

Does Kentucky's Merit-based Scholarship Program, KEES, Improve College Completion?

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Executive Summary

College completion is a complex process involving numerous socioeconomic factors at the individual, institutional, and governmental levels. One important factor is the way in which financial aid is disbursed so that affordability does not serve as a barrier to completion.

Awarding scholarships on the basis of merit is one aspect of financial aid structure that has grown in popularity over recent decades, in turn, receiving considerable attention from policy researchers with the intent to assess how they affect an array of postsecondary education outcomes. To date, research of merit-based aid's effect on college completion has been relatively sparse, yielding contradictory results.

This study aims to add to the body of literature concerning merit-based aid and college completion, as well as inform state policymakers as to whether Kentucky's merit-based aid program, KEES, contributes to the goal of increasing the level of degree completion. Analysis concluded that KEES increases the likelihood of completing college by a modest percentage across multiple models. It was also found that this increase in likelihood was greater among higher-achieving and higher-income students. Lastly, results indicated that KEES decreased the time to completion. The study concludes with several practical recommendations to be considered based on the results yielded.

Introduction

One of the widely accepted goals of state financial aid programs is to increase the number of citizens going to and completing college. College completion has clear effects on a state's economic performance. A larger proportion of the population with postsecondary degrees has been linked to higher per capita income, lower poverty rates, and a healthier, more engaged citizenry. Moreover, the current economic and political environment has created an urgency to improve economic conditions, in turn, placing added pressure on postsecondary systems to graduate students at a higher rate as a means to increase the educated workforce. The performance of public universities in this respect has been criticized, though, with national graduation rates at 4-year public institutions currently around 56 percent. Kentucky's performance is considerably below that of the national rate, at 47 percent (NCES, 2010).

For more than a decade, Kentucky policy makers have placed emphasis on increasing educational attainment as a means to raise the standard of living and quality of life of Kentucky citizens to the national average. As seen in **Table 1**, Kentucky performs worse than the national average in several areas related to education and family economic status, and ranks below at least 40 other states on every indicator. In response, Kentucky policy makers established a goal of doubling the number of citizens with a bachelor's degree by 2020 in an attempt to improve the state's performance on the listed indicators (Kentucky Council on Postsecondary Education, 2007).

While the overall strategy to provide financial aid to Kentucky students in postsecondary institutions deserves evaluation, this study is limited to an assessment of the Kentucky Educational Excellence Scholarship (KEES), as an important element of that overall strategy.

Table 1. Kentucky performance in various economic areas (U.S. Census Bureau, 3-year estimates 2009-2011)

	Kentucky	National Average	Kentucky Rank
Population with a bachelor's or higher	21.1%	28.6%	46
Median Household Income	\$41,782	\$51,771	47
Population below poverty level	19.2%	15.7%	40
State Spending on Healthcare as % of GSP	20.4%	17.3%	43
Unemployment Rate	8.4%	7.3%	42

The question of interest here is whether and, if so to what degree, providing scholarship funds to students based on merit supports Kentucky's goal of increasing educational attainment through a higher rate of graduation among students who enroll in a public university. Research has produced varied results on this issue depending on which state program was studied. No such study has been conducted of KEES.

Kentucky Educational Excellence Scholarship

The Kentucky Educational Excellence Scholarship (KEES) allocates approximately 45 percent of state funds from lottery proceeds to high-performing high school students. Implemented in 1998, KEES was assigned one explicit goal according to state statute: to improve access to postsecondary education for students in Kentucky high schools. To reward and encourage achievement and to increase in-state college attendance among talented students have been cited as additional goals of KEES, although these goals were not listed in the enabling statute.

It is necessary to review the way in which KEES awards are structured, as it informs the research design. Also, taking note of how KEES is unique from other state merit-based

programs underlines the value added by this research. Award size earned through KEES is first based on a student's GPA each year in high school, instead of using cumulative GPA, as many other state merit-based programs do. Starting at a 2.5 GPA, a student is awarded \$125, increasing by \$25 for each 0.1 increase in GPA until the maximum of \$500 is reached per year. A student can also earn a bonus award for a higher ACT score, receiving an award of 36 dollars for a score of 15 and an additional \$36 for every one-point increase. This is a common feature among merit-based programs. Lastly, there is a need-based component, added in 2008-2009, where a low-income student can earn between \$200 and \$300 for each qualifying score on an AP or IB exam. **Table 2** illustrates this award structure for the minimum and maximum amounts.¹

As Table 2 shows, the amount a student receives each year in college is the sum of what they earned throughout their four years in high school. In 2011, the average award received was \$1,225. KEES award amounts are smaller than those of most other merit-based programs, but the qualification criteria are lower, which has resulted in almost 90 percent of certified high school students having received some amount of scholarship funds. For instance, programs in Georgia, Florida, Louisiana, Massachusetts, New Mexico, and West Virginia offer full tuition awards or more.

Another manner in which state merit-based programs vary greatly is the set of criteria a student must meet in order to retain the award while in college. For KEES, a student receives the annual award the next year provided he or she achieves a cumulative GPA of 2.5 or higher at the

¹ The AP/IB exam component makes it difficult to illustrate minimum or maximum award amounts. There are 34 AP exams offered, but according to the College Board, the average student takes three exams during their high school career. IB exams are offered in over 50 different courses, but a typical IB Diploma Program offers between 12 and 15 courses.

Table 2. Minimum and Maximum KEES Award Earned By GPA and ACT Score

Type of Award	Dollar Amount Earned	
	2.5 GPA	4.0 GPA
Base Award		
Freshman Year	\$125	\$500
Sophomore Year	\$125	\$500
Junior Year	\$125	\$500
Senior Year	\$125	\$500
Subtotal: Base Award	\$500	\$2,000
ACT Award	Score of 15	Score of 36
	\$36	\$500
Total for Annual KEES Award	\$536	\$2,500

end of the year.² There is also an 8- or 10-semester limit (depending on the degree requirements) to use the KEES award. Any semester in which an award is disbursed counts as one full semester, even if only a partial award is disbursed due to part-time enrollment or if the student is not on-track to graduate within eight or ten semesters. Data are very limited as to the reasons behind a student losing his or her KEES award. Among all students using their KEES award in the first year of college during academic years 2000 and 2006, second-year use fell by an average of 23 percentage points (Legislative Research Commission, 2011).

Lastly, it is important to consider the debate surrounding state merit-based programs like KEES. Beyond the desire to simply understand the impact of a policy growing in popularity, what serves as the underlying impetus for research of merit-based programs is that they represent a substantial divergence from providing state funds to students based on financial need. Often, studies will frame the issue in this way, as a contentious choice between supporting need-based

² These criteria have changed recently. Students starting college prior to the 09-10 academic year must maintain a GPA of 3.0 to receive their full award the next year. These students receive half of the award if their GPA is 2.5-2.99. Students starting college in 09-10 can still receive the full award with a GPA of 2.5-2.99 if they are considered to be on-track to graduate within 8 semesters.

