Experimental Evidence on the Impacts of Need-Based Financial Aid: Longitudinal Assessment of the Wisconsin Scholars Grant

Drew M. Anderson
RAND Corporation*

Katharine M. Broton
University of Iowa

Sara Goldrick-Rab
Temple University

Robert Kelchen
Seton Hall University

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Abstract

College financial aid is intended to improve academic performance and college completion rates and create longer-term benefits by reducing financial stress and debt. However, very few studies clearly distinguish causal impacts of financial aid programs over an extended period of time. Building on prior evidence from a randomized experiment with the Wisconsin Scholars Grant, this study examines college completion, field of degree, and graduate school enrollment over a period of up to ten years. That longer period of observation reveals that some of the program's initial positive effects, documented in earlier studies, faded over time. The program shortened time-to-degree among its first cohort of university students and a greater fraction earned degrees in science, technology, engineering, and mathematics (STEM) fields, but it did not increase their overall odds of degree completion or rates of entry into graduate school. However, when additional cohorts of program participants are considered, there are some signs of improvement. For example, impacts on six-year degree completion rates trended upward for later cohorts, exhibiting a statistically significant impact for the most recent cohort examined. While the program also delivered financial aid (albeit with less purchasing power) to students at two-year colleges, positive impacts on their educational outcomes were not evident. This longitudinal assessment adds to the growing body of evidence that dollars delivered via traditional financial aid programs are exhibiting inconsistent effects when it comes to ameliorating students' financial challenges and promoting student success.

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INTRODUCTION

Scholarship providers and government entities seek to offset the high and rising price of college through financial aid in order to help students from low-income families complete degrees, an accomplishment that less than half of students who enroll in college currently achieves (National Center for Education Statistics, 2018). But it is difficult to assess whether this strategy promotes degree completion, in part because the impacts of financial aid must be cleanly disentangled from the characteristics of those who receive it. Randomized experiments provide the best evidence on program impact, but they are very rarely used to assess financial aid, and longitudinal follow-up on their outcomes is even less common.

Since 2008 the Wisconsin Scholars Grant (WSG), operated by the Fund for Wisconsin Scholars, has offered renewable grant support to students with financial need attending Wisconsin's public colleges and universities. The Fund uses a lottery to select among eligible students, facilitating rigorous estimation of program impacts. Several studies and a book have examined the program's first cohort of students over a four-year period (Anderson & Goldrick-Rab, 2018; Broton, in press; Broton, Goldrick-Rab, & Benson, 2016; Broton & Monaghan, 2018; Goldrick-Rab, 2016; Goldrick-Rab, Kelchen, Harris, & Benson, 2016). Those studies documented improvements in on-time degree completion for university students, potentially because the grant reduced the time students spent working for pay. The effects were more pronounced for students with less academic preparation and those with college-educated parents. Moreover, students offered the grant were more likely to declare majors in science, technology, engineering, or mathematics (STEM) fields. However, positive impacts were not evident

for two-year students, on average or for subgroups, in part because of challenges with program implementation.

Did those findings persist over time? This study extends the observation period for the first cohort to consider impacts over up to ten years and compares impacts on the first cohort with those for three subsequent cohorts. We consider impacts on degree completion, field of degree, and graduate school enrollment, drawing on longitudinal administrative data. The results offer a more robust view of the Wisconsin Scholars Grant's contributions to students at universities and two-year colleges, and a look at how the impacts of financial aid evolve over time.

Longer-term follow-up can be illuminating for several reasons. Observing the same cohort of students over time makes it possible to see whether initial differences in outcomes between program participants and non-participants persist, or if differences shrink as non-participants catch up or participants lose ground. In the case of the WSG, we examine whether the grant increased the overall odds of completing a degree, or rather accelerated that process by allowing more intensive and successful coursework. Conditional on earning a degree, acceleration might yield benefits in terms of completing in a field with better labor market returns, leaving college with less debt, and entering the labor market or graduate school more quickly.[1]

Longer-term follow-up studies have been a growing focus in the social sciences. Early childhood and K-12 interventions sometimes exhibit "sleeper" effects where initial positives fade out only to reappear in adulthood (Chetty, Friedman, Hilger, Saez, Schanzenbach, & Yagan, 2011; Chetty, Friedman, & Rockoff, 2014; García, Heckman,

[1] This study focuses on educational outcomes. We plan to assess impacts on debt and labor market outcomes in a follow-up paper.

Leaf, & Prados, 2017). But very few studies of college financial aid include follow-up studies. Existing evaluations with longer time horizons generally point to positive effects of financial aid on college completion and post-college financial stability, even if overall differences in degree completion are not present (Attewell, Lavin, Domina, & Levey, 2007; Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2016; Scott-Clayton & Zafar, 2016; Denning, Marx, & Turner, 2017).

For ongoing programs, follow-up allows for estimation of program impacts across additional cohorts of students. Replication of randomized controlled trials, which is a built-in feature of the WSG program, is exceedingly rare in education research; in other fields, repeated studies have significantly shaped the evidence base when landmark studies fail to replicate (Hedges, 2018). Changes in effects could arise from shifts in the student population, or changes in the effectiveness of the aid program. The WSG eligibility criteria were stable over time, and random selection allows for differencing out any positive or negative changes in potential outcomes across cohorts. During the period of this study, the percent of college net price covered by the grant amount declined substantially. However, over that same period of time the implementation of the newly established program may have improved, for example via clearer communications with students (Fund for Wisconsin Scholars, 2015). Clearer communication could be important, as Goldrick-Rab (2016) documented confusion experienced by some students seeking to make sense of the program's rules and requirements. Prior research has also demonstrated the power of clear communication about college financing (Bettinger, Gurantz, Kawano, & Sacerdote, 2012; Bird,

Castleman, Goodman, & Lamberton, 2017; Castleman & Meyer, 2016; Castleman, Meyer, Sullivan, Hartog, & Miller, 2017; Castleman & Page, 2017).

In this longitudinal follow-up study, we pose three sets of questions about the WSG program's impacts on both university students and two-year college students.

1. Did the WSG's initial effects on college attainment persist over longer time periods? Were there any resulting impacts on field of degree, or on education beyond the initial institution (i.e. graduate school enrollment for university students, and university enrollment for two-year students)?
2. Did effects on educational outcomes vary across the program's first four cohorts?
3. Did key attainment impacts vary by prior academic achievement (as found in earlier studies), or by gender, race/ethnicity, or by whether or not students were eligible for free or reduced price lunch in high school (a proxy for poverty)?

To preview the results, we find that the WSG's early positive effects among the first cohort of university students attenuated over time: the program did not boost overall rates of degree attainment or entry into graduate school over a period of up to ten years. However, students offered the WSG earned degrees more quickly and were more likely to earn them in STEM fields. Moreover, when comparing impacts across the program's first four cohorts of students there is a statistically significant upward trend in degree attainment over six years ($p<0.01$). For the 2011 cohort, 68% of students offered the WSG completed a degree by 2017, compared to 63% of comparison group students

(p<.001). There is some evidence that these results are driven by larger positive impacts among men.

The WSG made a smaller financial contribution to two-year students and we observe fewer students in this evaluation, and perhaps as a result we do not detect any consistent positive program impacts. However, the WSG's early negative effects among two-year college students, which Anderson and Goldrick-Rab (2018) show are associated with problems in identifying and communicating to eligible students, attenuated over a longer time horizon.

The benefits of examining financial aid programs with repeated randomized experiments and observing impacts over ten years are evident, given the strong selection mechanisms and complex educational processes at play. The results of this evaluation align with a growing body of evidence indicating that traditional approaches to administering financial aid may achieve less than desired, and other ways of addressing students' evident financial needs should be considered. The remainder of the paper discusses in greater detail the WSG program, data collection, analysis, and our results.

COLLEGE AFFORDABILITY

The role of higher education in fostering social mobility has become even more important in recent decades. Even though real median earnings of bachelor's degree recipients have stagnated over the last 25 years, the gap between bachelor's degree recipients and those with less education has grown as other Americans have seen declines in income (Ma, Pender, & Welch, 2016). The vast majority of the jobs gained

since the end of the Great Recession have gone to workers with at least an associate's degree (Carnevale, Jayasundera, & Gulish, 2016). The economic and non-economic benefits of higher education remain sizable even when controlling for selection, highlighting the continued importance of a college education (Doyle & Skinner, 2017; Oreopoulos & Petronijevic, 2013).

Income Disparities and College Affordability

Despite the overall substantial benefits to receiving a college education, the American higher education system remains deeply stratified by family income. There are longstanding gaps in both college access and completion rates by family income, and little has been done to effectively close them (Bailey & Dynarski, 2011). For example, just 23% of students from the lowest socioeconomic status quartile earned at least an associate degree within eight years of graduating high school, compared to 67% of students in the top quartile (authors' calculation using data from the Education Longitudinal Study of 2002). This is a problem given that the returns to college completion are especially large for academically-marginal students and for those who are relatively unlikely to attend (Brand & Xie, 2010; Ost, Pan, & Webber, 2018; Turner, 2016; Zimmerman, 2014).

