Free community college and college completion: Evidence from Tennessee*

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Abstract

We study the rollout of Tennessee's tuition-free community college program, Tennessee Promise, which preceded similar efforts in over twenty states as well as multiple federal proposals. Promise increased college enrollment by 5.9 percentage points for 19 year-olds and increased associate's degree attainment by 3.8 percentage points for 22 year-olds. Gains in associate's degrees faded thereafter, suggesting that Promise accelerated post-secondary enrollment to the year after high school. Eligible cohorts had jobs with better pay prospects at age 21, but this advantage also diminished. By age 24, Promise cohorts were not significantly more or less likely to hold bachelor's degrees.

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1 Introduction

"Free college" is a compelling message and commitment that national, state, and local governments, as well as colleges themselves, routinely use to maintain access to an affordable higher education, attract students to particular schools, programs, or occupations, retain students in-state, or simplify the outcome of a complex and uncertain patchwork of scholarships, grants, and tuition discounts. Although the ethos of free education has a long history in the United States, free college has generally come with eligibility criteria that limit expenditures or reflect funder preferences. A leading example is the U.S. GI Bill, which conditions generous post-secondary benefits on a period of military enlistment. Publicly funded merit-based scholarships such as the Georgia and Tennessee HOPE scholarships were initially set to cover their respective flagship university's tuition, and are available to high-achieving students who enroll in-state. Some states offer early-commitment scholarships to middle school or high school students who pledge to adhere to academic and behavioral standards before enrolling in college. Other conditional tuition-free opportunities include grants covering the tuition cost of specific programs, or loan forgiveness following a period of employment in specific fields. Most recently, local and state "Promise" programs have grown in number and scope throughout the United States, offering the latest iteration of free college to perhaps the largest class of eligible students.

We investigate if and how the introduction of one such Promise program in Tennessee affected students' college enrollment and attainment of college degrees following a phased rollout from one county in 2009 to every high school graduate in the state by 2015. The program that came to be known as Tennessee Promise offers any 12th grader, regardless of income, achievement, or program of study, a free-tuition

guarantee if they enroll in one of the state's public community or technical colleges. Specifically, the state "Promise" is to cover any gap between full-time tuition and fees and a student's other sources of grant aid. Since most students are eligible for need-based Pell grants and/or state merit aid, the cost per participating student is very low: under $1,000 per year.[1] The single-county phase of Promise increased eligible students' college enrollment by 2 - 3 percentage points, or up to 7% of the mean (Carruthers & Fox, 2016), and increased associate's degree attainment by 1 percentage point (24%) (Carruthers et al., 2023b). Here, we use the American Community Survey (ACS) to estimate effects of all Tennessee Promise phases, including the first-in-the-nation statewide implementation in 2015, on the likelihood that an eligible high school graduate enrolls in college, the likelihood that they attain an associate's or bachelor's degree within six years of graduating from high school, and early career measures of income and job quality.

The breadth of access to Promise programs is what sets them apart from other financial aid vehicles that also tout "free college." Many Promise scholarships do not have income, achievement, service, program, or post-schooling work criteria. Access to financial aid or lower tuition tends to help more students go to college (Deming & Dynarski, 2010), more so if aid eligibility is simple and certain (Page & Scott-Clayton, 2016; Burland et al., 2023). This may be why pledge-based aid has had limited or even negative effects on college going (Harris et al., 2023; Goldhaber et al., 2020). Merit-based aid, which by design targets higher achieving high school students who are already likely to go on to college, has had varying effects on college enrollment across different contexts (Cornwell et al., 2006; Bruce & Carruthers, 2014; Fitzpatrick & Jones, 2016). By contrast, broad-based Promise programs that award tuition grants

[1]Students can maintain Promise eligibility with 2 terms of full-time enrollment per year. Scholarship expenses average $1,800 per student across up to 5 semesters (Tennessee Higher Education Commission, various years).

regardless of prior performance are linked to higher rates of college enrollment and completion for traditional-aged students (Carruthers & Fox, 2016; Bartik, 2014; Bifulco et al., 2019; Page et al., 2019; House & Dell, 2024; Bartik et al., 2021; Bell, 2021b; Carruthers et al., 2023b).

Today's Promise programs differ in two major respects. Which colleges they cover is the first. Many are narrowly designed around one specific college and its surrounding community. Others, like the El Dorado Promise and Kalamazoo Promise, support students from a specific community who attend many different colleges and universities. Newer statewide models such as the New York Excelsior Scholarship and Tennessee Promise are wide in terms of both student eligibility and participating institutions. Within those groupings are sectoral points of differentiation. Kalamazoo Promise, El Dorado Promise, and the Excelsior Scholarship can be used at two-year and four-year schools, whereas Tennessee Promise only pays toward tuition and fees at community and technical colleges. The second difference is in the relationship, or lack thereof, between program aid and other sources of aid. Some programs cover a student's tuition from the "first dollar," allowing recipients to apply any additional aid toward supplies, books, and living expenses. Others, like Tennessee Promise, only cover the "last dollar" difference between tuition and a student's other grants and scholarships. There were 23 statewide promises of free college as of 2022, most of which resemble Tennessee Promise's last-dollar funding structure (Campaign for Free College Tuition, 2022). While Promise scholarships tend to have a broader base of eligible students than other forms of aid, last-dollar grants offset very little of the full cost of attending college, particularly for lower income students.

