



NEED-BASED FINANCIAL AID AND COLLEGE PERSISTENCE:
EXPERIMENTAL EVIDENCE FROM WISCONSIN*

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We examine the impacts of a private need-based college financial aid program distributing grants at random among first-year Pell Grant recipients at thirteen public Wisconsin universities. The Wisconsin Scholars Grant of \$3,500 per year required full-time attendance. Estimates based on four cohorts of students suggest that offering the grant increased completion of a full-time credit load and rates of re-enrollment for a second year of college. An increase of \$1,000 in total financial aid received during a student's first year of college was associated with a 2.8 to 4.1 percentage point increase in rates of enrollment for the second year.

JEL codes: C93, D03, H24, I23

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The United States government currently provides more than \$132 billion per year in grant, loan, and work-study assistance to undergraduates (Baum and Payea 2011), but there is little evidence as to whether financial aid promotes college credit and eventual degree attainment among those it induces to attend college (Bettinger 2011).¹ While there are well-established economic returns to college attendance, those returns are strongest for students who accrue at least a year or two of college credits (Kane and Rouse 1995; Heckman, Lochner, and Todd 2008). Yet over the last forty years, as college enrollment rates swelled, college persistence rates did not (Bailey and Dynarski 2011). National estimates from the Beginning Postsecondary Students study suggest that 14% of the federal Pell Grant recipients entering universities each year fail to enroll for a second year of college, and only about 40% receive a bachelor's degree within six years.

Most financial aid research conflates effects on college attendance and effects on college persistence, even though the two likely represent very different sets of decisions for individuals. In this paper we capitalize on a statewide program to estimate the impacts of need-based grant on college persistence. Specifically, with an experimental design we estimate the impacts of the privately funded Wisconsin Scholars Grant (WSG), which is distributed at random among eligible first-year undergraduates attending Wisconsin's thirteen public universities. Drawing on longitudinal data collected for four cohorts of students eligible to participate in the WSG program (nearly 15,000 people in total), we examine the impact of offering an additional \$3,500 grant (renewable for up to five years) on the college continuation decisions of Pell Grant recipients.

We estimate that, on average, offering students the new grant generated small, positive impacts on their retention rates, credit completion, and grade point average. Effects appear strongest at the institutions where typical academic performance among Pell recipients (e.g. based on the control group) leaves the most room for improvement. Since the net increases in total financial aid (including all grants, loans, and work-study monies) resulting from treatment varied due to how the grant crowded out existing aid, we use a multi-site instrumental variables

¹ This figure includes \$48 billion in federal grants (\$34 billion of which is the Pell Grant), \$70 billion in loans, \$13 billion in tax credits and deductions, and \$1 billion in work-study funds. However, in comparison to the average cost of tuition and fees (currently \$8,244 for in-state students at public universities), grants are fairly small; an average Pell is \$3,828 per full-time-equivalent student (Baum and Payea 2011).

approach to estimate the impact of dollars actually received on retention. Students receiving more aid during their first year of college stayed enrolled longer; specifically we find a 2.8 to 4.1 percentage point increase in retention to the second year of college accruing to a \$1,000 increase in total financial aid.

The paper proceeds as follows: Section I provides additional background on prior evidence of the impacts of need-based financial aid programs, Section II describes the Wisconsin grant program, experimental design, and data, Section III presents estimates of impacts on educational outcomes for each student cohort and across cohorts, and Section IV concludes with a discussion of implications for future research and policy.

I. IMPACTS OF NEED-BASED FINANCIAL AID

Evidence suggests that the income inequality characterizing America's economy in the early decades of the 21st century is unlikely to abate without substantial increases in the rates of college attainment among Americans from low-income families (Goldin and Katz 2008; Long 2012). What contribution might need-based financial aid make to those efforts? Children from low-income families now face a nine percent chance of attaining a bachelor's degree. That low rate of college attainment is substantially attributable to high rates of college dropout, and is only moderately explained by their lower levels of high school preparation and tested ability (Bailey and Dynarski 2011). The substantial and rising cost of college is also a likely contributor, partly given higher price elasticity among low-income families (Dynarski 2003; Goldin and Katz 2008; Bowen, Chingos, and McPherson 2009; Deming and Dynarski 2010).

Historically, need-based grants have aimed to encourage students to attend college, but there is growing interest in whether they also help them re-enroll each semester, complete credits, get good grades, and eventually earn degrees. It is difficult to assess the impacts on these outcomes because most studies of grants examine the total impact on both college enrollment and persistence (e.g., McPherson and Shapiro 1991; Kane 1994; Light and Strayer 2000; Bound and Turner 2002; DesJardins et al. 2002; Paulsen and St. John 2002; Seftor and Turner 2002; van der Klauuw 2002; Stinebrickner and Stinebrickner 2003; Bettinger 2004; Singell 2004; Singell and Stater 2006; Kane 2007; Stater 2009). The few quasi-experimental studies focusing on the persistence margin suggest that a \$1,000 increase in aid improves college retention rates by two

to four percentage points (Bettinger 2004; Bettinger 2010). An effect of this magnitude is also consistent with estimates of how grant aid affects initial college attendance, where a \$1,000 increase in aid appears to incur a three to four percentage point increase in rates of college enrollment (Dynarski 2003). Thus, financial aid grants seem to benefit students, albeit to a limited extent. It tends to be the case that studies finding otherwise are dated (i.e. Hansen 1983; Kane 1995), analyzing the responses of students attending college many decades ago, when costs and benefits were much lower and before price discrimination was heavily utilized in higher education (there has been a distinct shift away from low-tuition models to high-tuition with discounting) (Harris & Goldrick-Rab 2012; Long 2012).

Yet given how few estimates have been generated, some question their precision and reliability, especially since estimates for programs like those delivering grants to needy students are susceptible to bias resulting from selection (Cellini 2008). In other words, students receiving aid are different in substantial ways, both observable and not, from those students who do not, and this may provide either an over or an under-statement of grants' effects (Goldrick-Rab, Harris, and Trostel 2009). Many of the most rigorous studies of whether grants impact college persistence consider programs that are not simple or strictly need-based, but instead impose additional requirements on students in an effort to increase effectiveness (Bettinger 2011). For example, the West Virginia PROMISE program, which offered free tuition and fees to students to earning a minimum GPA and enrolling more-than-full-time (completing 30 credits per year instead of 24), boosted four-year bachelor's degree completion rates by 26% (from a base of 27 percentage points) (Scott-Clayton 2011). In contrast, experimental evaluations of two Canadian university-based aid programs with strong academic performance requirements yielded far more modest impacts (Angrist, Lang, and Oreopoulos 2009; Angrist, Oreopoulos, and Williams 2010), and a randomized trial of a University of New Mexico program with moderate academic requirements only produced small positive short-term impacts on credit completion (Patel and Richburg-Hayes 2012). Three other experimental studies of scholarship programs targeted students in poverty (primarily mothers receiving welfare) at community colleges in Louisiana, Ohio, and New York, providing grant funds directly to students—outside the financial aid system—in exchange for achieving specific credits and grades. Those efforts produced some increases in both attempted and completed credits and modest change in re-enrollment rates (Patel and Richburg-Hayes 2012).

Despite the relative preponderance of evaluations focused on performance-based financial aid, the vast majority of U.S. federal and state financial grant programs remain need-based and straightforward, with only modest academic requirements. The federal Pell Grant program, perhaps the best-known, only requires students to enroll in college full-time (12 credits) in order to receive the full grant, and merely demands that students make “satisfactory academic progress” each term in order to retain the aid. Since there are relatively few evaluations of such simple programs, we contribute to the literature on aid by examining the effects of a relatively simple Wisconsin program.

II. THE WISCONSIN SCHOLARS GRANT AND EXPERIMENTAL DESIGN

The Wisconsin Scholars Grant (WSG) is a privately funded program, initiated in 2008 and supported by a \$168 million endowment from the Fund for Wisconsin Scholars, making it one of the largest need-based grant programs in the state (Pope 2010).² This paper describes impact estimates based on the entering cohorts of 2008, 2009, 2010, and 2011, with the most detailed estimates focusing on data from the program’s first cohort.

A. The Treatment

The WSG program offers Pell-eligible students a \$3,500 grant per year for up to five years, with a total potential maximum award of \$17,500 per student.^{3,4} This amounts to 20.4% of their estimated costs of attendance, and 69.9% of students’ annual demonstrated financial need.⁵

Students are eligible for the WSG if they are Wisconsin residents who attended and graduated from a state public high school within three years of matriculating to one of the state’s 13 public universities, where they enrolled for at least 12 credits (full-time), completed the Free

² More information on the Fund for Wisconsin Scholars is at www.ffws.org.

³ A student is eligible to receive the Pell Grant if his or her expected family contribution, as determined by completion of a federal aid application and a need analysis methodology, is below a certain value (\$4,041 in the 2008-2009 academic year). For more details, see Dynarski and Scott-Clayton (2007).

⁴ The grant is transferable among all public colleges and universities in Wisconsin. Students are still eligible if they switched to a Wisconsin public two-year college, but the grant amount declines to \$1,800 per year.

⁵ The estimated cost of attendance is set by institutions and includes tuition, fees, and an estimated budget for room, board, books, and other expenses. Students are not allowed to have a financial aid package worth more than the cost of attendance. The demonstrated financial need is defined as the cost of attendance less the expected family contribution and the pre-treatment financial aid package.

Application for Federal Student Aid (FAFSA) and qualified for a federal Pell Grant, while still possessing calculated unmet need (net of all grant aid) of at least \$1.⁶

The program first begins to interact with students during their first semester of college when, following random selection using administrative records, students are sent an award notification letter in the mail.⁷ In response, students must affirm specific pieces of their grant eligibility that cannot be checked with available administrative records, and return a form accepting the award. Financial aid administrators then take the money sent by the WSG program and integrate it into students' financial aid packages, notifying them electronically of their new award by the end of the first term.

All private financial aid is subject to state and federal regulations requiring that students' aid awards not exceed an institution's cost of attendance, and wherever possible, private aid supplants government aid. In addition, as a 'last dollar scholarship,' the WSG program explicitly aims to displace student loans. Therefore, while students were told that the WSG had a \$3,500 value, other aid frequently was crowded out, reducing the effective net increases in students' aid packages resulting from treatment (an issue examined further in the next section). This is an organizational inefficiency common to many aid programs, such as the Gates Millennium Scholars (GMS) award, but is often overlooked by researchers (Amos et al., 2009).⁸ Drawing on lessons from those other programs, the WSG program stipulated that institutional aid could not be supplanted, and that the grant had to be awarded in its entirety (i.e., no partial awards were possible).

⁶ The WSG could not plausibly have affected college entry in the first cohort and it is very unlikely to have affected the initial enrollment decision of later cohorts. While the program was first announced about one year before the awards were made (December 2007), program details were not public until September 2008 and even then received little publicity. Because of this, we think our estimated impacts are purely on persistence and not on the initial decision to enroll in college.

⁷ For the cohorts we describe in this paper, the letter was sent in October. Students were also sent an e-mail from their financial aid officer verifying the legitimacy of the grant and to watch for documents in the mail.