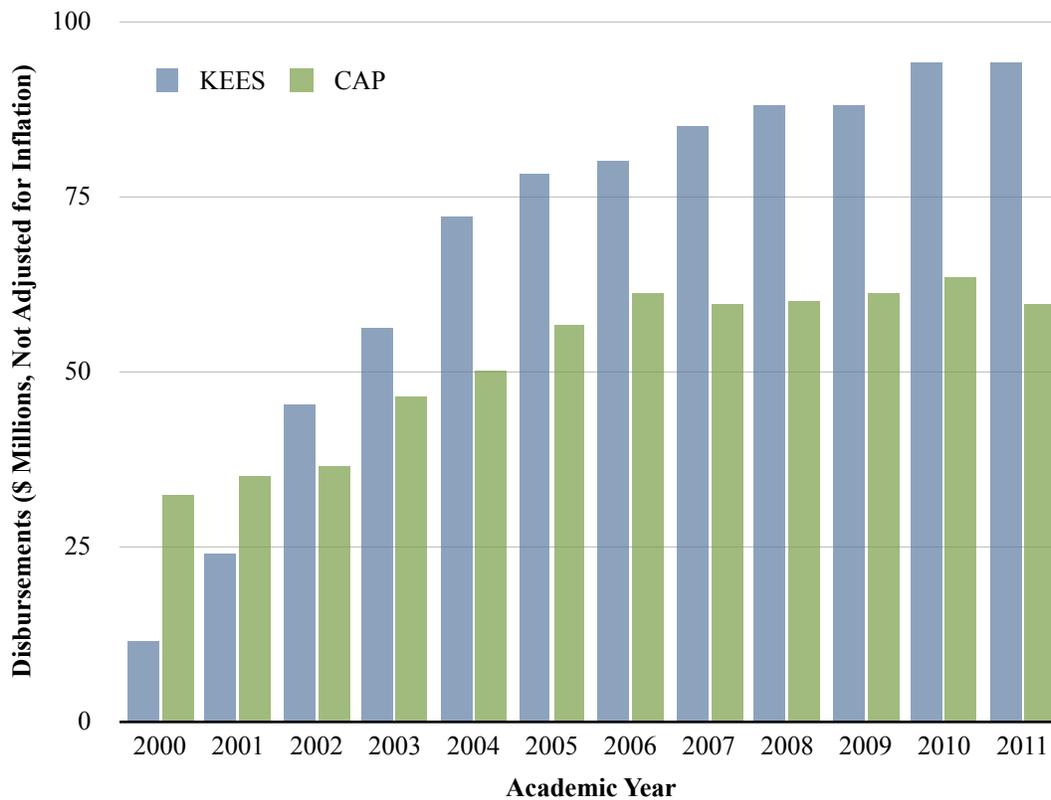
versus merit-based aid. Proponents of merit-based aid argue the programs achieve their intended goals and create educational and economic benefit for the state. Critics posit such programs disproportionately favor middle- and high-income families. While there is evidence to support both arguments, states continue to dedicate a large portion of available aid toward merit-based programs. Over the past decade, funding for merit-based programs grew 348 percent, compared to 99 percent for need-based programs (Long & Riley, 2007).

This debate between need-based and merit-based aid pertains to Kentucky as well.

Figure A compares the growth in disbursement between KEES and Kentucky's largest need-based aid program, College Access Program Grant (CAP), from 2000 to 2011. It is important to note that while absolute amounts between the two programs are fairly disparate, the percent change in disbursements over this time period have been relatively equal. Since its full implementation in 2004, KEES disbursements increased approximately 23 percent by 2011. Comparatively, CAP disbursements increased approximately 19 percent during this same time. However, controversy over KEES is amplified when considering that, in 2011, over 76 thousand eligible applicants for CAP went unfunded due to inadequate appropriations, amounting to an estimated \$120 million in unmet need (Kentucky Legislative Research Commission, 2011).

It is recognized that this study attempts to assess the performance of KEES via a metric (college completion) that has never been explicitly stated by policy makers as a goal of the program. Nevertheless, given Kentucky's overall goal to double the number of Kentuckians with a bachelor's degree by 2020, it might be helpful to know if the state funds allocated to KEES is contributing to its achievement by improving college completion. If not, the aim of this study is not to provide a better alternative, as doing so would require an additional and separate empirical

Figure A. KEES and CAP Disbursements for Academic Years 2000 to 2011



analysis into the determinants of college completion. It is expected that the debate concerning how to best allocate state financial aid funds will continue for many years. The aim of this study is strictly to inform this debate through the lens of college completion.

Merit-Based Scholarships

Kentucky's program, and all other state merit-based scholarships, is modeled after the Georgia HOPE scholarship. Since the HOPE scholarship's creation in 1993, approximately 24 states have implemented identical or similar programs.³ Various research efforts have attempted to estimate the effects these programs have on a range of factors related to postsecondary education.

³ Due to the wide variation in award structure, eligibility/retainment criteria, and funding sources, researchers differ when counting broad-based, state-funded merit scholarships. The Kentucky LRC count 14 programs, while Sjoquist and Winters (2012b) count 25, and other studies count between these two amounts.

Enrollment

Empirical evidence shows that merit-based scholarships had significant positive impacts on enrollment between 1988 and 1997, increasing enrollment in Georgia 4-year public institutions by 12 percent, as well as increasing enrollment among Georgia's eight historically black colleges and universities by 38-44 percent (Cornwell, Mustard, Sridhar, 2003). A follow-up study of the Georgia system by two of the same authors concluded that merit-based aid can affect student sorting, increasing selectivity among a state's flagship public institutions. This was partially explained by an increase in high-performing students choosing to attend in-state schools so they could receive the merit-based award. Considering the socioeconomic relationship with academic achievement, this increase in selectivity also leads to a more racially and economically homogenous student body within these schools (Cornwell & Mustard, 2006). There is a plethora of literature on the topic of peer effects that may shed light on whether this is a desirable or tolerable consequence of merit-based aid programs.

Access

As was mentioned earlier, access, specifically equitable access, is typically how opponents of state merit-based programs frame the issue, criticizing the decision to fund students based on merit rather than financial need. The case has been made by some that the prevailing shift from need-based to merit-based aid in some states has exacerbated the underrepresentation of low-income and minority students in higher education (Long & Riley, 2007; Adelson, 2006; Dynarski, 2004). On the other hand, Doyle (2010) found merit-based programs have no effect on the availability of need-based aid and argues that studies claiming otherwise make the unsupported assumption that funds allocated for merit-based aid would be automatically transferred to need-based aid.