Figure 1 previews our results for college enrollment. We find that the statewide expansion of Promise in Tennessee (panel A) corresponded with a sharp increase

in first-time freshmen enrollment in the state's community colleges and technical colleges (TCATs), where aid could be used, alongside a small decline in four-year college and university enrollment (panel B). In the ACS, age 18 - 19 high school graduates were likewise much more likely to report that they were attending school after 2015 (panel C).[2] Looking within the state, we see that in counties with privately funded free community college programs prior to Tennessee Promise, college enrollment rates started to rise in 2013, one year after the largest of those programs (and pre-cursor to Tennessee Promise) began to expand across the state (panel D). Enrollment leapt in the remaining counties once the statewide Promise took over in 2015. Trends for degree attainment in Figure 2 point to a rising rate of associate's degree attainment for Tennessee 20 - 22 year-olds that accelerated after 2016, with the first cohorts who would have been eligible for statewide Tennessee Promise.

Regression results agree with these descriptive patterns: Access to Promise raised the likelihood of post-secondary attendance among 18 - 19 year-olds by 5.9 percentage points (9.7% of the counterfactual mean), with somewhat larger estimated effects for Nonwhite students and students outside of metro areas. Shifting ahead to ages 20 - 23, we can potentially attribute Promise with a 1.5 - 3.8 percentage-point higher likelihood of associate's degree attainment, or up to 48% of the counterfactual by age 22. Gains in associate's attainment were larger for White than Nonwhite students, and similar by gender and metro/non-metro residence. Effects on enrollment and associate's attainment are indistinct from zero by age 24, suggesting that Promise may have led students to enroll in community colleges and complete associate's degrees earlier than they would have otherwise.

[2]Figure 1 panel C trends for post-secondary enrollment exclude 2020. Enrollment rates for this population were higher than in adjacent ACS years, which is inconsistent with evidence that college enrollment declined in 2020 (National Student Clearinghouse, 2022; Tennessee Higher Education Commission, 2024). This may be due to experimental weights used to adjust for ACS collection problems and data quality challenges during the pandemic (IPUMS, 2024). Our main regression results include 2020 ACS samples, although results are robust to their exclusion (Figure 8).

Diversion is a prominent concern with financial aid that is limited to two-year schools, i.e., the possibility that programs like Promise will reroute students from four-year schools that tend to have more resources and better graduation outcomes. Descriptive patterns for bachelor's degree attainment in Figure 2 panel B as well as our regression results suggest this has not been the case in Tennessee. Instead, we estimate imprecisely positive effects on Bachelor's degree attainment 5 - 6 years after high school.

ACS data give us the opportunity to explore effects of Promise on labor market outcomes, bearing in mind that it is difficult to forecast earnings trajectories from the immediate post-schooling years (Minaya & Scott-Clayton, 2018). And at the cohort level we study, direct effects on participants are difficult to separate from indirect and general equilibrium effects. We estimate that Promise-eligible cohorts had higher earnings than the counterfactual, although coefficients are generally imprecise and mirrored to a large degree in slightly older, ineligible cohorts. Eligibility is more concretely tied to jobs with better long-term pay prospects, although these gains in job quality are limited to age 19 - 21 and more urban parts of the state. Affected students may have realized an immediate return on their college education in terms of better jobs, but these advantages faded quickly. If Promise led students to complete college earlier than they otherwise would have, it is possible that their workforce gains were also accelerated rather than permanently improved.

We factor the timing of potential income gains into our welfare evaluation of Promise, which follows the marginal value of public funds (MVPF) framework (Hendren & Sprung-Keyser, 2020). Tuition discounts plus estimated gains in after-tax income over ages 18 - 23 yield a $1.93 benefit per $1 in net government cost. This is the same net benefit that Hendren & Sprung-Keyser (2020) report for Kalamazoo Promise, which had proportionately larger benefits and costs as Tennessee Promise. The ex-

tent to which we can attribute higher age 18 - 23 income to Promise is uncertain, however, and the favorable $1.93 MVPF has a wide confidence interval ranging from $0.07 to $7.59. Benefits after age 23 are unclear but would likely increase the Promise MVPF, particularly if there are longer-term effects on Bachelor's degree receipt.

One insight that these findings add to the financial aid literature, and in particular, research on other "free college" Promise programs, is evidence that a local program can effectively scale with statewide implementation. In the short term, eligibility for the statewide phase of Promise raised degree attainment by at least as much as eligibility for the single-county phase. Second, our attainment findings indicate that a free community college program can raise two-year college completion without penalizing the likelihood of four-year college completion. Within 6 years of high school, Promise-eligible students were not significantly more or less likely to have attained a bachelor's degree. This echos work by Carruthers et al. (2023b), who find no significant effects of the single-county phase on bachelor's degree receipt. In a review of 43 financial aid studies, Nguyen et al. (2019) show that each $1,000 in additional grant aid can raise degree completion by 1.8 - 2.2 percentage points. With expenses of less than $1,000 per Promise student per academic year, Promise meets or exceeds this range over the 4 - 5 years following high school.

