.671 | -0.021\*\* |
| Top Decile | 0.949 | 0.620 | 0.671 | -0.050\*\*\* | 0.606 | 0.647 | -0.041\*\*\* | 0.588 | 0.632 | -0.044\*\*\* |
|  |
|  |
|   |   | Employed in GA 7 Years after HS | Employed in GA 8 Years after HS | Employed in GA 9 Years after HS |
|   |   | 1995-1996 | 1990-1991 | Difference | 1995-1996 | 1990-1991 | Difference | 1995-1996 | 1990-1991 | Difference |
| Bottom Decile |  | 0.774 | 0.798 | -0.024\*\*\* | 0.754 | 0.779 | -0.025\*\*\* | 0.745 | 0.766 | -0.021\*\* |
| Second Decile |  | 0.775 | 0.802 | -0.027\*\*\* | 0.766 | 0.788 | -0.022\*\* | 0.749 | 0.779 | -0.029\*\*\* |
| Third Decile |  | 0.785 | 0.799 | -0.014 | 0.762 | 0.777 | -0.015 | 0.756 | 0.766 | -0.010 |
| Fourth Decile |  | 0.787 | 0.813 | -0.026\*\*\* | 0.773 | 0.797 | -0.024\*\*\* | 0.760 | 0.775 | -0.015\* |
| Fifth Decile |  | 0.788 | 0.812 | -0.024\*\*\* | 0.763 | 0.789 | -0.026\*\*\* | 0.749 | 0.777 | -0.028\*\*\* |
| Sixth Decile |  | 0.772 | 0.796 | -0.024\*\*\* | 0.751 | 0.776 | -0.025\*\*\* | 0.734 | 0.766 | -0.032\*\*\* |
| Seventh Decile |  | 0.772 | 0.802 | -0.030\*\*\* | 0.753 | 0.784 | -0.031\*\*\* | 0.736 | 0.770 | -0.035\*\*\* |
| Eight Decile |  | 0.756 | 0.791 | -0.035\*\*\* | 0.732 | 0.775 | -0.043\*\*\* | 0.716 | 0.750 | -0.035\*\*\* |
| Ninth Decile |  | 0.742 | 0.776 | -0.034\*\*\* | 0.719 | 0.760 | -0.041\*\*\* | 0.700 | 0.742 | -0.042\*\*\* |
| Top Decile |   | 0.669 | 0.718 | -0.050\*\*\* | 0.650 | 0.713 | -0.063\*\*\* | 0.638 | 0.697 | -0.059\*\*\* |
|  |
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|  |  |  |  |  |  |  |  |  |  |  |
|   |   | Employed in GA 4 Years after HS | Employed in GA 5 Years after HS | Employed in GA 6 Years after HS |
|   |   | 1995-1996 | 1990-1991 | Difference | 1995-1996 | 1990-1991 | Difference | 1995-1996 | 1990-1991 | Difference |
| Bottom Decile |  | 0.824 | 0.826 | -0.002 | 0.814 | 0.815 | -0.001 | 0.793 | 0.804 | -0.011 |
| Second Decile |  | 0.829 | 0.825 | 0.004 | 0.814 | 0.822 | -0.008 | 0.795 | 0.807 | -0.012 |
| Third Decile |  | 0.835 | 0.820 | 0.015\* | 0.831 | 0.824 | 0.007 | 0.811 | 0.815 | -0.004 |
| Fourth Decile |  | 0.829 | 0.823 | 0.006 | 0.815 | 0.827 | -0.012 | 0.805 | 0.825 | -0.020\*\* |
| Fifth Decile |  | 0.828 | 0.820 | 0.007 | 0.819 | 0.827 | -0.008 | 0.805 | 0.824 | -0.019\*\* |
| Sixth Decile |  | 0.815 | 0.825 | -0.010 | 0.816 | 0.826 | -0.010 | 0.796 | 0.813 | -0.018\*\* |
| Seventh Decile |  | 0.827 | 0.823 | 0.003 | 0.817 | 0.831 | -0.014\* | 0.786 | 0.817 | -0.031\*\*\* |
| Eight Decile |  | 0.814 | 0.821 | -0.007 | 0.807 | 0.818 | -0.012 | 0.783 | 0.804 | -0.021\*\* |
| Ninth Decile |  | 0.801 | 0.815 | -0.013 | 0.791 | 0.824 | -0.032\*\*\* | 0.770 | 0.798 | -0.028\*\*\* |
| Top Decile |   | 0.773 | 0.778 | -0.005 | 0.726 | 0.765 | -0.039\*\*\* | 0.699 | 0.735 | -0.036\*\*\* |
| \*Significant at 10%; \*\*Significant at 5%; \*\*\*Significant at 1%. |  |  |  |  |  |  |

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| Table 7: Effects of HOPE on Unconditional Post-College Retention in Georgia, Census and ACS PUMS |
|   | (1) | (2) | (3) | (4) |
|  | Hickman  | Modified Hickman | Sjoquist-Winters | Sjoquist-Winters |
|   | Specification | Specification | Specification A | Specification B |
| HOPE | -0.0131 | -0.0102 | -0.0013 | 0.0068 |
|  | (0.0060) | (0.0060) | (0.0060) | (0.0057) |
| HOPE\*College | 0.0358  | 0.0356  | N/A | N/A |
|  | (0.0089) | (0.0081) |  |  |
|  |  |  |  |  |
| Ages Included | 23-27 | 23-35 | 23-35 | 23-35 |
| Notes: Standard errors are clustered by year of birth in the first two columns and by state-year of birth in the last two columns. |

1. Georgia also created a HOPE Grant program for students pursuing diplomas or certificates in technical programs. [↑](#footnote-ref-1)
