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Interventions to Promote Postsecondary Attainment: *April 2018 Update*

The Washington State Legislature directed the Washington State Institute for Public Policy (WSIPP) to "calculate the return on investment to taxpayers from evidence-based prevention and intervention programs and policies."[1] In continuing this effort, WSIPP's Board of Directors authorized WSIPP to work on a joint project with the MacArthur Foundation and the Pew Charitable Trusts Results First Initiative. This project extended WSIPP's benefit-cost analysis to a variety of new topics, including postsecondary education programs.

In December 2016, we presented meta-analytic and benefit-cost results for a variety of postsecondary education programs.[2] The current report updates our benefit-cost methodology and the previous findings for some interventions. We also present results for newly reviewed programs.

In Section I, we explain our research approach. In Section II, we describe changes since our last report. Section III presents our new findings for four topic areas:

1) Financial interventions,
2) Student support interventions,
3) Brief information interventions, and
4) Concurrent enrollment interventions.

Summary

WSIPP's Board of Directors authorized WSIPP to work on a joint project with the MacArthur Foundation and the Pew Charitable Trusts to extend WSIPP's benefit-cost analysis to higher education programs.

We present new findings for four topic areas: 1) financial interventions; 2) student support interventions; 3) brief information interventions; and 4) concurrent enrollment interventions.

The findings presented in this report expand on results released in a December 2016 report. For each intervention, we gathered all the research we could locate from the U.S. We screened the studies for methodological rigor and then computed an average effect of the programs on specific outcomes. When possible, we also independently calculated benefits and costs and conducted a risk analysis to determine which programs consistently have expected benefits that exceed costs.

We find evidence that most of the reviewed interventions achieve at least some desired outcomes. Some have benefits that outweigh the costs and others do not. We present these findings in this report and display them in Exhibits 5 through 11.

Suggested citation: Hoagland, C., Bitney, K., Cramer, J., Fumia, D., & Lee, S. (2018). *Interventions to promote postsecondary attainment: April 2018 update* (Document Number 18-04-2301). Olympia: Washington State Institute for Public Policy.

[1] Engrossed Substitute House Bill 1244, Chapter 564, Laws of 2009.

[2] Fumia, D., Nicolai, C., Nafziger, M., Hirsch, M., & Hoagland, C. (2016). *Interventions to promote postsecondary attainment: A review of the evidence and benefit-cost analysis.* (Doc. No. 16-12-2301). Olympia: Washington State Institute for Public Policy.

I. Research Methods

The Washington State Legislature or WSIPP's Board of Directors often directs WSIPP to assess the effectiveness and benefits and costs of programs and policies that could be implemented in Washington State. These studies are designed to provide policymakers with objective information about which programs or policy options ("programs" or "interventions") work to achieve desired outcomes and when possible, report on the likely long-term economic consequences of these options.

WSIPP implements a rigorous, three-step research approach for this type of study:

1) Identify what works (and what does not). For each program under consideration, we systematically review all rigorous research evidence and estimate the program's effect on a desired outcome or set of outcomes. The evidence may indicate that a program worked (i.e. had a desirable effect on outcomes), caused harm (i.e. had an undesirable effect on outcomes), or had no detectable effect.

2) Assess the return on investment. Given the estimated effect of a program from Step 1, we estimate—in dollars and cents—how much the program would benefit people in Washington were it implemented and how much it would cost the taxpayers to achieve this result. We use WSIPP's benefit-cost model to develop standardized, comparable results for all programs that illustrate the expected returns on investment. We present these results as net present values on a per-participant basis. We also consider how monetary benefits are distributed across program participants, taxpayers, and other people in society.

3) Determine the risk of investment. We allow for uncertainty in our estimates by calculating the probability that a program will at least "break even" if critical factors—like the actual cost to implement the program and the precise effect of the program—are lower or higher than our estimates.

We follow a set of standardized procedures (see Exhibit 1) for each of these steps. These standardized procedures support the rigor of our analysis and allow programs to be compared on an "apples-to-apples" basis.

For full detail on WSIPP's methods, see WSIPP's Technical Documentation.[3]

[3] WSIPP (December 2017). *Benefit-cost technical documentation*. Olympia, WA: Author.

Exhibit 1

WSIPP's Three-Step Approach

Step 1: Identify what works (and what does not)

We conduct a meta-analysis—a quantitative review of the research literature—to determine if the weight of the research evidence indicates whether desired outcomes are achieved, on average.

WSIPP follows several key protocols to ensure a rigorous analysis for each program examined:

- Search for all studies on a topic—We systematically review the national research literature and consider all available studies on a program, regardless of their findings. That is, we do not "cherry pick" studies to include in our analysis.
- Screen studies for quality—We only include rigorous studies in our analysis. We require that a study reasonably attempts to demonstrate causality using appropriate statistical techniques. For example, the comparison group must be similar to the treatment group on at least academic, demographic, and socioeconomic characteristics. Studies that do not meet our minimum standards are excluded from analysis.
- Determine the average effect size—We use a formal set of statistical procedures to calculate an average effect size for each outcome, which indicates the expected magnitude of change caused by the program (e.g., dual enrollment) for each outcome of interest (e.g., college enrollment).

Step 2: Assess the return on investment

WSIPP has developed, and continues to refine, an economic model to provide internally consistent monetary valuations of the benefits and costs of each program on a per-participant basis.

Benefits to individuals and society may stem from multiple sources. For example, a program that reduces the need for government services decreases taxpayer costs. If that program also improves participants' educational outcomes, it will increase their expected labor market earnings. Finally, if the program reduces crime, it will also reduce expected costs to crime victims.

We also estimate the cost required to implement an intervention. If the program is operating in Washington State, our preferred method is to obtain the service delivery and administrative costs from state or local agencies. When this approach is not possible, we estimate costs using the research literature, using estimates provided by program developers, or using a variety of sources to construct our own cost estimate.

Step 3: Determine the risk of investment

Any tabulation of benefits and costs involves a degree of uncertainty about the inputs used in the analysis as well as the bottom-line estimates. An assessment of risk is expected in any investment analysis, whether in the private or public sector.

To assess the uncertainty in our bottom-line estimates, we look at thousands of different scenarios through a Monte Carlo simulation. In each scenario we vary a number of key factors in our calculations (e.g., expected effect sizes, program costs), using estimates of error around each factor. The purpose of this analysis is to determine the probability that a particular program or policy will produce benefits that are equal to or greater than costs if the real-world conditions are different than our baseline assumptions.

Programs Reviewed

To assess the effectiveness of programs designed to improve college outcomes, WSIPP reviewed existing studies of programs implemented in the U.S. since 1975. We focus on programs for students attending college early in their career by including studies with an average participant age under 28 for interventions occurring in college and under 20 for interventions occurring prior to college.

To be included in this report, studies examining programs prior to college must report outcomes for the whole study sample. Thus, we exclude studies that report outcomes for only college enrollees when the intervention occurs prior to college. We also exclude studies that only use aggregated enrollment or graduation rates measured at the state level. These studies may not explain individual-level student behavior.

Brief descriptions of each newly reviewed program can be found in Section III.

Outcomes Examined

To be in our analysis, studies must include one or more quantitative measures of an educational outcome. Postsecondary outcomes of interest include enrollment, developmental course credits earned,[4] college grade point average (GPA), student persistence in college, and degree receipt. We also report other outcomes (such as labor market earnings) when available. We report outcomes for programs implemented with 2- and 4-year college students separately when possible because institution type could affect program implementation, outcomes, benefits, or costs.

The primary economic benefit we consider in our benefit-cost model is the change in an individual's future earnings associated with changes in educational outcomes—i.e., enrollment, persistence, and degree receipt.[5] We also estimate societal benefits associated with educational attainment that accrue above and beyond the individual returns to education.

For higher education programs, we consider two types of costs: program costs and costs associated with attending college.

First, we estimate the cost of the specific program, including costs associated with staff time, administration, and materials.

Second, we consider the costs of educating a student at an institution of higher education. Those in college incur costs related to tuition and fees as well as books and related materials. If a program increases rates of college enrollment or persistence, then affected students incur the costs of attendance. We calculate the total per-student expenditures associated with changes in educational attainment at 2- and 4-year institutions. We also consider the value of earnings students forgo while attending college.

[4] Developmental courses refer to pre-college-level courses intended to prepare students for college-level courses. Developmental courses may also be referred to as "remedial courses," and we use these terms interchangeably.

[5] We cannot currently monetize benefits from changes in GPA or developmental course credits earned.

II. Summary of Updates

This report includes updates to our program reviews and changes to our benefit-cost methodology for higher education programs.

Program Review Updates

In our prior report, we focused primarily on programs for high school students or graduates. This report expands our analysis of programs targeted at students in college and presents findings for newly reviewed programs. We include a list of new and updated programs in Exhibit 2.

The remainder of the report focuses on the findings for newly reviewed programs. Findings for previously reviewed programs may have changed due to updates to the benefit-cost model, updates to literature reviews, or changes to estimated effect sizes.[6] See Appendix I for a list of changes to previously reviewed programs and updated findings. Updated findings for all higher education programs can also be found on our website.[7]

Benefit-Cost Updates

We made three major changes to the way we estimate the monetary benefits of postsecondary interventions.

First, we now estimate effects and monetary benefits for programs targeting low-income students separately from programs targeting all students. Low-income students tend to receive more federal and/or state aid to cover the costs of tuition, which we now account for when calculating the benefits from higher education. We also account for differences in the average rates of high school graduation, college enrollment, and college completion for low-income students compared to the average rates for students from all income levels.

Second, we now distinguish between interventions for high school graduates and interventions for high school students when estimating monetary benefits from college enrollment and degree receipt. We previously assumed that all high school student program participants graduate from high school when estimating college enrollment and completion rates. This report includes benefit-cost findings from several interventions targeting high school *students* (who may or may not graduate from high school), which are distinct from benefit-cost findings from interventions for high school graduates.

Finally, we added the ability to estimate monetary benefits for the effects of interventions on the years of college completed through measures of student persistence.[8]

More detailed information about program and benefit-cost updates can be found in Appendices II and III.

[6] We adjust a study's effect size based on the rigor of the research design. We report adjusted effect sizes throughout this report. We also report unadjusted effects for each program on our website.

[7] http://www.wsipp.wa.gov/BenefitCost?topicId=11.

[8] We generally define persistence as the percentage of students enrolling in additional years of college following initial enrollment. We measure persistence within the 1st year (enrolling in spring semester of the 1st year) and persistence into additional years (enrolling in the fall term of the 2nd, 3rd, 4th, or 5th year of college).

Exhibit 2

Program Reviews

New programs
Accelerated Study in Associate Programs (ASAP)
Brief informational interventions
College in the high school
Community college promise programs
Early college high schools
Learning communities—linked developmental and college courses
Learning communities—linked developmental and student success courses
Need-based grants
Student success courses
Tuition sticker price
Updated programs
College advising provided by counselors
College advising provided by peer mentors
Dual enrollment
Early commitment programs
Merit aid
Opening Doors advising in community college
Performance-based scholarships
Summer outreach counseling
Text message reminders

III. Research Findings

We present meta-analytic and, when possible, benefit-cost findings for four topic areas:

1) Financial interventions,
2) Student support interventions,
3) Brief information interventions, and
4) Concurrent enrollment interventions.

For each topic area, we present key considerations, brief descriptions, and summary findings for each program we reviewed along with an exhibit displaying meta-analytic and benefit-cost findings, when possible.

Descriptions of how to read the meta-analytic and benefit-cost exhibits are provided in Exhibits 3 and 4.

Exhibit 3

How to Interpret WSIPP's Meta-Analytic Results (Exhibits 5, 6, 8, & 10)

The columns of the meta-analytic exhibits are described below.