Achievement

There is research concluding that merit-based aid programs increase academic achievement in high school students and reduce the achievement gap between students by race (Henry & Rubenstein, 2002). However, given the GPA requirements students must meet to retain their scholarship award, a significant number of merit-based scholarship recipients lose their award after the first year, especially those in science, technology, engineering, and mathematic (STEM) fields of study (Dee & Jackson, 1999). This observation has been used to show that merit-based programs deter students from choosing STEM majors for fear of failing to maintain the required GPA to retain their award (Zhang, 2011).

Merit-Based Scholarships and College Completion

The process of a student completing college is a complex one involving sociological and economic factors at the individual, institutional, and governmental levels. Melguizo (2011) provides a review of the research aimed to identify causal factors related to completion. Of these factors, affordability is often linked to a student's ability to remain in college and has been considered a primary cause for many of the emerging trends in college-going behavior, such as the rise in popularity of for-profit institutions, community colleges, and online courses.

Research efforts have attempted to investigate the relationship among the cost of college, income, and completion. For instance, a 2006 study found that 36 percent of low-income students completed a bachelor's degree within eight years as opposed to 81 percent among high-income students (Adelman). Additionally, reducing the cost of attending college through financial aid has been shown to increase access and completion, especially among low-income populations (Deming & Dynarski, 2009). However, given the complexity of reliably predicting college completion, the specific causal effects of financial aid are still unclear, resulting in a large

variation as to how states structure their financial aid, including the provision of merit-based scholarships.

Research pertaining most specifically to the topic of this study - merit-based aid's impact on college completion - is fairly sparse and has yielded contradictory results. Using OLS regression, Dynarski (2008) found a positive significant effect of merit-aid on college completion, yielding an increase of approximately three percent in completions. She used a public-use microdata sample (PUMS) of 1 percent of the population to categorize students in Georgia and Arkansas who graduated after their respective merit-based programs had begun as a natural treatment group. High school students in states without such programs were categorized as a control group. Sjoquist and Winters (2012a) revisited this study. They used a 5% PUMS, instead of 1%, after finding no difference in education levels between the two. Using data from the 2000 decennial census long-form questionnaire and "more appropriate inference procedures for clustering" (pg. 4), they found no significant relationship between state merit-based scholarship programs and college completion.

Sjoquist and Winters (2012b) describe limitations present with both of these studies. They explain that using only two states to form the treatment group, compared to the control group which consisted of sample data from all states without a merit-based scholarship, resulted in large standard errors. Additionally, the Arkansas program placed a cap on income that limited recipients and potential effects, and Georgia's income cap was removed during the time both studies used to assign treatment groups. Lastly, due to the timing of the studies, only persons aged 22-25 in Georgia were assigned to the treatment group. Since many people are still in

college at these ages, the effects of the Georgia program may have not been fully realized at the time of the analyses.

Three studies have been conducted of a particular state's merit-based aid program and its impact on college completion: Georgia, West Virginia, and Tennessee. Henry, Rubenstein, and Buglar (2004) studied the HOPE scholarship in Georgia, finding a significant positive effect on college completion. Using logistic regression, they found that the HOPE program increased the odds of graduating from a two-year college within four years by almost 100 percent. The odds of graduating from a four-year college were 72 percent higher for HOPE recipients. Their treatment group consisted of 1,915 HOPE recipients graduating in 1995 with an overall GPA of close to 3.0. They matched these with a group of non-HOPE recipients with the same core course GPA and similar institution choice but with an overall GPA below the 3.0 criterion.

Scott-Clayton (2011) found that the PROMISE program in West Virginia had a positive significant effect on college completion. She followed four cohorts entering a public four-year college between 2000 and 2003 for five years after matriculation and concluded that the PROMISE program increased four-year graduation rates by 9.4 percent and five-year graduation rates by 4.5 percent. Lastly, Bruce and Carruthers (2011) studied the Tennessee HOPE program and found no significant effect on graduation rates. They used regression discontinuity and difference-in-difference models with four student cohorts between 2005-2008. The mixed results of these studies underline the lack of generalizability with research conducted on one or two state programs due to variations in criteria, awards, and funding structures.

The most comprehensive study conducted on this topic was by Sjoquist and Winters (2012b), employing the same approach as was used in the Dynarski (2008) and Sjoquist and

Winters (2012a) but expanding it to include 25 states that implemented a merit-based program between 1991 and 2004, as opposed to only two states. In addition to only using data from year 2000, they also used data from the 2001-2010 American Community Survey, thus overcoming the limitation whereby many within the treatment group may still be in college. To account for some of the variation between state programs, they created three sub-groups among states according to “strength” of the scholarship based on the size of award and breadth of people eligible under the criteria. Nine states, including Kentucky, were categorized as having strong programs.

Sjoquist and Winters (2012b) used a linear probability model, comparing states with strong merit programs to states with no program to derive their findings. They also conducted various checks for robustness, running models that included all merit program states, each merit state individually, and various combinations of student and state characteristics. Across all model specifications, they found that state merit-based aid programs had no meaningful effect on college completion.

While Sjoquist and Winters provide valuable new information regarding the comprehensive effect of merit-based aid on college completion, it is not definitive. Sjoquist and Winters would likely agree, considering that they attempted to strengthen support for their findings with an additional assessment looking solely at the Georgia postsecondary system. They used individual level data to compare the graduation rates of students who received the HOPE scholarship to students with a relatively equivalent GPA before the HOPE program was implemented. They found that the HOPE program had no effect on college completion, thus

supporting the findings of their larger study but contradicting the findings of Henry, Rubenstein, and Buglar (2004).

There are limitations to their approach of using census sample data to assess merit-based aid programs across states. Sjoquist and Winters (2012b) do not observe data at the individual level for important factors related to completion, such as GPA, ACT scores, other sources of financial aid, family income, and such. Nor can they control for institutional effects, or the complexities and nuances of each state merit aid program. Policy makers should use caution when generalizing results from studies conducted of other state programs to inform policy decisions within their own state. Only four state merit programs have undergone such focused study. It may be the case that evaluating programs in the other states will yield no new information compared to that which Sjoquist and Winters have already provided. Still, evaluating programs within other states is a necessary step in confirming or challenging their findings.

Research Design

Data

For this study, student-level data for three academic years, 2006-2008, were obtained from the Kentucky Council on Postsecondary Education. The dataset included 47,531 observations, representing all in-state, first-time freshmen who matriculated into a public two-year or four-year institution immediately after graduating high school. Individuals who matriculated a semester or more after graduating high school were removed from the dataset for two reasons. First, depending on how long ago the individual graduated high school, they may have not been eligible for a KEES award. Second, delaying matriculation could indicate some nonrandom characteristic for which the model does not account, such as financial stress or

motivation, which could affect the likelihood of graduation and bias results. This resulted in 22,645 observations being removed representing individuals who graduated high school in years ranging from 1931 to 2005, leaving the 47,531 observations noted above.