About 70% of students from lower-income families attend public colleges and universities where tuition and fees have steadily risen faster than the rate of inflation, including a 35% increase since the beginning of the Great Recession (authors' calculation using data from the National Postsecondary Student Aid Study; Ma, Baum, Pender, & Welch, 2017). Students are increasingly financing these costs through borrowing. The median student debt among bachelor's degree recipients who ever

receive a Pell Grant rose from $17,000 in 2000 to $25,000 in 2012 (authors' calculation using the National Postsecondary Student Aid Study). Lower-income students are the most likely to struggle to repay debt. Seven years after entering repayment, just 46% of students in the bottom income tercile at the typical community college, and 69% of students at the typical public university, had repaid any principal on their loans. The corresponding percentages in the top tercile were 69% and 78% (authors' calculations using data from the College Scorecard).

The Contribution of Financial Aid

Need-based grant aid programs are designed to help make college more affordable for students from lower-income families. Evidence from quasi-experimental and experimental studies generally shows modest positive effects of financial aid at increasing college enrollment and degree attainment (Page & Scott-Clayton, 2014; Castleman & Long, 2016).

A growing body of research, relying on longer-term follow-up, suggests that the effects of aid can carry over into economic prosperity after college as well. Scott-Clayton (2011) and Scott-Clayton and Zafar (2016) studied the West Virginia PROMISE program, which uses high school GPA and ACT score criteria to provide a grant similar in size to the WSG, up to $3,500 per year at universities. The grant increased degree attainment over the short-run, but these effects attenuated after ten years. Using multiple sources of administrative data, the authors find positive effects on earnings, neighborhood characteristics, and an index of financial health, potentially operating through faster attainment of degrees.

Bettinger and his colleagues (2016) studied the Cal Grant, which includes both income and high school GPA eligibility criteria, and covers full tuition at public universities as well as a large subsidy for private colleges and universities. Students with high GPAs whose incomes were near a cutoff value did not see increases in earnings or degrees, but rather used the funds to shift enrollment to more selective private colleges. In contrast, students with low incomes and GPAs near a cutoff value demonstrated increases in persistence and graduation, stayed in California longer, and earned about 5% more in their early 30s (though earnings estimates were noisy). Denning, Marx, and Turner (2017) studied the Pell Grant among university students in Texas. Over a shorter time horizon, they found that being eligible for just a few hundred dollars in additional aid in the first year of enrollment led to 5% to 8% increases in earnings seven years later.

One of the only other randomized evaluations of a need-based financial aid program comes from Angrist, Autor, Hudson, and Pallais (2014, 2016) who evaluated the Susan Thompson Buffett Program, which randomly assigned grant aid to Nebraska high school seniors who had financial need and were interested in attending an in-state public college or university. Average grant aid offers of $6,200 in the first year and $6,400 in the second year increased second-year persistence rates by 7.2 percentage points, with larger impacts for lower-ACT and nonwhite students at four-year colleges. But four-year graduation rates in the two-year and four-year sectors were actually higher in the control group than the treatment group, although more treatment than control students were still enrolled in college after four years.

There is still a significant gap in research focusing on longer-term effects of purely need-based financial aid, particularly for two-year college students. Students from families with lower incomes and lower levels of education are concentrated at two-year colleges. Wherever they enroll, lower-income students tend to take longer to graduate than students with more family resources, in part driven by the complexity and stress of their lives (Attewell & Lavin, 2012; Goldrick-Rab, 2016). When aid is delivered with minimal additional complexity, or with supports that reduce complexity, effects tend to be stronger (e.g. Scrivener, Weiss, Ratledge, Rudd, Sommo, & Fresques, 2015).

Conceptual and empirical research indicates that the effectiveness of grant aid may vary by student background characteristics (e.g., Bettinger et al., 2016; Castleman & Long, 2016; Goldrick-Rab et al., 2009). Prior research on the WSG, in particular, shows effect heterogeneity by prior academic achievement and socioeconomic background (Anderson & Goldrick-Rab, 2018; Broton et al., 2016; Broton & Monaghan, 2018; Goldrick-Rab et al., 2016). In this study, we examine variation in educational outcomes across factors likely to influence time to degree including prior academic achievement, gender, race/ethnicity, and eligibility for free or reduced price lunch. Extant research indicates that men lag behind women in degree attainment, but the magnitude of this gap shrinks over a longer time frame since men are more likely to persist after four years (Buchmann, DiPrete, & McDaniel, 2008; DiPrete & Buchmann, 2013; Freeman, 2004). Similarly, students from underserved backgrounds often take longer to complete college since they are more likely to juggle financial, work and family commitments; examination of graduation rates over a longer time horizon indicates that

racial/ethnic and socioeconomic gaps narrow (Attewell et al., 2007; Attewell & Lavin, 2012).

The research questions stated above are motivated by these issues. The Wisconsin Scholars Grant program provides a particularly useful setting to learn more about the effectiveness of financial aid at addressing stratification in higher education.

PAYING FOR COLLEGE IN WISCONSIN

Public higher education in Wisconsin consists of two systems. The University of Wisconsin (UW) System has 13 four-year universities and 13 two-year UW Colleges campuses, and the Wisconsin Technical College System (WTCS) has 16 two-year technical colleges with a total of 49 branch campuses.[2] Goldrick-Rab (2016) discusses the landscape of Wisconsin higher education in greater detail. This paper focuses primarily on the UW universities and colleges, though we also examine one cohort of WTCS students.

Price of college

Table 1 shows several components of the price of college in Wisconsin over the ten-year period of this evaluation, from 2008-09 (when the initial WSG cohort entered college) until 2017-18. The data come from the U.S. Department of Education's Integrated Postsecondary Education Data System, which collects information directly reported by colleges and universities.

During that period, tuition and fees increased by 13% at the UW Colleges, by almost 30% at the UW universities, and by 32% in the WTCS. But tuition is only a small

[2] This information applies to the evaluation period. In summer 2018, changes were made to the administrative responsibility of the UW Colleges and they are no longer independent of the universities.

fraction of the price of college. Nationwide, non-tuition and fee expenses currently represent 64% of the total cost of attendance for off-campus students attending public 4-year colleges and 79% for students at public 2-year colleges (Ginder, Kelly-Reid, & Mann, 2018). In Wisconsin, the total cost of attendance (including room and board, books and supplies, transportation, medical expenses, and personal expenses) grew by 17% at the UW Colleges, 26% in the WTCS, and 32% at UW universities.

Financial aid increased more slowly, and it only partially offset those prices. All WSG students also received the Pell Grant during their first year of college, and the vast majority also received the state need-based grant called the Wisconsin Grant. The modal student received a maximum Pell Grant and a maximum Wisconsin Grant, and received little additional grant aid from other sources, according to our detailed analyses of the first cohort's financial aid packages (Goldrick-Rab et al., 2016). In 2017-18 the public grants provided $5,920 from Pell at all institutions, $2,324 from the Wisconsin Grant at UW institutions, and $1,084 from the Wisconsin Grant at technical colleges. After taking those grants into account, the typical low-income student eligible for the WSG faced a net price of $7,400 to $8,400 when the Fund initiated the WSG in 2008-2009. Ten years later, those net prices had grown substantially, to more than $10,000 per year for two-year college students and nearly $12,000 per year for university students.

But during that same period, the WSG's dollar amount remained the same for students in this evaluation, amounting to $3,500 for university students and $1,800 for two-year college students. Therefore, the WSG's purchasing power—expressed in

terms of the percent of net price it covered—declined from 47% to 30% for university students and from 22% down to 18% for two-year college students.

Table 1. Sticker and Net prices and the Wisconsin Scholars Grant: 2008-09 to 2017-18

	UW Colleges	WTCS	UW universities
Tuition and required fees ($)			
2008-09	4,584	3,287	6,523
2017-18	5,172	4,332	8,450
Full cost of attendance ($)			
2008-09	16,174	13,567	15,171
2017-18	18,942	17,145	20,070
Maximum public need-based aid (Pell and Wisconsin Grant $)			
2008-09	7,711	5,836	7,711
2017-18	8,244	7,004	8,244
Remaining net price ($)			
2008-09	8,463	7,731	7,460
2017-18	10,698	10,141	11,826
WSG purchasing power (% of remaining net price covered by WSG)			
2008-09	21%	23%	47%
2017-18	17%	18%	30%

Notes: Authors' calculations from the Integrated Postsecondary Education Data System based on the cost of attendance for students living off-campus in the two-year sector and on-campus in the four-year sector. Public need-based aid comes from the Pell Grant and the Wisconsin Grant, and the maximum amount is also the modal amount among recipients and the modal amount in our WSG sample. For the cohorts in our analysis, the WSG is always $3,500 at UW universities, and $1,800 at the UW Colleges and WTCS, though the amount increased to $4,000 for university students for the 2016 cohort and beyond.

WSG Program Operation and Development

The Fund for Wisconsin Scholars (Fund) seeks to reduce financial barriers for low-income students and reduce debt in order increase the number of Wisconsin

students completing degrees (Fund for Wisconsin Scholars, 2008). The Fund defines this population as traditional college students (e.g. first-time full-time recent high school graduates) who already receive need-based aid but still have some costs to cover. Grants are offered within this population by lottery. The requirements of initial take-up and maintained eligibility to renew the grant have caused some selected students (lottery winners) not to receive aid. However non-take-up and non-renewal have both been addressed by program improvements and policy changes.