2 Background

In Tennessee, privately funded and operated free college programs date back to 1999, when the Ayers Foundation began serving residents of two rural counties in the Southwestern part of the state. The Ayers program combined need-based college scholarships with advising and required students to remain drug-free and have no criminal record. The state's now-dominant Promise model was initiated in Knox County with the 12th grade class of 2009 and served that county alone for

three years. Beginning with the class of 2012, Knox Achieves became tnAchieves and expanded to include 27 counties before statewide implementation as Tennessee Promise in 2015. Figure 1 panel A plots the expansion in terms of 12th grade cohort eligibility.

The structure of Knox Achieves, tnAchieves, and Tennessee Promise were very similar, and we refer to them jointly as Promise or the Promise model. All three programs provided mentoring and last-dollar tuition grants to students making a seamless transition from high school to college, required periodic community service, and required that students file for federal financial aid. Key programmatic differences between the three are that (1) Knox Achieves and tnAchieves were privately funded, whereas Tennessee Promise scholarships are paid out of endowed lottery reserves, (2) Tennessee Promise is available to private and home-schooled high school graduates, whereas the earlier programs were limited to public high school students, and (3) Tennessee Promise grants can be used at four-year schools with associate programs, although this option is rarely exercised in practice.[3]

Nonetheless, the implementation of statewide Tennessee Promise in 2015 may have been more potent than earlier county-by-county expansions. Tennessee Promise launched at the same time as a state "Drive to 55" campaign which targeted 55% as the rate at which Tennessee's working-age adults should hold post-secondary credentials. With the Drive to 55, Tennessee joined most other states in setting aspirational attainment thresholds to meet future job requirements (Brown, 2023). Over 90% of 12th graders signed up to at least learn more about Promise in 2015, whereas participation rates in early-adopting counties was under 20%. Governor Haslam ceremoniously signed Tennessee Promise legislation seven times at different locations

[3]In participating four-year schools, Tennessee Promise grant amounts are capped at average in-state community college tuition and fees.

across the state (Tamburin, 2015). Tennessee Promise received considerable state and national attention, including a visit from President Obama in 2015, who announced the first national proposal for free community college from Pellissippi State Community College in Knoxville (Tennessee Board of Regents, 2015). "America's College Promise" was not implemented during the Obama administration, and later iterations in the Biden administration were also unsuccessful (Startz, 2021; Meyer et al., 2024). Nonetheless, tuition-free college has expanded since 2015 as other states implemented or broadened their own Promise programs. Many of these shared Tennessee's focus on community colleges and last-dollar funding (Campaign for Free College Tuition, 2022).

3 Related Research

Promise programs have grown substantially over the last two decades, followed by a proportionate degree of research devoted to evaluating the effect of Promise eligibility on student outcomes across many different contexts. Monaghan (2024) reviews common themes emerging from the related research as well as less settled questions and under-studied areas. We add to one of the cited under-studied areas with new insights on the effect of a statewide free community college program on degree completion and income several years after high school. Policy implications extend beyond Tennessee, since last-dollar funding and/or an emphasis on two-year schools are found in most of the statewide programs that followed Tennessee Promise (Campaign for Free College Tuition, 2022).

Pre-dating statewide Promise programs are narrower place-based initiatives, where local high school graduates use a Promise scholarship to cover tuition at a specific community college. Single-school Promise programs have increased enrollment, transfer, and degree attainment in some settings (Bell, 2021a; Bell & Gandara, 2021;

Gandara & Li, 2020; Hyder, 2024), but not universally (Monaghan & Hawke, 2024), and not to the extent that researchers can detect community-wide changes in attainment for eligible cohorts (Ruiz et al., 2020).

There are also a number of programs where students from a specific high school or school district can use a Promise scholarship at many different institutions. Among these wider Promise programs, perhaps the most well known is Kalamazoo Promise, which started in 2005. Kalamazoo Promise offers public high school graduates from Kalamazoo, Michigan a full-tuition scholarship for any public two-year or four-year college in Michigan, or at select private colleges.[4] The El Dorado Promise scholarship can be used at an even wider range of institutions. The Arkansas program supports El Dorado High School graduates who enroll in any college or university in the U.S. with a first-dollar scholarship worth up to the maximum tuition at an Arkansas public university. The local Tennessee programs that preceded Tennessee Promise are additional examples of tuition guarantees that could be applied to multiple institutions. Generally, multi-institution Promise programs have been found to positively impact enrollment and persistence (Andrews et al., 2010; Bartik et al., 2021; Bifulco et al., 2019; Carruthers & Fox, 2016; Daugherty & Gonzalez, 2016; Page et al., 2019; Swanson & Ritter, 2020). Results have been likewise encouraging for educational attainment, but the magnitude of effects on degree production and degree completion tend to be larger for the more generous first-dollar programs (El Dorado: Swanson & Ritter (2020); Kalamazoo: Bartik et al. (2021)) than for the local predecessor to Tennessee Promise (Carruthers et al., 2023b). Fewer studies have examined long-term outcomes such as earnings, and those that have report little to no

[4]The Kalamazoo Promise award amount depends on length of local K-12 attendance. For example, students only attending tenth through twelfth grade do not receive funding. Students who attend ninth through twelfth grade receive 65 percent of tuition while students who attend kindergarten through twelfth grade receive 100 percent of tuition. The scholarship was limited to public in-state colleges and universities until 2014, when the program expanded to include 14 private colleges in Michigan. The award amounts for private colleges is determined annually.

discernible change in earnings up to ten years after high school (Carruthers et al., 2023b; Hershbein et al., 2021).