The dataset included variables for a student's high school cumulative GPA, ACT score, annual KEES award, and whether the student had earned an associate or bachelor's degree by the time the data was obtained. For students who did earn a degree, the year and semester in which the degree was conferred was included, as well as the conferring institution. At the time the data were obtained, information regarding degrees conferred was only available up to the Spring semester of 2013. For students who matriculated in 2006, degree status tracks seven years, or 14 semesters, of potential postsecondary enrollment. For students who matriculated in 2008, degree status tracks five years, or ten semesters, of potential postsecondary enrollment. While it is possible that students who matriculated in any of the three academic years included in the data could complete a degree in the near or distant future, the 2008 cohort has an additional year before their college completion outcome affects the typical unit of analysis for graduation rate - six years. Therefore, the 2008 cohort was excluded when analyzing the likelihood of graduating within six years but was included when analyzing the likelihood of graduating within four or five years.

Finally, the dataset included a number of variables to control for other factors that might affect completion rates. These included the student's gender, additional sources of federal and state financial aid the student was to receive at the time of matriculation, individual or family financial information (estimated cost of attendance, expected family contribution, and total income), the county the student lived in, and the institution in which they matriculated.

Research Questions

The primary focus of this study is to assess whether the data indicates that the KEES program has an effect on college completion, specifically the completion of a bachelor's degree, considering Kentucky's educational goal to double the number of citizens who have attained a bachelor's degree. However, the effect of KEES on overall completion (either associate or bachelor's) is also measured. There are a variety of ways to measure this effect, thus generating the following research questions:

Research Question 1: Are there significant differences in the likelihood to complete college between KEES recipients and non-recipients?

Research Question 2: Does the amount of KEES award relative to a student's total family income affect college completion?

Research Question 3: Are there significant differences in the amount of time taken to graduate college between KEES recipients and non-recipients?

Methodology

Selection bias presents a serious challenge to analyzing the effect of a program that rewards higher-achieving students. Therefore, it is paramount to control for other factors known to affect a student's likelihood to complete college, thus minimizing the effect of selection bias. Provided controls are sufficient, then any observable difference in the likelihood to complete college between KEES recipients and non-recipients can be attributed to the program. Based on the data available, this study used Equation 1 below to estimate effects of KEES on college completion:

$$\text{Prob}(Y_{ic}) = \alpha + \beta_1 \text{KEES}_{ic} + \beta_2 \text{ACAD}_{ic} + \beta_3 \text{DEMO}_{ic} + \beta_4 \text{MISS}_{ic} + \varepsilon_{ic} \quad (1)$$

Where Y is the probability that student i who is attending college c will complete a degree, KEES is the explanatory variable of interest which will be used as either a dichotomous or continuous

variable, ACAD is a vector of academic covariates, DEMO is a vector of demographic covariates, MISS is a vector of covariates used to control for missing data among observations, and ε is a residual error term. This dual treatment of the KEES variable is used due to its tiered award structure. Therefore, it is sensible to estimate effects in terms of both meeting the eligibility criteria to receive an award and an increase in award received.

Table 3 provides summary statistics for the total sample, as well as for KEES recipients and non-recipients. Academic covariates included high school GPA, rounded high school GPA, and ACT composite score. The rounded GPA variable was necessary due to several thousand observations using a GPA rounded presumably to the nearest integer. Demographic covariates included gender, an indicator variable for low-income, total family income, and amount of financial aid received.

Table 3 presents some challenges that will be discussed in more detail under the limitations section, but a few are worth mentioning here. First, the mean high school GPA and ACT scores among KEES non-recipients are highly confusing. The dataset clearly contains individuals who were eligible for KEES but were reported as receiving no KEES by their institution. This may indicate some degree of reporting error in the data, effects from other eligibility requirements not accounted for in the model, or both. In addition to the GPA and ACT requirements, a student must be a U.S. citizen, national, or permanent resident, and not be a convicted felon. Second, there are a large number of missing observations for GPA and total family income. Numerous tabulations were run to see if any pattern existed among county, institution, or academic year reporting but these observations appear to be missing at random.

Table 3. Summary statistics of all in-state, first-time freshmen enrolling in Kentucky public postsecondary institutions (Council on Postsecondary Education, 2006-2008)

	KEES Recipients	KEES Non-recipients	Total
Demographic			
Number	35,755	11,776	47,531
Male	43.9%	46.5%	44.6%
Low-income	29.1%	15.1%	25.6%
Mean total income (\$ ten-thousands)*	6.36	4.69	6.28
Mean financial aid (\$ thousands)	2.48	1.05	2.12
Academic			
Mean high school GPA**	3.33 (0.51)	2.79 (0.74)	3.29 (0.55)
Mean ACT composite score	22 (4.21)	20 (4.26)	22 (4.28)
Institution Type			
Research	34.6%	18.6%	30.7%
Regional	50.3%	35.4%	46.6%
Community College	15.1%	46.0%	22.7%

Note: Standard deviation in parentheses

* 14,964 missing observations

** 11,426 missing observations

Therefore, no basis was found for removing these observations, and instead, they were assigned a missing indicator that was controlled for in the model.

Overall, most of the summary statistics align with what one would assume to be the differences between KEES recipients and non-recipients: on average, non-recipients have a lower family income, achieve a lower high school GPA and ACT score, and attend regional universities or community colleges at a higher proportion. Low-income, however, does not align with what is typically observed among lower-achieving students. Since receipt of the Federal Pell Grant is used as a proxy for low-income, one possible explanation is that those at the lowest end of the income distribution fail to submit the FAFSA, thus underestimating the percentage of non-recipients identified as low-income. Although, those at the highest end of the income

distribution are also unlikely to submit the FAFSA. This, too, could explain why KEES non-recipients received less financial aid, but financial aid is also largely driven by cost of attendance, which is higher among KEES recipients due to a larger proportion of them attending research and regional universities.