Students are eligible for the WSG if they enroll full-time in Wisconsin public colleges and universities within three years of graduating from a public high school in Wisconsin (and are under 22 years old). They must apply for financial aid via the FAFSA, receive a Pell Grant, and have at least $1 in remaining unmet need (full cost of attendance minus other grants and scholarships, minus Expected Family Contribution). At that point, financial aid administrators use administrative records to flag them as eligible for the WSG. Then the Fund works with the state financial aid agency to conduct a lottery to select recipients. In other words, students do not apply for the WSG.[3] During the period of this evaluation, the Fund selected about 1,200 new recipients each year, split between two- and four-year students, though the number of new recipients has declined for more recent cohorts.

After the lottery, the Fund sends students a letter, and they must acknowledge that letter and return an acceptance form. Then the grant is integrated into their financial

[3] Some students who are not awarded the WSG may nonetheless learn about the Fund for Wisconsin Scholars and may even apply to receive small amounts of support, but those "stipends" operate through a completely separate selection process governed by each campus's financial aid office. We do not find evidence of crowd-out of other grant aid among WSG recipients, or any evidence of compensatory grant aid given to students in the comparison group.

aid package by first covering out-of-pocket expenses, then reducing loans if necessary, and finally reducing work-study funds if necessary to create space for the grant. Students must accept the new aid package for it to go into effect.

As reported in Table 2, we observe program take-up rates ranging from 59% (for two-year students in the program's third cohort) to 99% (for university students in the program's second cohort).[4] Lower take-up, despite students' evident financial need and interest in grant support, is likely attributable to communications challenges (Goldrick-Rab, 2016). Some students never receive the letter from the Fund, while others receive the communication but are suspicious or do not understand the benefits. This problem may have improved as the program became more established and, for example, colleges added information about it to financial aid handbooks (e.g., University of Wisconsin-Milwaukee, 2016).

In addition, some students offered the grant have revealed that despite the information pulled from administrative records, they are not eligible for the program. For example, in the first cohort a substantial number of two-year college students were initially offered the grant but then reported graduating from high school more than three years prior, causing them to lose the support (Anderson & Goldrick-Rab, 2018). We identified the subgroup of likely-ineligible students in both the treatment and control groups, and estimated negative impacts on persistence caused by award letters for aid the students would never receive. These negatives could relate to loss of trust in the program, in financial aid, and/or in their institution or college more broadly (Goldrick-Rab

[4] These data come from Annual Reports of the Fund for Wisconsin Scholars. Take-up is not directly observable in the data for this study.

& Kolbe, 2016). This problem appears to have attenuated over time as data quality improved.

Continued receipt of the WSG depends on compliance with certain requirements. Students must remain continuously enrolled full-time, and maintain Satisfactory Academic Progress (defined by each institution, but typically consisting of a 2.0 GPA and passing a certain percentage of credits attempted). Until 2012-13, students also could lose the WSG if they were no longer eligible to receive the Pell Grant, but then the Fund removed that requirement. Anderson and Goldrick-Rab (2018) and Goldrick-Rab (2016) found that lack of initial take-up, dropping out, dropping to part-time, or losing Pell Grant aid all contributed to loss of the grant among selected students. However, the rate of non-receipt fell even among full-time Pell recipients. The Fund for Wisconsin Scholars (2015) acknowledged these challenges and sought to improve communications about the requirement of continuous full-time enrollment, as well as implemented a change to only require initial Pell eligibility.

METHODOLOGY

Sampling

This evaluation's analytic sample includes 20,718 students who were eligible for the WSG between fall 2008 and fall 2011, comprising the program's first four cohorts. Sample sizes by program group, sector, and cohort are displayed in Table 2. The data come from a snapshot of longitudinal administrative records, linked via the student FAFSA with a high rate of success. Starting from the group of students eligible for the WSG, the final sample loses just 112 students due to non-match across administrative

databases, and loses an additional 28 students because treatment status was unclear in the eligibility records.

Of note in Table 2 is the growing number eligible for random assignment at universities. This is attributable mainly to federal policy changes expanding Pell Grant eligibility, as we observe more students with relatively higher family incomes enter the sample. However, we do not see changes in the composition of the group on measures such as academic preparation or other demographics, and the percent of students with zero Expected Family Contribution did not change.

Table 2. Sample Sizes and Program Take-up Rates by Cohort

	Sample Sizes				Take-up Rates	
	Two-year		Universities		Two-year (%)	Universities (%)
	WSG	Control	WSG	Control		
2008	586	879	612	2,534	60	91
2009	110	583	498	3,610	82	99
2010	162	602	516	4,257	59	83
2011	200	761	619	4,189	60	74
Total (N=20,718)	1,058	2,825	2,245	14,590	-	-

Notes: The 2008 sample of two-year students includes those attending both Wisconsin Technical Colleges and the UW Colleges, whereas the later cohorts include only UW Colleges. Grant distribution to WTCS students after the 2008 cohort is not available in this evaluation and the Fund discontinued grants to new WTCS students in 2016-17.

Data

Educational outcomes are assessed over nine years using data from the National Student Clearinghouse (NSC), which cover the vast majority of college enrollments and

degrees nationwide (NSC, 2018). Degree completion is defined as completion of a degree or certificate of any kind. Graduate school enrollment is enrollment at a four-year institution following graduation from a university.[5] The tenth year of enrollment (potentially graduate enrollment or post-degree enrollment in community colleges) is proxied by FAFSA filing, as enrollment data from the NSC are not yet available.

With somewhat less accuracy and completeness, the NSC data also include the student's field of degree at college completion (present for 80% of degree completions). STEM is defined as majors in computer science, engineering, mathematics and statistics, biological and biomedical sciences, and other physical sciences. On average, 16% of students in the control group at universities majored in STEM fields where field was observable, which is similar to the national average of 17% (National Center for Education Statistics, 2017).[6]

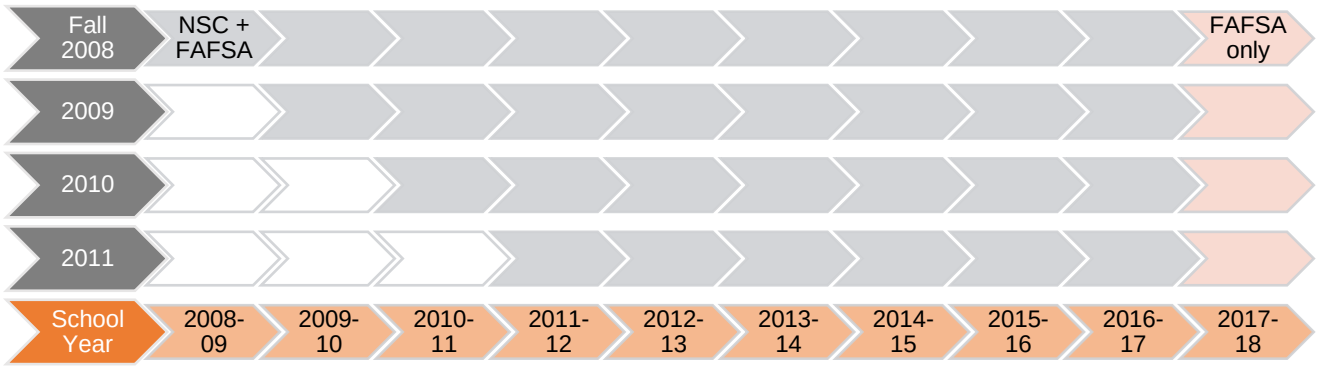
Background measures come from two sources. The Wisconsin Department of Public Instruction records provide measures of gender, age, race/ethnicity, ACT score for test-takers, and an indicator of poverty for all high school completers (eligibility for free or reduced price lunch, which requires a family income below 185% of the federal poverty level). The match to these data is 93%, with most of the non-match likely explained by older or private school students who entered the randomization pool in error as described above. In addition, FAFSA records provide measures of gender, age, family income, and other household information. The 2009-10 filing year is missing

[5] One in five students who graduates from a university in this study and subsequently enrolls elsewhere enters a two-year college, which is not defined as graduate school enrollment for this purpose.
[6] Broton and Monaghan (2018) use college administrative records to examine university students' declared major three years following initial college enrollment, using a similar definition of STEM. In that sample, 19% of students in the control group and 27% of students who were offered the WSG majored in a STEM field of study.

in these data because of a deleted file, affecting the second cohort's baseline information. Missing data on background characteristics changes the sample for baseline equivalence tests, but not for the main analysis.

The data are longitudinal, and the length of the observational period between 2008-09 and 2017-18 varies by cohort, as depicted in Figure 1.

Figure 1. Cohorts and Observable Data by School Year



Notes: "NSC" denotes enrollment and college completion data from the National Student Clearinghouse, which are not available for 2017-18.