Finally, statewide Promise programs are broad both in terms of eligibility and the set of institutions where aid can be used. Tennessee Promise is a leading example of this model and has been the focus of most research on statewide Promise-style financial aid. Early on, annual reports from the Tennessee Higher Education Commission documented unprecedented gains in college going for the class of 2015 and later (Tennessee Higher Education Commission, various years), similar to what we show in Figure 1. Subsequent research showed that enrollment gains were concentrated in eligible institutions (Bell, 2021b) and well exceeded trends in other states (House & Dell, 2024; Nguyen, 2020). Other findings include higher tuition at Promise-eligible institutions (Bell, 2021b), lower borrowing among eligible students (Odle et al., 2021), and the emergence of supplementary programs that assist students with advising, networking, and non-tuition costs of attending college (Dickason et al., 2023; Carruthers & Pratt, 2024).

After Tennessee Promise's introduction in 2015, over 20 other states quickly followed with their own variations on tuition-free college. Similar to local place-based programs, there are wide differences across state-level programs in eligibility requirements and colleges where aid can be used. The Oregon Promise is a state-level program that covers tuition through a last-dollar scholarship at any community college in Oregon for high school graduates in the state with at least a high school GPA of 2.5. Gurantz (2020) found that the Oregon Promise increased enrollment in the state's two-year schools, but largely due to students substituting away from four-year schools. Hodara & Childress (2021) find suggestive evidence that marginal eligibility for Oregon Promise increased college persistence and degree completion, although results were imprecise due to small samples. Another state-level program

that has been studied is the New York Excelsior Scholarship Program, which was initiated in 2017 and provides a last-dollar scholarship for students with a household income of $125,000 or less to attend a two-year or four-year college in either the State University of New York (SUNY) system or the City University of New York (CUNY) system. Excelsior recipients commit to paying back all or part of their scholarship if their move out of New York shortly after college. Previous work has documented low take-up for the Excelsior Scholarship (Scott-Clayton et al., 2022) as well as negligible impacts on college enrollment (Nguyen, 2019).

We add to research on financial aid, and Promise programs in particular, in two ways. First, we extend the timeline of research on Tennessee Promise and its local predecessors to consider the model's effects on associate and bachelor degree completion, as well as early career success in the labor market. Prior work has been limited to estimated gains in initial enrollment, or longer-term effects of the Promise model's one-county phase. Understanding longer-term outcomes of all phases including the statewide implementation is important to Tennessee as well as many other states that adopted similar initiatives. A related feature of our findings is that they are the first to document effects of a Promise model that scaled from one county's place-based program to all high school graduates in the state.

Second, and more broadly, estimated effects of low-barrier but low-cost Promise aid complement what we know about merit-based and need-based financial aid. These other aid vehicles tend to be more generous per student but have eligibility, application, and renewal criteria that limit the number of students who can expect to use the aid. Need-based aid does not reliably push more students into college, whereas merit-based appears to be more influential on students' college enrollment decisions (Dynarski et al., 2023). The straight-forward nature and wide design of the Promise model in Tennessee may be responsible for its positive impacts on enrollment, but if

those enrollment gains come largely from under-prepared or under-supported students, we might expect little change in degree attainment. Nevertheless, our findings here suggest that marginal Promise students are at least as likely to complete two-year and four-year college degrees, possibly earlier than they would have otherwise.

4 Methods and Data

Descriptive enrollment trends in Figure 1 panel D rely on state administrative data connecting Tennessee's K-12 students to their post-secondary National Student Clearinghouse records. Since the entire state was ultimately covered by Promise, these data do not offer counterfactual outcomes for "never treated" individuals, which hinders unbiased identification of dynamic program effects (De Chaisemartin & d'Haultfoeuille, 2020; Goodman-Bacon, 2021). In addition, Tennessee Promise emerged during a broader effort, much of it led by states, to increase college attainment and meet expected labor demand for high-skilled, college educated workers. Tennessee's post-secondary attendance and degree completion trends in the 2010s may have coincided with similar patterns throughout the U.S. We evaluate Promise by comparing post-secondary outcomes for eligible cohorts with outcomes from other states using the Census Bureau's American Community Survey (ACS).

The expansion of Promise from one Tennessee county in 2009 to the state in 2015 allows for a two-way fixed effects empirical design. Specifically, we estimate the following for state-year-age aggregations:

$$y_{ast} = Promise_{ast}\beta + Age_a\delta + \gamma_s + \gamma_t + \varepsilon_{ast}, \tag{1}$$

where y_{ast} is average post-secondary enrollment or attainment rates for individuals

at time t, from age/cohort a and state s. State-year-age averages are computed from individual responses using ACS person weights. $Promise_{ast}$ is a continuous measure of the percent of the cohort who were eligible for Promise when they were 17. The ACS is a year-round survey and we are not able to align ACS years with academic years, or pinpoint the reference period a respondent has in mind when they report their post-secondary enrollment status. This leads to a degree of measurement error in $Promise_{ast}$ eligibility for individuals of the same age but different high school classes. With this in mind, and to increase sample sizes for aggregate outcomes, main results group individuals of age a and $a+1$, from 18 - 19 through 23 - 24, and estimate Equation 1 for adjacent-age cohorts. Age_a is an age indicator for the younger of each adjacent-age grouping, and γ_s and γ_t control for state and survey year fixed effects.