⁸ This may be because it is difficult to observe financial aid package data. For example, while Bettinger (2010) notes that students who were allocated more Pell and state grant aid from the Ohio policy he studied appeared to benefit more, the data he had made it impossible to know how much of an increase in total aid students effectively received—he did not observe aid packages and thus could not examine resulting changes in institutional aid, loans, or work-study. If his conclusion, that more grant aid lowers dropout rates, is correct, then the estimated size of the impact per \$1000 may be understated.

Students can receive the grant for up to 10 semesters or five academic years. Grant renewal terms require that students maintain Pell eligibility and enroll at a Wisconsin public university or two-year college, full-time (at least 12 credits) at the start of each term, as well as make satisfactory academic progress.⁹

B. Implementation

New programs often have growing pains as they hammer out effective ways to implement their rules, communicate with constituents, and figure out other challenges. In one sense, studying new efforts presents an opportunity to better understand the factors moderating program effects, but it also comes with costs. This study has the most extensive data for the WSG program's first cohort, and therefore we present the most detailed analyses for that cohort, describe program implementation to the best of our ability, and include results for three later cohorts using the limited amount of administrative data we could obtain. In addition, the lead author is also undertaking a new, comprehensive evaluation of the matured program with the cohort of students beginning college in fall 2013.

Implementation could alter program impacts; for example the accuracy of both institutional and student knowledge of program rules may have improved, or it may have become more trusted. For example, it was not until the fourth year of implementation that the WSG program provided financial aid officers with a comprehensive handbook of instructions, although limited guidelines were provided in the first three years. As a result, interviews conducted with financial aid officers revealed variation in their understandings of the criteria regarding who was eligible for the grant, the conditions under which it could be renewed, and what messages they were to provide students about the award. There was also significant turnover among the aid officers over time, potentially reducing institutional knowledge of the program. This may have affected how much total aid students received from the grant, and how continuously the grant was awarded.

⁹ The Pell Grant also requires that students make satisfactory academic progress (SAP), which typically means a C average or equivalent and "academic standing consistent with the requirements for graduation" from the institution. Apart from SAP, there were no stated GPA requirements for the WSG.

In addition, interviews taking place within weeks of mailing the initial award letter to the first cohort suggest that some students thought the grant was a “scam” and were suspicious enough to seek more information from their financial aid officers. Students reported that they did not know “where it came from” or “what it was for.” This was not, however, unique to the WSG—they made similar statements about the federal Pell Grant.

Like many government programs, the WSG’s program rules were unevenly followed and in some cases misunderstood by students. To reinstate the grant after an absence from college, students had to notify their financial aid office and the program’s executive director and write a request to be reinstated.¹⁰ Students in the first cohort were not regularly reminded about the grant’s renewal criteria but the program did issue a few emailed communications containing “different messages about eligibility, transferring, good luck with classes, and other general information.”¹¹ But surveys we administered to the first cohort in the months after the program began and again a year later showed that barely half of students offered the grant knew that it was part of their financial aid package. Some students were also confused about the grant’s academic requirements. On surveys, fully 83% of students assigned to treatment revealed that they misunderstood the grant’s requirements,¹² and recipients of the federal Academic Competitiveness Grant (ACG), which required a B average, seem to have mistakenly thought that the Wisconsin grant demanded full-time enrollment and a B average.

It is important to remember that financial aid is always administered through a highly complex bureaucratic structure, which may have its own independent effects. Data collected from the program, aid officers, and students over four years suggest that these issues gradually improved over time for the WSG program. For example, it continued to work out kinks in the delivery of the financial aid and the messaging to aid officers. By examining the program’s impacts across multiple cohorts we sought to assess the stability of program impacts, as well as generate some hypotheses about whether aspects of implementation might be important.

C. Randomization, Sampling, and Take-Up

¹⁰ The Fund’s Executive Director reported that very few students did so.

¹¹ This is an excerpt from a personal communication from the Fund’s Executive Director to the authors.

¹² Specifically, in a survey administered to the 2008 cohort, three years after they were first awarded the grant, recipients incorrectly identified either the number of credits and/or grade required to maintain the WSG.

Students did not apply for the WSG program. Rather, financial aid officers identified eligible students using their institutional administrative records, and sent their names to a state agency overseeing the distribution of several grant and loan programs. In conjunction with the research team, in 2008 the Fund used random assignment to select which eligible students received the WSG. Researchers did not oversee random assignment in the subsequent three cohorts, but the same process was reportedly used and we performed checks on baseline equivalence to verify randomization. It is notable that the program did not operate for research purposes, and student participation was not predicated on research participation. This meant that we studied the program as it operated in real life, rather than examining a trial program created for research purposes (Heckman 2005). It also means, however, that we did not decide to whom the grant would be targeted, or set its terms.

The number of eligible students fluctuated with each cohort, depending mainly on the number of Pell-eligible students in the state, and the precision with which administrators followed program rules in identifying students meeting the criteria. In 2008 the pool included 3,157 new freshmen and that number grew with each subsequent year, until in 2011 it included nearly 5,000 students. Estimates based on the first cohort (see Table 1) indicate that 57% of the students were female, 25% were members of a racial/ethnic minority group, and 53% were the first in their family to attend college.¹³ In fall 2008, the average adjusted gross income of their parents was just under \$30,000 and the average expected family contribution was \$1,631. Thus, most students came from families living above the poverty line, yet qualifying as “working poor” because they earned less than 200% of the federal poverty threshold (Center on Wisconsin Strategy 2010).¹⁴ Since the grant’s eligibility criteria stipulated it, their mean age was just over 18, and just 2.8% were independent for tax purposes.

The number of grants the WSG offered each year (e.g. the size of the treatment group) fluctuated slightly according to the program’s endowment, ranging from 550 to 621 per year. For comparison purposes, the control group includes all students not offered the grant, except for the

¹³ Racial/ethnic minority groups include African-Americans, Native Americans, Hispanics, Southeast Asians, and multiracial students who are from at least one of these groups. Information on race was obtained from a student survey, as it is not included in the FAFSA, and as such is only available for about 80% of the full sample.

¹⁴ 27% of families in Wisconsin earned less than 200% of poverty in 2010, compared to 30% nationwide (Center on Wisconsin Strategy 2010).

first cohort, for which we drew a stratified random sample of 900 students (instead of the full pool) to serve as the control group.¹⁵ In selecting that control group, we blocked the list of non-recipients by university in order to facilitate the collection of an oversample of non-white students. Thus, the size of the control group is 50% larger than the treatment group, and contains more students attending racially and ethnically diverse institutions.¹⁶ We use weights when analyzing that cohort to account for the sampling design.

The paper's main analyses are based on the full samples for the second through fourth cohorts, and a nearly complete sample for the first cohort. Table 1 includes details on a set of subsamples from the first cohort that we use for some analyses. Prior to each analysis, we examine baseline characteristics to check for initial equivalence and take steps to address variation across the samples, but even with those best efforts in mind we caution readers about the limited generalizability of the estimates.

D. Data

The State of Wisconsin lacks a student-unit record data system for higher education. In order to examine the college outcomes of students offered the Wisconsin Scholars Grant, we negotiated data agreements between the state agency that possesses financial aid information, the University of Wisconsin System, each of the 13 public universities in that system, and the Fund for Wisconsin Scholars. Over time, data agreements changed, and we did the best we could with the available data, considering effects across cohorts with varying amounts of information. Next we describe each measure, its data source, and the samples for which it is observed.

Baseline equivalence. For all four cohorts, we utilize data on the initial institution a student attended and the incidence and number of terms of prior enrollment in the University of

¹⁵ We could not obtain the data for the entire group of non-recipients in the first cohort due to our initial data agreements and data collection costs, but note that there are diminishing statistical returns to control group size with a fixed treatment group (Bloom 2005).

¹⁶ We employ sampling weights to adjust for the unbalanced allocation of students between the treatment and control groups in the first cohort. The sampling weights are calculated as the (inverse) probability of selection. In the treatment group, the probability is the same for all students regardless of campus. In the control group, the calculation is analogous, except that the probability of selection in the control group varies by campus because of the number of students selected for treatment assignment and the selection of a larger control group (over-sampling) in more diverse campuses. Our results are robust to the use of various sampling weights. We do not, however, use non-response weights.

Wisconsin System before their stated first term of college. In addition, for the first cohort, we use data from students' pre-treatment federal applications for student financial aid (FAFSA) to examine whether the treatment and control group were similar at baseline. We also examine equivalence in the composition of the aid packages for two subsamples of cohort one.

Re-enrollment and degree completion. We measure whether and where a student is enrolled in college each semester two ways. First, for all four cohorts we rely on data from the University of Wisconsin System, which records all enrollments at the 13 universities and 13 two-year branch campuses in that system. Second, for the first cohort we also use data from the National Student Clearinghouse (NSC), a centralized reporting system that collects publicly available directory information obtained from the colleges and universities attended by 92 percent of American undergraduates, to estimate impacts on transfer. All public universities in Wisconsin participate in the NSC.¹⁷ We combine enrollment and degree attainment into a single persistence measure since only three percent of students completed a degree in the three years observed.¹⁸ Additionally, although we know from state administrative records that all 1500 students were enrolled in fall 2008, 34 do not show up in the NSC records as having been enrolled. Data missingness is orthogonal to treatment; for more information on this, see Goldrick-Rab and Harris (2010).

Credit completion and grade point average. For all cohorts, we observe credits and grades as measured by the University of Wisconsin System (though for the first cohort we only observe this for the two subsamples).¹⁹ Of course, if students differentially left the system, these analyses might be subject to bias, but estimates based on the first cohort suggest that there was no impact of the treatment on transfer rates outside of the System (Appendix A1). We report grade point average for enrolled students, and for students who are not enrolled, we use the GPA

¹⁷ Only 12 colleges in Wisconsin who participate in the IPEDS did not participate in the NSC as of 2008-2009. The largest of these is Herzing University, a for-profit institution with a student enrollment of under 1,500. Total enrollment at these 12 schools (none of which are public institutions) is just over 7,000 students.

¹⁸ We also calculated an alternative measure that simply measured degree attainment. Since the results do not differ, we use the combined persistence-degree attainment measure in our analyses.

¹⁹ In order to observe completed credits and GPA, a student must have registered for and completed a credit and passed the class with a D or above. Credits for pass/fail classes, which are not included in GPA calculations, are not recorded with this measure. Credits derived from pre-college enrollment, including Advanced Placement tests, are also not included.

from the last term enrolled, following Scott-Clayton (2011), while recognizing that estimation of causal effects on GPA is not as straightforward as with other academic outcomes.²⁰

Financial aid and loan burden. Since the WSG program intends to increase the size of students' financial aid packages and reduce student debt, we compute term-specific total aid received, the composition of the package including specific grant amounts, and all forms of debt reported to the financial aid office. We observe this data for subsample B of the first cohort only.