Empirical Approach

For the first two research questions confirming program impacts, we estimate equations of the following form.

$$Y_i = \rho WSG_i + \gamma_{C(i)} + \varepsilon_i \quad (1)$$

Y_i represents an outcome for individual i, such as degree completion within six years of matriculation. The coefficient of interest is ρ, the effect of being selected to receive a WSG offer, which is denoted by WSG_i. ρ represents the difference in means between the program group and the control group, with regression adjustments for cohort fixed effects $\gamma_{C(i)}$ in analyses with multiple cohorts. Since the WSG employs lotteries to determine program participation (blocked by cohort and sector), this

comparison reveals the causal effect of the WSG offer. This is an intent-to-treat estimate, since not all students take up the WSG offer (see Table 2). We estimate effects separately for two-year college students and university students and display the results graphically, with corresponding levels and estimates in tables.

For the third research question, exploring effect heterogeneity, we estimate the following equation.

$$Y_i = \beta X_i + \delta WSG_i + \tau WSG_i * X_i + \gamma_{C(i)} + \varepsilon_i \quad (2)$$

Here X_i denotes a binary group membership for individual i. The groups examined are women/men, white/racial or ethnic minority, high/low ACT score, and eligibility/ineligibility for free or reduced price lunch in high school. Among university students, low ACT students are those who scored below 22 (the median among four-year test takers) or did not take the exam (about 6% of students). In the two-year sector, low ACT students are those who score below 18 (the bottom quartile among two-year test takers) or do not take the exam (25% of students). The coefficient δ expresses the WSG effect in the group with $X_i = 0$, and the coefficient τ expresses the difference in effects for the group with $X_i = 1$. We report results pooling cohorts and focusing on two outcomes in each sector over six years: degree completion (both), STEM degree attainment (four-year sector), and upward transfer (two-year sector).

To examine the success of randomization at creating equivalent groups at baseline, Table 3 pools the four cohorts and estimates the equation (1) with a baseline characteristic as the dependent variable, and additionally calculates effect sizes of group differences. Results indicate that the WSG lotteries generally resulted in balanced groups. There are some small differences by gender at universities and by age and

parental income at two-year colleges, but none that suggest the need for statistical adjustments, particularly in light of the successful randomization and low attrition (What Works Clearinghouse, 2017).

Table 3 shows that the two-year college students were less likely to have taken the ACT and scored lower on it. In both sectors about three in five students were women, and about four in five students were white. Average parental incomes are relatively low, resulting in over half of the two-year college students and a third of university students having a zero calculated Expected Family Contribution, qualifying them for the maximum in federal and state need-based aid.

Table 3. Baseline Equivalence of WSG and Control Groups, Pooled Cohorts

	Two-year College Students			University Students		
	Control	WSG Diff.	ES	Control	WSG Diff.	ES
Men (%)	40.5	1.9	0.05	43.7	** -2.3	-0.06
Age at enrollment	19.4	** -0.4	-0.51	18.1	-0.0	-0.21
Race/ethnicity (%)						
White non-Hispanic	81.9	1.5	0.06	78.0	1.1	0.04
Black non-Hispanic	4.9	* -1.6	-0.20	8.3	-1.0	-0.08
Hispanic	4.2	-0.7	-0.10	3.9	0.1	0.01
Asian/Pacific Islander	7.8	0.5	0.05	8.6	-0.4	-0.03
Other race	1.2	0.1	0.05	1.2	0.2	0.11
Free/reduced-price lunch in HS	37.9	0.4	0.01	31.9	-1.6	-0.05
ACT score group (%)						
Non-taker	33.8	-2.2	-0.08	10.2	0.5	0.03
Below basic (0-16)	11.8	-0.1	-0.01	6.0	-0.3	-0.04
Basic (17-21)	33.7	2.3	0.07	33.9	-0.0	0.00
Proficient (22-27)	18.7	0.3	0.01	41.4	0.3	0.01
Advanced (28-36)	2.0	-0.3	-0.11	8.5	-0.4	-0.03
EFC zero (%)	51.3	-3.2	-0.08	33.7	-1.2	-0.03
EFC if positive ($1,000s)	2.6	0.5	0.09	3.4	0.0	0.09
Parental income ($1,000s)	24.3	*** 2.3	0.28	35.0	-0.0	0.09

Notes: WSG differences and effect sizes are regression-adjusted with cohort fixed effects. ACT score categories are those used by Wisconsin's Department of Public Instruction to report college readiness. Sample size varies by row with some missing data as describe above. Standard errors are robust.

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

IMPACTS OF THE WSG FOR UNIVERSITY STUDENTS

The first Wisconsin Scholars Grant program cohort started college in the fall of 2008. When the outcomes of university students were assessed over four years, the normative period of time in which bachelor's degree completion is expected, positive impacts were clear. Goldrick-Rab and her colleagues (2016) reported a 28% increase in the rate of bachelor's degree completion, up from 16% in the control group to 21% in the treatment group. Did those impacts persist over time, increasing overall attainment for that initial group of students? Figure 2 indicates that they did not, as the WSG *accelerated* degree completion for the Fall 2008 cohort rather than improving the students' overall chances of completing degrees.

We began by revising the prior analysis of four-year graduation rates using the entire control group rather than a stratified sample. Consistent with the previous study, there is a statistically significant 19% increase in degree completion rates over four years (on a base of 20.6%). But five years after initial enrollment, students who were *not* offered the WSG had attained degrees at the same rates as WSG students. In fact, in years seven through nine, the completion rates of students offered the WSG lagged behind those of their counterparts by almost five percentage points ($p<0.05$, see Figure 2). Nine years after initial enrollment, 66% of students offered the WSG had completed a degree compared to 71% of students not offered the WSG.

Did subsequent cohorts of university students also experience an acceleration in degree completion, earning more degrees in four years because of the WSG? Figure 3 and Table 4 indicate that they did not. Across the first four cohorts, among students not offered the WSG, degree completion over four years was relatively stable (averaging

24%) with a slight upward trend over time. Only the first cohort demonstrated statistically significant improvements due to the WSG over a four-year horizon.

Figure 2. WSG Impact on Degree Completion over 9 years: University Students, 2008 Cohort

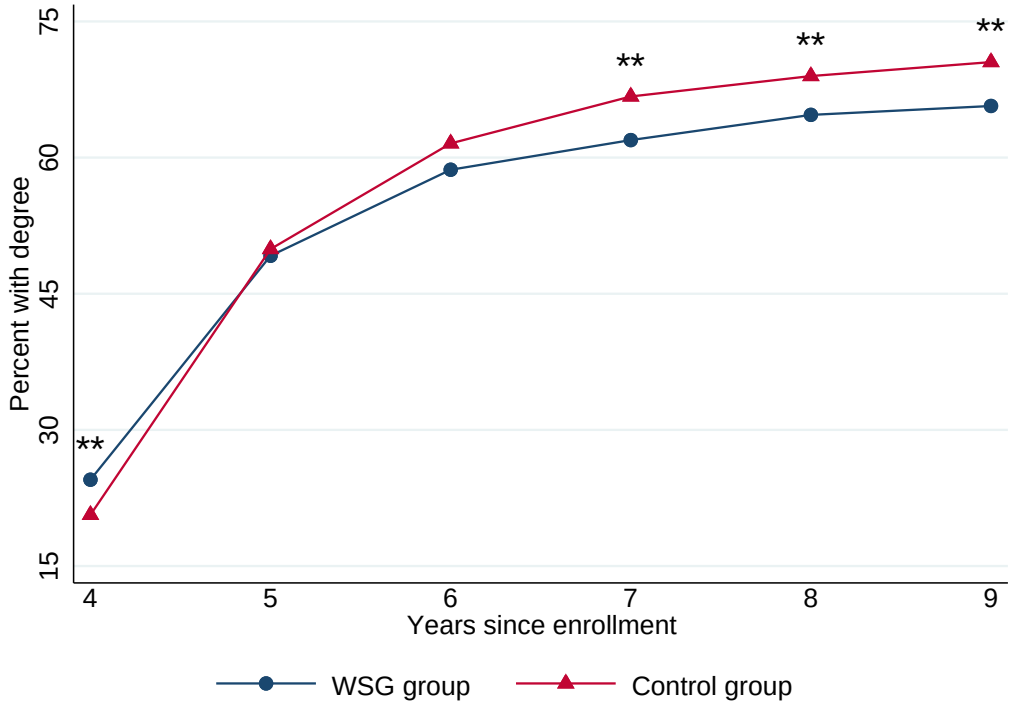


Figure 3. WSG Impact on 4-year Degree Completion: University Students, 2008-11 cohorts