From 2007 - 2023 one-year ACS micro-data (Ruggles et al., 2024), we limit the sample to high school graduates ages 18 - 24. For Tennesseans (inferred from state of residence one year prior), our measure of Promise exposure is equal to the statewide rate of eligibility when they were age 17. Growth in $Promise_{ast}$ within Tennessee is depicted in Figure 1 panel A, and is equal to the percent of 12th graders who lived in counties where Knox Achieves, tnAchieves, or Tennessee Promise were active.[5]

We code $Promise_{ast}$ as zero for ACS respondents from outside of Tennessee. This allows us to isolate the effect of Tennessee's version of tuition-free community college. Tennessee Promise preceded similar state efforts, however, and setting $Promise_{ast} = 0$ for all other states understates the extent of Promise-like programs throughout the United States. In some specifications we exclude other states with their own Promise programs as recorded by the Upjohn Institute's Promise Programs Database (Miller-

[5]We do not use metro area locations in the ACS to refine $Promise_{ast}$ to the sub-state level, since the county-by-county expansion did not encompass metro areas.

Adams et al., 2017) and the Campaign for Free College Tuition (2022). This tends to increase estimated effects on enrollment and degree completion (Figure 8)

We estimate the effect of Promise on four post-secondary outcomes for ACS respondents, each aggregated to the state-year-age level using ACS person weights. These include a binary indicator equal to one for individuals who were enrolled in post-secondary education during the 3-month ACS reference period, as well as three measures of educational attainment: Some college without a degree, associate's degree, or bachelor's degree. We additionally consider how Promise may have affected two labor market outcomes: log income from wages and salaries, and log occupation score. We compute an individual's occupation score to be average income among all ACS respondents in the U.S. sample for a given year who reported having the same occupation (weighted by ACS person weights). As with other outcomes, we aggregate log income and occupation score to the state-year-age level.

Standard errors from Equation 1 can be severely underestimated when there is one treated group (Conley & Taber, 2011; Ferman & Pinto, 2019; MacKinnon et al., 2023), as is the case here with one treated state. In results to follow, we make inferences about the statistical significance of $Promise_{ast}$ coefficients from 1,000 permutations of $Promise_{ast}$ values to other states and times.

5 Results

5.1 Main Results

Table 1 reports Equation 1 results for four post-secondary outcomes. First, we estimate that access to tuition-free community college through Tennessee's Promise model significantly increases the likelihood that an 18 - 19 year-old high school

graduate is enrolled in college. The 5.9 percentage-point gain in post-secondary enrollment (9.7% of the counterfactual mean) mirrors the 5.9-point 2014 - 2015 increase in college going following statewide Promise implementation (Tennessee Higher Education Commission, various years) and seen in Figure 1. Post-secondary enrollment remains elevated 1 - 2 years after high school, although 1.9 percentage-point higher rates of enrollment for 19 - 20 year olds are statistically insignificant. Older individuals, age 20 - 24, are not more or less likely than the counterfactual to be in college if they had access to Promise as 17 year-olds.

At the margin, a student who chooses college because of Promise over work, the military, or other opportunities might be less likely to complete college with a credential that helps them recover the indirect and direct (non-tuition) costs of college. This would manifest as a higher likelihood of "some college, no degree" educational attainment, which tends to have a very uncertain lifetime return (Webber, 2024; Carruthers et al., 2023a). The second block of Equation 1 results in Table 1 indicates that Promise eligibility increases the likelihood of "some college, no degree" among 18 - 19 year olds, an age at which many are still enrolled in college and pursuing degrees. This effect does not persist, and for older individuals there is no significant effect of Promise eligibility on the likelihood of some college without credential completion.

The third block of Table 1 results suggests that Promise eligibility significantly increases associate's degree attainment by 1.5 percentage points at age 19 - 20 (in alignment with the normal, two-year time to degree), rising to 3.8 percentage points at age 21 - 22. These are large effects, measuring 48 - 54% of expected associate's attainment among 19 - 23 year-olds. Students enrolling in Tennessee community colleges shortly before statewide Promise were 31 - 35% likely to graduate within 6 years (Tennessee Higher Education Commission, 2023). This, combined with higher enrollment as 18 - 19 year-olds, suggests that Promise pushed more students into

two-year colleges, where marginal Promise students were at least as likely to succeed as their pre-program counterparts. Their higher likelihood of associate's attainment attenuated to 2.4 percentage points at age 22 - 23 and was no different than zero by age 23 - 24, suggesting that Promise may have accelerated college going from the mid-20s to the years immediately following high school.

Prior expectations on how free community college may have affected four-year degree attainment are unclear. Promise increased college going and reduced the sticker price of the first two years of college, and so may have likewise increased bachelor's degree completion down the road. The program incentivized the two-year college pathway, however, and bachelor-bound students would have had to navigate a transfer to a four-year college or university. A large volume of research has documented a lower likelihood of four-year completion for students who start college in a 2-year school (Scott-Clayton, 2015; Schudde & Jabbar, 2024), and Figure 1 panel B documents at least a short-term reduction in four-year college going after the statewide implementation of Promise. Nonetheless, Equation 1 indicates little change in bachelor's degree receipt by age 24. If anything, Promise may have increased Bachelor's degree attainment several years after high school. The 2.8-point estimated increase shown in Table 1 Column (6) is weakly significant but consistent with what Carruthers et al. (2023b) found for the early one-county phase of Promise, which likewise had an imprecisely positive relationship with four-year college completion several years later.