E. Methods

We begin by estimating the impacts of offering the WSG to students on their academic outcomes, using OLS regression, for each cohort and then across cohorts. We test for treatment impacts on semester-to-semester retention (from the first semester in which treatment was awarded, through the third semester—one year after treatment began), credit accumulation, and GPA as well as cumulative outcomes such as the total number of credits attained, cumulative GPA, the number of semesters enrolled, and transfer. Then we extend the analysis to look at impacts over the second and third years of college, for the cohorts for which we can observe those outcomes.

We run covariate-adjusted models for every analysis, including university fixed effects for each cohort, as well as age, race, gender, dependency status, expected family contribution, and parental education for the first cohort. However, all of the regressions testing for impacts on financial aid and academic outcomes are presented without any covariates because the results are very similar to the adjusted models.²¹

The experimental analyses are conducted in an intent-to-treat (ITT) framework, capturing the effect of the program's full interactions with students, which go beyond the simple receipt of additional dollars of aid. We use this approach because only assignment to treatment is random,

²⁰ Students can only have grades if they are enrolled; thus if the grant influences enrollment, then this could give the false appearance that the program influenced GPA when in fact it may be that different students were enrolled and had grades observed.

²¹ Covariate-adjusted estimates of impacts on academic and financial aid outcomes are presented in Appendices A5-A9.

and in practice all financial aid requires bureaucratic program interactions—it is rarely the case that aid is delivered directly into students’ hands.²²

Most but not all students sent the WSG award letter responded to it; this may be due to non-receipt, misunderstanding, or knowledge that they were in fact ineligible for the award. The take-up rate was highest in the first cohort (92%) and diminished to 74% in the fourth cohort.²³ If the intervention is posited to exert positive impacts only through receipt, then the ITT estimates understate the true program impact. Because we only observe take-up at the student level for the first cohort, a treatment-on-treated (TOT) impact comparing treatment recipients to non-recipients is only possible for that cohort. Moreover, the TOT estimate is biased if non-recipients of the grant were affected; we have some reason to suspect that receipt of the award letter may have impacted student behavior even when the grant dollars were not received. For this reason, we estimate impacts on grades in the very first term for each cohort (see Table 2), noting that the award letter itself may have affected student effort. Finally, we also focus on the ITT because duration of the grant receipt was limited—there was a sharp drop-off after the second year of college, mainly due to the continued requirement of Pell eligibility.²⁴

Next, in order to understand how much additional financial aid students really received from the treatment, we estimate impacts on students’ financial aid packages during the first three years of college using OLS regression. In addition to estimating impacts on total financial aid received, we test for differences in grant aid, loans, and work-study funds received by year. These impacts are reported unconditional on enrollment in later years; conditioning on enrollment yields a similar pattern of results (Appendix A8).²⁵

Then, we conduct an instrumental variables analysis to examine the impact of the total increase in financial aid resulting from program participation on subsequent enrollment.

²² The one known exception is the Performance-Based Scholarship Demonstration program led by MDRC, where in some sites aid is delivered outside of the mandated aid system. The policy relevance of estimates from such demonstrations is limited unless one expects fundamental changes to the aid delivery system.

²³ According to the program’s Executive Director, this unexpected decline in take-up rates is likely due to turnover among the institutional administrators tasked with identifying eligible students, communicating with them, and distributing the award.

²⁴ We observe this drop-off for the first cohort, and cannot examine it for the others—however, the rules were the same for all cohorts.

²⁵ We perform these analyses only for the first cohort, as we lack financial aid data for other cohorts.

Specifically, leveraging the experimentally induced increase in total aid and taking advantage of the fact that treatment was assigned at random across 13 universities, we use site-specific instruments to estimate the impact of each \$1000 in additional aid received by students in their first year of college, on their rates of retention in their second year. Following the work of Sean Reardon and colleagues (Reardon and Raudenbush forthcoming; Raudenbush, Reardon, and Nomi 2012; Reardon et al. 2012), as well as exemplars such as Kling, Liebman and Katz (2007), in this case we believe a multiple site-multiple instrument approach is preferable to a site-fixed effects IV model using a single instrument because it enhances precision by taking advantage of variable impacts of the treatment on financial aid packages (the mediator) across universities.²⁶

Therefore, in the first stage of the two stage least squares regression model, we predict the total amount of financial aid received during the first year of college (in \$1000s) using a set of campus by treatment interactions:

$$A_i = \alpha_s + \sum_{s=1}^{13} \beta_s (D_i^s \cdot T_i) + v_i X_i + e_i, e_i \sim N(0, \sigma^2) \quad (1),$$

where A_i is the predicted total amount of aid received, D_i^s is equal to one if a student is at campus s and zero otherwise, T_i is equal to one if a student was offered the Wisconsin Scholars Grant, and X_i is a set of covariates including race, gender, age, parental education, expected family contribution, and college fixed effects. The second stage of the model then regresses retention to the second year on the predicted amount of aid received from the first stage, \hat{A}_i , and the same set of covariates as before:

$$Y_i = \gamma_s + \delta_i \hat{A}_i + \kappa_i X_i + u_i, u_i \sim N(0, \theta^2) \quad (2),$$

where Y_i is retention to the second year, \hat{A}_i is the predicted amount of aid received, and X_i is the vector of covariates.

In addition to the usual set of assumptions required for identification in instrumental variables models (Angrist, Imbens, and Rubin 1996), an additional assumption—that there is no

²⁶ To eliminate concerns about endogeneity, we restrict this analysis to students who were enrolled within the University of Wisconsin System in the spring 2009 semester.

correlation between the site-average compliance rates and the site-average effects of the mediator—is required (Raudenbush, Reardon, and Nomi 2012; Reardon and Raudenbush forthcoming). We discuss this later in the paper.

F. Baseline Equivalence

If random assignment resulted in a good draw, recipients and non-recipients of the offer of the WSG should be equivalent on observable and unobservable baseline characteristics at the start of college (pre-treatment). We check for balanced allocation in every cohort and sample with a series of tests using observable characteristics. Panel A of Table 1 reports means of selected student characteristics for control students across all four cohorts, and Panel B does the same for the first cohort’s subsamples. In each case, we present coefficients from OLS regressions indicating whether and by how much the treatment group differed from the control group.

The program did not block random assignment according to university, and thus the first check on baseline equivalence we perform is to look at the distribution of students across universities. In addition, we examine the percent of students with recorded enrollment in UW System prior to treatment, and the number of terms enrolled during that time. Across the four cohorts and 60 comparisons, we find that only two treatment differences are statistically significant, and both are in cohort 3, suggesting that the treatment group had a higher incidence of pre-treatment college enrollment compared to the control group. In addition to the individual t-tests, we also report the results of an F-test of joint significance of all the observable measures and fail to reject that they are jointly different from zero for any of the four cohorts.

We are able to perform far more extensive checks for the first cohort, and we find that of the 33 independent comparisons in Table 1, only two are statistically different and present only in subsample B. But again, the F-test suggests the treatment and control groups are equivalent. Rates of missing data are quite similar between the control and treatment groups, as evidenced by the very comparable proportion assigned to treatment in each subsample.

II. IMPACTS ON ACADEMIC AND FINANCIAL AID OUTCOMES

A. Average Treatment Impacts on Academic Outcomes

The WSG program began several weeks after students' first semester of college started, and thus we estimate program impacts on college retention, credit completion, and grade point average across all four cohorts and for up to six semesters. We examine a total of three years of outcomes for cohorts 1 and 2, two years for cohort 3, and one year for cohort 4. We first display short-term academic impacts (from the first semester until the third—a year after treatment was initiated) in Table 2, and then display longer-term academic impacts (for the fourth through sixth semesters, and cumulative impacts) in Table 3.

There is some indication that the program's impact began as soon as students were notified that they were chosen for the WSG. This intervention, even prior to the actual appearance of the new financial resources, seems to have very modestly boosted students' academic performance and slightly increased their number of completed credits during the first term of college (Table 2). The estimated program impacts grew stronger in the second term, after the funds were distributed. The pooled estimates suggest that the offer of the WSG increased retention in that term from just over 93% to about 95%, and also increased the percent of students completing at least 12 credits from 79 to 81.4%. The impacts appear to persist through the following fall, when just 81.7% of the control group returned for a second year of college, compared to 84.2% of the treatment group. The point estimates for all of these impacts are quite consistent across cohorts.

Over time, treatment impacts appear to fade (see Table 3). The estimated impact on retention grows weaker and becomes non-significant by semester four, and there are no detectable effects by the third year of college. We explore potential reasons for this in the next section.²⁷

Finally, we consider the possibility that some of our estimates are subject to ceiling effects operating at institutions where retention and achievement were already quite high, independent of treatment (specifically, universities where the rates of retention to the second year of college exceeded 90 percent for the control group). As Table 4 illustrates, we find that the

²⁷ Since these estimates only consider enrollment within the UW System, we also estimated impacts on transfer outside of the System for the first cohort using National Student Clearinghouse data. While about one in four students transferred, and 16 percent did so by leaving the system, there were no discernible differences according to whether or not students were offered the WSG (see Appendix A1) and thus we do not believe that this data restriction affects the estimated impacts of the grant on re-enrollment.

positive impacts of treatment on retention and credits are only clearly distinguishable from zero at those universities where there was room for growth.²⁸ For example, treatment increased retention to the second year of college from 78.6 to 82% at the ten universities we designate as having lower average retention, but did not appear to cause a change in the 92.8% retention rate at the other three universities where retention on average is higher. To be clear, we are not suggesting that the treatment impacts are necessarily heterogeneous—the group differences are not statistically significant—but rather that the presence of ceiling effects at some universities may mute the estimated average treatment impacts.

B. Impacts on Financial Aid Received

Given these modest and variable impacts of offering students the \$3,500 WSG, we next turn to an examination of how much additional financial aid they actually received as a result of treatment. Table 5, Panel A shows that pre-treatment, students in the first cohort received just over \$11,000 in financial aid, including \$6,739 in grants and almost \$3,800 in loans.²⁹ That amount should immediately increase during the second term of college, for students assigned to treatment, though in some cases the net increase should be affected by reductions in existing aid. Comparing the financial aid packages of treatment and control students at the end of the first year of college reveals that assignment to treatment (the \$3,500 grant offer) induced a \$1,471 increase in total financial aid (conditioning on enrollment in the second term yields an increase of \$1,545).³⁰ The average total increase in aid resulting from the WSG was \$3,214 rather than \$3,500 due to the 92.8% takeup rate, and just over \$1,100 in loans were crowded out. Moreover, as Panel B shows, because of crowd out, and high rates of ineligibility for grant renewal after the first year (25% of students lost the grant after year one), the treatment and control groups had the *same amount of total financial aid* after the first year of college. While the treatment group had more than \$1,000 in additional grant aid, the control group had more loans. The net effect was that even with the addition of the \$3,500 grant, the two groups had equivalent amounts of aid

²⁸ We show baseline equivalence tests for these two groups in Appendix A2 and tests for impacts on cohort 1 only in Appendix A4.

²⁹ This is based on 645 of 828 students from subsample B. We received pre-treatment financial aid data from ten of thirteen campuses, and there is a small amount of missing data within these campuses.

³⁰ Ideally we would prefer to compare the aid packages *immediately* following treatment, but we do not observe those for the control group.

with which to finance college, and Table 3 suggests that this resulted in no impact on college retention rates.