2. Sjoquist and Winters (2012a) suggest that some of these results may be due to inappropriate econometric techniques. [↑](#footnote-ref-2)
3. Studies have also suggested that attending college in a particular location affects post-college location decisions within metropolitan and non-metropolitan areas (Blackwell et al. 2002; Winters 2011b, 2011c) [↑](#footnote-ref-3)
4. Bound et al. (2004) consider the relationship between the flow of BA graduates and the stock of college graduates. They find that there is substantial net migration of graduates. While interesting, they cannot directly measure the probability that a graduate of a college in a given state is more or less likely to migrate. Abel and Deitz (2012) examine the correlation between the production and stock of college graduates at the metropolitan level and generally find only a small positive effect. [↑](#footnote-ref-4)
5. Groen and White (2004) find similar results in a related study. [↑](#footnote-ref-5)
6. Hawley and Rork (2013) estimate the effect of merit aid programs on out-migration of college-educated adults, while Sjoquist and Winters (2012b) extend Hickman’s approach to all states with merit-aid programs. [↑](#footnote-ref-6)
7. Our sample is restricted to students who enroll in the USG immediately after graduating high school. Thus, we use the phrases “years after graduating high school” and “years after enrolling in college” interchangeably. [↑](#footnote-ref-7)
8. The approach used by Hickman (2009) has also been used by others such as Dynarski (2008) to measure other effects of HOPE and other merit-aid programs. [↑](#footnote-ref-8)
9. Sjoquist and Walker (2010) provide a description and history of HOPE. [↑](#footnote-ref-9)
10. Prior to adopting the HOPE program Georgia student aid program was very small. For example, in 1990-91, student aid per recipient in Georgia was the third lowest in the country (National Association of State Student Grant & Aid Programs, 1991). Between 1990-91 and 2010-11, student aid increased 31 times in Georgia and 5 times for the U.S. [↑](#footnote-ref-10)
11. Rothstein and Rouse (2011) explore how student debt affects post-college employment choices. [↑](#footnote-ref-11)
12. Additional studies examining the effects of state merit aid programs on college enrollment decisions include Goodman (2008), Farrell and Kienzl (2009), Pallais (2009), and Zhang and Ness (2010), [↑](#footnote-ref-12)
13. Going to school in-state because of HOPE could increase the probability that students will live in-state when they complete their schooling. This is the effect that Groen (2004) measures, but we are unable to isolate and measure the effect of going to college in-state on retention. [↑](#footnote-ref-13)
14. $N\_{21}$equals zero since there are no HOPE stayers enrolled in the USG in period 1;$N\_{32}$ is zero since Group 3 students do not attend college in Georgia in period 2. [↑](#footnote-ref-14)
15. These conditions are sufficient but not necessary for $∆ρ<0$. [↑](#footnote-ref-15)
16. The other 28 percent includes enrollment at private institutions and in the public technical college system. [↑](#footnote-ref-16)
17. ES-202 are a commonly used data that provide near universal coverage of a state’s employment and are the basis for the U.S. Department of Labor’s Quarterly Census of Employment and Wages. Employees of any firm that is required to pay the unemployment insurance tax are included. Although there are some workers who are not covered, for example, self-employed workers, the U.S. Department of Labor estimates that the data cover 98 percent of all jobs. [↑](#footnote-ref-17)
18. This result and others in the paper are robust to controlling for gender and race/ethnicity. [↑](#footnote-ref-18)