A slightly modified model was used to estimate results for Research Question 2. In order to assess whether the amount of KEES award relative to a student's total family income affects college completion, an interaction term between the amount of KEES and total family income was computed. As seen in Equation 2, the interaction term is now the variable of interest although the KEES variable remains in the model. All other variables are as they were defined in Equation 1. If KEES were found to have an effect on college completion, then it would be valuable to know how this effect behaves relative to a recipient's total family income.

$$\text{Prob}(Y_{ic}) = \alpha + \beta_1(\text{KEES} * \text{INCOME})_{ic} + \beta_2 \text{KEES}_{ic} + \beta_3 \text{ACAD}_{ic} + \beta_4 \text{DEMO}_{ic} + \beta_5 \text{MISS}_{ic} + \epsilon_{ic} \quad (2)$$

In order to estimate the effects of KEES on the time taken to graduate (research question 3), a hazard model, or time-to-event analysis, was used. In this model, the rate at which students in the dataset graduate can be analyzed, controlling for any variables that might explain a difference in graduation rates between two groups. By controlling for the same variables defined in Equation 1, the effect KEES has on the time to graduation can be estimated. Academic years 2006, 2007, and 2008 were included in the hazard model, and a variable was created indicating the maximum number of semesters each cohort has had to graduate up to the point the data was obtained. Since all three cohorts have had at least 10 semesters to graduate, the model was designed to analyze the changes in rate of graduation at 10, 12, and 14 semesters.

Results

College Completion

For analysis of KEES effects on college completion overall, whether a student earned either a bachelor's or associate degree was used as the dependent variable in Equation 1.

Ordinary least squares regression with institutional fixed effects was used for estimation, and the KEES variable of interest is an indicator of whether the student received any KEES award. A separate analysis was run to estimate the effects of KEES using the continuous form of the KEES variable, so that effects could be interpreted in terms of size of award. Results for both analyses are shown in **Table 4**. The model using the dichotomous KEES variable yielded a KEES effect that is positive and significant. On average, receiving KEES is associated with an expected 3.6 percent increase in the predicted probability of completing college, all else equal. The continuous KEES variable also yielded a positive and significant result. On average, a \$1,000 increase in KEES award is associated with an expected 21.4 percent increase in the predicted probability of completing college, all else equal.

This same analytical approach was then used to estimate the effect of KEES on the likelihood of earning a bachelor's degree within 4, 5, and 6 years. Estimation was restricted to students who matriculated to a 4-year institution and were not enrolled in an associate degree program. Results are shown in Table 4. All models except that which used the dichotomous KEES variable to estimate the effect on the probability of earning a bachelor's degree within 4 years yielded a positive and significant effect. Receiving KEES is associated with an expected 3.1 percent increase in the predicted probability of earning a bachelor's within 5 years, and an increase of 4.8 percent in the predicted probability of earning a bachelor's within 6 years, all else equal. In using the continuous KEES variable, a \$1,000 increase in KEES award is associated

Table 4. Regression results modeling dichotomous and continuous KEES effect on multiple college completion outcomes

Completion Outcomes	Model	Estimate	Sample Size	R-Squared
Earned AA or BA	KEES (Dichotomous)	0.036*** (0.008)	47,531	0.177
	KEES (\$ thousands)	0.214*** (0.006)	47,531	0.201
Earned BA within 4 years	KEES (Dichotomous)	-0.008 (0.009)	34,549	0.146
	KEES (\$ thousands)	0.120*** (0.006)	34,549	0.158
Earned BA within 5 years	KEES (Dichotomous)	0.031*** (0.010)	34,549	0.166
	KEES (\$ thousands)	0.219*** (0.006)	34,549	0.195
Earned BA within 6 years	KEES (Dichotomous)	0.048*** (0.012)	22,737	0.144
	KEES (\$ thousands)	0.246*** (0.008)	22,737	0.182

Covariates	Parameter Estimates		***p<0.01; **p<0.05; *p<0.10
	KEES (Dichotomous)	KEES (\$ thousands)	
Male	-0.061*** (0.004)	-0.058*** (0.004)	<i>Note:</i> Standard error in parentheses. Estimates are OLS regression coefficients modeling the relationship between variables and the probability of college completion. Reported covariate estimates are from the regression using overall completion as the dependent variable. All covariate estimates of subsequent regression models were within the 95% confidence interval of the overall completion regression and significance levels did not change with one exception: financial aid. However, financial aid estimates remained below 0.005. Therefore, covariate estimates are only reported once.
Low-income	-0.079 *** (0.007)	-0.065*** (0.007)	
Total income (\$ ten-thousands)	0.002 *** (<0.001)	0.002*** (<0.001)	
Financial aid (\$ thousands)	0.001 (0.001)	<0.001 (0.001)	
High school GPA	0.251*** (0.005)	0.065*** (0.007)	
ACT composite	0.019*** (<0.001)	0.012*** (0.001)	
Missing total income	0.054*** (0.011)	0.103*** (0.010)	
Missing financial aid	0.019 (0.011)	0.038*** (0.010)	
Rounded high school GPA	0.060*** (0.005)	0.025*** (0.005)	
Missing high school GPA	0.796*** (0.017)	0.375*** (0.020)	

with an expected 12.0 percent increase in the predicted probability of earning a bachelor's degree within 4 years; a 21.9 percent increase within 5 years; and a 24.6 percent increase within 6 years, all else equal.

While not a primary focus of this study, the fixed effects design used in the various regression models allows us to estimate the approximate effect each public institution has on the probability of college completion. Institutional effects on the probability of completing college with either an associate or bachelor's degree are reported in **Table 5**; effects on the probability of earning a bachelor's degree within 5 years are reported in **Table 6**. Effects were derived from the dichotomous KEES variable regression model. In both tables, each public institution is listed. Those with a CTC, CC, or TC are 2-year institutions. To the right is the institution's effect on the probability of completion centered around the mean set at zero. For instance, being a student at Murray University increases the probability of completion by 8.3 percent controlling for all variables defined in Equation 1, while any university with an effect below zero decreases the probability of its students completing college. It's worth noting that with the exception of Western Kentucky Community and Technical College, all 2-year institutions decrease the likelihood of completing either an associate or bachelor's degree, on average. Knowing these institutional effects may be valuable when considering possible policy implications.

Most covariates in the model yield results that are consistent with intuitive knowledge and previous research. Males and those coming from low-income circumstances have a lower likelihood of completing college across all models. Predictably, as a student's high school GPA or ACT scores increase, so too does his or her probability of completion across all models. A student's total family income does have a positive significant effect on the likelihood of

Table 5. Institutional fixed effects on the probability of completing college

Institution	Effect centered around the mean of 0
Murray University	0.083
University of Kentucky	0.049
Western Kentucky University	0.047
Western Kentucky CTC	0.033
Eastern Kentucky University	0.003
Morehead State University	0.000
Madison CC	-0.011
Maysville CTC	-0.011
Owensboro CTC	-0.011
University of Louisville	-0.013
Northern Kentucky University	-0.026
Southeast CTC	-0.027
Gateway CTC	-0.041
Somerset CC	-0.042
Kentucky State University	-0.049
Hopkinsville CTC	-0.055
Hazard CTC	-0.065
Big Sandy CTC	-0.068
Bluegrass CTC	-0.079
Eastern CTC	-0.082
Henderson CTC	-0.103
Ashland CTC	-0.118
Bluegrass TC	-0.146
Jefferson CTC	-0.175

completion, but the magnitude was surprisingly small - 0.2 percent for every \$10 thousand increase. Financial aid did not have the effect in this model one would expect. An increase of \$1000 in financial aid has virtually no effect on the likelihood of completion according to the results. This would be contrary to most research on the topic.