The last two blocks of Table 1 consider the possible effect of Promise on log income and log occupation score. Promise may affect cohort labor market outcomes through direct and indirect channels. The program's direct and intended channel would help students enroll in college and complete college, developing skills and earning credentials that are rewarded with higher pay and better jobs. At the same

time, if young adults are more likely to substitute part of their time toward college over work, employers who rely on young workers might raise pay to compete for a smaller pool. Either channel could explain estimated 7 - 9% gains in cohort income shown in Table 1. In support of general equilibrium effects or unobserved labor market dynamics that co-moved with Promise, we show in Table 2 that slightly older cohorts, who would have been ineligible for Promise, also realized 5% higher income (with weak statistical significance) in the years following Promise introduction or expansion.

Earnings immediately after college can be unreliable signals of longer term labor market success (Minaya & Scott-Clayton, 2018). Occupational score represents job quality in terms of earnings at all experience levels, and even in the short run, this may do a better job detecting if eligible students are on more favorable income trajectories. Additionally, we might expect general equilibrium effects of the college-work substitution to be concentrated at the bottom of the job ladder, and to have less bearing on a cohort's ability to find work above the entry level. The last block of Table 1 indicates that new Promise eligibility among 17 year-old cohorts increased their occupation scores by 7 - 8% over ages 19 - 21. The timing of discernibly better jobs coincides with the cohort's rise in college enrollment and associate's degree attainment. But as with effects on associate's degree attainment, estimated effects on occupational scores also decline to null after age 21.

Looking across Table 1 findings, the story that emerges is one where free community college immediately increases college going for eligible cohorts, who are then more likely to graduate from a community college by age 22 - 23 and possibly find better jobs than they would have otherwise. Both are short-term effects, however, and the counterfactual scenario may have been one where students enrolled in a two-year college a little later and ultimately found work at the same level of prospective pay.

Next, we estimate Equation 1 by gender, race, and metro area residence. Figure 3 documents positive effects of Promise on post-secondary enrollment for each subgroup at age 18 - 19, at or exceeding 5.0 percentage points, declining to par or lower-than-expected rates of enrollment by age 23 - 24. Age 18 - 19 gains in enrollment were larger for Nonwhite than White ACS respondents, and for respondents living outside of metro areas. Nonwhite individuals also exhibited larger declines in enrollment over ages 20 - 23. Turning to associate's and bachelor's degree attainment by subgroup (Figures 4 and 5), we find that Nonwhite students had lower and less precise gains in 2-year college completion than the other five subgroups, as well as imprecisely lower rates of four-year college completion by age 23 - 24.

Equation 1 effects on log income by subgroup are shown in Figure 6. Estimated effects are positive over all ages we observe for each subgroup, but confidence intervals are usually imprecise enough to include zero. Males and metro area residents are exceptions to that pattern. Both exhibit significantly higher log income at age 20, as in Table 1. Finally, 7 illustrates estimated effects on log occupation score by subgroup. We find that the rise in occupation score is driven largely by metro-area residents in eligible cohorts. Their potential pay is 12% greater than the counterfactual at age 20 - 21 before abruptly falling to par at age 21 - 22. Promise students in more urban areas may have been in a better position to capitalize on newly acquired associate's degrees, although that advantage does not appear to have persisted into their mid-20s.

5.2 Marginal Value of Public Funds

The marginal value of public funds (MVPF) for Promise is the ratio of participants' willingness to pay to government costs (Hendren & Sprung-Keyser, 2020). We derive the MVPF of Promise under the assumption that willingness to pay for Promise is

the sum of a cohort's tuition discounts and estimated additional income, net of taxes. Estimates of additional income from age 18 - 23 are positive but somewhat imprecise, so the end result is a relatively high but uncertain MVPF.

From 2019-20 through 2022-23, Promise scholarship outlays averaged $28 million per year (Tennessee Higher Education Commission, various years), or about $600 per participant, per semester. After applying a 3% discount over 2.5 years, the scholarship itself would be worth $1,708 as a lump sum at age 18. Between age 18 - 23, eligible cohorts earn 6.6 - 9.4% more than the counterfactual (Table 1), or $5,101 in additional after-tax, present value income per capita.[6] Putting these pieces together, estimated willingness to pay for Promise is $6,809, which we can think of as the amount of an unconditional transfer at age 18 that would make a student indifferent between having or not having access to Promise.

On the public cost side of the ledger, we start again with $1,708 per student direct spending on scholarships and subtract $1,189 in additional tax revenues. We also need to consider the public cost of subsidizing college for students who would not have enrolled in the absence of Promise. This cost will be minimal if, as suggested by Table 1 findings, Promise did not permanently increase college-going so much as shift the timeline from age 22+ to age 18 - 19. On strictly financial terms, the state might prefer to enroll students later than earlier (not necessarily as a matter of policy preference). We add $3,008 to the public cost per student to represent the net-present-value difference between state and local support for two-year college enrollment over ages 18 - 20 versus 21 - 23.[7] This brings net public cost per student

[6] In level terms, average control income plus a 6.6 - 9.4% premium is as much as $26,000, or about 200% of the federal poverty limit in 2021. We apply an 18.9% effective tax rate that accounts for typical federal and state individual income tax at this level of earnings, net of SNAP transfers and health subsidies (Congressional Budget Office, 2016; Hendren & Sprung-Keyser, 2020).