1) Intervention describes the name of the intervention or policy analyzed. Some programs and policies are general categories of a type of intervention, while others are specific name-brand programs. Descriptions of each program can be found preceding each exhibit as well as on our website.
2) Outcome identifies the specific outcome of interest measured in the studies included in the meta-analysis.
3) # of effect sizes represents the number of effects we included in our meta-analysis. Generally, this number reflects the number of studies included in the meta-analysis.
4) Effect size is a standard metric that summarizes the degree to which a program or policy (e.g., dual enrollment) affects a measured outcome of interest (e.g., college enrollment). Positive effect sizes indicate that, averaged across all included studies, the intervention increased the likelihood of the outcome for treatment groups. Negative effect sizes indicate that, on average, participation in the intervention reduced the likelihood of the outcome. We report adjusted effect sizes, which account for the rigor of study research designs.
5) Standard error identifies the variation or uncertainty in our estimated adjusted effect size. Our effect sizes are estimates and can vary depending on numerous factors. The smaller the standard error, the more certain we are about the estimated effect size.
6) p-value is another measure of certainty in our estimated effect size. The p-value can range from 0 to 1 and represents the chance that we would observe the reported effect if the intervention truly had no effect at all. We report the p-value associated with the unadjusted effect size.
7) # in treatment represents the total number of treated individuals across all studies included in the meta-analysis.

Exhibit 4

How to Interpret WSIPP's Benefit-Cost Results (Exhibits 7, 9, & 11)

The numbered columns on the benefit-cost exhibits are described below.

1) Program name describes the name of the intervention analyzed. Some programs are general categories of a type of intervention, while others are specific name-brand programs. Descriptions of each program can be found preceding each exhibit as well as on our website.#
2) Total benefits are the average benefits of the intervention, per-participant. This is the sum of the taxpayer and non-taxpayer benefits.
3) Taxpayer benefits are benefits that accrue to the taxpayers of the state of Washington through avoided publicly funded health care system costs and/or taxes participants would pay on their increased labor market earnings.
4) Non-taxpayer benefits include benefits that accrue directly to program participants; benefits to others, such as reduced costs to private health insurance providers; and indirect benefits, such as the value of a statistical life and the deadweight costs of taxation.
5) Costs are the estimated per-participant cost to implement the program in Washington, relative to the cost of treatment as usual. If the cost is positive, the intervention is estimated to be cheaper than the treatment as usual.
6) Benefits minus costs (net present value) are the net benefits, or the difference between the total benefits and the cost to implement the program, per participant. If this number is positive, the expected benefits of the program exceed the estimated cost. If this number is negative, the program is estimated to cost more than the sum of the expected benefits.
7) Benefit to cost ratio represents the estimated value to Washington State for each dollar invested in the program. It is the total benefits, divided by the cost of the program. If a program cost is positive, the benefit-to-cost ratio is designated as "n/a"— not applicable.
8) Chance benefits will exceed costs describes the risk of the investment. In our benefit-cost analysis, we account for uncertainty in our estimates by allowing key inputs to vary across thousands of scenarios. We run our benefit-cost model 10,000 times; this statistic shows the percentage of cases in which the total benefits were greater than the costs.

Note:

The benefit-cost section of WSIPP's website presents our current findings for a variety of public policy topics. Items on these tables are updated periodically as new information becomes available. Interested readers can find more information by clicking each entry in the tables.

1) Financial interventions

Financial interventions are programs that change the cost of college attendance for students. In December 2016, we reported on financial aid programs. We expand our prior analysis to include new financial aid programs and add findings for tuition price policies. Meta-analytic findings for financial aid and tuition price changes are reported in Exhibit 5.

We cannot currently estimate the benefits and costs resulting from changes in tuition price or financial aid programs. Changes in tuition price change the cost of education, while financial aid programs shift the cost from one payer to another. Our benefit-cost model cannot currently incorporate these changes in college costs appropriately.

Tuition sticker price increase

Studies included in these meta-analyses estimate the effects of a change in the tuition sticker price on students' college outcomes, including the likelihood that a student will enroll in college. Sticker price refers to the advertised, full-price tuition. Results are presented as "elasticities" and are interpreted as the percent change in an outcome we expect from a 1% increase in tuition price. See Appendix IV for a discussion about interpreting elasticities in the tuition price results.

Because there are substantive differences in the costs of attending 2-year and 4-year colleges, students may respond differently to tuition price changes at 2-year and 4-year colleges. We analyze price changes at 2- and 4-year colleges separately.

These meta-analyses include only studies that examined full tuition price and used individual-level data in their analyses. See Appendix IV for our meta-analyses of alternative tuition price specifications.

In our preferred analysis, we find that an increase in tuition at 2-year institutions decreases enrollment and graduation at 2-year schools. Similarly, we find that 4-year enrollment and graduation decline when tuition at 4-year institutions increases. We also find some evidence that an increase in tuition at 4-year institutions increases enrollment at 2-year colleges.

Financial aid programs

The primary purpose of financial aid programs is to reduce a recipient's cost of college attendance. Individual students may receive direct aid from local, state, and federal government sources; postsecondary institutions; and private organizations. Financial aid programs may give money to the recipient or directly to the higher education institution. Aid programs often target low-income students, although income eligibility requirements may vary.

In this report, we present meta-analytic findings for two types of financial aid programs.

Need-based grants. Need-based grant programs provide means-tested financial assistance to low-income students. Need-based grants can come from many sources and in various forms. In our analysis, we include studies of need-based federal and state grants with minimal eligibility requirements. Example programs in this review include the Federal Pell Grant Program[9] and state grant programs similar

[9] https://studentaid.ed.gov/sa/types/grants-scholarships/pell.

to Washington's State Need Grant.[10] Studies evaluating grants funded by private entities may also be included if the grants are implemented at the state or national level. We exclude need-based aid provided by colleges and universities as well as other grant programs that have conditions for aid receipt other than income (such as work-study programs or merit-based aid).

Our findings indicate that need-based grants available to students prior to college increase enrollment in and graduation from 4-year institutions, while we find little effect of these grants on attainment at 2-year institutions. When provided to college students, we find that need-based grants increase 4-year degree receipt and earnings later in life.

Community college promise programs. Promise programs are place-based scholarship programs. Typically, promise programs provide free tuition for at least one year of college and have minimal academic requirements. Promise programs also have an early outreach component so that students are made aware of the financial aid availability and its requirements early in their high school career.

In our previous analysis of early commitment programs, we included the outcomes from promise programs, which provide tuition coverage for at least one 4-year institution.[11] In this report, we reviewed promise programs that offer tuition coverage only for community college. We found only one example of a rigorously evaluated program, Knox Achieves (later renamed Tennessee Achieves).

From this single evaluation, we find positive effects on high school graduation and enrollment at 2-year institutions, while we find a decrease in 4-year college enrollment.

[10] https://www.wsac.wa.gov/state-need-grant.

[11] Early commitment programs refer to the broad category of programs that offer assured college financial assistance early in students' academic careers, conditional on meeting certain program requirements. Promise programs are a type of early commitment program.

Exhibit 5

Meta-Analytic Results: Financial Interventions

Intervention	Outcome	# of effect sizes	Effect size	Standard error	p-value	# in treatment
Tuition price changes:						
Tuition sticker price increase at 2-year college (for college students)	**Persistence within 1st year**	1	-0.088	0.093	0.344	33,513
Tuition sticker price increase at 2-year college (for high students and graduates)	Apply to 4-year college	1	-0.037	0.001	<0.001	1,424,316
	Enroll in 2-year college	5	-0.144	0.042	0.001	597,044
	Enroll in 4-year college	4	0.021	0.021	0.320	593,969
	Enroll in any college	15	-0.199	0.043	<0.001	3,220,756
	Graduate with 2-year degree	1	-0.280	0.127	0.027	294,089
	Graduate with 4-year degree	2	0.200	0.249	0.422	379,267
	Graduate with any degree	3	-0.413	0.457	0.367	16,594
Tuition sticker price increase at 4-year college (for college students)	**Persistence within 1st year**	1	-0.064	0.012	<0.001	61,481
	Persistence into 5th year	2	0.282	0.221	0.202	7,653
Tuition sticker price increase at 4-year college (for high school students and graduates)	Apply to 4-year college	1	-0.037	0.001	<0.001	1,424,316
	Enroll in 2-year college	1	0.106	0.046	0.022	10,254
	Enroll in 4-year college	4	-0.280	0.086	0.001	38,227
	Enroll in any college	23	-0.117	0.024	<0.001	3,264,722
	Graduate with any degree	2	-0.895	0.300	0.003	9,774
Financial aid:						
Need-based grants (for high school students and graduates)	**Enroll in 2-year college**	1	0.003	0.029	0.927	3,776
	Enroll in 4-year college	1	0.097	0.033	0.003	3,485
	Enroll in any college	7	0.131	0.049	0.008	33,407
	Persistence into 2nd year	2	0.199	0.146	0.174	3,967
	Graduate with 2-year degree	1	0.004	0.028	0.881	4,423
	Graduate with 4-year degree	2	0.169	0.028	<0.001	4,875
Need-based grants (for college students)	**Transfer from 2- to 4-year college**	1	0.019	0.071	0.793	397
	Persistence within 1st year	4	0.082	0.030	0.001	7,797
	Persistence into 2nd year	8	0.051	0.017	0.526	37,497
	Persistence into 3rd year	4	0.023	0.037	0.526	1,820
	Graduate with 2-year degree	2	-0.004	0.105	0.973	772
	Graduate with 4-year degree	2	0.101	0.015	<0.001	14,460
	College grade point average	7	0.017	0.011	0.117	39,463
	Earnings	1	0.053	0.022	0.015	13,860
Community college promise programs (for high school students)	High school graduation	1	0.262	0.055	<0.001	2,071
	Enroll in 2-year college	1	0.754	0.030	<0.001	2,071
	Enroll in 4-year college	1	-0.209	0.039	<0.001	2,071

Note:
Although we cannot estimate the overall benefits and costs of tuition price changes and financial aid programs at this time, bolded outcomes are generally monetizeable in our benefit-cost approach.

2) Student support interventions

Our review of student support interventions expands and updates student advising programs from the December 2016 report. The student support interventions included here aim to help college students adjust to and navigate college. We report meta-analytic findings for three types of student support interventions in Exhibit 6 and benefit-cost findings in Exhibit 7.

Accelerated Study in Associate Programs (ASAP). ASAP is a program intended to increase graduation rates among community college students. ASAP includes 1) mandatory full-time study; 2) financial support; 3) frequent, intensive advising; 4) learning communities; and 5) condensed, blocked course schedules. The target population is low-income, first-time first-year students who intend to study full time. Students can remain in ASAP until they leave college. The average ASAP student remains enrolled in the program for at least four semesters.

On average, we find that ASAP increases educational attainment and achievement by increasing the likelihood of transferring to a 4-year institution, persisting in college, receiving a 2-year degree, and improving college GPA. We also find an increase in developmental (i.e. remedial) credits earned. We cannot conduct a benefit-cost analysis for ASAP because we are unable to estimate costs appropriately. Similar to financial aid programs described in the previous section, the financial support component of ASAP changes who pays for college.

Student success courses. Student success courses are for-credit courses designed to teach first-time students nonacademic skills and increase college readiness. The content of these courses can vary widely but generally includes topics like study skills, time management, academic planning, college orientation, and personal wellness. We exclude studies of courses that are bundled first-year courses or built into living and learning communities (where all students in the course live on the same floor or in the same dorm).

Our findings indicate that student success courses increase educational attainment. When targeted at 2-year college students, we find that student success courses increase 2-year degree receipt. On average, benefits exceed costs 65% of the time.

For student success courses targeting 4-year college students, we find increases in persistence within the 1st year—i.e. from the first to second semester—and into the 2nd year. We expect positive net benefits 64% of the time.

Linked learning communities.

Linked learning communities co-enroll cohorts of undergraduate students in two or more courses with the aim of improving academic achievement through increased social and curricular integration. Learning community instructors, sometimes with assistance from a coordinator, integrate curricula by creating lesson plans and shared assignments that facilitate collaboration among students and connections between courses. We examine two types of linked learning communities.

Learning communities—linked developmental and college courses. Student cohorts were co-enrolled in a developmental English, math, or reading course linked with at least one other standard college course (e.g., English composition or American history). While all included studies examined a model of linking developmental education with college-level courses, there was variation. Some linked a developmental education course with one or more courses, while others provided additional supports like tutoring and vouchers for textbooks. There were also varying levels of collaboration and curricular integration between instructors, coordinators, and school faculty across studies. In all included studies, students were enrolled in a learning community for a single semester.

We find that learning communities that link development and college courses increase remedial credits earned. In our analysis, the benefits do not exceed the costs, on average. We expect positive net benefits 18% of the time.