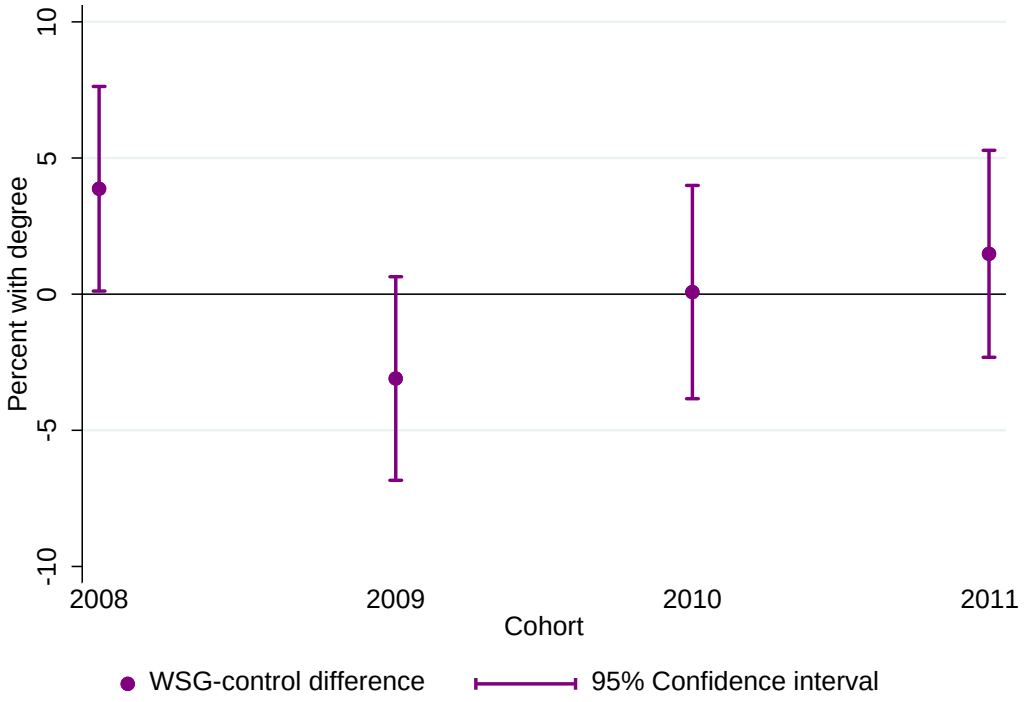


Table 4. WSG Impact on University Students, 2008-11 Cohorts

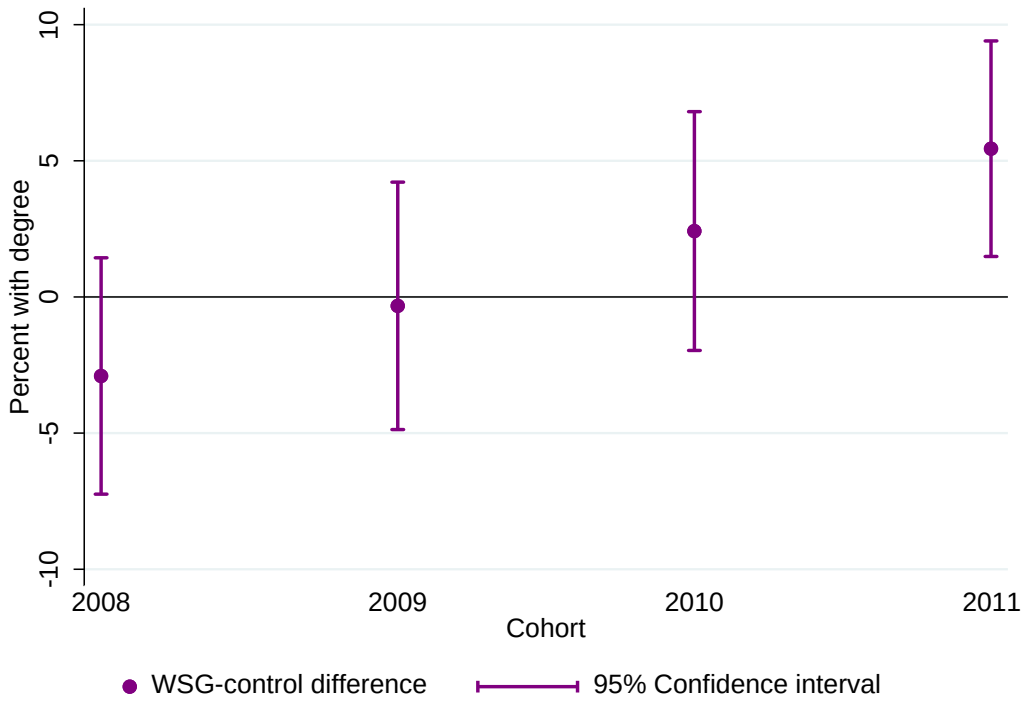
	Control Mean	WSG Difference	Standard Error
Degree completion (in 4 years)			
2008 cohort	20.6	3.9	** 1.9
2009 cohort	22.6	-3.1	1.9
2010 cohort	24.1	0.1	2.0
2011 cohort	27.0	1.5	1.9
Pooled cohorts	24.0	0.7	1.0
Degree completion (in 6 years) †			
2008 cohort	61.6	-2.9	2.2
2009 cohort	62.6	-0.3	2.3
2010 cohort	61.9	2.4	2.2
2011 cohort	62.6	5.4	*** 2.0
Pooled cohorts	62.2	1.3	1.1
Degree completion (in 9 years)			
2008 cohort	70.5	-4.8	** 2.1
STEM degree (ever)			
2008 cohort	14.1	6.8	*** 2.3
2009 cohort	15.1	5.9	** 2.4
2010 cohort	16.5	-2.8	2.1
2011 cohort	14.5	4.1	2.6
Pooled cohorts	16.3	3.6	*** 1.2
Graduate school (ever)			
2008 cohort	20.0	-0.7	1.8
2009 cohort	17.5	0.8	1.8
2010 cohort	15.1	0.3	1.7
2011 cohort	14.2	-1.1	1.5
Pooled cohorts	15.2	-0.2	0.8

Notes: † Can reject flat trend across cohorts. Estimated slope in treatment effect 2.8 pc pts, $p<0.01$. Each WSG difference comes from a single regression. Pooled regressions include cohort fixed effects. Standard errors are robust.

* $p<0.10$ ** $p<0.05$ *** $p<0.01$

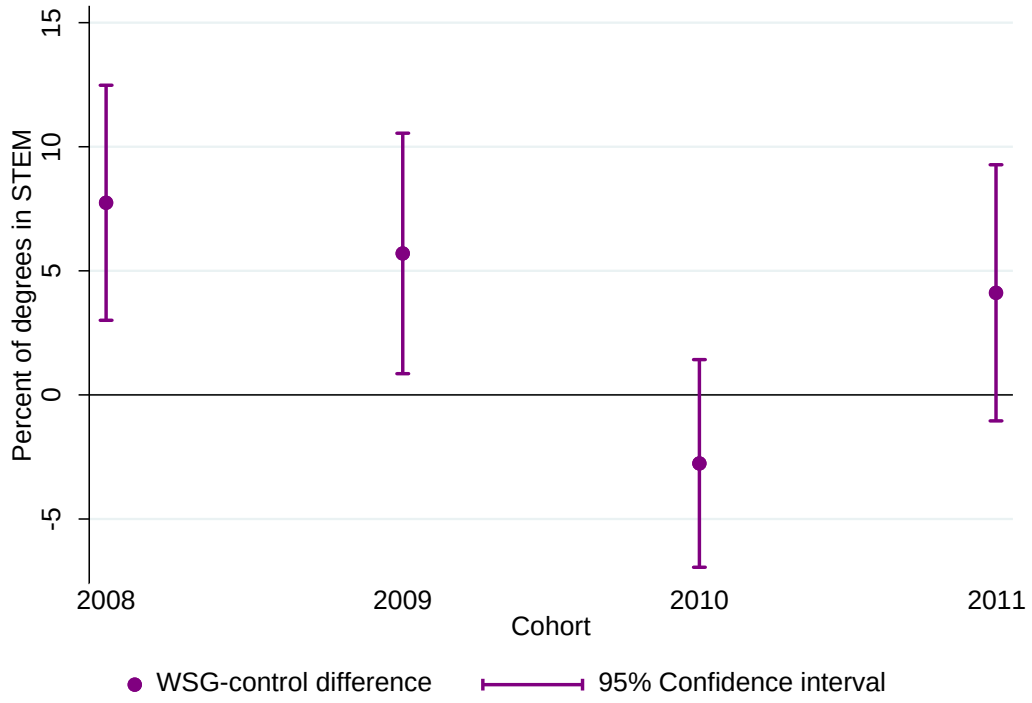
However, when degree completion is examined over a longer window of six years rather than four, there is evidence that over time the WSG did improve overall bachelor's degree completion rates for at least one later cohort. Figure 4 reveals that while the WSG did not increase completion rates over a six-year period for the first three cohorts, impacts trended upward and the fourth cohort demonstrated a positive improvement. Again, the share of students in the control group earning a degree was stable over time at about 62%. Among students entering college in 2011, those offered the WSG were 5.4 percentage points more likely to earn a degree over six years, relative to a control group baseline of 62.6% (an almost 9% increase, $p<0.01$). The upward trend is nearly linear, consistent with efforts toward program improvement on this key outcome (Table 4). We estimate the slope of the upward trend to be an improvement of 2.8 percentage points in each cohort, which is statistically significantly different from a flat slope ($p<0.01$).

Figure 4. WSG Impact on 6-year Degree Completion: University Students, 2008-11 Cohorts



Moreover, the earlier impacts on participation in STEM majors detected for the program's first cohort persisted over time, affecting field of degree (Broton & Monaghan, 2018). On average, just over 16% of students who were not offered the WSG earned a degree in STEM, but the WSG increased that share by 6.8 and 5.9 percentage points in the 2008 and 2009 cohorts, respectively (an increase of 48% and 39%, at $p<0.01$ and $p<0.05$). Pooling all four cohorts together and measuring STEM field for degrees earned at any point in time, the positive impact on completing degrees in STEM was 3.6 percentage points ($p<0.01$) on a control group base of 16.3% (Table 4).