To explore further the potential that crowd-out of existing financial aid ameliorated the potential positive benefits of the WSG, we next re-estimate treatment impacts according to whether the student attended a university where the WSG was often re-packaged to displace loans. Specifically, using the site variation in treatments impacts on total financial aid displayed in Table 7, Panel A, we distinguish between universities where students saw treatment impacts on total aid of less than \$1,000 and those where treatment led to at least a \$1,000 increase in total aid. This variation is largely attributable to (a) differences in how campuses packaged students' financial aid awards after receiving the WSG, and (b) the amount of unmet need students had prior to receiving the grant (which is affected by both the institution's cost of attendance and students' willingness to accept loans). Table 6 shows the results, which suggest that all of the estimated positive treatment impacts on retention, credits, and grades accrued to students attending universities where the WSG resulted in at least a \$1,000 increase in total financial aid by not crowding out loans.³¹ This would seem to indicate that, at least in the short term, students benefit from the increased monetary resources associated with loans. It is too early to tell if students who saw their loans displaced by the program benefitted over the longer-term in other ways.

C. Instrumental Variables Estimates

Given the indication from the experimental analyses that modest treatment impacts on academic outcomes are associated with modest increases in total financial aid, we explore the *mediating* influence of the actual total amount of aid students held during their first year of college. In other words, we examine whether assignment to treatment induced an increase in the total amount of aid students received in year one, which then affected their decision to enroll in year two. To estimate this impact of a mediator not assigned at random, we take advantage of the large amount of university-level variation in the treatment impact in total aid, which ranges from near zero to nearly \$3,000 (Table 7).

³¹ We show baseline equivalence tests for these two groups in Appendix A3.

Table 7 presents the OLS and IV estimates of the effects of total financial aid on retention to the second year of college. We use university by treatment variation to instrument for the total aid students received during their first year of college. The OLS estimate indicates that the impact of an additional \$1,000 in financial aid generated at best a 1.0 percentage point increase in second year retention rates, but we cannot confirm that the true effect is different from zero. The corresponding IV estimate is much larger, 2.8 percentage points, and is statistically significant. This suggests a substantial amount of endogenous variation in students' financial aid packages (with needier students getting more financial aid) that downwardly biases the OLS estimates. This estimated effect is consistent with estimates from the quasi-experimental literature of the effects of aid on persistence (Bettinger 2011).

We also estimate impacts for the subset of ten universities where there was room for improvement in retention (control group retention rates below 90 percent). The OLS estimate for that group is 1.1 percentage points, and the IV estimate is even larger at 4.1 percentage points (Table 7, Panel B).

Of course, this IV multi-site approach to estimating the average treatment effect rests on several assumptions. For example, one key to our identification strategy is the assumption that random assignment is a strong instrument for the mediator. The F statistic (8.56) suggests this requirement is met. In addition, we must invoke the exclusion restriction, and fortunately can partially test it because our dataset includes information on other hypothesized mediators. Table 8 illustrates the results of an analysis in which we estimate treatment impacts (the stage 1 equation) on the number of hours students worked, their degree expectations, and their self-reported mental health. We find no evidence that these factors were affected by assignment to treatment.

Furthermore, we must also assume that there is no correlation between the effect of treatment on the mediator and the effect of the mediator on retention (this assumption is the continuous-mediator analogue to the no-defier assumption for binary mediators). This assumption would be violated if financial aid officers increased total aid more for those students who they deemed more likely to benefit from the treatment. This is unlikely since financial aid officers are constrained by a set of federal and state rules regarding aid packaging. However, it remains possible that the IV estimate is biased if the same result occurred through students'

preferences and actions. We cannot rule out this possibility, and thus the results should be interpreted with that caveat in mind.

III. CONCLUSION

Financial aid has long been evaluated for its effectiveness at promoting college attendance. But the utility of college at promoting social mobility hinges on students completing years of college credits, and facilitating college persistence among students from low-income families appears to require offsetting the growing costs associated with college attendance. Need-based financial grants are a popular mechanism with which to lower those costs. In this analysis, we provide new evidence that in doing so they are modestly effective at inducing students to remain enrolled, earn slightly more credits, and get somewhat better grades—and that these effects are likely stronger when students receive more aid. Unlike most prior studies of need-based grants, our estimates are based on a randomized experiment with four cohorts of students, and yet we note that the estimated impacts are quite comparable to those obtained from Bettinger’s work with both the federal Pell Grant (2004) and an Ohio program (2010).

The estimated effects of aid seem to accrue to all financial aid dollars – whether they come from grants or loans. In other words, it seems that in terms of promoting college persistence, Pell recipients benefit from having more dollars in hand during college, even though down the road it means they will have more debt as well. These potentially countervailing effects deserve more inquiry and consideration, as families increasingly rely on loans to finance college.

The usefulness of replicating experimental work with real life programs as they evolve is also worthy of further consideration. Monetary interventions are rarely simple drops of cash from the sky; instead they reach their recipients through a process, one in which can affect the monetary and non-monetary value of the money. Programs are often slow to evolve, and while this one changed a bit over time, the most meaningful alterations are now occurring. For example, the WSG no longer requires that students continue to be Pell-eligible to receive the grant, an effort to increase the duration of receipt. Examining effects across multiple cohorts helped to provide a sense of the reliability of the results, the degree to which the validity of the estimates are sensitive to statistical power (these impacts are objectively small, and require large

sample sizes to detect), and provide some space to consider how program implementation relates to effectiveness.

Finally, this analysis suggests that efforts to improve persistence rates among economically disadvantaged students would benefit from changes to the rules regarding financial aid packaging. Programs like the WSG commonly observe their philanthropic dollars supplant government dollars, and while this may promote greater equity among financial aid recipients, it may not be the most efficient approach. A closer examination of how packaging practices vary across institutions may yield greater insights into which changes would be most effective.

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Table 1. Baseline Equivalence Tests.
Panel 1A. Baseline Equivalence by Cohort.

Characteristic	Cohort 1		Cohort 2		Cohort 3		Cohort 4	
	Control Mean	Treatment Difference	Control Mean	Treatment Difference	Control Mean	Treatment Difference	Control Mean	Treatment Difference
Distribution of initial attendance (pct)								
University 1	6.7	0.3 (1.8)	8.0	-1.1 (1.2)	7.7	-1.0 (1.1)	7.5	-1.0 (1.1)
University 2	6.7	-0.1 (1.5)	5.8	0.0 (1.1)	6.0	-0.8 (1.0)	6.1	0.0 (1.0)
University 3	6.0	0.3 (1.3)	10.5	0.2 (1.5)	8.1	0.5 (1.3)	7.1	0.7 (1.2)
University 4	5.2	-0.7 (1.5)	5.6	-0.1 (1.1)	5.0	1.3 (1.1)	5.6	0.3 (1.0)
University 5	6.9	0.3 (1.6)	6.5	-0.0 (1.2)	6.9	-0.8 (1.1)	7.4	-0.1 (1.1)
University 6	7.6	0.6 (1.7)	8.5	0.4 (1.4)	8.5	0.6 (1.3)	8.6	-0.7 (1.2)
University 7	13.7	1.0 (2.2)	9.4	0.1 (1.4)	8.6	-1.9 (1.2)	9.0	-0.7 (1.2)
University 8	4.9	-0.2 (1.6)	5.1	-0.5 (1.0)	4.0	-0.1 (0.9)	3.4	0.7 (0.8)
University 9	1.3	-0.3 (0.5)	1.3	0.3 (0.6)	1.5	-0.6 (0.5)	1.4	-0.1 (0.5)
University 10	10.3	-1.2 (1.9)	8.9	-0.0 (1.4)	9.9	-1.0 (1.3)	9.3	0.8 (1.3)
University 11	18.4	-1.1 (2.2)	19.2	-1.0 (1.9)	21.5	2.5 (1.9)	24.6	-1.2 (1.8)
University 12	6.2	0.4 (1.2)	5.1	0.2 (1.1)	3.9	0.0 (0.9)	3.9	0.9 (0.9)
University 13	6.1	0.7 (1.7)	5.4	1.3 (1.2)	7.9	1.9 (1.3)	5.7	0.4 (1.0)
Prior enrollment (pct)	9.1	2.2 (2.2)	8.1	(0.8) (1.4)	11.8	3.9** (1.6)	8.5	-0.5 (1.2)
Terms enrolled	0.16	0.03 (0.04)	0.11	0.01 (0.02)	0.20	0.14*** (0.04)	0.11	0.01 (0.02)
P-value from F-test	1.000		0.997		0.301		0.983	
Sample Size	692	475	3582	495	4280	540	4168	615

SOURCE: University of Wisconsin System.

Panel 1B. Sample Characteristics and Baseline Equivalence of Cohort 1 Students (Fall 2008) by Assignment to Treatment.

Characteristic	Full Sample		Subsample A		Subsample B	
	Mean	Difference	Mean	Difference	Mean	Difference
Gender (percent female)	56.7	1.6 (2.8)	55.9	5.0 (3.1)	59.6	3.6 (3.6)
Targeted minority (pct, self-report)	25.2	0.2 (2.7)	22.4	1.6 (3.0)	22.4	1.6 (3.0)
Average age (years)	18.25	0.00 (0.03)	18.25	0.01 (0.03)	18.24	0.03 (0.04)
First in family to attend college (pct)	53.6	-0.6 (2.9)	55.0	-2.6 (3.2)	53.7	0.0 (3.9)
Father has an AA or higher (pct)	28.3	2.0 (2.8)	27.4	2.9 (3.1)	29.3	1.0 (3.7)
Mother has an AA or higher (pct)	35.9	1.9 (2.9)	33.7	4.7 (3.2)	33.3	4.2 (3.8)
Financially dependent on parents (pct)	97.0	0.4 (0.9)	96.9	0.7 (1.0)	96.8	0.9 (1.2)
Expected family contribution (\$)	1,607	60 (128)	1,609	49 (147)	1,631	83 (174)
Zero expected family contribution (pct)	31.7	-2.7 (2.5)	32.7	-3.3 (2.9)	33.9	-8.3** (3.4)
Parent(s)' adjusted gross income (\$)	29,437	1,203 (1,009)	29,014	1,352 (1,136)	28,646	2,908** (1,361)
Parent(s)' investment net worth (\$)	5,644	-1,110 (744)	5,231	-880 (826)	5,691	-791 (1,034)
P-value from global F-test	0.658		0.197		0.260	
Sample Size	900	600	692	475	471	357

SOURCES: Data come from a student's 2008 FAFSA except for race, which is self-reported on a survey.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) We cannot identify universities in the sample by name due to data agreements.
- (3) Cohort 1 had 2557 students in the control group and 600 in the treatment group, but due to data agreements we are unable to observe the full sample.
- (4) Prior enrollment measures any enrollment history in the University of Wisconsin System prior to the beginning of the first semester of college.
- (5) Targeted minority groups include: African-Americans, Latinos, Southeast Asians, Native Americans, and multiracial. "Targeted" refers to a policy of the University of Wisconsin System, in which all sample participants began college.
- (6) The global F-test (panel B) includes all above measures except race.
- (7) Parent investments (dependents only) had few extreme values with undue influences and were Winsorized at the 95th percentile (Tukey, 1962).
- (8) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Table 2. Short-Term Academic Impacts by Semester and Cohort.