It is also potentially confounding to the effects found from KEES. KEES relies on the same concepts of lowering cost and providing financial incentives in order to have any effect; the same as other forms of financial aid. It is suspected that the issue may be attributable to the limited scope of

financial aid in this model, which only includes federal grants, subsidized loans, and state grants.

Obviously, institutions play a large role in financial aid that isn't accounted for in this model.

Throughout the rest of the study, financial aid remains in my model specifications on the basis that it is an important factor according to a consensus of researchers.

Table 6. Institutional fixed effects on the probability of earning a bachelor’s degree within 5 years

Institution	Effect centered around the mean of 0
Murray University	0.066
Western Kentucky University	0.039
University of Kentucky	0.024
Eastern Kentucky University	-0.019
Kentucky State University	-0.028
University of Louisville	-0.031
Morehead State University	-0.033
Northern Kentucky University	-0.059

KEES Relative To Income

Since effects were found in the previous section, it is worth analyzing whether the amount of KEES award relative to a student’s total family income has an effect on college completion. Instead of conducting this analysis on all completion outcomes included in the

previous section, this analysis was restricted to students attending a 4-year institution and not enrolled in an associate degree program. Results were estimated using Equation 2, with whether a student earned a bachelor’s degree within 5 years as the dependent variable. Results are reported in **Table 7**.

Results show that, on average, as total family income increases \$10 thousand, the effect of \$1000 in KEES awards is associated with an expected 0.4 percent increase in the predicted probability of earning a bachelor’s within 5 years, all else equal. Although there exists a statistically significant relationship between the amount of KEES award and a student’s total family income, the magnitude is quite negligible. The covariates in this model act as one would expect, except for financial aid, which has a very small, insignificant estimated effect.

Time to Completion

Based on the results in Table 4, it is unclear whether KEES effects the time a student takes to complete college. Receiving any amount of KEES does not increase the likelihood that a student will earn a bachelor’s degree within 4 years, but it does increase the likelihood of completing the degree within 5 and 6 years. An increase of \$1000 in KEES award increases the

Table 7. Regression results highlighting the interaction between KEES and income

Variable	Estimate (std. error)
KEES (\$ thousands)	0.206*** (0.007)
KEES*INCOME	0.004*** (0.001)
Male	-0.054*** (0.005)
Low-income	-0.079*** (0.008)
Total family income (\$ ten-thousands)	-0.004*** (0.001)
Financial aid (\$ thousands)	-0.002 (0.001)
High school GPA	0.068*** (0.008)
ACT composite	0.012*** (0.001)
Missing total income	0.121*** (0.014)
Missing financial aid	0.015 (0.014)
Rounded high school GPA	-0.032*** (0.006)
Missing high school GPA	0.370*** (0.025)
Constant	-0.326*** (0.027)
Sample Size	34,549
R-squared	0.196

***p<0.01; **p<0.05; *p<0.10;

Note: Estimates are OLS regression coefficients modeling the relationship between variables and the probability of earning a bachelor's degree within 5 years.

likelihood of earning a bachelor's within each 4-, 5-, and 6-year interval. While it may be reasonable to assume that KEES does have an effect on the time to completion, a hazard model can be used to estimate the approximate magnitude of that effect. For this, two analyses were conducted. First, the dichotomous KEES variable was used to estimate the effect on overall college completion (earning either an associate or bachelor's). The second analysis also used the dichotomous KEES variable but was restricted to only include those students seeking a bachelor's degree at a 4-year institution. As was noted before, since all three cohorts have had at least 5 years to

graduate, the hazard model was set at 10, 12, and 14 semesters. Results of these analyses are shown in **Table 8**.

Both models yield positive significant results for the receipt of KEES. On average, the receipt of KEES increases the overall completion rate among students seeking either an associate or bachelor's at public institutions by 24.4 percent, holding other variables constant. Among only bachelor's degree-seeking students attending 4-year colleges, receipt of KEES increases the

Table 8. Hazard model results modeling the relationship between variables and the time to completion

	AA or BA Completion	BA Completion
Variables	Hazard Ratio	Hazard Ratio
KEES (dichotomous)	1.244*** (0.034)	1.089*** (0.034)
Male	0.783*** (0.011)	0.810*** (0.013)
Low-income	0.768*** (0.018)	0.713*** (0.018)
Total family income (\$ ten-thousands)	1.006*** (0.001)	1.006*** (0.001)
Financial aid (\$ thousands)	1.001 (0.003)	1.000 (0.003)
High school GPA	2.299*** (0.040)	2.457*** (0.049)
ACT	1.066*** (0.002)	1.067*** (0.002)
Missing total income	1.386*** (0.050)	1.312*** (0.059)
Missing financial aid	0.894*** (0.032)	0.981 (0.043)
Rounded high school GPA	0.632*** (0.011)	0.582*** (0.011)
Missing high school GPA	8.501*** (0.537)	11.100*** (0.827)
Constant	<0.001*** (<0.001)	<0.001*** (<0.001)
Sample Size	47531	34549
Prob > Chi2	<0.001	<0.001

***p<0.01; **p<0.05; *p<0.10

Note: Estimates are Weibull regression coefficients modeling the relationship between variables and the rate of graduation at 5, 6, and 7 years.

rate of graduation by 8.9 percent, all else equal. In other words, observing the graduation rates of this sample of students across seven years, receiving KEES has a positive effect on that graduation rate, after controlling for other factors that might explain why those students graduate at a higher rate. Once again, all other variables except for financial aid have significant

relationship in the direction one would expect according to previous research and previous models of this study.

Discussion

Results from all but one model specification in Table 4 provide supporting evidence that KEES has a positive significant effect on college completion. This effect differs greatly between the specification of KEES as a dichotomous variable or as a continuous variable. It is likely that the continuous model yields results that are biased positively. The effects found from a \$1000 increase in KEES certainly capture to some degree the impact of having more financial support and incentive for completing college, but it also captures a substantial increase in academic achievement. While achievement is controlled for through GPA and ACT score, the effect of an increase in KEES award on the likelihood to complete college is biased upward to the extent these two variables cannot capture unobservable characteristics of these higher-achieving students, such as motivation or innate ability. Overall, the results yielded from the continuous KEES model can reasonably be interpreted to mean that the effect of KEES on the probability of completion increases among higher achieving students, which is consistent with previous literature (Bruce & Carruthers, 2011). Results from Table 7 supplement these findings in a different way. Although the effect was small, the effect of KEES on the likelihood to complete college (as measured by earning a bachelor's degree within 5 years) increases as a student's total family income increases. In general, these results together appear to suggest that KEES funds are most effective at improving college completion when distributed to higher-achieving, higher-income students.