Learning communities—linked developmental and student success courses. Student cohorts were co-enrolled in a developmental math or reading course linked with a student success course, which provided lessons focused on time management practices, goal setting and planning, study skills, and using academic and campus resources. In all included studies, students were enrolled in a learning community for a single semester.

On average, we find little effect of learning communities that link developmental and student success courses on educational attainment outcomes. We find that estimated benefits exceed costs 34% of the time.

Exhibit 6

Meta-Analytic Results: Student Support Interventions

Intervention	Outcome	# of effect sizes	Effect size	Standard error	p-value	# in treatment
Accelerated Study in Associate Programs (ASAP)*	**Transfer from 2- to 4-year college**	2	0.183	0.077	<0.001	1,452
	Graduate with 2-year degree	3	0.382	0.100	<0.001	4,786
	Graduate with 4-year degree	1	0.164	0.232	0.226	1,001
	Persistence within 1st year	1	0.402	0.095	<0.001	460
	Persistence into 2nd year	3	0.198	0.044	<0.001	4,786
	College grade point average	2	0.030	0.023	0.018	3,717
	Remedial credits earned	1	0.237	0.067	<0.001	451
Student success courses (for 2-year college students)	**Persistence within 1st year**	1	0.038	0.066	0.568	458
	Persistence into 2nd year	1	0.007	0.066	0.912	458
	Graduate with 2-year degree	1	0.026	0.015	0.001	12,245
	College grade point average	1	0.024	1.808	0.990	86
Student success courses (for 4-year college students)	**Persistence within 1st year**	3	0.298	0.185	0.012	332
	Persistence into 2nd year	4	0.143	0.071	0.005	671
	Persistence into 3rd year	1	0.087	0.140	0.243	181
	Persistence into 4th year	1	0.092	0.194	0.374	94
	College grade point average	1	0.047	0.157	0.573	54
Learning communities—linked developmental and college courses (for 2-year college students)	**Persistence within 1st year**	4	0.026	0.028	0.360	2,738
	Persistence into 2nd year	2	0.048	0.040	0.229	1,377
	Remedial credits earned	4	0.091	0.044	0.038	2,738
Learning communities—linked developmental and student success courses (for 2-year college students)	**Persistence within 1st year**	2	0.054	0.043	0.211	1,470
	Persistence into 2nd year	1	-0.009	0.065	0.883	709
	Remedial credits earned	2	0.031	0.059	0.604	1,470

Notes:

Bolded outcomes are monetizeable.

* We cannot report benefit-cost results for ASAP at this time because of the financial assistance portion of the program.

Exhibit 7

Benefit-Cost Results: Student Support Interventions

Program name (1)	Total benefits (2)	Taxpayer benefits (3)	Non-taxpayer benefits (4)	Costs (5)	Benefits minus costs (net present value) (6)	Benefit to cost ratio (7)	Chance benefits will exceed costs (8)
Student success courses (for 2-year college students)	$539	$55	$484	($276)	**$264**	$1.96	**65 %**
Student success courses (for 4-year college students)	$3,007	$705	$2,301	($589)	**$2,418**	$5.11	**64 %**
Learning communities—linked developmental and college courses (for 2-year college students)	$219	$101	$118	($867)	**($647)**	$0.25	**18 %**
Learning communities—linked developmental and student success courses (for 2-year college students)	$147	$50	$97	($381)	**($234)**	$0.39	**34 %**

3) Brief information interventions

Brief information interventions are communications, such as physical mail and brief conversations, intended to help high school students and their families make accurate judgments about the costs and benefits of attending college. The interventions are non-intrusive, are designed to reduce confusion about college and financial aid options, and do not encourage students to attend specific colleges. The target population is low-income high school seniors, especially those who would be more likely to apply to college if they knew more about the availability of financial aid. Intervention intensity varies among the five programs included in this analysis—while some programs mailed two to three generic letters, others mailed packets of information customized to students' locations and characteristics (e.g. family income) or provided brief one-on-one conversations about financial aid opportunities. We present meta-analytic results for this type of intervention in Exhibit 8 and benefit-cost results in Exhibit 9.

We find that, on average, the expected monetary benefits of brief information interventions outweigh costs 45% of the time.

Exhibit 8

Meta-Analytic Results: Brief Information Interventions

Intervention	Outcome	# of effect sizes	Effect size	Standard error	p-value	# in treatment
Brief information interventions (for high school students)	Apply to 4-year college	2	0.110	0.113	0.331	114,479
	File a FAFSA	2	-0.070	0.045	0.126	966
	Enroll in 2-year college	2	0.002	0.023	0.923	63,872
	Enroll in 4-year college	2	-0.003	0.009	0.738	63,872

Note:
Bolded outcomes are monetizeable.

Exhibit 9

Benefit-Cost Results: Brief Information Interventions

Program name (1)	Total benefits (2)	Taxpayer benefits (3)	Non-taxpayer benefits (4)	Costs (5)	Benefits minus costs (net present value) (6)	Benefit to cost ratio (7)	Chance benefits will exceed costs (8)
Brief information interventions (for high school students)	($206)	($38)	($168)	($72)	**($278)**	($2.86)	**45%**

4) Concurrent enrollment interventions

Concurrent enrollment interventions allow high school students to simultaneously earn transferrable college and high school credits upon course completion. We previously reviewed one type of concurrent enrollment program (dual enrollment) in our December 2016 report. We update those findings (see Appendix I) and examine two additional types of concurrent enrollment in this report. Meta-analytic and benefit-cost results for these interventions are displayed in Exhibits 10 and 11, respectively.

College in the high school. College in the high school programs allow high school sophomores, juniors, and seniors to complete college courses on their high school campus. The high school and a partner college work closely to ensure that college in the high school coursework is comparable to similar courses taught on the college campus.

We find positive effects of college in the high school on high school graduation and high school GPA. Based on our analysis, we expect the benefits to outweigh the costs of this program more than 99% of the time.

Early college high school. Early college high schools are alternative high schools designed to help under-served and underrepresented students transition to the college environment. Located on college campuses or as small stand-alone schools, early college high schools provide students with the opportunity to take high school and college courses to complete their high school graduation requirements. Unlike dual enrollment programs, where students attend a high school and elect to take courses at a college in their junior or senior year, students enroll in early college high schools in the 9th grade and participate for four years. Curricula are specifically designed to help students transition from high school to college. Upon graduation, students usually have finished the equivalent of two years of college course work (enough to complete a 2-year college degree or enter a 4-year college as a junior).

We identified one rigorous evaluation of ten early college high schools across the United States. All of these high schools were oversubscribed and used lottery systems to select students. In our analysis, we find an increase in the likelihood of enrolling in and graduating from 2-year colleges. We expect benefits to outweigh costs 92% of the time.

Exhibit 10

Meta-Analytic Results: Concurrent Enrollment Interventions

Intervention	Outcome	# of effect sizes	Effect size	Standard error	p-value	# in treatment
College in the high school (for high school students)	High school grade point average	4	0.041	0.028	0.028	1,402
	High school graduation	3	0.276	0.082	0.001	819
Early college high school (for high school students)	**High school graduation**	1	0.150	0.323	0.641	1,010
	Enroll in 2-year college	1	0.511	0.231	0.027	1,044
	Enroll in 4-year college	1	0.120	0.226	0.595	1,044
	Graduate with 2-year degree	1	0.905	0.261	0.001	1,044
	Graduate with 4-year degree	1	0.277	0.195	0.156	1,044

Note:
Bolded outcomes are monetizeable.

Exhibit 11

Benefit-Cost Results: Concurrent Enrollment Interventions

Program name (1)	Total benefits (2)	Taxpayer benefits (3)	Non-taxpayer benefits (4)	Costs (5)	Benefits minus costs (net present value) (6)	Benefit to cost ratio (7)	Chance benefits will exceed costs (8)
College in the high school (for high school students)	$37,546	$10,984	$26,563	($270)	**$37,276**	$139.00	**100%**
Early college high school (for high school students)	$82,595	$19,195	$63,400	($3,965)	**$78,629**	$20.83	**92%**

Appendices

Interventions to Promote Postsecondary Attainment: *April 2018 Update*

I. Results from Previously Reviewed Programs

Changes to our benefit-cost model allowed us to update the results of previously reviewed programs. For example, we added the ability to estimate monetary benefits differently depending on whether the target population is high school students or high school graduates and whether the population is low income, which resulted in some changes to our benefit-cost findings. Appendix II provides additional details about population-specific estimates. We are also now able to estimate the monetary benefits and costs of persistence through college, an outcome for which we formerly reported meta-analytic results only. Details about this new capability can be found in Appendix III. In addition, because of this new capability, we now report findings separately for 2-year and 4-year college students for programs that measure persistence outcomes. Finally, we updated the literature reviews for several programs. Exhibit A1 gives a brief overview of all updated programs.[12] Updated meta-analytic and benefit-cost results are displayed in Exhibits A2 and A3.

[12] Based on an analysis of all studies included in the higher education policy area, we estimated multiplicative adjustment values for studies with less rigorous research designs. Programs with meta-analytic results that changed solely because of this adjustment are not included in Exhibit A1. However, these changes can be found on the website.

Exhibit A1

Changes to Previously Reviewed Programs

Previously reviewed programs	Change	New program name
College advising provided by counselors (for high school students)	Estimated results for high school students (rather than high school graduates) Updated literature review	No change
College advising provided by peer mentors (for high school students)	Estimated results for high school students (rather than high school graduates)	No change
Dual enrollment (for high school students)	Estimated results for high school students (rather than high school graduates) Updated literature review	No change
Early commitment programs (for middle and high school students)	Updated literature review	No change
Merit aid (for high school students)	Disaggregated into two categories: with and without a financial need requirements Updated literature review for merit aid with financial need requirements	Merit aid (for high school students) Merit aid with financial need requirements (for high school students)
Opening Doors advising in community college	No longer examining separately but included in broader intensive advising category Monetized persistence outcome	Intensive advising (for 2-year college students)
Performance-based scholarships (for college students)	Disaggregated into two categories: 2-year and 4-year students Monetized persistence outcome Estimated results for a low-income population	Performance-based scholarships (for 2-year college students) Performance-based scholarships (for 4-year college students)
Performance-based scholarships (for high school students)	Estimated results for a low-income population Estimated results for high school students (rather than high school graduates)	No change
Summer outreach counseling (for high school graduates)	Added a new outcome	No change
Text message reminders (for college students)	Disaggregated into two categories: 2-year and 4-year students Monetized persistence outcome	Text message reminders (for 2-year college students) Text message reminders (for 4-year college students)
Text message reminders (for high school graduates)	Updated literature review	Text message reminders (for high school students and graduates)

Exhibit A2

Meta-Analytic Results: Previously Reviewed Interventions

Intervention	Outcome	# of effect sizes	Effect size	Standard error	P-value	# in treatment
College advising provided by counselors (for high school students)	**Enroll in 2-year college**	3	-0.019	0.060	0.744	9,207
	Enroll in 4-year college	4	0.194	0.063	0.002	11,953
	Persistence into 2nd year	1	0.349	0.070	<0.001	1,687
College advising provided by peer mentors (for high school students)	High school grade point average	1	-0.022	0.041	0.593	1,038
	High school graduation	1	-0.088	0.054	0.106	1,038
	Enroll in 2-year college	2	-0.031	0.044	0.474	1,552
	Enroll in 4-year college	2	0.105	0.043	0.015	1,552
Dual enrollment (for high school students)	High school grade point average	2	0.106	0.061	0.023	275
	High school graduation	4	0.177	0.114	0.210	22,848
	Enroll in 4-year college	2	0.053	0.205	0.959	20,206
	Graduate with 2-year degree	1	-0.270	0.035	<0.001	1,700
	Graduate with 4-year degree	1	0.196	0.013	<0.001	9,723
Early commitment programs (for middle and high school students)	High school grade point average	1	-0.015	0.004	<0.001	88,375
	High school graduation	2	0.108	0.114	0.548	100,991
	Enroll in 2-year college	2	0.013	0.020	0.208	12,841
	Enroll in 4-year college	3	0.106	0.058	0.062	16,387
	Persistence into 4th year	1	-0.060	0.047	0.043	855
	Graduate with 2-year degree	1	0.029	0.047	0.669	855
	Graduate with 4-year degree	2	0.070	0.067	0.236	2,765
	Incarceration	1	-0.010	0.007	0.179	45,393
Intensive advising (for 2-year college students)	**Transfer from 2- to 4-year college**	1	-0.077	0.058	0.181	1,073
	Graduate with 2-year degree	1	-0.105	0.323	0.744	1,073
	Persistence into 2nd year	1	0.098	0.053	0.064	1,073
	Persistence into 3rd year	1	0.079	0.056	0.155	1,073
	College grade point average	2	-0.006	0.059	0.917	1,093
	Remedial credits earned	1	0.086	0.043	0.046	1,073
Merit aid (for high school students)	**Enroll in 2-year college**	5	0.000	0.055	0.995	37,583
	Enroll in 4-year college	5	0.060	0.038	0.114	39,283
	Enroll in any college	8	0.067	0.035	0.039	439,323
	Persistence into 2nd year	2	0.015	0.045	0.729	5,672
	Persistence into 4th year	1	-0.063	0.012	<0.001	20,769
	Graduate with 2-year degree	4	-0.006	0.002	0.008	400,331
	Graduate with 4-year degree	4	-0.015	0.016	0.333	400,331
Merit aid with financial need requirements (for high school students)	**Graduate with 4-year degree**	2	0.244	0.325	0.451	379
	Enroll in 2-year college	1	-0.234	0.066	<0.001	991
	Enroll in 4-year college	4	0.144	0.043	0.001	13,696
	Persistence into 2nd year	2	0.035	0.064	0.591	791
	Persistence into 3rd year	2	0.218	0.069	0.002	735
	Persistence into 4th year	2	0.139	0.091	0.128	578