[7] State and local support for two-year colleges is $12,534 per student in Tennessee (State Higher Education Executive Officers Association, 2024).

to $3,527.

The resulting MVPF from this exercise is 1.93. This means that individuals value Promise at just under $2 per $1 of public outlay. An MVPF of 1.93 is on par with or higher than 40% of 22 evaluations of post-secondary admission criteria, application assistance, tuition discounts, and scholarships that Hendren & Sprung-Keyser (2020) review. Notably, Promise's MVPF is essentially equivalent to that for Kalamazoo Promise (Bartik et al., 2021), a substantially more generous free-tuition program that had proportionately larger effects on degree attainment. The Tennessee Promise MVPF is fairly uncertain, however, given large standard errors for most of the income effects reported in Table 1. Using the lower and upper bounds of 95% confidence intervals for those estimates, the MVPF could be as small as $0.07, or as high as $7.59, per $1 of net public spending. Placebo specifications discussed below add to this uncertainty. Slightly older, ineligible cohorts also realized income gains that coincided with growth in the dosage of Promise at a point in time, although not to the same degree as eligible cohorts.

We left a number of elements out of the Promise MVPF computation that would likely increase willingness to pay further and decrease public cost. Willingness to pay, for example, excludes any value that students place on knowing the tuition cost of college with certainty (Burland et al., 2023). We also excluded any net savings in public expenditures from students who started college in two-year schools rather than four-year schools because of Promise. This substitution has been found in related work on phases of Tennessee Promise (Carruthers & Fox, 2016; House & Dell, 2020) but cannot be discerned in the ACS, and does not appear to have altered trends in four-year degree receipt. We additionally omitted projections for earnings after age 24. If we carried the 8% estimated premium forward, the additional tax revenue would easily pay for the program and result in an infinite MVPF. A premium larger

than 8% may be warranted if the likelihood of Bachelor's degree receipt increases through the mid-20s, as suggested by Table 1.

5.3 Alternate and Placebo Specifications

Results are broadly robust to five modifications of Equation 1 shown in Figure 8: Excluding ACS respondents outside of Tennessee who may have been eligible for other statewide Promise scholarships, single-age a samples rather than a pooled with $a+1$, including controls for state-year population characteristics (race and ethnicity profiles, median age, median income, unemployment, labor force non-participation, inter-state mobility, and educational attainment), excluding 2020 ACS samples, and adding controls for state-specific linear time trends. We see the same pattern of findings across these alternate specifications. Each indicates that Promise increased college enrollment for recent high school graduates (Figure 8 Panel A), increased the rate of associate degree attainment among 20 - 22 year-olds (Panel C), had unclear effects on bachelor's degree attainment by by age 24 (Panel D), and had inconsistently positive effects on income and occupation score (Panels E and F).

Table 2 reports Equation 1 results for the estimated effect of $Promise_{ast}$ at age 22 on outcomes of interest between age 22 - 23 and 28 - 29. This is largely a falsification test, since 22 year-olds were not eligible for the Tennessee Promise tuition guarantee, application assistance, or mentoring that was targeted at traditional-aged students moving directly from high school to college. Age 22 year-olds also would not have been eligible for Tennessee Reconnect, which was introduced at the same time as Tennessee Promise and provided a tuition guarantee to nontraditional students (specifically, those age 25 and older) enrolling in a technical college. It is possible, however, that 22 year-olds were nonetheless affected by the Tennessee Promise message and enthusiasm surrounding the state "changing the conversation" about

college (Tennessee Office of the Governor, 2016), or that institutional responses to the Drive to 55 campaign had its own effects on ineligible students.

We find little to no placebo effects of gains in $Promise_{ast}$ availability at age 22 on college enrollment or attainment. One exception is a significantly higher likelihood of Bachelor's degree attainment at age 23 - 24, by 2.3 percentage points (7.6% of the control mean). The differential is successively smaller and more imprecise in later years. It is unclear if this was a spillover effect of Tennessee Promise and simultaneous higher education policies, but the time path of placebo effects on Bachelor's completion runs counter to the rising, imprecise effects for the treated cohorts (Table 1). We take this as evidence against unobserved factors that co-moved with Tennessee Promise and independently led to higher rates of degree completion.

Turning to placebo effects and labor market outcomes, we find that untreated age-22 cohorts had about 5% higher income than their peers at age 24 - 26. Although the premium is weakly significant, it rivals the 7 - 9% magnitude we see among treated cohorts in Table 1. This is one root of our uncertainty about 7 - 9% estimated effects on early-career earnings, in addition to considering general equilibrium effects from parts of the cohort substituting into college over work. We are not able to determine if Promise's effect on college going shifted labor supply in such a way that older, untreated cohorts in the workforce also earned more. Alternatively, unobserved labor market dynamics may have been pushing wages up overall, in concert with the Promise expansion. The latter story would bias upward the estimated effects of Promise on income.