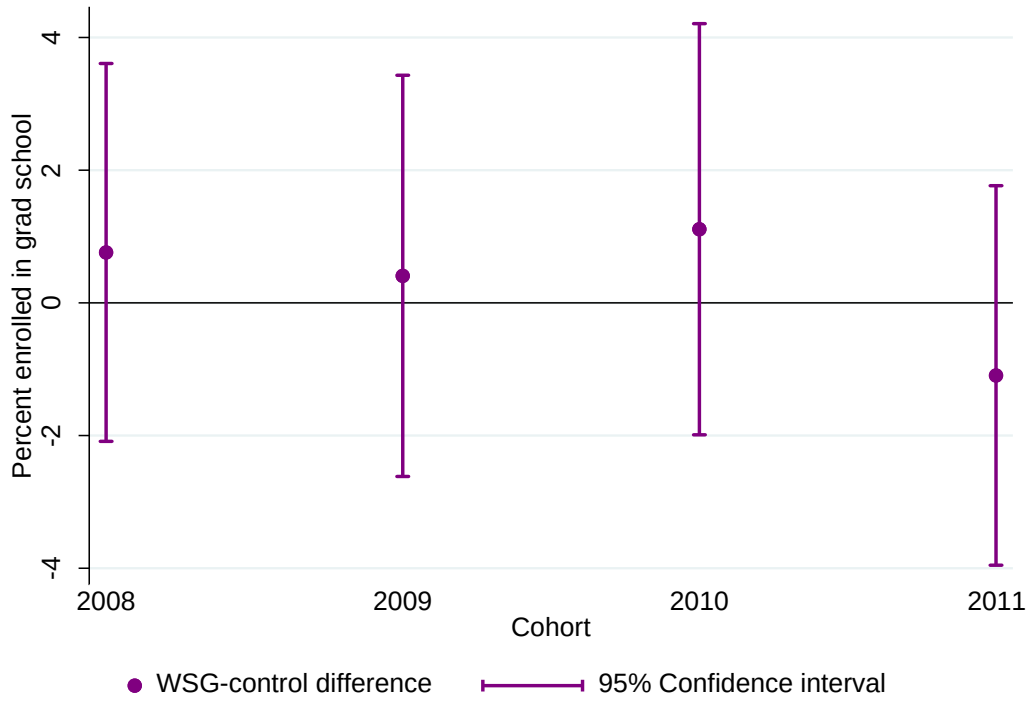
Figure 5. WSG Impact on STEM Completion over 6 years: University Students, 2008-11 Cohorts



It is possible that by accelerating time-to-degree (for the Fall 2008 cohort), increasing rates of attainment over six years (for the Fall 2011 cohort), and/or increasing the odds of majoring in STEM fields, the WSG may have impacted the chances that students would attend graduate school. Therefore, we next examine that outcome for the longest possible window of observation per cohort, ranging from nine years for the 2008 cohort to six years for the 2011 cohort. In the control group, the likelihood of attending graduate school decreases in each subsequent cohort as we observe them for fewer and fewer years after college (see Table 4). In the 2008 cohort, 20% of university students not offered the WSG attended graduate school compared to just over 14% in the 2011 cohort. We find no evidence that the WSG impacted graduate

school enrollment in any cohort with impacts ranging from -1.1 to 0.8 percentage points (Figure 6, Table 4).

Figure 6. WSG Impact on Graduate School Enrollment over 6 years: University Students, 2008-11 Cohorts



Prior research identified differences in the WSG's impacts according to the student's parental education and their prior academic achievement. However, no differences were detected based on the student's gender, race/ethnicity, or income (Goldrick-Rab et al., 2016). We therefore next explore the potential for heterogeneous treatment impacts, focusing on degree attainment over six years and in STEM fields.

Men were less likely than women to complete degrees over six years but more likely to earn a degree in a STEM field. Racial/ethnic minority students, those with low ACT scores, and those coming from poorer households were also less likely to

complete degrees, and students with low ACT scores were much less likely to earn degrees in STEM. But we find no evidence that the WSG's impacts on six-year degree completion or degree attainment in STEM fields varied according to students' family background or prior academic preparation (Table 5).

Focusing on the cohorts where we found evidence for overall positive effects, we find suggestive evidence that the effects on STEM are driven by larger effects among men, even though they start from a higher baseline level of participation,. The effects on six-year completion are also stronger for men than for women.

Table 5. Heterogeneous Impacts of WSG on 6-year Degree Completion and STEM Degree Completion: University Students, Pooled 2008-2011 Cohorts

	Completed a Degree by 6 Years		Percent of Degrees STEM	
	Coefficient	Standard Error	Coefficient	Standard Error
Men	-10.0	*** 0.8	5.0	*** 0.5
WSG	-1.0	2.2	1.0	0.7
Men * WSG	4.8	** 2.2	2.8	** 1.4
Racial/Ethnic Minority	-18.8	*** 1.0	-3.0	*** 0.5
WSG	1.3	1.2	2.4	** 0.8
Minority * WSG	-1.7	2.8	-1.3	1.5
Low ACT	-14.1	*** 0.8	-8.6	*** 0.5
WSG	3.1	** 1.4	2.4	** 1.1
Low ACT * WSG	-4.2	* 2.2	-0.6	1.4
FRPL	-11.5	*** 0.9	-2.3	0.5
WSG	1.3	1.3	2.4	*** 0.9
FRPL * WSG	-1.3	2.5	-0.8	1.4

Notes: Each set of three coefficients comes from a regression including cohort fixed effects. Low ACT students are those who scored below 22 (the median among four-year test takers) or did not take the exam (about 6% of students). FRPL means eligibility for free or reduced price lunch in high school, which requires a family income below 185% of the federal poverty level. Standard errors are robust.

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

IMPACTS OF THE WSG FOR TWO-YEAR COLLEGE STUDENTS

Turning to Wisconsin's two-year college students, we first revisit prior findings. For the 2008 cohort, we previously reported no program impacts on persistence to the second year of college, transfer rates, or degree completion rates (Goldrick-Rab, 2016)

and even found some evidence of negative impacts for the Wisconsin Technical College System students, seemingly driven by notification of treatment group assignment despite not meeting the grant's eligibility criteria (Anderson & Goldrick-Rab, 2018).

In this analysis, we began by examining impacts of the WSG on persistence to the second year of college for students who began at two-year colleges. As shown in Table 6, the 2008 cohort of students (the only one to include both UW Colleges and WTCS students) had a control group persistence rate of 53%, which was significantly higher than the treatment group (5.6 percentage points, $p<0.05$). Students offered the WSG in the Fall 2008 cohort started out behind their control group peers in terms of reaching the second year of college, but they eventually earned college degrees at similar rates (Figure 7). Although only about 31% of students offered the WSG earned a degree within three years (the typical benchmark for first-time, full-time students starting at two-year colleges), this rate rose to 36% within four years and surpassed 50% nine years after college entry (Table 6). As the eventual rate of degree completion surpassed initial persistence rates to the second year of college, it is clear that many two-year college students stopped out at some point before returning to earn a degree. This is consistent with a large body of academic literature on stopout and swirling (Goldrick-Rab & Pfeffer, 2009; Miller & Goldrick-Rab, 2015; NSC Research Center, 2015).

Figure 7. WSG Impact on Degree Completion over 9 years: Two-year Students, 2008 Cohort