19. This means that we cannot use our GPA as the bright line to distinguish those in the 1990 and 1991 cohorts who would have been eligible for HOPE. [↑](#footnote-ref-19)
20. This approach is similar to that employed by Hickman (2009). Hickman controls for education level, age, gender, and race. While some of our sample may have gone on to post-college programs, we do not have that information. Our pre- and post-HOPE samples have the same age, so we do not have to control for that, and our results are robust to controlling for gender and race/ethnicity. [↑](#footnote-ref-20)
21. A potential alternative explanation is that the post-HOPE USG cohort stayed in school longer and delayed entry into the labor force. For example, HOPE may alter undergraduate course taking behavior as suggested by Cornwell et al. (2005) so that students take fewer courses per semester to increase the likelihood of earning good grades and take longer to graduate. Additionally, HOPE may reduce student debt and allow students to pursue more years of education than they would without HOPE. To account for this alternative, we explore in results not shown measuring retention as equal to one if a student is either employed in Georgia *or* enrolled in the USG during a given year. Doing so has only a minimal effect on the results, especially once students are several years removed from high school. We conclude that students staying in school longer does not meaningfully affect our results. [↑](#footnote-ref-21)
22. Bound and Turner (2007) and Zhang (2009) more generally examine the effects of public funding on higher education attainment. [↑](#footnote-ref-22)
23. Of course it is possible that this effect is due to a change in the composition of freshmen resulting from HOPE. [↑](#footnote-ref-23)
24. Results are robust to using probit or logit instead. [↑](#footnote-ref-24)
25. Adding additional variables does, however, increase the accuracy of the prediction. For example, the mean values of the predicted HOPE variable for the post-HOPE cohorts are 0.769 and 0.539 for recipients and non-recipients for the first specification, but adding the additional controls in the fourth specification produces mean predicted HOPE values of 0.829 and 0.400 for recipients and non-recipients. The Adjusted R2 also increases from 0.223 to 0.423 moving from the first to the fourth column. The tradeoff is that pre- and post-HOPE structural changes in institution attended and high school GPA could affect the comparability of predicted HOPE pre- and post-HOPE. The potential bias is a bigger concern than the noise resulting from excluding these predictors. [↑](#footnote-ref-25)
26. Since $\hat{HOPE}$ is a continuous variable, the regression is not technically a difference in differences regression. [↑](#footnote-ref-26)
27. Comparing by ability decile attempts to control for grade inflation. [↑](#footnote-ref-27)
28. The 2007-2010 ACS were presumably unavailable to Hickman and using the 1990 census offered little advantage since Florida’s merit program was adopted in 1997. [↑](#footnote-ref-28)
29. If merit aid caused more students to attend college it would affect the composition of the control sample pre- and post-merit aid, whether we use Hickman’s control group or ours. But research such as Dynarski (2000) suggest that merit aid affects *where* students attend college, but that they do not significantly affect *whether* a young person attends college. [↑](#footnote-ref-29)
30. However, this does not mean that the two procedures would produce different results for Florida. In fact, the Sjoquist-Winters specification produces very similar results for Florida as the Hickman procedure. [↑](#footnote-ref-30)