Intervention	Outcome	# of effect sizes	Effect size	Standard error	P-value	# in treatment
	Persistence into 5th year	1	-0.041	0.158	0.796	210
	College grade point average	2	0.110	0.077	0.152	525
Performance-based scholarships (for 2-year college students)	Graduate with any degree	3	0.055	0.053	0.305	2,036
	Persistence into 2nd year	3	0.052	0.046	0.259	2,036
	Persistence into 3rd year	2	-0.001	0.102	0.992	1,425
	Persistence into 4th year	1	0.054	0.063	0.387	751
	Persistence into 5th year	1	0.136	0.065	0.035	751
	College grade point average	1	0.148	0.483	0.759	366
	Remedial credits earned	1	0.250	0.481	0.603	505
Performance-based scholarships (for 4-year college students)	Graduate with any degree	1	0.109	0.075	0.143	536
	Persistence into 2nd year	1	-0.008	0.081	0.920	536
	Persistence into 3rd year	1	0.094	0.099	0.344	536
	Persistence into 4th year	1	-0.019	0.089	0.828	536
Performance-based scholarships (for high school students)	**Enroll in 4-year college**	1	0.000	0.039	1.000	1,361
	Enroll in 2-year college	1	0.115	0.039	0.003	1,361
	Graduate with any degree	1	0.014	0.044	0.758	1,547
	Persistence into 2nd year	1	0.138	0.052	0.008	1,547
	Persistence into 3rd year	1	0.050	0.045	0.265	1,547
	Persistence into 4th year	1	0.088	0.042	0.038	1,547
Summer outreach counseling (for high school students)	**Enroll in 2-year college**	2	-0.026	0.072	0.721	1,015
	Enroll in 4-year college	2	0.118	0.053	0.025	1,015
	Enroll in any college	5	0.102	0.033	0.030	4,697
Text message reminders (for 2-year college students)	**Persistence into 2nd year**	1	0.331	0.178	0.063	115
Text message reminders (for 4-year college students)	**Persistence into 2nd year**	1	-0.169	0.143	0.235	297
Text message reminders (for high school students and graduates)	**Enroll in 2-year college**	2	0.025	0.080	0.756	6,269
	Enroll in 4-year college	2	0.012	0.057	0.832	6,269

Note:
Bolded outcomes are monetizeable.

Exhibit A3

Updated Benefit-Cost Results for Previously Reviewed Interventions

Program name (1)	Total benefits (2)	Taxpayer benefits (3)	Non-taxpayer benefits (4)	Costs (5)	Benefits minus costs (net present value) (6)	Benefit to cost ratio (7)	Chance benefits will exceed costs (8)
College advising provided by counselors (for high school students)	$28,383	$6,644	$21,739	($782)	**$27,601**	$36.31	**98%**
College advising provided by peer mentors (for high school students)	($1,115)	($1,009)	($106)	($784)	**($1,899)**	($1.42)	**45%**
Dual enrollment (for high school students)	$30,880	$9,501	$21,378	($1,509)	**$29,370**	$20.46	**100%**
Intensive advising in community college (for 2-year college students)	($3,725)	($400)	($3,324)	($812)	**($4,536)**	($4.59)	**16%**
Performance-based scholarships (for 2-year college students)	($1,075)	$11	($1,085)	($2,631)	**($3,705)**	($0.41)	**1%**
Performance based scholarships (for 4-year college students)	($242)	$162	($405)	($2,816)	**($3,059)**	($0.09)	**11%**
Performance-based scholarships (for high school students)	$6,049	$1,312	$4,737	($1,505)	**$4,544**	$4.02	**92%**
Summer outreach counseling (for high school graduates)	$18,247	$4,248	$13,999	($96)	**$18,151**	$189.73	**89%**
Text message reminders (for 2-year college students)	$3,622	$531	$3,091	($35)	**$3,587**	$103.53	**96%**
Text message reminders (for 4-year college students)	($970)	($145)	($825)	($35)	**($1,005)**	($27.73)	**12%**
Text message reminders (for high school students and graduates)	$3,887	$857	$3,031	($9)	**$3,878**	$410.21	**60%**

II. Estimating the Baseline Distribution of Educational Attainment Levels

Estimating the monetary benefits of higher education programs requires estimating 1) the change in the number of students attending and/or graduating from college and 2) the economic value of that change as measured by the earnings associated with postsecondary attainment.

To calculate the change in the number of students at each educational attainment level, we first estimate a baseline distribution of students in Washington with a high school diploma, some college attainment, an associate's (2-year) degree, and a bachelor's (4-year) degree. We then apply our effect size estimates to the baseline distribution to predict the change in the baseline distribution as a result of program participation.

In our December 2016 report, we estimated baseline distributions of educational attainment for three distinct baseline populations: high school graduates, 2-year college enrollees, and 4-year college enrollees. In this report, we also estimate the baseline distribution of educational attainment for high school students. We added this population because many of the higher education programs analyzed in this report target K–12 students, but not all of these students will graduate from high school. Using the baseline rates for high school graduates could overestimate the benefits of these programs. We also use low-income population baselines for all student populations (high school students and graduates as well as 2- and 4-year enrollees) in the postsecondary attainment model when at least 70% of students in a meta-analysis are low income.[13]

Exhibit A4 displays the predicted high school graduation rates for both the general student population and the low-income student population. We use the high school graduation rate to calculate the college enrollment rate for the high school student population by multiplying the college enrollment rate for high school graduates by the high school graduation rate.

Exhibit A4

Baseline High School Graduation

High school students	General population	Low-income population
% graduate from high school	78.10%	68.00%

Estimates of the high school graduation rates are based on Washington's most recent "on-time" graduation rates, which are published by the Office of Superintendent of Public Instruction (OSPI). The on-time rate is defined as the percentage of public school students who graduate from high school within four years.

Exhibit A5 displays the postsecondary attainment model inputs for high school students as well as the new low-income student population inputs for all populations.

[13] The persistence portion of the model does not distinguish between low-income students and all students. Additionally, the persistence model does not apply to either the high school student or high school graduate populations.

Exhibit A5

Distribution of Higher Education Achievement

	General population		Low-income population	
	2-year college	4-year college	2-year college	4-year college
High school students				
% enroll in college	21.20%	24.88%	18.36%	13.60%
Of those who enroll, % graduate college	31.57%	67.79%	29.34%	60.23%
High school graduates				
% enroll in college	27.14%	31.86%	27.00%	20.00%
Of those who enroll, % graduate college	31.57%	67.79%	29.34%	60.23%
2-year college enrollees				
% graduate from 2-year institution	31.57%		29.34%	
% transfer to 4-year institution	19.18%		19.18%	
Of those who transfer, % graduate from 4-year institution	56.00%		56.00%	
4-year college enrollees				
% graduate from 4-year institution		67.79%		60.23%

Estimates of the baseline percent of high school graduates enrolling in 2-year programs, enrolling in 4-year programs, or not enrolling in higher education come from Washington's Education Research & Data Center (ERDC). Estimates are based on the 2016 enrollment percentages in ERDC's High School Feedback Reports, which measures college enrollment in the 12 months following high school graduation.[14] Estimates for low-income students are based on enrollment percentages for students receiving free- or reduced-price lunch.

We estimate the average college graduation and transfer rates using data from the Integrated Postsecondary Education Data System (IPEDS) weighted by the number of undergraduates at the college. We calculate the proportion of students enrolled at any 4-year institution in Washington (public or private) graduating within six years using data on a cohort of students entering college in the 2010-11 academic year. We calculate the proportion of 2-year college enrollees who earn an associate's degree within three years for a cohort of students entering a Washington State 2-year institution in the 2013-14 academic year. We also calculate the proportion of students enrolled in a 2-year college who transfer to a 4-year college within three years, which we obtain using the same IPEDS data. Estimates for 4-year and 2-year low-income students are based on a subset of students who receive the federal Pell Grant, which is a grant for low-income students. We then use data from the National Student Clearinghouse Research Center to estimate the proportion of transfer students who graduate with a Bachelor's degree.[15]

[14] https://erdc.wa.gov/data-dashboards/high-school-feedback-report.

[15] Shapiro, D., Dundar, A., Ziskin, M., Chiang, Y., Chen, J., Harrell, A., & Torres, V. (2013). Baccalaureate attainment: A national view of the postsecondary outcomes of students who transfer from two-year to four-year institutions. National Student Clearinghouse Research Center.

III. Methodology to Estimate Increased Earnings from Persistence

In our initial report on higher education, we focused on valuing the economic gains derived from enrolling in and/or graduating from college. To do this, we estimated a baseline distribution of students in Washington with some college attainment, an associate's (2-year) degree, and a bachelor's (4-year) degree. We then applied the effect size estimates from our meta-analyses to determine the expected change in distribution as a result of program participation. Finally, we assigned an economic value to the change in educational attainment.

For this report, we created a method to monetize persistence outcomes which are not captured by our postsecondary attainment model.[16] The persistence rate is generally defined as the percentage of students returning to (enrolling in) any college in the years following initial enrollment.

The persistence model uses the same intuition as the postsecondary attainment model. Estimating the benefits of persistence relies on estimating 1) the change in the number of students reaching a given year of education, given participation in a program and 2) the economic value of the earnings associated with an additional year of education.

To calculate a change in persistence, we first estimated a baseline percentage of students in Washington who persist to each year at either 2-year or 4-year institutions to approximate the likelihood of persisting in the absence of an intervention.[17] We then applied our effect size estimates to that baseline to predict the change in the probability of persisting as a result of program participation. Finally, we estimated economic returns by estimating the increase in future earnings and college costs from attending school for a longer period of time.