Panel 2A. Short-Term Academic Impacts by Cohort.

	Cohort 1		Cohort 2		Cohort 3		Cohort 4	
	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
	Mean	Impact	Mean	Impact	Mean	Impact	Mean	Impact
<u>Semester 1 (treatment began)</u>								
Credits earned	13.9	0.2 (0.2)	13.7	-0.0 (0.1)	13.7	0.2 (0.1)	13.8	0.2* (0.1)
Earned 12+ credits (pct)	87.9	0.6 (2.0)	88.6	1.5 (1.4)	87.4	0.5 (1.5)	92.2	1.3 (1.1)
Cumulative GPA	2.52	0.08 (0.06)	2.66	0.08* (0.04)	2.69	0.11*** (0.04)	2.76	0.03 (0.04)
<u>Semester 2</u>								
Retention (pct)	93.4	1.4 (1.5)	93.7	1.2 (1.1)	93.0	2.5*** (1.0)	93.4	1.4 (1.0)
Credits earned	12.0	0.3 (0.3)	12.7	0.2 (0.2)	12.6	0.4** (0.2)	12.8	0.4** (0.2)
Earned 12+ credits (pct)	73.5	1.1 (2.7)	80.0	0.9 (1.9)	78.6	5.5*** (1.7)	81.3	3.8** (1.6)
Cumulative GPA	2.48	0.07 (0.06)	2.62	0.06 (0.04)	2.64	0.09** (0.04)	2.70	0.04 (0.04)
<u>Semester 3</u>								
Retention (pct)	80.4	2.6 (2.4)	82.8	2.8* (1.7)	81.4	2.6 (1.7)	--	--
Credits earned	10.6	0.3 (0.4)	11.2	0.3 (0.3)	10.9	0.5* (0.3)	--	--
Earned 12+ credits (pct)	65.2	2.8 (3.0)	69.4	2.1 (2.2)	67.9	3.4 (2.1)	--	--
Cumulative GPA	2.46	0.07 (0.06)	2.62	0.04 (0.04)	2.63	0.09** (0.04)	--	--
Sample Size	692	475	3582	495	4280	540	4168	615

Panel 2B. Short-Term Academic Impacts on Four Cohorts (2008-2011).

	Control Mean	Treatment Impact
<u>Semester 1 (treatment began)</u>		
Credits earned	13.8	0.2** (0.1)
Earned 12+ credits (pct)	89.2	1.0 (0.7)
Cumulative GPA	2.68	0.06*** (0.02)
<u>Semester 2</u>		
Retention (pct)	93.4	1.7*** (0.5)
Credits earned	12.6	0.3*** (0.1)
Earned 12+ credits (pct)	79.0	2.4*** (0.9)
Cumulative GPA	2.63	0.05** (0.02)
<u>Semester 3</u>		
Retention (pct)	81.7	2.5** (1.1)
Credits earned	11.0	0.3** (0.2)
Earned 12+ credits (pct)	67.9	2.4* (1.3)
Cumulative GPA	2.59	0.05** (0.02)
Sample Size	12722	2125

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Retention includes any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (3) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (4) We only have two semesters of data for cohort 4.
- (5) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Table 3. Longer-Term Academic Impacts by Semester and Cohort.

Panel 3A. Longer-Term Academic Impacts by Cohort.

	Cohort 1		Cohort 2		Cohort 3		Cohort 4	
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	Control Mean	Treatment Impact	Control Mean	Treatment Impact
<u>Semester 4</u>								
Retention (pct)	75.6	1.9 (2.7)	78.1	1.3 (1.9)	77.4	2.4 (1.8)	--	--
Credits earned	9.9	-0.1 (0.4)	10.3	0.5* (0.3)	10.2	0.3 (0.3)	--	--
Earned 12+ credits (pct)	62.5	-3.9 (3.1)	64.2	5.1** (2.2)	62.5	1.6 (2.2)	--	--
Cumulative GPA	2.46	0.07 (0.06)	2.61	0.04 (0.04)	2.62	0.10*** (0.04)	--	--
<u>Semester 5</u>								
Retention (pct)	71.2	0.0 (2.9)	73.2	1.4 (2.1)	--	--	--	--
Credits earned	9.0	0.3 (0.4)	9.6	0.3 (0.3)	--	--	--	--
Earned 12+ credits (pct)	53.3	2.7 (3.1)	59.2	3.2 (2.3)	--	--	--	--
Cumulative GPA	2.47	0.06 (0.06)	2.63	0.04 (0.04)	--	--	--	--
<u>Semester 6</u>								
Retention (pct)	69.3	-1.4 (2.9)	71.0	1.3 (2.1)	--	--	--	--
Credits earned	8.8	-0.2 (0.4)	9.3	0.0 (0.3)	--	--	--	--
Earned 12+ credits (pct)	55.9	-2.4 (3.1)	57.8	0.0 (2.4)	--	--	--	--
Cumulative GPA	2.48	0.07 (0.06)	2.64	0.04 (0.04)	--	--	--	--
<u>Cumulative Outcomes</u>								
Credits completed	65.6	1.0 (1.8)	68.1	1.4 (1.2)	48.0	1.5** (0.7)	26.7	0.6** (0.3)
12+ credits/sem (pct)	57.7	-2.2 (3.1)	59.7	2.7 (2.3)	65.3	2.1 (2.1)	83.2	3.8** (1.5)
Semesters enrolled	4.90	0.05 (0.10)	4.98	0.08 (0.08)	3.51	0.08** (0.04)	1.93	0.02 (0.01)
Cumulative GPA	2.48	0.07 (0.06)	2.64	0.04 (0.04)	2.62	0.10*** (0.04)	2.70	0.04 (0.04)
Sample Size	692	475	3582	495	4280	540	4168	615

Panel 3B. Longer-Term Academic Impacts on Four Cohorts (2008-2011).

	Control Mean	Treatment Impact
<u>Semester 4</u>		
Retention (pct)	77.3	1.7 (1.2)
Credits earned	10.2	0.2 (0.2)
Earned 12+ credits (pct)	63.1	1.0 (1.4)
Cumulative GPA	2.59	0.05** (0.02)
<u>Semester 5</u>		
Retention (pct)	72.5	0.4 (1.7)
Credits earned	9.4	0.2 (0.3)
Earned 12+ credits (pct)	57.1	2.2 (1.8)
Cumulative GPA	2.57	0.03 (0.03)
<u>Semester 6</u>		
Retention (pct)	70.4	-0.2 (1.7)
Credits earned	9.1	-0.2 (0.3)
Earned 12+ credits (pct)	57.1	-1.2 (1.8)
Cumulative GPA	2.58	0.03 (0.03)
<u>Cumulative Outcomes</u>		
Credits completed	49.2	2.3*** (0.6)
Cumulative GPA	2.63	0.05** (0.02)
Sample Size	12722	2125

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Sample sizes vary in panel B--the maximum sample size is presented.
- (3) Outcomes include enrollment at any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (4) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (5) We only have four semesters of data for cohort 3 and two for cohort 4.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Table 4. Short-Term Academic Impacts by University Retention Rate.

	Lower Retention		Higher Retention		p-value
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	
<u>Outcomes by Semester</u>					
<u>Semester 1 (treatment began)</u>					
Credits earned	13.6	0.2*** (0.1)	14.5	0.0 (0.1)	0.250
Earned 12+ credits (pct)	87.5	1.2 (0.9)	95.5	0.3 (1.0)	0.499
Cumulative GPA	2.58	0.07*** (0.03)	3.02	0.02 (0.04)	0.233
<u>Semester 2</u>					
Retention (pct)	92.2	1.8*** (0.6)	97.4	1.3** (0.6)	0.564
Credits earned	12.2	0.3*** (0.1)	14.0	0.1 (0.1)	0.165
Earned 12+ credits (pct)	75.6	2.7** (1.1)	91.3	1.9 (1.3)	0.653
Cumulative GPA	2.53	0.06*** (0.02)	2.99	0.02 (0.03)	0.295
<u>Semester 3</u>					
Retention (pct)	78.6	3.4*** (1.3)	92.8	-0.2 (1.6)	0.077
Credits earned	10.4	0.4** (0.2)	13.2	0.2 (0.3)	0.619
Earned 12+ credits (pct)	63.4	3.4** (1.5)	83.8	-0.3 (2.3)	0.188
Cumulative GPA	2.48	0.06* (0.03)	2.97	0.05 (0.04)	0.918
Max Sample Size	9931	1678	2791	447	

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Outcomes include enrollment at any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (3) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (4) Lower-retention campuses (n=10) had control group retention rates of less than 90 pct, while higher-retention campuses (n=3) had control group retention rates of more than 90 pct.
- (5) The p-values reported are a test of the difference in treatment impacts between low and high retention campuses.
- (6) All four cohorts are pooled for semesters 1 and 2. Cohorts 1-3 are pooled for semester 3.
- (7) * represents p<.10, ** represents p<.05, and *** represents p<.01.

Table 5. Impacts on Financial Aid Packages over Three Years (Cohort 1).

Panel 5A: Financial Aid Packages Pre and Post Treatment, Conditional on Enrollment.

	Pre-Treatment		End of Year	
	Control Mean	Treatment Difference	Control Mean	Treatment Impact
Total financial aid received (\$)	11016.1	-194.3 (261.3)	12011.3	1544.7*** (212.3)
Any grants or scholarships (pct)	99.1	0.1 (0.8)	100.0	-0.3 (0.3)
Avg. amount of grant aid (\$)	6739.7	-184.8 (213.1)	7809.2	2758.7*** (212.9)
Wisconsin Scholars Grant (pct)	--	--	0.0	92.8*** (1.4)
Avg. amount of WSG (\$)	--	--	0.0	3213.9*** (51.0)
Federal Pell Grant (pct)	98.0	1.2 (1.0)	99.9	-0.1 (0.3)
Avg. amount of Pell (\$)	3317.6	-74.5 (118.5)	3391.1	-159.0 (101.1)
Any loans (pct)	82.0	-1.2 (3.3)	80.0	-6.0* (3.2)
Avg. amount of loans (\$)	3779.9	-17.3 (186.9)	3991.8	-1139.8*** (197.1)
Federal Work-Study (pct)	28.3	-0.8 (3.8)	17.4	-4.0 (2.8)
Avg. amount of work study (\$)	496.5	7.8 (70.1)	193.3	-71.8** (31.9)
Sample Size	378	267	453	341

Panel 5B: Impacts on Financial Aid Packages over Three Years, Unconditional on Enrollment.