Using KEES as a dichotomous variable may be more effective at measuring the marginal impact of receiving KEES. On one hand, it yields effects that align more closely with Scott-Clayton's (2011) findings on the effects of the West Virginia merit-based scholarship. There is no observable explanation of why KEES would be so much more effective at improving college completion as results using the continuous KEES variable would suggest. However, the results of this model are also likely to be biased, although it is difficult to speculate about the magnitude and direction of that bias. Additionally, the dichotomous model may be more appropriate for use in considering policy implications, as it is more realistic to enact policy that affects the KEES program at the margin either through eligibility criteria or award amount structure, rather than policy that would result in students improving their academic achievement enough to receive a higher amount of KEES award.

While previous studies have not used a hazard model to estimate the effect of merit-based scholarships on the time to completion, the results of the analysis align with those generated from other methods. In studies where an effect on time to completion has been found, it is attributed to the time constraint recipients have to use the scholarship award and a decrease in recipients working while in school. KEES recipients have up to 8 academic terms or 5 years after high school graduation to use their award. Provided that the award has a meaningful impact on the student's real or perceived ability to afford college, this time constraint should introduce an incentive to complete college faster than in the absence of KEES. Although this study does not include students' participation in the labor market, similar programs have been found to significantly reduce the likelihood of participation while in college (Bruce & Carruthers, 2011). It is reasonable to assume that KEES could have a similar effect.

Lastly, the results from Tables 5 and 6 present a serious challenge for Kentucky college completion goals that has less to do with the KEES program and more to do with the performance of the state's public institutions. Aside from the race/ethnicity of students, which is a notable limitation of the dataset used in this study, the model controls for important student characteristics that may explain the differences across the institutions in the probability of completion. It is difficult to determine what magnitude of effect should warrant concern, but the consistently negative effects among Kentucky's 2-year institutions perhaps deserve attention, especially those near the bottom of Table 5.

Limitations

There are a few substantial limitations to this study related to the available data, the nature of the KEES program, and the research design required as a result. As was mentioned before, the minimization of selection bias is of greatest concern when measuring the impact of merit-based aid programs. While the model used in this study controls for most student characteristics agreed to be an important factor in college completion, the results still reflect the *average* effects of KEES across the *entire* spectrum of academic achievement among high school students immediately matriculating to public postsecondary institutions. Therefore, the potential for selection bias is present, as there may be unobserved characteristics among the higher-achieving students who receive KEES that explain college completion.

Studies using student-level data to estimate the effects of merit-based aid typically attempt to minimize selection bias via either a matching design or regression discontinuity, both of which focus on the effects of a merit program's effects on students around the margin of

eligibility. This ensures that students included in the model are as similar in academic achievement as possible.

The unique structure of KEES is not conducive to either design. First, with matching, the low eligibility requirements of the KEES program make obtaining a suitable sample size exceptionally difficult. Few students who achieve less than a 2.5 high school GPA and below a 15 ACT attend college. An attempt to match those students with a sub-sample of KEES recipients along a set of characteristics is a challenge. This could theoretically be overcome as more academic years become available for analysis. Second, given that merit-based aid programs use high school GPA, ACT score, or both as eligibility criteria, it creates a threshold for treatment/control assignment conducive for regression discontinuity. However, this model requires that crossing the threshold be a significant predictor of treatment. Table 2 already showed that a sizable number of students eligible for KEES did not receive an award, according to the dataset. Additionally, since a student can earn KEES based on their GPA for each year in high school, a student's cumulative GPA is not a valid predictor of receiving KEES. To illustrate, in Scott-Clayton's (2011) study of the West Virginia scholarship, crossing the ACT threshold increased the likelihood of receiving an award by 70 percentage points. Using a similar model to measure the effect of crossing the GPA threshold on KEES receipt yielded only a 9 percent increase in likelihood.

Even if one were able to overcome these challenges in measuring the impact of KEES on college completion around the margin of eligibility criteria, the analysis may not be very fruitful in terms of policy implications. Unlike other programs that have been the focus of research to date, KEES uses a tiered award structure. Therefore, an analysis around the margin would be

measuring the impact that approximately \$300 has on college completion, depending on where a researcher places the upper- and lower- bounds of achievement. Not to suggest this amount of money would be meaningless, especially to low-income students, but it may be difficult to detect significant effects from that size of an award.

Limitations also exist with regard to the dataset itself. In addition to absence of race/ethnicity data, which likely introduces some degree of omitted variable bias, the dataset had a large amount of missing observations for high school GPA, total family income, and financial aid. Rather than significantly reducing the number of observations used in analysis, a dummy variable was created for each variable to indicate when an observation was missing. These missing values were then converted to zero and controlled for in the regression models. Regression coefficients for these missing variables were included in the results section, but were not a focus of discussion because not much can be derived from the results other than, in most instances, they have a significant effect on college completion. In fact, the missing high school GPA variable yielded the largest estimated effects among some model specifications. One is left to question how results may have differed overall had these observations not been missing.

Recommendations

Improve Data Collection

Although the Council on Postsecondary (CPE) provided data that was invaluable to this analysis, which in turn, hopefully helps inform policy makers on the effects of the KEES program, the current state of the data prevents a more robust analysis from being conducted. In particular, the collection of a high school student's GPA for each year in school would be very helpful in allowing a regression discontinuity analysis to be used. However, this does not sufficiently address what appears to be a very blurry application of the KEES eligibility criteria.

If Kentucky wants to obtain a more comprehensive understanding of the effects of KEES on college completion and an array of other important outcomes, then more complete data must be collected that explains why a student did or did not receive KEES. The quality of the CPE's data is obviously affected by the quality of the data they receive from the postsecondary institutions that provide it. The analysis in this study found no patterns with irregular or missing data among academic year, county, institution, or various student characteristics. Therefore, it may be a systemic issue with data reporting that the CPE may wish to look into in order to ensure more consistent reporting across institutions.

Analysis of Need-Based Aid

The intent of this study was to contribute to the research conducted on merit-based aid thus far and to inform the debate surrounding the KEES program through the lens of college completion. In describing the program, however, it was mentioned that the policy debate surrounding KEES (along with other state programs) typically assumes merit-based aid funding at the expense of need-based aid funding. This study does not provide any information to inform the comparative effectiveness of merit-based aid versus need-based aid. Limitations of internal validity aside, this is a first-pass study that provides Kentucky officials the estimated effect KEES has on a single strategic priority of the state's postsecondary education system - college completion. If one wants to analyze whether need-based aid's impact on completion is comparable, then separate analysis should be conducted or appropriate effects found in other studies could be used. In either case, this study provides one side of the analysis that is needed to compare the effects of merit-based aid versus need-based aid on college completion.