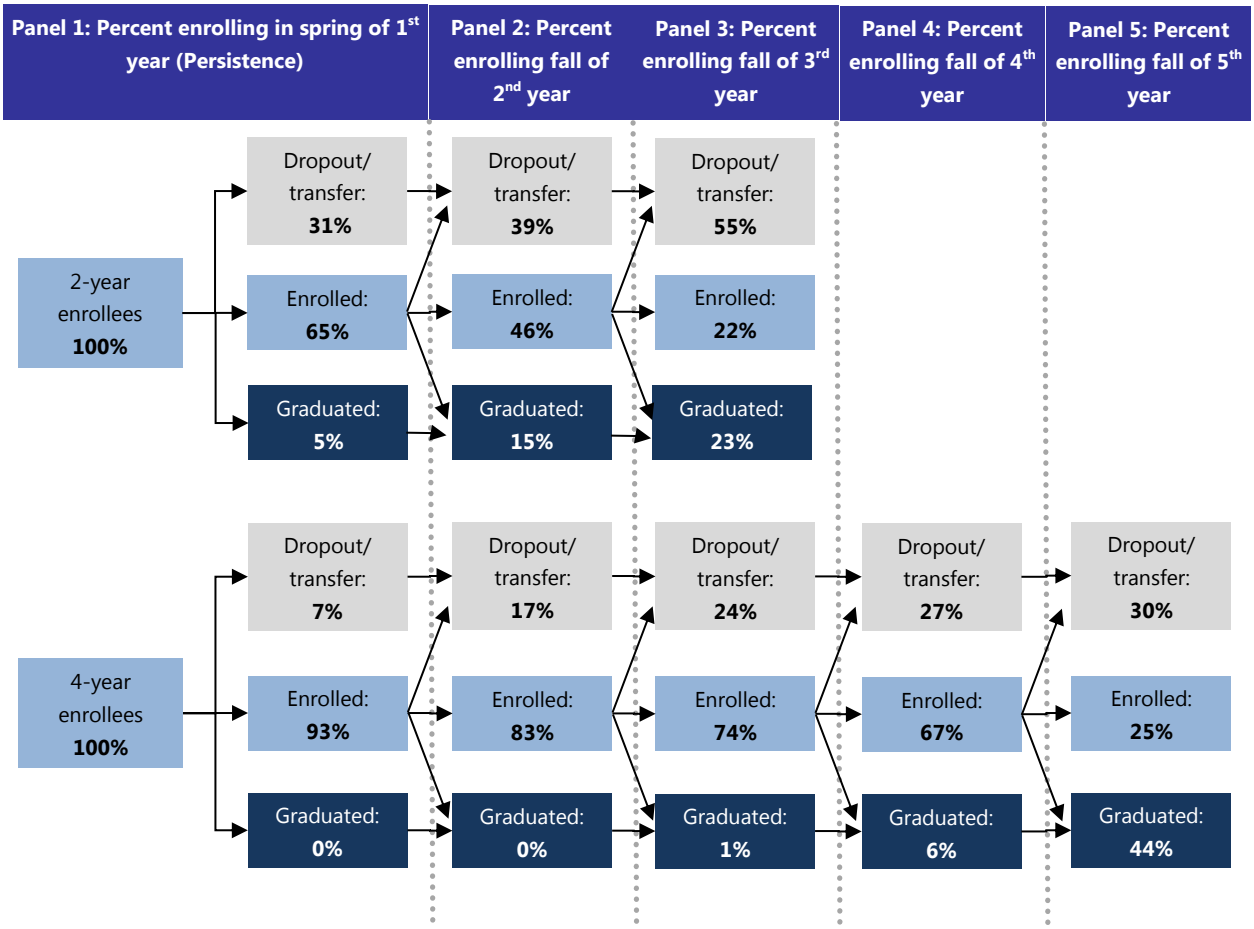
Estimating the Baseline Probability of Persistence

Students attending a 2-year college may have a different rate of persistence than students attending a 4-year college, so these groups are examined separately. We used data from the Washington State Board for Community and Technical Colleges to estimate the percentage of students who enroll in, graduate from, or drop out of 2-year college programs.[18] We used data from Washington's Office of Financial Management Public Centralized Higher Education Enrollment System to estimate the percentage of students who enroll, graduate, or are no longer enrolled in 4-year programs.[19] Exhibit A6 shows the percentage of students in the initial cohort who made it to each stage of enrollment in 2-year and 4-year colleges, respectively.

[16] The postsecondary attainment model monetizes changes in enrollment, transfer, and graduation.
[17] Given that the likelihood of persistence and value of an additional year of schooling may differ at 2-year versus 4-year institutions, we monetized persistence for students in 2-year institutions and 4-year institutions separately.
[18] Calculations are based on the 2009 enrolling class. The Washington State Board for Community and Technical Colleges collects information on public community and technical colleges operating in Washington State.
[19] Calculations are based on the 2007 enrolling class. Washington State's Office of Financial Management Public Centralized Higher Education Enrollment System collects information on public 4-year institutions in Washington State.

Exhibit A6

Baseline Persistence for 2-Year and 4-Year Students



Final baseline distribution: Percent of students at each persistence level					
2-year enrollees					
Initial enrollment	Persistence within 1st year	Persistence into 2nd year	Persistence into 3rd year		
100%	65%	46%	22%		
4-year enrollees					
Initial enrollment	Persistence within 1st year	Persistence into 2nd year	Persistence into 3rd year	Persistence into 4th year	Persistence into 5th year
100%	93%	83%	74%	67%	25%

Notes:

Baseline persistence information for 2-year students provided by the Washington State Board for Community and Technical Colleges.
Baseline persistence information for 4-year students provided by the Education Research and Data Center.

Estimating the Change in the Distribution of Persistence

We apply the effect size estimates from our meta-analyses to the persistence measures to determine the expected change in persisting through 2- or 4-year colleges. For example, suppose a program targeting 4-year college students increases persistence into the 2nd year by five percentage points and persistence into the 3rd year by three percentage points but does not have any information on the impact of the program on persistence within the 1st year or into the 4th or 5th years. Exhibit A7 shows the new likelihood of persistence in this scenario as a result of the percentage point change.

Exhibit A7

Change in Baseline Persistence Rate from a Hypothetical Intervention

Measured	Baseline likelihood of persisting	Percentage point change	New likelihood of persisting
Spring 2008 (persistence within the 1st year)	93.04%	-	93.04%
Fall 2008 (persistence into 2nd year)	83.42%	5	88.42%
Fall 2009 (persistence into 3rd year)	74.72%	3	77.72%
Fall 2010 (persistence into 4th year)	67.01%	-	67.01%
Fall 2011 (persistence into 5th year)	25.23%	-	25.23%

When calculating the new probability of persistence, we make the assumption that changing the probability of persisting to a given year does not change the probability of reaching other years. For example, an observed increase in the probability of persisting to the 2nd year does not imply that the probability of persisting through the 1st year changed. Correspondingly, we do not assume that increasing persistence into the 3rd year will necessarily increase the probability of persisting into the 4th year. We acknowledge that this assumption is likely to give a cautious estimate of the impact of a program.

The only exception to our constant persistence assumption occurs when the model predicts an impossible change in persistence. Consider the example in Exhibit A8 below. The program in this example only reports the persistence measure "persist into the 3rd year." Applying the estimated effect size on "persist into the 3rd year" to our base rate of 74.72% yields a unit change of 5 percentage points. Thus, we would predict that the program will increase persistence into the 3rd year from 74.72 % to 89.72%. Because we have no estimate of the change in persistence into the 2nd year, the model-predicted persistence into the 2nd year is the same as the baseline of 83.42%. This result is impossible because we would predict that more students are continuing to the 3rd year than continued to the 2nd year. We address this discrepancy by increasing the adjusted baseline persistence in the 2nd year to match the measured 3rd year persistence because students must persist to the 2nd year in order to persist to the 3rd year. We would then set the new adjusted persistence into the 2nd year and the 3rd year to 89.72%. Alternatively, if the model predicts that a program decreases persistence to the 3rd year, for example, and that fewer students would persist to the 3rd year than would persist to the 4th year under our baseline assumptions, then we adjust downward the baseline predicted probability of persisting to the 4th year.

If the model-predicted interstitial persistence measures are in conflict an earlier persistence measure is given priority and serves as an upper bound for subsequent persistence measures.[20] See Exhibit A9 for an example

[20] Interstitial persistence refers to the intermediate persistence level estimated directly from the meta-analytic effect size.

where the interstitial persistence in the 2nd year is 79.42% and 89.72% in the 3rd year. The adjusted 3rd year persistence would be set to the earlier predicted persistence rate of 79.42%.

Exhibit A8

Adjustment for Impossible Interstitial Persistence at 4-Year Institution
When There Is No Information

Measured	Baseline persistence	Percentage point change	Interstitial persistence	New adjusted persistence
Persistence within 1st year	93.04%	-	93.04%	93.04%
Persistence into 2nd year	**83.42%**	**-**	**83.42%**	**89.72%**
Persistence into 3rd year	74.72%	15	89.72%	89.72%
Persistence into 4th year	67.01%	-	67.01%	67.01%
Persistence into 5th year	25.23%	-	25.23%	25.23%

Exhibit A9

Adjustment for Impossible Interstitial Persistence at 4-Year Institution
When There Is Conflicting Information

Measured	Baseline persistence	Percentage point change	Interstitial persistence	New adjusted persistence
Persistence within 1st year	93.04%	-	93.04%	93.04%
Persistence into 2nd year	**83.42%**	**-4**	**79.42%**	**79.42%**
Persistence into 3rd year	**74.72%**	**15**	**89.72%**	**79.42%**
Persistence into 4th year	67.01%	-	67.01%	67.01%
Persistence into 5th year	25.23%	-	25.23%	25.23%

Once we have determined the percentage of students who reach each persistence level, we calculate the implied percentage of students who stop at each level and do not persist further. We use this implied percentage to apply the appropriate predicted labor market earnings beginning at the time students have completed their education. If we applied labor market benefits to the changes in persistence levels (and not the predicted terminal level of education), we would be estimating some benefits while students are still enrolled.

We estimate the percentage of students not continuing beyond each education level (terminal percentage) from the persistence measures with the following equations.

$$Terminal_{i,l} = Persist_{i,l} - Persist_{i,l+1}$$
$$\Delta Terminal_{l} = Terminal_{n,l} - Terminal_{b,l}$$

Where:

$Persist_{i,l}$ = The baseline or new persistence percentage at year of higher education "i"
$Terminal_{i,l}$ = The baseline or new terminal percentage at year of higher education "i"
$\Delta Terminal_{l}$ = The percentage point change in the terminal percent at year of higher education "i"

Recall the example in Exhibit A7. Increasing persistence to the 2nd year by five percentage points and persistence to the 3rd year by three percentage points will result in the number of students stopping in the spring semester of their 1st year to decrease by five percentage points because these students are persisting to at least the 2nd year.

$$
\begin{aligned}
Terminal_{\,baseline,\ 1st\ year} &= Persist_{\,baseline,\ 1st\ year} - Persist_{\,baseline,\ 2nd\ year} \\
&= 93.04 - 83.42 \\
&= \mathbf{9.62}
\end{aligned}
$$

$$
\begin{aligned}
Terminal_{\,new,\ 1st\ year} &= Persist_{\,new,\ 1st\ year} - Persist_{\,new,\ 2nd\ year} \\
&= 93.04 - 88.42 \\
&= \mathbf{4.62}
\end{aligned}
$$

$$
\begin{aligned}
\Delta Terminal_{\,1st\ year} &= Terminal_{\,new,\ 1st\ year} - Terminal_{\,baseline,\ 1st\ year} \\
&= 4.62 - 9.26 \\
&= \mathbf{-5.00}
\end{aligned}
$$

The number of students stopping in their 2nd year is predicted to increase by two percentage points. While the number of students who get to at least the 2nd year of college is increasing by five percentage points, the number of students who stop at the 2nd year is decreasing by three percentage points because these students are continuing to the 3rd year. This results in a net increase of two percentage points in the number of students stopping at the 2nd year.

$$
\begin{aligned}
Terminal_{\,baseline,\ 2nd\ year} &= Persist_{\,baseline,\ 2nd\ year} - Persist_{\,baseline,\ 3rd\ year} \\
&= 83.42 - 74.72 \\
&= \mathbf{8.70}
\end{aligned}
$$

$$
\begin{aligned}
Terminal_{\,new,\ 2nd\ year} &= Persist_{\,new,\ 2nd\ year} - Persist_{\,new,\ 3rd\ year} \\
&= 88.42 - 77.72 \\
&= \mathbf{10.70}
\end{aligned}
$$

$$
\begin{aligned}
\Delta Terminal_{2nd\ year} &= Terminal_{\,new,\ 2nd\ year} - Terminal_{\,baseline,\ 2nd\ year} \\
&= 10.70 - 8.70 \\
&= \mathbf{2.00}
\end{aligned}
$$

The number of students stopping in their 3rd year is predicted to increase by three percentage points. We do not know if these students will continue to persist, so we make the cautious assumption that they will stop in the 3rd year.