	2008-2009		2009-2010		2010-2011	
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	Control Mean	Treatment Impact
Total financial aid received (\$)	11825.7	1471.0*** (221.9)	10463.7	613.8 (444.2)	9883.1	18.4 (547.7)
Any grants or scholarships (pct)	100.0	-0.3 (0.3)	80.7	-1.4 (3.0)	69.2	-1.7 (3.5)
Avg. amount of grant aid (\$)	7667.0	2690.1*** (217.0)	6138.2	1775.3*** (370.0)	5653.2	1039.6** (409.5)
Wisconsin Scholars Grant (pct)	0.0	92.4*** (1.4)	0.0	67.5*** (2.5)	0.0	49.2*** (2.7)
Avg. amount of WSG (\$)	0.0	3143.4*** (52.6)	0.0	2236.0*** (86.6)	0.0	1653.5*** (91.9)
Federal Pell Grant (pct)	99.9	-0.1 (0.3)	75.7	-0.7 (3.2)	64.7	-1.2 (3.6)
Avg. amount of Pell (\$)	3333.7	-161.9 (100.4)	3047.6	-198.7 (158.2)	2902.3	-251.5 (184.7)
Any loans (pct)	80.1	-6.4** (3.1)	70.0	-8.0** (3.5)	62.3	-9.7*** (3.7)
Avg. amount of loans (\$)	3953.9	-1149.6*** (191.8)	4036.6	-1071.9*** (240.0)	3991.3	-965.7*** (273.5)
Federal Work-Study (pct)	17.1	-3.9 (2.7)	15.8	-3.8 (2.6)	11.2	-0.7 (2.3)
Avg. amount of work study (\$)	188.4	-70.7** (30.9)	205.0	-51.4 (37.2)	182.7	-43.3 (38.2)
Sample Size	470	356	470	356	470	356

SOURCES: University of Wisconsin System universities (panel A), University of Wisconsin System (panel B).

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) The pre-treatment measures in panel A exclude students at three of 13 universities, where no or insufficient data were provided, as well as small numbers of students at the other universities.
- (3) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Table 6. Heterogeneity by University Financial Aid Package Response to Treatment.

	Low Change in Aid		High Change in Aid		p-value Diff. in impacts
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	
<u>Outcomes by Semester</u>					
<u>Semester 1 (treatment began)</u>					
Credits earned	14.4	-0.0 (0.1)	13.5	0.3*** (0.1)	0.032
Earned 12+ credits (pct)	95.4	0.1 (0.9)	86.3	1.5 (0.9)	0.283
Cumulative GPA	2.79	0.02 (0.04)	2.63	0.08*** (0.03)	0.188
<u>Semester 2</u>					
Retention (pct)	94.4	0.7 (0.9)	92.9	2.2*** (0.6)	0.188
Credits earned	13.2	0.0 (0.2)	12.3	0.4*** (0.1)	0.107
Earned 12+ credits (pct)	84.8	1.9 (1.5)	76.3	2.8** (1.2)	0.661
Cumulative GPA	2.74	0.01 (0.03)	2.58	0.07*** (0.03)	0.204
<u>Semester 3</u>					
Retention (pct)	84.2	0.4 (1.9)	80.6	3.5*** (1.3)	0.170
Credits earned	11.8	-0.1 (0.3)	10.6	0.6*** (0.2)	0.094
Earned 12+ credits (pct)	73.9	-1.0 (2.3)	65.0	4.1** (1.6)	0.066
Cumulative GPA	2.70	0.01 (0.04)	2.54	0.07** (0.03)	0.193
Max Sample Size	4039	660	8683	1465	

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Outcomes include enrollment at any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (3) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (4) Low change in aid campuses (n=5) had treatment impacts of aid of less than \$1,000, while high change in aid campuses (n=8) had treatment impacts of greater than \$1,000.
- (5) The p-values reported are a test of the difference in treatment impacts between low and high change in aid campuses.
- (6) All four cohorts are pooled for semesters 1 and 2. Cohorts 1-3 are pooled for semester 3.
- (7) * represents p<.10, ** represents p<.05, and *** represents p<.01.

Table 7. Instrumental Variables Impacts of Total Financial Aid on Retention to Semester 3.

Panel 7A. Impacts of Treatment on Total Financial Aid (\$).

University	Treatment Impact	Sample Size
University 1	-16.9 (497.2)	41
University 2	2887.1*** (691.1)	54
University 3	2895.8*** (769.1)	76
University 4	203.9 (856.1)	26
University 5	1588.8** (614.5)	47
University 6	938.7 (729.5)	58
University 7	1453.3** (606.7)	102
University 8	1015.5 (1014.4)	22
University 9	668.8 (1137.7)	12
University 10	961.1 (715.2)	60
University 11	2386.5*** (553.2)	178
University 12	1735.1*** (655.7)	83
University 13	1266.9 (777.3)	37

Panel 7B. Impacts of Total Financial Aid on Retention.

OLS impact (13 colleges)	1.0*
	(0.6)
OLS impact (10 colleges)	1.1*
	(0.7)
IV impact (13 colleges)	2.8**
	(1.2)
IV impact (10 colleges)	4.1**
	(1.7)
Stage 1 F	8.56
Stage 1 R-squared	0.280

SOURCE: University of Wisconsin System.

NOTES:

- (1) This analysis only includes students in subsample B of cohort 1 and who remained enrolled in the UW System in spring 2009 (796 of 828 students).
- (2) Campus-level impacts are the result of campus-specific OLS regressions without covariates.
- (3) OLS impacts are the result of regressions across all campuses including race, gender, age, EFC, parental education, and campus dummy variable by WSG offer interactions.
- (4) IV impacts are the result of using the measure at the top of each column as an instrument for campus by treatment interactions. The same covariates used in the OLS model are used in the IV model.
- (5) The IV estimate for 13 colleges is for subsample B of cohort 1. The IV estimate for 10 colleges is only for colleges with control group retention rates of below 90 percent.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Table 8. Treatment Impacts on Other Potential Mediators.

University	Fall 08 hrs worked	Spring 09 expect grad degree (pct)	Fall 08 mental health (pct very good)	Max sample size
University 1	0.0 (2.3)	25.4 (17.2)	-8.4 (8.9)	41
University 2	-3.6* (2.0)	17.9 (14.5)	12.9 (10.5)	54
University 3	0.7 (1.7)	-12.5 (12.7)	19.5*** (7.1)	76
University 4	-3.2 (3.7)	-8.1 (22.0)	-3.2 (16.0)	26
University 5	1.0 (2.4)	-8.3 (18.1)	-8.7 (8.5)	47
University 6	-1.2 (2.3)	-21.5 (15.3)	10.3 (8.5)	58
University 7	-1.3 (1.9)	10.3 (10.8)	5.0 (6.8)	102
University 8	-3.1 (5.0)	-4.4 (27.5)	-13.3 (18.1)	22
University 9	-5.5 (4.8)	25.0 (33.1)	0.0 (0.0)	12
University 10	0.2 (2.4)	0.0 (16.0)	-13.3 (9.5)	60
University 11	0.3 (1.6)	4.9 (10.3)	1.0 (5.9)	178
University 12	-2.3 (2.6)	17.6 (16.4)	9.7 (6.9)	83
University 13	1.0 (2.4)	-23.3 (16.6)	-11.1 (11.1)	37

SOURCES: Fall 2008/spring 2009 WSLs surveys

NOTES:

- (1) This analysis only includes students in subsample B of cohort 1 and who remained enrolled in the UW System in spring 2009 (796 of 828 students).
- (2) Campus-level impacts are the result of campus-specific OLS regressions without covariates.
- (3) Hours worked combines survey questions regarding hours worked on campus and hours worked off campus.
- (4) Expectation of graduate degree is equal to 1 if a student expected to earn a master's degree or higher and 0 otherwise.
- (5) Mental health is coded as 1 if a student responded "very good" or excellent" and 0 otherwise.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A1. Treatment Impacts on Transfer by Year (Cohort 1).

Type of transfer (pct)	Year 1		Year 2		Year 3		Cumulative	
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	Control Mean	Treatment Impact	Control Mean	Treatment Impact
Any transfer	3.7	-0.9 (1.1)	16.6	-3.0 (2.3)	18.2	1.6 (2.5)	24.5	-1.8 (2.7)
Within UW System	3.4	-0.6 (1.1)	9.5	-2.2 (1.8)	7.8	1.5 (1.8)	14.3	-0.7 (2.2)
Outside UW System	2.4	-0.9 (0.8)	9.8	-2.0 (1.8)	10.9	2.2 (2.0)	16.2	-0.9 (2.3)
Sample Size	692	475	692	475	692	475	692	475

SOURCE: National Student Clearinghouse.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Transfer is defined as a semester without enrollment at the initial institution of attendance and an enrollment record elsewhere.
- (3) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A2. Baseline Equivalence by University Retention Rate.

Panel A. Cohort 1 (Fall 2008).

Characteristic	Lower Retention		Higher Retention	
	Control Mean	Treatment Difference	Control Mean	Treatment Difference
Gender (percent female)	55.5	4.2 (3.5)	57.8	8.3 (6.9)
Race/ethnicity (pct targeted minority)	26.3	1.6 (3.6)	8.2	1.0 (4.4)
Average age (years)	18.26	0.01 (0.04)	18.20	0.02 (0.06)
First in family to attend college (pct)	59.1	-5.5 (3.6)	38.2	9.3 (7.3)
Father has an AA or higher (pct)	23.6	4.4 (3.3)	42.7	-3.3 (7.5)
Mother has an AA or higher (pct)	30.9	7.6** (3.6)	45.5	-7.2 (7.5)
Financially dependent on parents (pct)	96.2	1.5 (1.2)	100.0	-2.7 (1.9)
Average expected family contribution (\$)	1,561	-17 (144)	1,803	312 (457)
Zero expected family contribution (pct)	36.6	-5.1 (3.3)	16.5	4.1 (5.7)
Parent(s)' adjusted gross income (\$)	28,169	1,922 (1,277)	32,378	-896 (2,470)
Parent(s)' investment net worth (\$)	4,914	-1,624* (842)	5,870	2,344 (2,140)
Any prior enrollment (pct)	9.2	1.7 (2.1)	10.2	-0.4 (4.2)
Terms of prior enrollment	0.17	0.01 (0.04)	0.15	-0.01 (0.07)
P-value from global F-test		0.059		0.821
Sample Size	570	380	122	95

Panel B. Cohorts 1-4.

Characteristic	Lower Retention		Higher Retention	
	Control Mean	Treatment Difference	Control Mean	Treatment Difference
Any prior enrollment (pct)	8.6	1.2 (0.8)	12.8	2.1 (1.8)
Terms of prior enrollment	0.13	0.05*** (0.02)	0.18	0.06* (0.03)
Sample Size	9931	1678	2791	447

SOURCES: Panel A: 2008 FAFSA except for race and prior enrollment, which comes from the University of Wisconsin System. Panel B: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Targeted minority groups include: African-Americans, Latinos, Southeast Asians, Native Americans, and multiracial. "Targeted" refers to a policy of the University of
- (3) Parent investments (dependents only) had few extreme values with undue influences and were Winsorized at the 95th percentile (Tukey, 1962).
- (4) Prior enrollment only includes enrollment within the University of Wisconsin System.
- (5) Lower-retention campuses (n=10) had control group retention rates of less than 90 percent, while higher-retention campuses (n=3) had control group retention rates of more than 90 percent.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A3. Baseline Equivalence by University Financial Aid Response to Treatment.