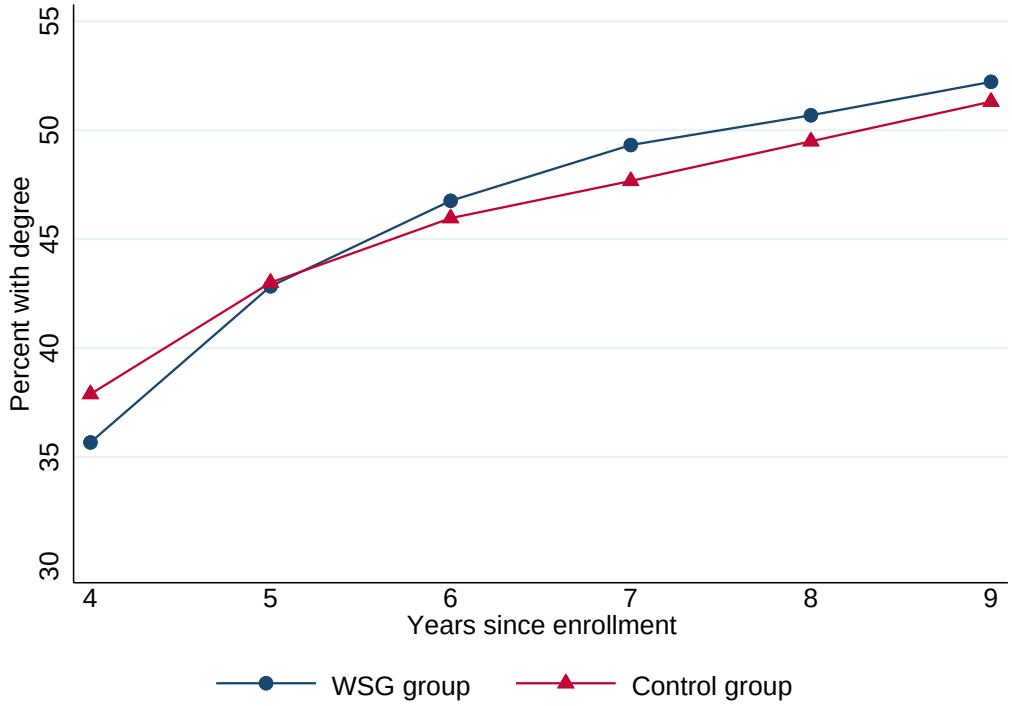
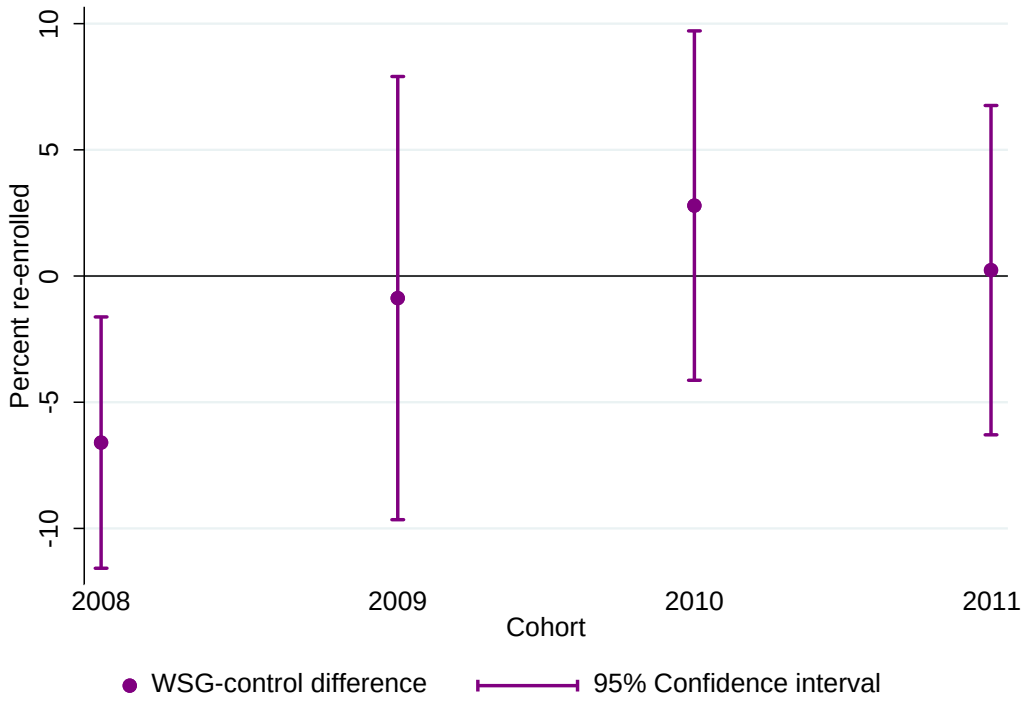


Figure 8 shows that the treatment-control difference trended upward, but the impact was not significantly positive for any single cohort.

Figure 8. WSG Impact on 2-year Persistence: Two-year College Students, 2008-11 Cohorts



Turning to degree completion over three years, we did not detect significant differences based on whether or not students were offered the WSG across any of the four cohorts, with a pooled difference of 0.9 percentage points favoring the control group (Table 6, Figure 9). Between 25.1% and 31.4% of control group students earned a degree within 150% of normal time, with the highest rate being in the 2008 cohort that also had the lowest persistence rates.

The story is similar when examining six-year degree completion rates as the outcome of interest. Across all four cohorts, 48.8% of control group students completed any degree within six years, and treatment group students earned degrees at nearly

identical rates. There were no statistically significant differences in degree completion rates or treatment-control differences across the cohorts.

Table 6. WSG Impact on Two-year College Students, 2008-11 Cohorts

	Control mean	WSG Difference	Standard Error
Persistence to a second year			
2008 cohort	53.0	-5.6	** 2.7
2009 cohort	64.7	-0.1	5.0
2010 cohort	69.6	6.3	3.9
2011 cohort	64.0	2.5	3.9
Pooled cohorts	61.9	-2.8	1.8
Degree completion (in 3 years)			
2008 cohort	31.4	-1.2	2.5
2009 cohort	25.6	-2.8	4.4
2010 cohort	28.2	-2.9	3.9
2011 cohort	25.1	0.9	3.5
Pooled cohorts	27.8	-0.9	1.7
Degree completion (in 6 years)			
2008 cohort	46.0	0.8	2.7
2009 cohort	47.7	-2.2	5.2
2010 cohort	51.7	3.3	4.4
2011 cohort	50.7	-1.2	4.0
Pooled cohorts	48.8	0.2	1.9
Degree completion (in 9 years)			
2008 cohort	51.3	0.9	2.7
Transfer to four-year (in 6 years)			
2008 cohort	18.0	-1.9	2.0
2009 cohort	43.9	7.0	5.2
2010 cohort	47.8	0.9	4.4
2011 cohort	41.7	-2.2	3.9
Pooled cohorts	36.1	-1.3	1.6

Notes: Each WSG difference comes from a single regression. Pooled regressions include cohort fixed effects and an indicator for WTCS students (only present in the first cohort). Standard errors are robust.

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

Figure 9. WSG Impact on 3-year Degree Completion: Two-year Students, 2008-11 Cohorts

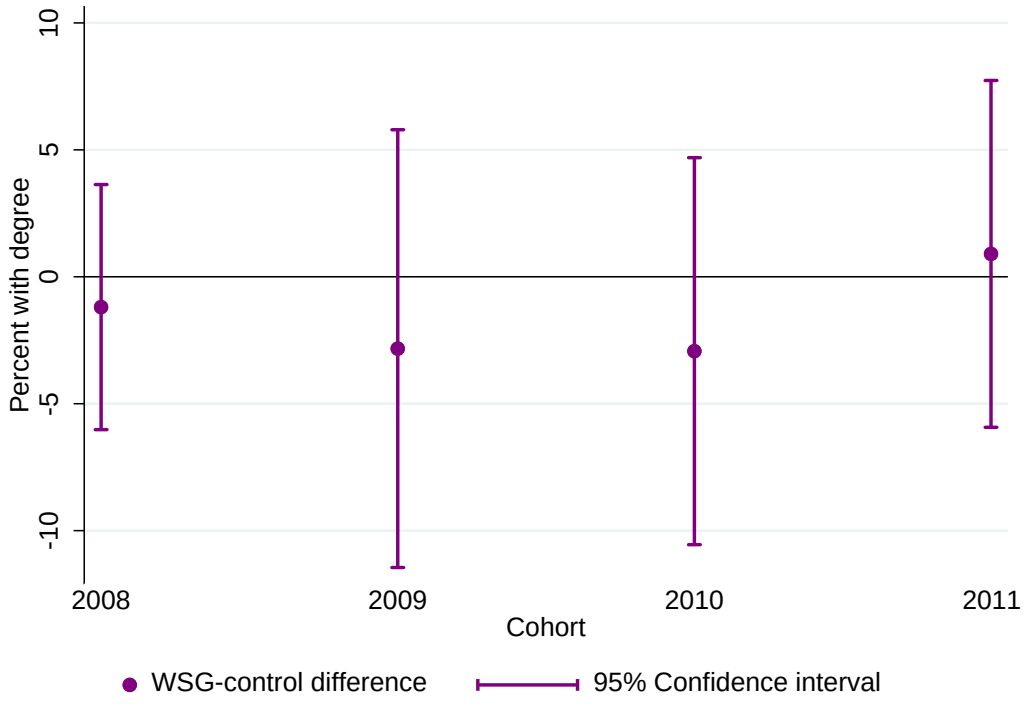
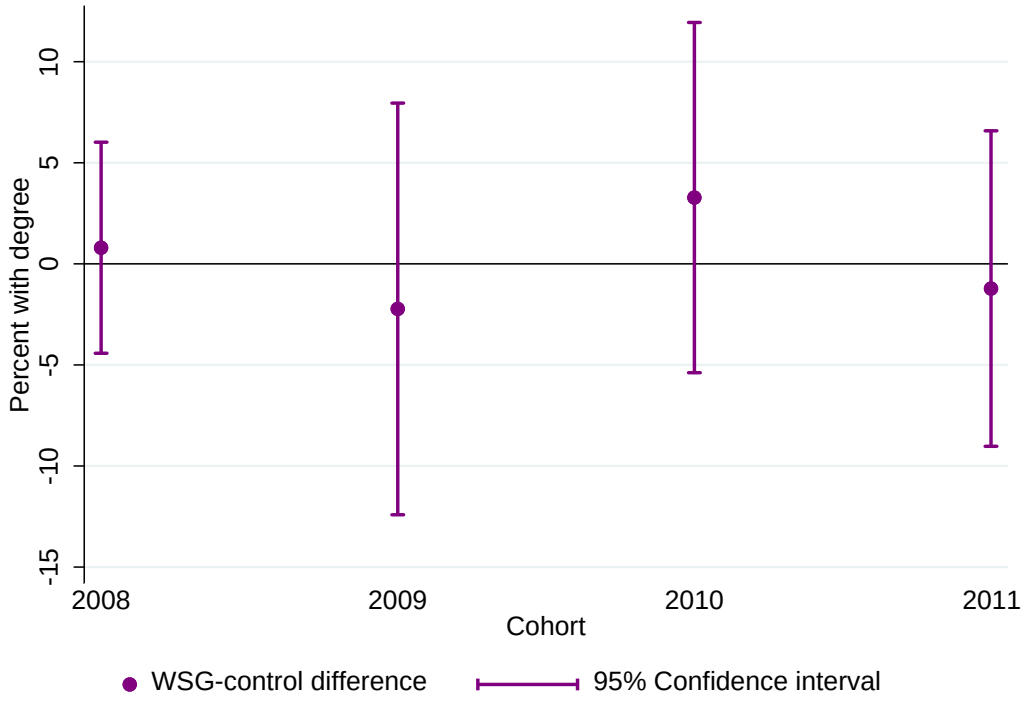
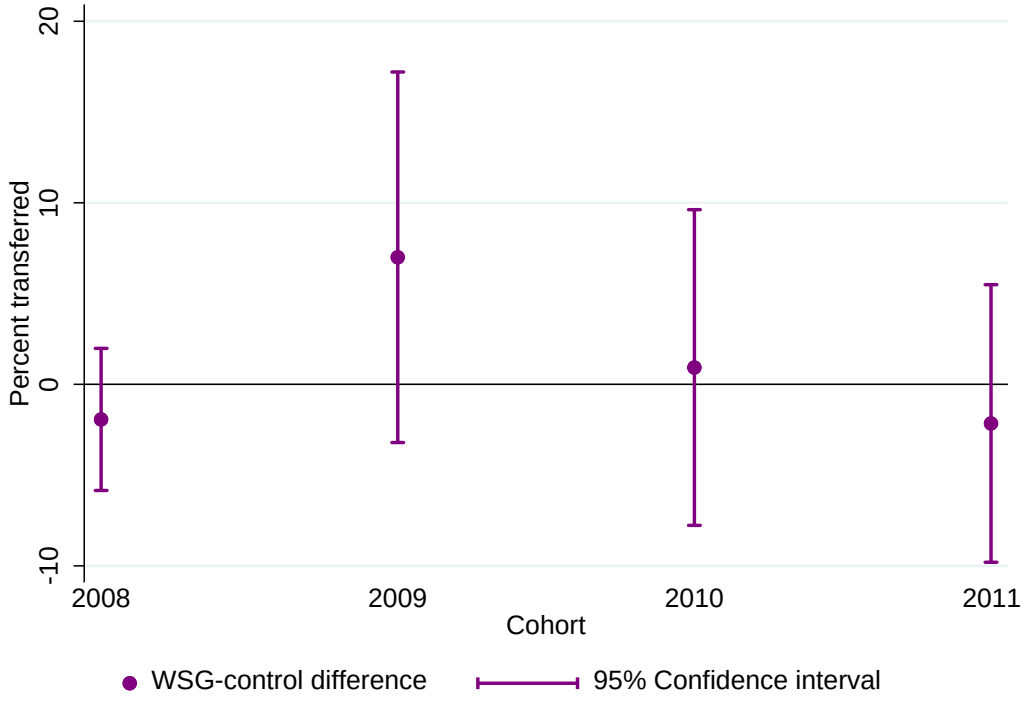