Exhibit A10

Converting Persistence Measures to Determine the Probability of Stopping

Outcome	Baseline likelihood of persisting	Predicted percentage point change (Persistence)	New likelihood of persisting	Baseline likelihood of stopping	New Baseline likelihood of stopping	Percentage point change (Terminal)
Enroll	100.00%	0	100.00%	6.96%	6.96%	0
Persistence within 1st year	93.04%	0	93.04%	9.62%	4.62%	-5
Persistence into 2nd year	83.42%	5	88.42%	8.70%	10.70%	2
Persistence into 3rd year	74.72%	3	77.72%	7.71%	10.71%	3
Persistence into 4th year	67.01%	0	67.01%	41.78%	41.78%	0
Persistence into 5th year	25.23%	0	25.23%	25.23%	25.23%	0

The benefit of persisting to the 2nd year is calculated by multiplying the percentage point change in the distribution of students who go no further than their 2nd year (the "percentage point change in terminal") by their predicted earnings. The same methodology is used to monetize persisting to other levels. Finally, the total impact of persistence is the summation of the benefit of all persistence measures.

Estimating the Returns to Labor Market Earnings from Changes in Persistence

Next, we provide a brief summary of our methodology to estimate the returns to changes in persistence. For more detail, see WSIPP's Technical Documentation.[21]

To estimate the change in earnings as a result of persistence, we begin with the modified observed earnings streams for people with a high school degree.[22] For each additional year of higher education that the student persists, we increase the expected earnings by a persistence earnings factor. We determine the specific predicted earnings for each level of terminal education (year of enrollment in postsecondary education) by multiplying the predicted high school earnings by the persistence earnings factor. The persistence earnings factor is determined by multiplying the number of years of higher education completed at each terminal education level by our estimate for the returns of an additional year of higher education.

[21] WSIPP (December 2017). *Benefit-cost technical documentation*. Olympia, WA: Author.

[22] For detailed information about the earnings streams by education attainment models used in higher education, please see Section 4.1b in the Technical Documentation.

Number of Years of Completed Higher Education.

Exhibit A11 shows the parameters we use for the expected time spent in postsecondary education for each persistence (terminal education) level.

Exhibit A11

Time Spent in Higher Education

Educational pathway	Years
Persistence within 1st year	0.5
Persistence into 2nd year	1
Persistence into 3rd year	2
Persistence into 4th year	3
Persistence into 5th year	4

We conducted a meta-analysis to determine the expected causal increase in earnings per year that would result from an additional year of education (our persistence earnings factor). To be included, papers had to meet our normal standards for rigor,[23] analyze the returns to 2- and 4-year college education separately, and control for degree receipt. By controlling for degree receipt, these results measure the returns to an additional year for students who do not complete a degree. This gives us a cautious estimate of the impact of education on earnings because it only monetizes the impact of the complete year of education. It does not include an estimate of the increased probability of graduation, which we would also expect to increase lifetime earnings. We found two papers that met our criteria.[24] We estimated that each additional year of education at a 2-year institution would increase earnings by 6.3% over the earnings of a high school graduate. Each additional year of education at a 4-year institution would increase earnings by 6.5% over the earnings of a high school graduate. We multiply the estimated earnings increase by the number of years completed at each persistence (terminal education) level to determine the persistence earning factor, illustrated in Exhibit A12.

Exhibit A12

Estimates of the Persistence Earnings Factor of Higher Education on Earnings

Outcome	2-year degree	4-year degree
Persistence within 1st year	1.032	1.033
Persistence into 2nd year	1.063	1.065
Persistence into 3rd year	1.126	1.130
Persistence into 4th year	-	1.195
Persistence into 5th year	-	1.260

Exhibit A11 shows the years of education and corresponding earnings factor associated with each persistence measure. "Persistence within the 1st year" multiplies earnings by 0.50 years because this outcome captures individuals who were induced to enroll in the second semester of their 1st year. "Persistence within the 1st year" monetizes the predicted earnings increase for a single semester of college. We multiply the earnings

[23] See Section 2.5 of WSIPP's Technical Documentation for details on WSIPP's standards of rigor.

[24] Marcotte, D.E., Bailey, T., Borkoski, C., & Kienzl, G.S. (2005). The returns of a community college education: Evidence from the National Education Longitudinal Survey. *Educational Evaluation and Policy Analysis, 27*(2), 157-175 and Kane, T.J., & Rouse, E. (1995). Labor-market returns to two-and four-year college. *The American Economic Review, 85*(3), 600-614.

factor by the predicted compensation (salary + benefits) for a high school graduate to determine the predicted compensation for each level of persistence.

We assume a student has no earnings while in college. We also assume that students are able to find work earning their expected wages immediately after leaving college. For example, suppose two students began college when they were 18; Student A persisted to the 2nd year of college, while Student B persisted to the 3rd year of college. We expect Student A would start to earn wages when he was 19 because he was enrolled in school when he was 18. We expect Student B would start to earn wages when she was 20 because she was enrolled in school when she was 18 and 19. Student B's delayed entry into the workforce, as a result of being enrolled in college, is calculated as a reduction in the expected benefit of college.

Estimating Costs of Education Due to Persistence

We use the same methodology to cost education as the postsecondary attainment model. Students who persist in college incur the cost of additional years of college education. In our model, we consider the costs of tuition, fees, and books. We estimate the yearly cost of attending 2-year and 4-year institutions using data from IPEDS as described in WSIPP's Technical Documentation.[25]

For each terminal level of education, we multiply the time in school by the cost of the type of attendance (2-year versus 4-year) to determine the stream of costs for the persistence level. We then estimate the net present value of the stream of costs associated with attending college. We derive the cost of persistence by estimating the net present cost of attendance under the baseline and new distribution of terminal education levels (in this case, terminal year of education). The cost of persistence is the summation of all costs at each persistence level. We report this cost as a negative benefit.

Comparison of the Persistence and the Postsecondary Attainment Models

The persistence model allows us to estimate monetary benefits of programs for which enrollment and graduation were not measured by program evaluations. This gives us the opportunity to expand our benefit-cost analysis to a broader set of interventions in higher education. Exhibits A13 and A14 compare the predicted earnings in the persistence model for each level of persistence and the predicted causal earnings for "some college" and degree recipients in the postsecondary attainment model. This also acts as a surface check of our persistence model because we would expect the returns to persisting to the 5th year of education at a 4-year college to be lower than the predicted returns to graduating from a 4-year college. We would also expect the returns of persisting to the 3rd year of a 2-year college program to be similar, but lower than the returns to graduating from a 2-year college.

[25] WSIPP (December 2017).

Exhibit A13

WSIPP Projected Annual Earnings, 2015 Dollars
For 2-year College Students

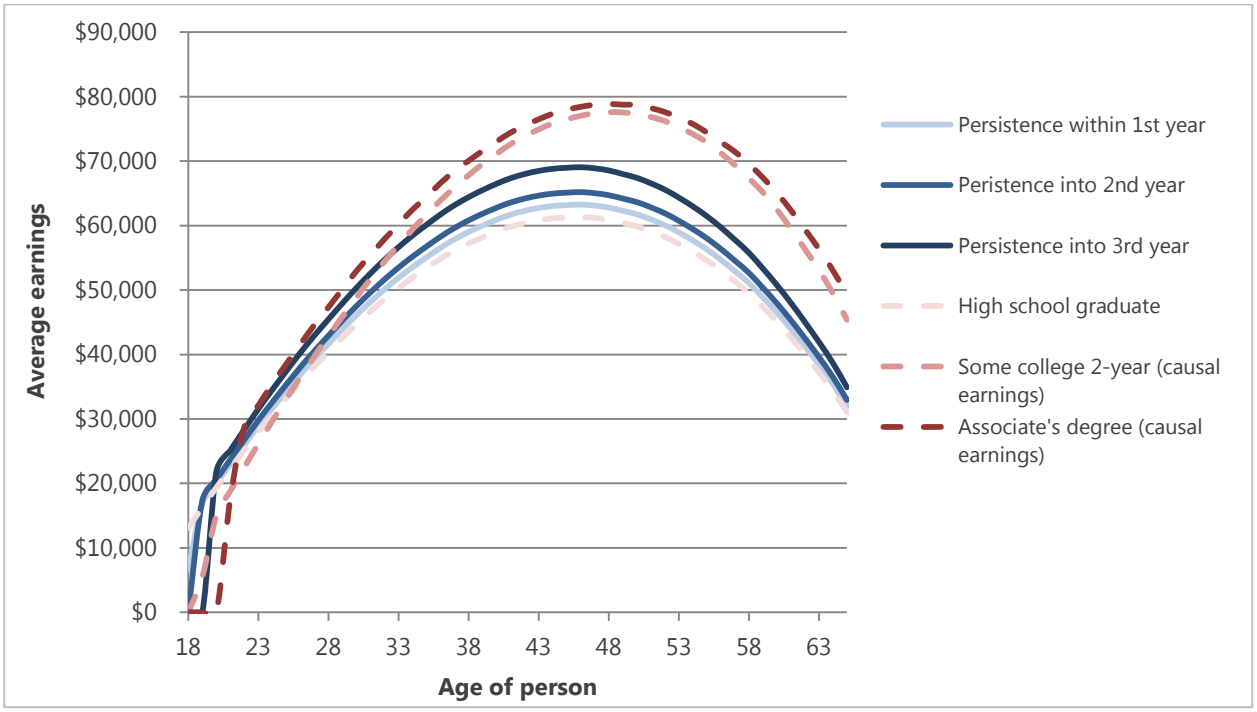
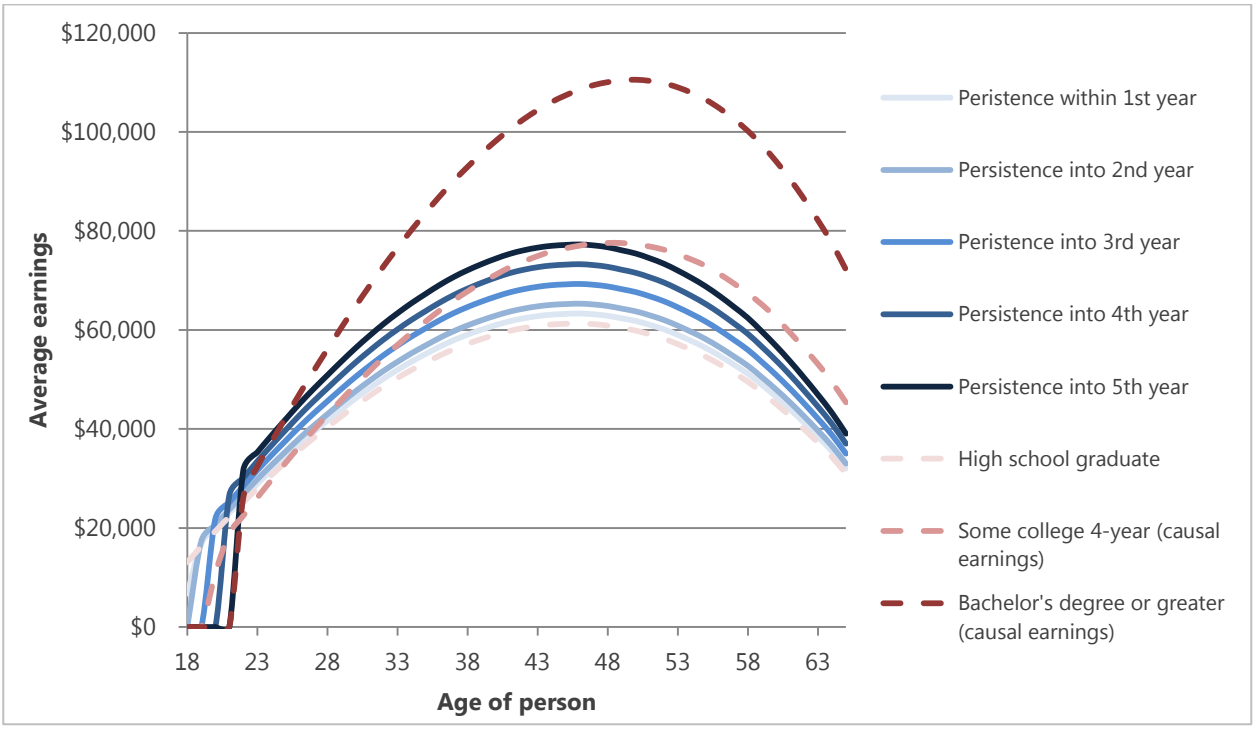


Exhibit A14

WSIPP Projected Annual Earnings, 2015 Dollars
For 4-year College Students



Although the persistence and postsecondary attainment models capture different aspects of educational attainment (with the persistence model essentially offering a different methodology for modeling returns to some college when continuation information is missing), they model the same type of monetary benefit—increased labor market earnings. When programs measure persistence and enrollment and/or graduation, including the earnings estimates from both the persistence model and the postsecondary attainment model would lead to an overestimation of the returns to the program, because the earnings increase captured in persistence would already be at least partially captured in the postsecondary attainment model. We apply "trumping" rules to reduce the chances that double counting will occur.