Panel A. Cohort 1 (Fall 2008).

Characteristic	Low Change in Aid		High Change in Aid	
	Control Mean	Treatment Difference	Control Mean	Treatment Difference
Gender (percent female)	57.7	2.5 (6.0)	55.1	6.1* (3.6)
Race/ethnicity (pct targeted minority)	18.7	-1.3 (5.4)	24.0	2.8 (3.7)
Average age (years)	18.20	-0.02 (0.06)	18.27	0.02 (0.04)
First in family to attend college (pct)	55.1	0.2 (6.3)	54.9	-3.9 (3.8)
Father has an AA or higher (pct)	26.4	0.7 (5.9)	27.9	3.8 (3.6)
Mother has an AA or higher (pct)	37.5	2.4 (6.4)	32.1	5.6 (3.7)
Financially dependent on parents (pct)	96.2	0.5 (2.3)	97.2	0.7 (1.0)
Average expected family contribution (\$)	1,539	207 (336)	1,639	-20 (154)
Zero expected family contribution (pct)	32.0	-0.5 (5.7)	33.0	-4.6 (3.3)
Parent(s)' adjusted gross income (\$)	28,708	2,035 (2,257)	29,150	1,057 (1,301)
Parent(s)' investment net worth (\$)	4,768	-741 (1,530)	5,257	-894 (938)
Any prior enrollment (pct)	6.3	1.0 (3.1)	10.8	1.3 (2.4)
Terms of prior enrollment	0.09	0.03 (0.05)	0.21	-0.00 (0.05)
P-value from global F-test		0.996		0.170
Sample Size	138	136	554	339

Panel B. Cohorts 1-3.

Characteristic	Low Change in Aid		High Change in Aid	
	Control Mean	Treatment Difference	Control Mean	Treatment Difference
Any prior enrollment (pct)	7.6	0.6 (1.2)	10.5	1.6* (0.9)
Terms of prior enrollment	0.11	0.03 (0.02)	0.16	0.06*** (0.02)
Sample Size	4039	660	8683	1465

SOURCES: Panel A: 2008 FAFSA except for race and prior enrollment, which comes from the University of Wisconsin System. Panel B: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Targeted minority groups include: African-Americans, Latinos, Southeast Asians, Native Americans, and multiracial. "Targeted" refers to a policy of the University of
- (3) Parent investments (dependents only) had few extreme values with undue influences and were Winsorized at the 95th percentile (Tukey, 1962).
- (4) Prior enrollment only includes enrollment within the University of Wisconsin System.
- (5) Low change in aid campuses (n=5) had treatment impacts of aid of less than \$1,000, while high change in aid campuses (n=8) had treatment impacts of greater than \$1,000.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A4. Short-Term Academic Impacts by University Retention Rate (Cohort 1).

	Lower Retention		Higher Retention		p-value
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	
<u>Outcomes by Semester</u>					
<u>Semester 1 (treatment began)</u>					
Credits earned	13.9	0.3 (0.3)	14.2	0.1 (0.2)	0.561
Earned 12+ credits (pct)	86.1	0.9 (2.3)	95.6	-0.8 (2.9)	0.647
Cumulative GPA	2.42	0.10 (0.07)	2.97	-0.03 (0.11)	0.278
<u>Semester 2</u>					
Retention (pct)	91.8	2.2 (1.8)	100.0	-1.8 (1.3)	0.068
Credits earned	11.5	0.5 (0.3)	14.1	-0.2 (0.5)	0.211
Earned 12+ credits (pct)	69.5	2.0 (3.2)	90.3	-3.0 (4.6)	0.373
Cumulative GPA	2.36	0.11 (0.07)	2.97	-0.07 (0.09)	0.112
<u>Semester 3</u>					
Retention (pct)	76.6	4.5 (2.8)	96.1	-5.2 (3.6)	0.036
Credits earned	10.0	0.4 (0.4)	13.1	0.1 (0.7)	0.704
Earned 12+ credits (pct)	60.4	4.6 (3.4)	85.0	-5.0 (5.7)	0.151
Cumulative GPA	2.33	0.10 (0.06)	2.99	-0.09 (0.09)	0.08
Sample Size	570	380	122	95	

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Outcomes include enrollment at any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (3) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (4) Lower-retention campuses (n=10) had control group retention rates of less than 90 percent, while higher-retention campuses (n=3) had control group retention rates of more than 90
- (5) The p-values reported are a test of the difference in treatment impacts between low and high retention campuses.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A5. Adjusted Treatment Impacts on Short-Term Outcomes by Semester and Cohort.

Panel A. Treatment Impacts by Cohort.

	Cohort 1		Cohort 2		Cohort 3		Cohort 4	
	Unadj Impact	Fixed Effects	Unadj Impact	Fixed Effects	Unadj Impact	Fixed Effects	Unadj Impact	Fixed Effects
<u>Semester 1 (treatment began)</u>								
Credits earned	0.2 (0.2)	0.2 (0.2)	-0.0 (0.1)	0.0 (0.1)	0.2 (0.1)	0.2 (0.1)	0.2* (0.1)	0.2* (0.1)
Earned 12+ credits (pct)	0.6 (2.0)	0.3 (1.8)	1.5 (1.4)	1.5 (1.3)	0.5 (1.5)	0.8 (1.4)	1.3 (1.1)	1.2 (1.1)
Cumulative GPA	0.08 (0.06)	0.08 (0.06)	0.08* (0.04)	0.08** (0.04)	0.11*** (0.04)	0.10*** (0.04)	0.03 (0.04)	0.03 (0.04)
<u>Semester 2</u>								
Retention (pct)	1.4 (1.5)	1.5 (1.4)	1.2 (1.1)	1.7* (0.9)	2.5*** (1.0)	2.5*** (1.0)	1.4 (1.0)	1.4 (1.0)
Credits earned	0.3 (0.3)	0.3 (0.3)	0.2 (0.2)	0.3 (0.2)	0.4** (0.2)	0.4** (0.2)	0.4** (0.2)	0.4** (0.2)
Earned 12+ credits (pct)	1.1 (2.7)	0.8 (2.7)	0.9 (1.9)	1.1 (1.8)	5.5*** (1.7)	5.6*** (1.6)	3.8** (1.6)	3.8** (1.5)
Cumulative GPA	0.07 (0.06)	0.07 (0.05)	0.06 (0.04)	0.07* (0.04)	0.09** (0.04)	0.08** (0.04)	0.04 (0.04)	0.05 (0.04)
<u>Semester 3</u>								
Retention (pct)	2.6 (2.4)	2.5 (2.4)	2.8* (1.7)	3.3** (1.7)	2.6 (1.7)	2.7 (1.7)	--	--
Credits earned	0.3 (0.4)	0.3 (0.4)	0.3 (0.3)	0.4 (0.3)	0.5* (0.3)	0.5** (0.3)	--	--
Earned 12+ credits (pct)	2.8 (3.0)	2.7 (2.9)	2.1 (2.2)	2.6 (2.1)	3.4 (2.1)	3.3 (2.0)	--	--
Cumulative GPA	0.07 (0.06)	0.06 (0.05)	0.04 (0.04)	0.06 (0.04)	0.09** (0.04)	0.10*** (0.04)	--	--
Treatment Sample Size	475		495		540		615	

Panel B. Treatment Impacts on Four Cohorts (2008-2011).

	Unadj Impact	Fixed Effects	Cohort Interactions
<u>Semester 1 (treatment began)</u>			
Credits earned	0.2** (0.1)	0.2** (0.1)	0.2 (0.2)
Earned 12+ credits (pct)	1.0 (0.7)	0.7 (0.7)	0.4 (1.9)
Cumulative GPA	0.06*** (0.02)	0.06*** (0.02)	0.08 (0.06)
<u>Semester 2</u>			
Retention (pct)	1.7*** (0.5)	1.8*** (0.5)	1.5 (1.4)
Credits earned	0.3*** (0.1)	0.3*** (0.1)	0.3 (0.3)
Earned 12+ credits (pct)	2.4*** (0.9)	2.5*** (0.9)	1.0 (2.7)
Cumulative GPA	0.05** (0.02)	0.05*** (0.02)	0.07 (0.06)
<u>Semester 3</u>			
Retention (pct)	2.5** (1.1)	2.7*** (1.0)	2.5 (2.4)
Credits earned	0.3** (0.2)	0.4** (0.2)	0.3 (0.4)
Earned 12+ credits (pct)	2.4* (1.3)	2.6** (1.3)	2.6 (2.9)
Cumulative GPA	0.05** (0.02)	0.06** (0.02)	0.06 (0.05)
Treatment Sample Size	2125		

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Retention includes any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (3) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (4) The fixed effects model has college fixed effects; the cohort interaction model has fixed effects plus treatment by cohort interactions.
- (5) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A6. Adjusted Treatment Impacts on Longer-Term Academic Outcomes by Semester and Cohort.

Panel A. Treatment Impacts by Cohort.

	Cohort 1		Cohort 2		Cohort 3		Cohort 4	
	Unadj Impact	Fixed Effects	Unadj Impact	Fixed Effects	Unadj Impact	Fixed Effects	Unadj Impact	Fixed Effects
<u>Semester 4</u>								
Retention (pct)	1.9 (2.7)	1.8 (2.6)	1.3 (1.9)	2.0 (1.9)	2.4 (1.8)	2.5 (1.8)	--	--
Credits earned	-0.1 (0.4)	-0.1 (0.4)	0.5* (0.3)	0.6** (0.3)	0.3 (0.3)	0.4 (0.3)	--	--
Earned 12+ credits (pct)	-3.9 (3.1)	-4.1 (3.0)	5.1** (2.2)	5.6** (2.2)	1.6 (2.2)	1.6 (2.1)	--	--
Cumulative GPA	0.07 (0.06)	0.06 (0.05)	0.04 (0.04)	0.06 (0.04)	0.10*** (0.04)	0.10*** (0.04)	--	--
<u>Semester 5</u>								
Retention (pct)	0.0 (2.9)	-0.0 (2.8)	1.4 (2.1)	1.9 (2.1)	--	--	--	--
Credits earned	0.3 (0.4)	0.3 (0.4)	0.3 (0.3)	0.4 (0.3)	--	--	--	--
Earned 12+ credits (pct)	2.7 (3.1)	2.6 (3.0)	3.2 (2.3)	3.7 (2.3)	--	--	--	--
Cumulative GPA	0.06 (0.06)	0.06 (0.05)	0.04 (0.04)	0.06 (0.04)	--	--	--	--
<u>Semester 6</u>								
Retention (pct)	-1.4 (2.9)	-1.4 (2.9)	1.3 (2.1)	1.7 (2.1)	--	--	--	--
Credits earned	-0.2 (0.4)	-0.2 (0.4)	0.0 (0.3)	0.1 (0.3)	--	--	--	--
Earned 12+ credits (pct)	-2.4 (3.1)	-2.4 (3.1)	0.0 (2.4)	0.1 (2.3)	--	--	--	--
Cumulative GPA	0.07 (0.06)	0.07 (0.05)	0.04 (0.04)	0.05 (0.04)	--	--	--	--
<u>Cumulative Outcomes</u>								
Credits completed	1.0 (1.8)	0.9 (1.7)	1.4 (1.2)	1.8 (1.2)	1.5** (0.7)	1.5** (0.6)	0.6** (0.3)	0.6** (0.2)
12+ credits/sem (pct)	-2.2 (3.1)	-2.3 (3.0)	2.7 (2.3)	3.0 (2.2)	2.1 (2.1)	2.4 (2.0)	3.8** (1.5)	3.8*** (1.4)
Semesters enrolled	0.05 (0.10)	0.04 (0.10)	0.08 (0.08)	0.11 (0.07)	0.08** (0.04)	0.08** (0.04)	0.02 (0.01)	0.01 (0.01)
Cumulative GPA	0.07 (0.06)	0.07 (0.05)	0.04 (0.04)	0.05 (0.04)	0.10*** (0.04)	0.10*** (0.04)	0.04 (0.04)	0.05 (0.04)
Treatment Sample Size	475		495		540		615	

Panel B. Treatment Impacts on Four Cohorts (2008-2011).