Benefit-Cost Analysis of KEES

Similar to the recommendation to analyze the effect of need-based aid, it is also recommended that a benefit-cost analysis be conducted of KEES. The direct cost of the program is known, and it is reasonable to assume any indirect costs could be estimated as well. Now, the results of this study may represent the best resource available in estimating the social benefits produced from the effect KEES has on college completion. Increased completion, or degrees conferred, is often highlighted as a key educational outcome that will improve Kentucky's economy and the quality of life of its citizens. Using the results of this study, one could calculate the social benefit generated from the approximate increase in associate and bachelor's degrees that is attributable to KEES. Scott-Clayton (2011) and Dynarski (2008) include a benefit-cost analysis in their studies that may be replicable for KEES.

Beware the 2-Year Pipeline

As the cost of college continues to rise, it is becoming more frequent for college-going students to reduce that cost by spending part of the time at a community college. Attendance at 2-year institutions has risen in Kentucky, and improving the transfer "pipeline" between 2-year and 4-year institutions is an established goal of the CPE as a means to increase educational attainment. Kentucky should undoubtedly continue to improve the transfer process for students making such a decision. While encouraging the increased enrollment across 2-year institutions is a sound strategy toward increasing the number of postsecondary degrees, Kentucky officials should beware of relying on it too heavily. With only one exception, Kentucky 2-year public institutions actually decrease the likelihood of completion, some arguably to a very concerning degree. Kentucky should consider investigating further as to why this effect is present. After all, an increase in the number of degrees is almost a necessary outcome of increased enrollment, but

if in that effort more students are failing to complete college, then the cost of student debt and lost wages may have an offsetting effect on increased degrees.

Summary

State merit-based aid has received considerable attention among researchers over the past decade. Affording college is becoming more difficult for high school graduates as constrained state budgets and stagnant family incomes require a higher tolerance of student debt.

Meanwhile, merit-based aid has become an increasingly popular policy choice, thus warranting analysis as to what effects this form of resource distribution has on state educational goals. Few studies have measured merit-aid's effect on college completion, and those that have present conflicting results that are not generalizable. Therefore, the effect of the KEES program on college completion was measured.

The analysis concluded that KEES increases the likelihood of completing college with an associate or bachelor's degree by 3.6 percent; a bachelor's within 5 years by 3.1 percent; and a bachelor's within 6 years by 4.8 percent. No effect was found for earning a bachelor's within 4 years. This effect increases among levels of higher academic achievement and family income. The analysis also found that KEES increases the rate of overall completion by 24.4 percent and earning a bachelor's within 5 years by 8.9 percent. The study concludes with offering multiple recommendations concerning better data collection to help improve internal validity in future KEES studies, additional analyses to build from this study, and further investigation into why the state's 2-year institutions may be decreasing the likelihood of college completion.

References

- Adelman, C. (2006). "The Toolbox Revisited: Paths to Degree Completion From High School Through College." Washington, DC: U.S. Department of Education.
- Bruce, D.J. & Carruthers, C.K. (2011). "Jackpot? The Impact of Lottery Scholarships on Enrollment and Earnings in Tennessee." In *Annual Meeting of the Association for Public Policy Analysis and Management*.
- Cornwell, C. & Mustard, D. (2006). "Merit Aid and Sorting: The Effects of HOPE-Style Scholarships on College Ability Stratification." *IZA Discussion Paper Series*, No. 1956.
- Cornwell, C., Mustard, D.B. & Sridhar, D.J. (2003). "The Enrollment Effects of Merit-Based Financial Aid: Evidence from Georgia's HOPE Scholarship." University of Georgia.
- Dee, T. & Jackson, L. (1999). "Who Loses HOPE? Attrition from Georgia's College Scholarship Program." *Southern Economic Journal*, Vol. 66, No. 2: 379-390.
- Deming, D. & Dynarski, S. (2009). "Into College, Out of Poverty? Policies to Increase the Postsecondary Attainment of the Poor." *National Bureau of Economic Research*. Cambridge, MA.
- Doyle, W.R. (2010). "Does Merit-Based Aid "Crowd Out" Need-Based Aid?" *Research in Higher Education*, Vol. 51, No. 5: 397-415.
- Dynarski, S. (2004). "The New Merit Aid." In *College Choices: The Economics of Which College, When College, and How to Pay for It*. Caroline M. Hoxby (ed) Chicago: University of Chicago Press: 63-97.
- Dynarski, S. (2008). "Building the Stock of College-Educated Labor." *Journal of Human Resources*. Vol. 43, No. 3: 576-610.
- Henry, G.T. & Rubenstein, R. (2002). "Paying for Grades: Impact of Merit-Based Financial Aid on Educational Quality." *Journal of Policy Analysis and Management*, Vol. 21, No. 1: 93-109.
- Henry, G.T., Rubenstein, R. & Bugler, D.T. (2004). "Is HOPE Enough? Impacts of Receiving and Losing Merit-Based Financial Aid." *Educational Policy*, Vol. 18, No. 5: 686-709.
- Kentucky Council on Postsecondary Education (2011). "Double the Numbers: Kentucky's Plan to Increase College Graduates."
- Legislative Research Commission. (2011). "A Study of the Kentucky Educational Excellence Scholarship." *Office of Education Accountability*, Report No. 386.
- Long, T.B. & Riley, E. (2007). "Financial Aid: A Broken Bridge to College Access." *Harvard Educational Review*, Vol. 77, No. 1: 39-63.
- Melguizo, T. (2011). A Review of the Theories Developed to Describe the Process of College Persistence and Attainment. In John C. Smart and Michael B. Paulsen (Eds.), *Higher Education: Handbook of Theory and Research*, volume 26 (pp. 395-424). The Netherlands: Springer.
- National Center for Educational Statistics (NCES). (2012). Retrieved from http://collegecompletion.chronicle.com/state/#state=ky§or=public_four

- Scott-Clayton, J. (2011). "On Money and Motivation: A Quasi-experimental Analysis of Financial Incentives for College Achievement." *Journal of Human Resources*, Vol. 46, No. 3: 614- 646.
- Sjoquist, D.L. & Winters, J.V. (2012a). "Building the Stock of College-Educated Labor Revisited." *Journal of Human Resources*, Vol. 47, No. 1: 270-285.
- Sjoquist, D. & Winters, J. (2012b). "State Merit-Based Financial Aid Programs and College Attainment." *IZA Discussion Paper Series* No. 6801.
- Zhang, L. (2011). "Does Merit-Based Aid Affect Degree Production in STEM Fields? Evidence from Georgia and Florida." *The Journal of Higher Education*, Vol. 82, No. 4 (July/August).