Our first trumping rule is that we count the biggest winner (the outcome that predicts the largest present value of benefits) when multiple measures of the same type of monetary benefit run in the same direction. If a meta-analysis indicates a gain in both persistence and graduation, we compute the expected benefits from the present value of labor market earnings for both outcomes, select the outcome with the largest gain in present value benefits, and drop the other outcome from the benefit-cost analysis. We expect that in most cases the postsecondary attainment model will "trump" the persistence model because the predicted returns to a degree are so much larger than the expected returns to an additional year of schooling.

Our second trumping rule is that we count the biggest winner and the biggest loser (the outcome that predicts the largest magnitude change in each direction is monetized) when measures of the same type of monetary benefit run in opposite directions. For example, if a program measures an increase in the graduation rate but a decrease in persistence, we compute the expected present value of labor market gains from the increase in graduation and the expected present value loss from the reduction in persistence and then add these two together. This allows us to improve our current estimates on the returns for some programs because it captures the fact that while some students are induced to graduate because of their program, others drop out and have lower returns than they might have had in absence of the program.

For more information about our "trumping" rules, see WSIPP's Technical Documentation.[26]

[26] Ibid.

IV. Extended Tuition Price Analysis

When conducting the meta-analysis for tuition price, we found that tuition price was captured in one of three ways in the literature, 1) sticker price[27]—analyzed at the individual level,[28] 2) sticker price—analyzed at the group level,[29] and 3) tuition, net of Federal Pell grants[30]—analyzed at the individual level. We produced separate analyses for each of these approaches.

The three measurement approaches lead to their own respective interpretations. Group-level analyses consider the effects of aggregate-level tuition price changes on aggregate-level outcomes. The results of group-level effects may most accurately predict changes in outcomes when those outcomes are observed at a group level. For example, the group-level analyses will be most useful in predicting the effects of tuition price changes on the statewide college enrollment rate. The group-level analyses are less useful in an attempt to understand how individual students respond to tuition price changes. Net-of-Pell analyses assume students have knowledge of their financial aid opportunities and respond accordingly. Results from net-of-Pell analyses are useful in cases wherein we can be confident in the validity of that assumption. Our preferred measure of tuition is sticker price, analyzed at the individual level.

We prefer results from papers that evaluate the impact of price changes at the individual level because individual-level analyses can provide information about individual student decisions that is obscured in group-level analyses. We may observe that a change in the average tuition price of a state's colleges affects the aggregate college enrollment rate in the state, but the aggregated data would ignore heterogeneity within the state's population of college-going individuals. Individual-level studies can account for differences in the characteristics of the individuals who are making the decisions of interest. These analyses can be more useful than group-level analyses when considering changes in tuition price at one or multiple colleges, but will be less useful when considering simultaneous tuition price changes at all of a state's colleges. We report the effect sizes for the group-level studies in Exhibit A15 because they may reflect the changes we would expect to observe in aggregated results.

We prefer results from papers that evaluate the impact of sticker price changes because the sticker price captures information about individuals' responses that net-of-Pell prices may obscure. Many Pell-eligible high school graduates are unaware of their eligibility for financial aid resources. As a result, low-income individuals often overestimate the net price of postsecondary education. Sticker prices are more visible to most students. In a realistic setting, those who are familiar with their financial aid eligibility will take that eligibility into consideration while still observing the sticker price. We report the effect sizes for the tuition price net-of-Pell studies in Exhibit A15 for comparison.

We can illustrate differences in results from these analysis specifications using college enrollment outcomes reported in Exhibit A15 as an example. With regards to changes in 2-year college enrollment in response to changes in 2-year college tuition price, the group-level analyses produced effects that are larger in magnitude than those from the individual-level analyses. The opposite is true in the case of changes to 4-year college enrollment caused by changes in 4-year college tuition price: our individual-level analyses suggest students are more responsive to tuition price changes than do our group-level analyses. For the outcome of enrollment in any college, which reflects changes in college enrollment without distinguishing

[27] Sticker price refers to the advertised price of college.
[28] Individual-level analysis is based on data from individual student records or from individual-level surveys.
[29] Group-level analysis is based on data from aggregated school or state records or from aggregate-level surveys.
[30] Tuition net of Pell grant refers to the tuition price after subtracting federal Pell grants from the sticker price.

between college types, the effects from group-level studies were largest and those from net-of-Pell studies were smallest.

Exhibit A15

Comparison of Results from Preferred and Alternative Tuition Price Measures

Intervention	Outcome	# of effect sizes	Effect size	Standard error	P-value	# in treatment
Tuition price changes						
1% increase in tuition price (2-year, sticker price, individual-level)	Apply to 4-year college	1	-0.037	0.001	<0.001	1,424,316
	Enroll in 2-year college	5	-0.144	0.042	0.001	597,044
	Enroll in 4-year college	4	0.021	0.021	0.320	593,969
	Enroll in any college	15	-0.197	0.040	<0.001	3,226,075
	Persistence within 1st year	1	-0.088	0.093	0.343	33,513
	Graduate with 2-year degree	1	-0.280	0.127	0.027	294,089
	Graduate with 4-year degree	2	0.200	0.249	0.422	379,267
	Graduate with any degree	3	-0.413	0.457	0.367	16,594
1% increase in tuition price (4-year, sticker price, individual-level)	Apply to 4-year college	1	-0.037	0.001	<0.001	1,424,316
	Enroll in 2-year college	1	0.106	0.046	0.022	10,254
	Enroll in 4-year college	4	-0.280	0.086	0.001	38,227
	Enroll in any college	23	-0.117	0.024	<0.001	3,264,722
	Persistence within 1st year	1	-0.064	0.012	0.000	61,481
	Persistence into 5th year	2	0.282	0.221	0.202	7,653
	Graduate with any degree	2	-0.895	0.300	0.003	9,774
Alternative specifications						
1% increase in tuition price (2-year, sticker price, group-level)	**Enroll in 2-year college**	4	-0.506	0.039	<0.001	24,642
	Enroll in 4-year college	2	0.137	0.047	0.003	96
	Enroll in any college	1	-0.199	0.100	0.047	50
	Graduate with 2-year degree	1	0.264	0.275	0.337	16,791
1% increase in tuition price (4-year, sticker price, group-level)	Apply to 4-year college	7	0.018	0.008	0.029	2,842
	Enroll in 2-year college	2	0.221	0.620	0.721	96
	Enroll in 4-year college	9	-0.136	0.041	0.001	19,721
	Enroll in any college	2	-0.283	0.071	<0.001	338
	Graduate with 4-year degree	1	0.123	0.135	0.362	11,317
1% increase in tuition price (2-year, net of Pell, individual-level)	**Enroll in 2-year college**	3	-0.109	0.018	<0.001	3,018
	Enroll in 4-year college	3	0.046	0.009	<0.001	3,018
	Enroll in any college	3	-0.039	0.046	0.389	20,231
1% increase in tuition price (4-year, net of Pell, individual-level)	Apply to 4-year college	2	-1.429	0.242	<0.001	73,600
	Enroll in 2-year college	3	0.009	0.007	0.246	3,018
	Enroll in 4-year college	4	-0.221	0.015	<0.001	30,749
	Enroll in any college	3	-0.039	0.046	0.389	20,231
	Persistence into 5th year	1	-0.022	0.079	0.777	6,383

Understanding and using the ES estimate for tuition

The effect sizes reported in Exhibit 5 and Exhibit A15 represent "elasticities" interpreted as the percent change in the outcome given a 1% change in tuition price.

In our preferred analyses of the impact of tuition price on enrollment, we find that the weighted average elasticity effect sizes are -0.144 at 2-year colleges and -0.280 at 4-year colleges. For ease of interpretation, we use a 10% change in tuition to illustrate. These effect sizes would suggest that a 10% increase in tuition at 2- and 4-year colleges would lead to 1.4% and 2.8% reduction in the rate of enrollment at 2- and 4-year colleges, respectively. However, these estimates average the effects at a variety of college sticker prices, and we cannot assume that we would observe these decreases in enrollment at Washington community colleges or Washington 4-year colleges and universities. A student's response to price changes may depend on the base sticker price of college. For example, the response to a $200 decrease in tuition when the tuition sticker price is $2,000 may be different than the response to a $2,000 decrease in tuition when the tuition sticker price is $20,000. Although the percentage change in the tuition sticker price is the same, the dollar value of tuition savings is different.

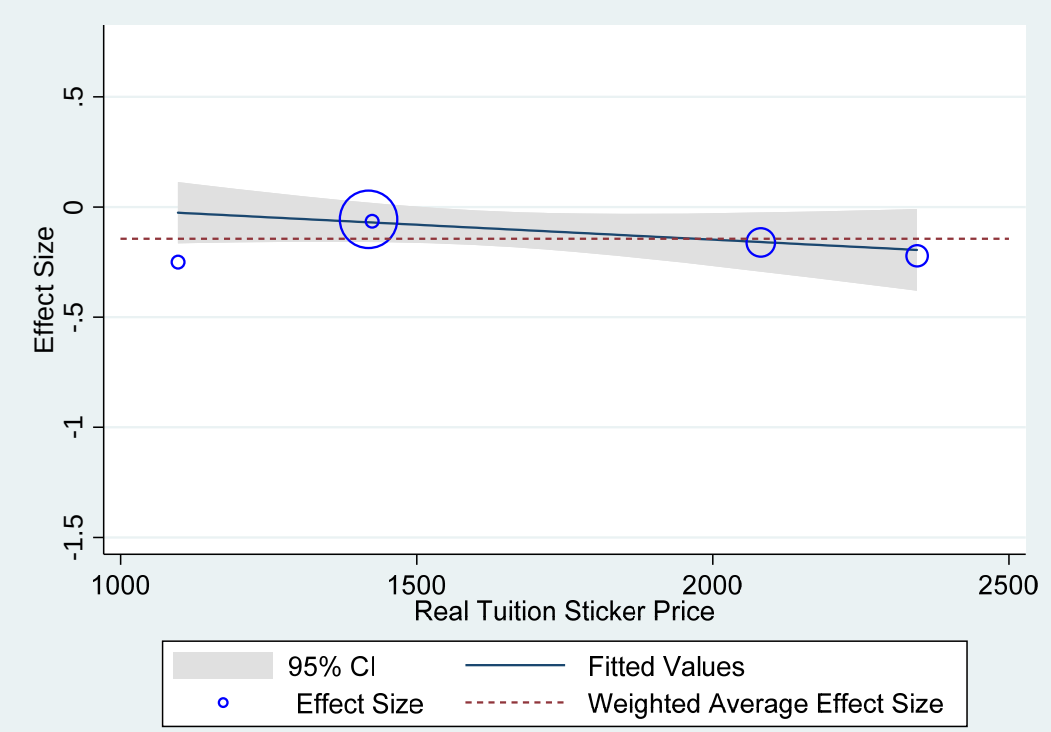
We examined the extent to which the estimated effect of a change in tuition price is related to the starting tuition. We regress the effect size estimates for enrollment in any college and enrollment in the same college type (2-year or 4-year) on the inflation adjusted tuition price.[31] Results are presented in Exhibits A16 and A17; all dollars are expressed in 2016 dollars. The figures in both exhibits show a prominent inverse relationship. The solid regression line shows the predicted elasticity effect size for each base tuition level. The line falls as the base tuition increases for all outcomes indicating that the estimated reduction in enrollment from a tuition price increase is larger when a student faces a higher starting tuition. That is, the effect size is more negative as the starting tuition sticker price increases, meaning schools with higher tuition may see a larger drop in enrollment when tuition increases than schools with a relatively lower base tuition.