Figure 10. WSG Impact on 6-year Degree Completion: Two-year Students, 2008-11 Cohorts



Since one mission of the UW Colleges is to prepare students to transfer to four-year institutions and a number of WTCS campuses also have liberal arts transfer programs, we examined whether students who began at a two-year college transferred to a four-year college within six years of college entry (Figure 11). The low percentage of control group students from the 2008 cohort who ever transferred (18% versus between 42% and 48% in other cohorts) reflects differences in the composition of the randomization pool during the program's first year as well as including the presence of WTCS students in the first cohort. Nevertheless, there were no statistically significant impacts on transfer rates for any of the cohorts. The same is true when focusing solely on UW Colleges in the first cohort (results not shown but available upon request).

Figure 11. WSG Impact on 6-year Transfer Rate: Two-year Students, 2008-11 Cohorts



Finally, we tested for heterogenous treatment effects on degree completion and transfer rates among two-year students by gender, race/ethnicity, academic preparation, and eligibility for free or reduced price lunch (Table 7). As in the four-year sector, each of these characteristics is strongly associated with levels of outcomes, and we test if they are associated with treatment-control differences in outcomes. Although the coefficients on the interaction effects are generally statistically non-significant, there is some evidence that minority students assigned to the treatment group completed degrees at a higher rate over six years (8.7 percentage points, $p<0.10$) and that students from the lowest-income families were more likely to transfer upward as a result of grant aid (7.8 percentage points, $p<0.05$).

Table 7. Heterogeneous Impacts of WSG on 6-year Degree Completion and Transfer Rates: Two-year College Students, Pooled 2008-2011 Cohorts

	Completed a Degree by 6 Years		Transfer to 4-year Inst. by 6 Years	
	Coefficient	Standard Error	Coefficient	Standard Error
Men	-10.5	*** 1.9	-0.1	1.8
WSG	0.5	2.4	-0.6	2.1
Men * WSG	-0.6	3.6	-2.0	3.2
Racial/Ethnic Minority	-16.7	*** 2.6	-8.0	*** 2.5
WSG	-1.7	2.3	-2.9	2.1
Minority * WSG	8.7	* 5.1	4.6	4.9
Low ACT	-17.4	*** 2.1	-18.2	*** 2.1
WSG	-1.4	2.8	-0.9	2.8
Low ACT * WSG	3.3	4.0	-2.0	3.7
FRPL	-10.1	*** 2.1	-6.8	*** 2.0
WSG	-1.5	2.6	-4.9	** 2.4
FRPL* WSG	4.3	4.1	7.8	** 3.8

Notes: Each set of three coefficients comes from a regression including cohort fixed effects and an indicator for WTCS students (only present in the first cohort). Low ACT students are those who score below 18 (the bottom quartile among two-year test takers) or do not take the exam (25% of students. FRPL means eligibility for free or reduced price lunch in high school, which requires a family income below 185% of the federal poverty level. Standard errors are robust.

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

DISCUSSION

Need-based financial grants are a longstanding approach to increasing college attainment among low-income students, and the Wisconsin Scholars Grant is like many state and private programs around the country. In some ways, it mirrors the Pell Grant, operating under the same rules as the rest of Title IV financial aid. Students must meet eligibility criteria and conform to program requirements to take-up and continue to receive the funds. And, consistent with most other grant programs, the purchasing power of the grant declines both as a student moves through college and in successive cohorts, as tuition increases. Unlike state and federal grant programs, however, eligible students are randomly selected to receive the grant, providing a rare opportunity to examine the causal impacts of need-based financial aid.

This paper re-examines prior evidence on the Wisconsin Scholars Grant and expands that inquiry by examining impacts over a longer span of time. While the program's first cohort of university students benefitted from accelerated rates of degree completion and a higher proportion of students earned a degree in a STEM field, overall that cohort did not exhibit higher rates of degree completion or higher rates of entry into graduate school. However, students overall were more likely to earn a degree in STEM, and one later cohort demonstrated higher overall rates of degree attainment. Examining degree completion rates for these low-income students revealed that given more time to finish, most did earn degrees, whether or not they received the WSG. This may be related to the program's focus on full-time students who transitioned quickly from high school; low-income students who typically exhibit lower rates of degree completion often initially enroll part-time or delay college entry.

Among students who began at two-year colleges, we generally found that the WSG did not significantly affect persistence, completion, or transfer rates over a six-year time period. However, the short-term negative findings for the first cohort associated with low take-up dissipated over time. Approximately half of the first-time, full-time students in the sample completed at least one degree within six years of entering college, and there is suggestive evidence that minority students assigned to the treatment group may have completed degrees at higher rates than similar students who were placed in the control group.

It is difficult to tell whether changes in program implementation and/or shifts in the purchasing power of the WSG are related to program impacts. The program did not change much over those four cohorts, though more recently the Fund increased the grant amount for university students (raising it from $3,500 to $4,000) and ended support for new cohorts of WTCS students, while adding a mentoring program for some university students (Fund for Wisconsin Scholars, 2018). The results for two-year students could have shifted over time, given the evident upward trend between 2008 and 2010.

Evaluating post-college outcomes, and making additional use of the rare replication of a randomized education intervention, remains an important research goal. The impacts on university students warrant further study. Earning degrees more quickly and in more lucrative STEM fields could yield labor market returns. Higher rates of degree attainment could yield economic and social benefits as well. College is still one of the main pathways out of poverty, and a long literature exists to estimate the economic returns to college. However, both the labor market and the research methods

available are evolving. Additional research is needed to provide updated estimates of the relationship between additional schooling and early-career employment and earnings, relevant to the post-Great Recession time period, and to examine impacts on a wider range of socioeconomic outcomes. Even where there were no effects on degree attainment, additional financial aid could free up time for students to make investments that directly help in the labor market, such as networking and internships, or improve their quality of life.

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