	Unadj Impact	Fixed Effects	Cohort Interact
<u>Semester 4</u>			
Retention (pct)	1.7 (1.2)	1.9* (1.2)	1.8 (2.6)
Credits earned	0.2 (0.2)	0.3 (0.2)	-0.1 (0.4)
Earned 12+ credits (pct)	1.0 (1.4)	1.2 (1.3)	-4.2 (3.0)
Cumulative GPA	0.05** (0.02)	0.06** (0.02)	0.06 (0.05)
<u>Semester 5</u>			
Retention (pct)	0.4 (1.7)	0.7 (1.6)	-0.1 (2.8)
Credits earned	0.2 (0.3)	0.3 (0.2)	0.3 (0.4)
Earned 12+ credits (pct)	2.2 (1.8)	2.5 (1.8)	2.6 (3.1)
Cumulative GPA	0.03 (0.03)	0.04 (0.03)	0.06 (0.05)
<u>Semester 6</u>			
Retention (pct)	-0.2 (1.7)	0.0 (1.7)	-1.5 (2.9)
Credits earned	-0.2 (0.3)	-0.1 (0.2)	-0.3 (0.4)
Earned 12+ credits (pct)	-1.2 (1.8)	-1.0 (1.8)	-2.5 (3.1)
Cumulative GPA	0.03 (0.03)	0.04 (0.03)	0.07 (0.05)
<u>Cumulative Outcomes</u>			
Credits completed	2.3*** (0.6)	2.4*** (0.6)	0.9 (1.7)
Cumulative GPA	0.05** (0.02)	0.06*** (0.02)	0.07 (0.05)
Treatment Sample Size	2125		

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Sample sizes vary in panel B--the maximum sample size is presented.
- (3) Outcomes include enrollment at any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (4) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (5) The fixed effects model has college fixed effects; the cohort interaction model has fixed effects plus treatment by cohort interactions.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A7. Adjusted Treatment Impacts on Academic Outcomes for Cohort 1.

	Unadj Impact	Cov Adj
<u>Semester 1 (treatment began)</u>		
Credits earned	0.3 (0.2)	0.2 (0.2)
Earned 12+ credits (pct)	1.1 (2.1)	1.1 (2.0)
Cumulative GPA	0.03 (0.07)	0.02 (0.06)
<u>Semester 2</u>		
Retention (pct)	-0.6 (1.3)	-0.5 (1.3)
Credits earned	-0.0 (0.3)	-0.1 (0.3)
Earned 12+ credits (pct)	-2.6 (3.0)	-2.6 (2.9)
Cumulative GPA	0.04 (0.06)	0.03 (0.06)
<u>Semester 3</u>		
Retention (pct)	0.9 (2.6)	0.7 (2.6)
Credits earned	0.1 (0.4)	0.1 (0.4)
Earned 12+ credits (pct)	1.7 (3.4)	1.2 (3.3)
Cumulative GPA	0.02 (0.06)	0.01 (0.06)
<u>Semester 4</u>		
Retention (pct)	-2.4 (3.0)	-2.4 (3.0)
Credits earned	-0.7 (0.5)	-0.7 (0.5)
Earned 12+ credits (pct)	-8.0** (3.6)	-7.9** (3.5)
Cumulative GPA	0.02 (0.06)	0.01 (0.06)
<u>Semester 5</u>		
Retention (pct)	-2.7 (3.3)	-2.7 (3.2)
Credits earned	-0.1 (0.5)	-0.2 (0.5)
Earned 12+ credits (pct)	0.3 (3.7)	-0.1 (3.6)
Cumulative GPA	0.02 (0.06)	0.00 (0.06)
Treatment Sample Size	348	

Appendix A7. Adjusted Treatment Impacts on Academic Outcomes for Cohort 1 (Continued).

	Unadj Impact	Cov Adj
<u>Semester 6</u>		
Retention (pct)	-4.3 (3.4)	-4.3 (3.3)
Credits earned	-0.8 (0.5)	-0.8 (0.5)
Earned 12+ credits (pct)	-6.0 (3.7)	-5.5 (3.6)
Cumulative GPA	0.02 (0.06)	0.01 (0.06)
<u>Cumulative Outcomes</u>		
Credits completed	-1.3 (2.0)	-1.5 (1.9)
Full-time (12+ credits/sem, pct)	-7.2** (3.6)	-7.0** (3.5)
Number of semesters enrolled	-0.09 (0.11)	-0.09 (0.11)
Cumulative GPA	0.02 (0.06)	0.01 (0.06)
Treatment Sample Size	348	

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Outcomes include enrollment at any of the 13 four-year University of Wisconsin System universities, as well as the 13 two-year University of Wisconsin Colleges.
- (3) If a student was not enrolled in a given semester, the cumulative GPA from the previous semester is reported.
- (4) The covariate-adjusted model includes race, gender, parental education, age, EFC, and college fixed effects.
- (5) The sample used here is subsample B with a small amount of missing data on covariates.
- (6) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.

Appendix A8: Covariate-Adjusted Impacts on Financial Aid Packages over Three Years.

	2008-2009		2009-2010		2010-2011	
	Unadj Impact	Cov Adj	Unadj Impact	Cov Adj	Unadj Impact	Cov Adj
Total financial aid received (\$)	1465.4*** (224.2)	1580.7*** (202.6)	568.8 (447.3)	704.3 (431.0)	-12.9 (554.0)	94.5 (540.8)
Any grants or scholarships (pct)	-0.3 (0.3)	-0.3 (0.3)	-1.3 (3.0)	-0.8 (2.9)	-2.2 (3.5)	-1.8 (3.4)
Avg. amount of grant aid (\$)	2716.3*** (219.5)	2894.8*** (152.8)	1769.5*** (373.1)	1908.1*** (345.8)	983.0** (412.5)	1064.1*** (395.0)
Wisconsin Scholars Grant (pct)	92.5*** (1.4)	92.6*** (1.4)	68.0*** (2.5)	68.6*** (2.5)	49.5*** (2.7)	50.1*** (2.6)
Avg. amount of WSG (\$)	3152.0*** (52.6)	3153.7*** (51.3)	2249.1*** (87.3)	2269.0*** (84.9)	1664.4*** (92.9)	1684.7*** (91.0)
Federal Pell Grant (pct)	-0.1 (0.3)	-0.2 (0.3)	-0.4 (3.2)	0.2 (3.1)	-1.5 (3.6)	-1.2 (3.5)
Avg. amount of Pell (\$)	-160.3 (101.3)	-35.6 (34.2)	-195.9 (159.3)	-111.8 (144.6)	-268.8 (186.4)	-210.8 (178.6)
Any loans (pct)	-6.8** (3.1)	-6.9** (3.1)	-7.9** (3.5)	-7.7** (3.5)	-9.1** (3.7)	-8.9** (3.6)
Avg. amount of loans (\$)	-1186.1*** (193.5)	-1244.7*** (174.7)	-1117.0*** (240.1)	-1108.5*** (234.9)	-941.7*** (276.9)	-898.2*** (272.7)
Federal Work-Study (pct)	-3.7 (2.7)	-4.0 (2.6)	-3.5 (2.6)	-3.4 (2.5)	-0.7 (2.4)	-1.2 (2.3)
Avg. amount of work study (\$)	-66.1** (31.2)	-69.0** (29.7)	-45.2 (37.4)	-43.5 (35.8)	-42.0 (38.6)	-46.7 (38.4)
Treatment Sample Size	348		348		348	

SOURCE: University of Wisconsin System.

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) The covariate-adjusted model includes race, gender, parental education, age, EFC, and college fixed effects.
- (3) The sample used here is subsample B with a small amount of missing data on covariates.
- (4) * represents p<.10, ** represents p<.05, and *** represents p<.01.

Appendix A9: Impacts on Financial Aid Packages over Three Years, Conditional on Enrollment.

	2008-2009		2009-2010		2010-2011	
	Control Mean	Treatment Impact	Control Mean	Treatment Impact	Control Mean	Treatment Impact
Total financial aid received (\$)	12011.3	1544.7*** (212.3)	12772.9	849.0** (338.8)	13401.4	628.5 (456.8)
Any grants or scholarships (pct)	100.0	-0.3 (0.3)	93.4	-0.5 (2.2)	92.1	0.4 (2.4)
Avg. amount of grant aid (\$)	7809.2	2758.7*** (212.9)	7505.3	2288.4*** (358.9)	7709.6	1843.0*** (421.2)
Wisconsin Scholars Grant (pct)	0.0	92.8*** (1.4)	0.0	80.4*** (2.4)	0.0	69.7*** (3.0)
Avg. amount of WSG (\$)	0.0	3213.9*** (51.0)	0.0	2763.9*** (84.8)	0.0	2379.3*** (104.9)
Federal Pell Grant (pct)	99.9	-0.1 (0.3)	87.5	0.2 (2.8)	86.0	0.8 (3.1)
Avg. amount of Pell (\$)	3391.1	-159.0 (101.1)	3687.8	-177.8 (159.1)	3948.2	-205.7 (192.9)
Any loans (pct)	80.0	-6.0* (3.2)	82.0	-9.2*** (3.5)	82.5	-11.6*** (3.7)
Avg. amount of loans (\$)	3991.8	-1139.8*** (197.1)	4904.2	-1325.2*** (266.6)	5363.0	-1145.3*** (319.4)
Federal Work-Study (pct)	17.4	-4.0 (2.8)	19.9	-5.5* (3.2)	15.5	-0.8 (3.2)
Avg. amount of work study (\$)	193.3	-71.8** (31.9)	257.0	-66.6 (46.4)	251.8	-56.4 (52.9)
Sample Size	453	341	362	279	332	243

SOURCES: University of Wisconsin System universities (panel A), University of Wisconsin System (panel B).

Notes:

- (1) Standard errors from the regression are listed below the regression coefficients.
- (2) Students must have been enrolled within the UW System for both semesters in a given academic year to appear in this table.
- (3) * represents $p < .10$, ** represents $p < .05$, and *** represents $p < .01$.