The dashed line marks the weighted average effect size, which is the constant elasticity effect size presented in the report. In most exhibits, our constant elasticity effect sizes fall above the solid regression line for some base levels of tuition. For example, for the effect of a tuition increase at 2-year colleges on 2-year college enrollment (the first plot in Exhibit A16), the regression line crosses our reported effect size of -0.144 at about $2,000. For base tuitions higher than $2,000, our weighted average effect size is closer to zero—less negative—than the regression line meaning our effect size would represent a more moderate estimate of the potential drop in enrollment we might expect as a result of the tuition increase. For tuitions less than $2,000, we might predict a more modest student response to increases in tuition than our weighted average effect size would suggest. Thus, these findings illustrate that students are more responsive to changes in tuition when the base tuition is higher.

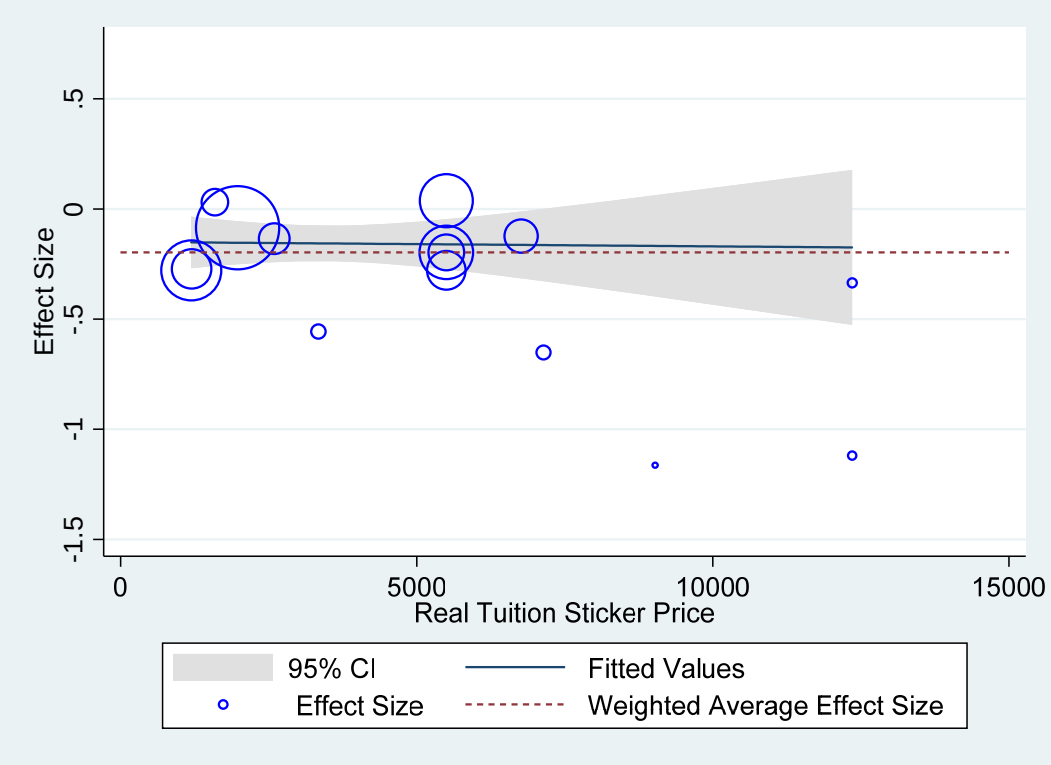
[31] We also regressed the effect size estimates for enrollment in any college and enrollment in the same college type on the inflation adjusted tuition price and its square. This did not substantively change our results.

Exhibit A16

Linear Relationship Between 2-Year Tuition Sticker Price and Effect Size



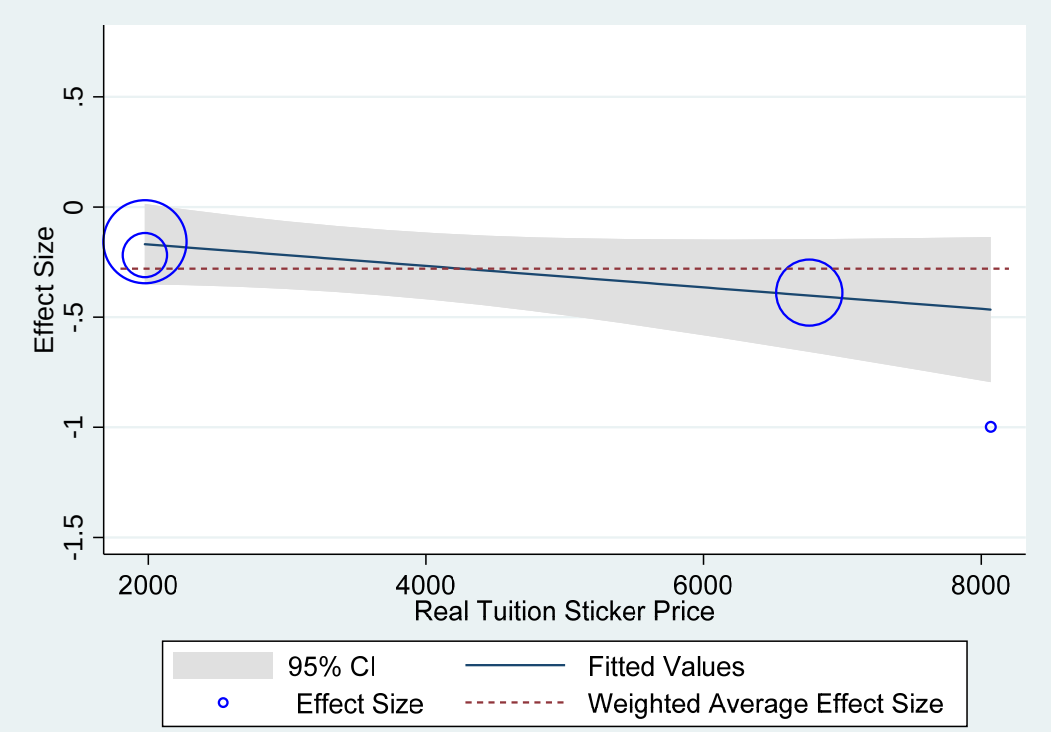
Enrollment at 2-year colleges (k = 5)



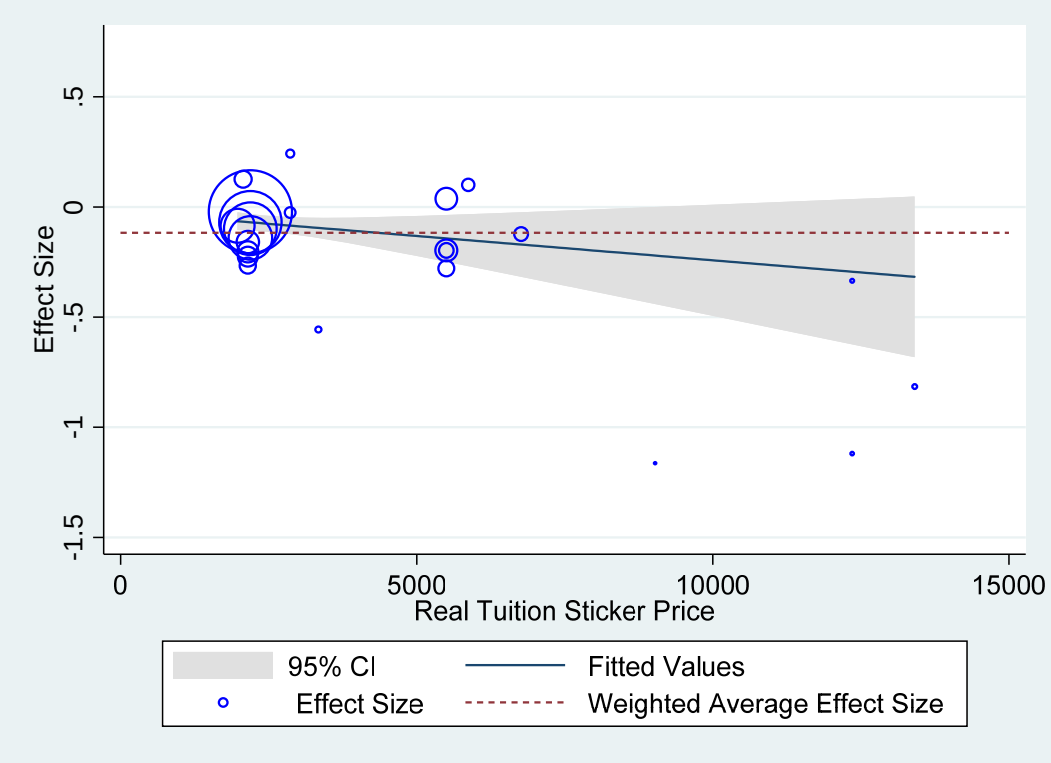
Enrollment at any college (k = 15)

Exhibit A17

Linear Relationship Between 4-Year Tuition Sticker Price and Effect Size



Enrollment at 4-year colleges (k = 4)



Enrollment in any college (k = 23)

V. Studies Used in the Meta-Analyses

Tuition sticker price increase at 2-year college (for college students)

Conger, D. & Turner, L.J. (2015). *The impact of tuition increases on undocumented college students' attainment.* Cambridge, MA: National Bureau of Economic Research.

Tuition sticker price increase at 2-year college (for high school students and graduates)

Baschnagel, C.N. (2015). *The price sensitivity of demand for higher education among non-traditional students.* (Doctoral dissertation). College Park, MD: University of Maryland.

Benson, J. (2010). *State policies and community college students: Do high school and finance policy reforms promote postsecondary attainment?* (Unpublished doctoral dissertation). Madison, WI: University of Wisconsin-Madison

Cardiff-Hicks, B. (2013). *The effect of tuition subsidies on student college choices* (Unpublished manuscript). Palo Alto, CA: Stanford University.

Chin, A., & Juhn, C. (2010). *Does reducing college costs improve educational outcomes for undocumented immigrants?: Evidence from state laws permitting undocumented immigrants to pay in-state tuition at state colleges and universities.* Cambridge, Mass: National Bureau of Economic Research.

Darolia, R., & Potochnick, S. (2015). Educational "when," "where," and "how": implications of in-state resident tuition policies for Latino undocumented immigrants. *The Review of Higher Education, 38*(4), 507-535.

Denning, J.T. (2017). College on the cheap: Consequences of community college tuition reductions. *American Economic Journal: Economic Policy, 9*(2), 155-188.

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Kane, T.J. (1995). *Rising public college tuition and college entry: How well do public subsidies promote access to college?* Cambridge, MA: National Bureau of Economic Research.

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Kennan, J. (2015). *Spatial variation in higher education financing and the supply of college graduates.* Cambridge, MA: National Bureau of Economic Research.

Kim, J.Y. (2011). *An analysis of the effects of state financial aid policy on the timing of postsecondary enrollment: A focus on income and race differences* (Doctoral dissertation). ProQuest LLC, Ann Arbor, MI.

McFarlin, I. (2007). *Do public subsidies promote college access and completion? Evidence from community college districts.* Ann Arbor, MI: University of Michigan, Ann Arbor.

McFarlin, Jr. I., Martorell, P., McCall, B.P. (2017). *Do public subsidies improve college attainment and labor market outcomes? Evidence from community college taxing district expansions.* Working Paper.

Rouse, C.E. (1994). What to do after high school: The two-year versus four-year college enrollment decision. *Choices and Consequences: Contemporary Policy Issues in Education*, 59–88.

St. John, E. (1990). Price response in enrollment decisions: An analysis of the High School and Beyond sophomore cohort. *Research in Higher Education, 31*(2), 161-176.

Tuition sticker price increase at 4-year college (for college students)

Bryan, B.J. (2013). *The financial nexus of college choice and persistence at for-profit institutions.* (Doctoral dissertation). Columbia, SC: University of South Carolina.

Conger, D., & Turner, L.J. (2017). The effect of price shocks on undocumented students' college attainment and completion. *Journal of Public Economics, 148*, 92–114.

Tuition sticker price increase at 4-year college (for high school students and graduates)

Baschnagel, C.N. (2015). *The price sensitivity of demand for higher education among non-traditional students.* (Doctoral dissertation).

Chin, A., & Juhn, C. (2010). *Does reducing college costs improve educational outcomes for undocumented immigrants?: Evidence from state laws permitting undocumented immigrants to pay in-state tuition at state colleges and universities.* Cambridge, Mass: National Bureau of Economic Research.

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