Even allowing for omitted factors in income determination, placebo results for occupation score indicate that Promise did not coincide with improvement in early career job quality for the untreated cohorts in a way that resembles what we estimate for

treated cohorts in Table 1. Within-state growth in Promise preceded small and imprecise variation in untreated occupation scores, measuring 1-2% higher or lower, versus statistically significant 7-8% gains for the treated cohorts over ages 19-21.

6 Conclusion

In 2015, Tennessee Promise became the first statewide model of "free college" in the United States in over 50 years. Promise was extraordinarily well received in Tennessee,[8] and early indicators of success in terms of college going motivated similar programs in other states as well as recurring federal proposals for free community college (Smith, 2017). The model was not without criticism, however, founded in concerns about low student success rates in community colleges, the difficulty of transferring community college credits toward higher degrees, financial effects on four-year schools, and last-dollar funding that allocated more aid to higher income students (National Review Editors, 2015; Semuels, 2015; Quinton, 2019).

Eight years after statewide Tennessee Promise, and 14 years after the single-county introduction of the program that grew to become Tennessee Promise, we find evidence that the program is successful in raising college enrollment among new high school graduates, and at least in the short term, in raising degree attainment. We estimate that Promise eligibility increases associate's degree among 22 year-olds by a large amount (up to 3.8 percentage points, or 48% of the mean), with effects attenuating to null thereafter. Eligibility has positive but imprecise effects on bachelor's degree attainment. Together, these patterns suggest that Promise led more students to seamlessly enroll in college after high school rather than in their mid-20s.

Conclusions for initial labor market outcomes are consistent with accelerated move-

[8] A poll of registered voters found 86% support for Promise, shortly after the program was proposed (Vanderbilt University, 2014).

ments into and through college, but also less clear and less robust to alternative estimators. Promise-eligible students in Tennessee had higher earnings to a degree that would have exceeded the net public cost by a factor equivalent to more effective but costlier Promise programs. But estimated income gains are imprecise and difficult to attribute directly to Promise since slightly older, ineligible Tennessee cohorts also saw higher incomes over the same period of time. Eligibility coincided with better jobs in terms of potential mid-career earnings, although these gains attenuated to zero by age 22.

Our findings have two primary limitations and opportunities for further research. First, we do not speak to the long-term return on investment in terms of higher earnings or better jobs, both of which motivated Tennessee Promise under the broader "Drive to 55" state attainment goal. Promise might have shifted the typical attainment timeline rather than permanently increased attainment, which could nonetheless increase students' lifetime income since the indirect, opportunity cost of college tends to be lower immediately after high school. Longer-term employment, earnings, and occupational outcomes will shed light on this question.

Second, we study one particular model of tuition-free college. Most other state Promise initiatives share Tennessee's last-dollar funding and/or emphasis on two-year community and technical colleges, but with many points of differentiation around eligible programs, post-college residency requirements, student need, and other criteria. Even within a single program, there can be funding and eligibility fluctuations over time (Gurantz, 2020; Miller-Adams & Iriti, 2022). More research is needed on if and how differences in Promise program components translate into differences in student outcomes.

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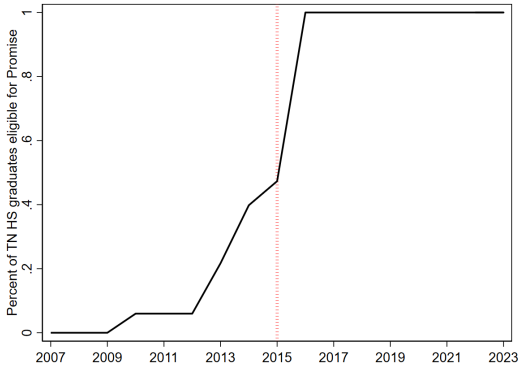
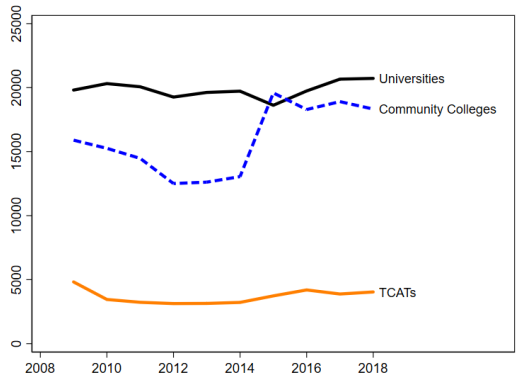
Figure 1: Tennessee Promise coincided with sharp increases in college enrollment in 2015.

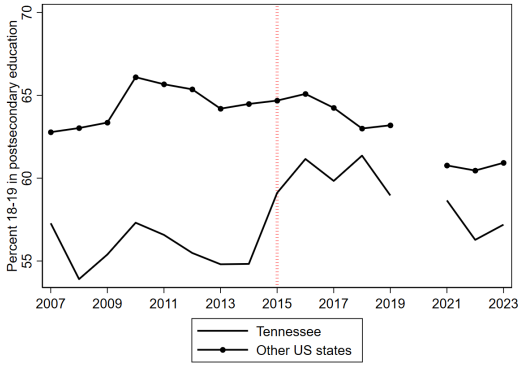
A. Percent of high school graduates eligible for Promise (state administrative data)



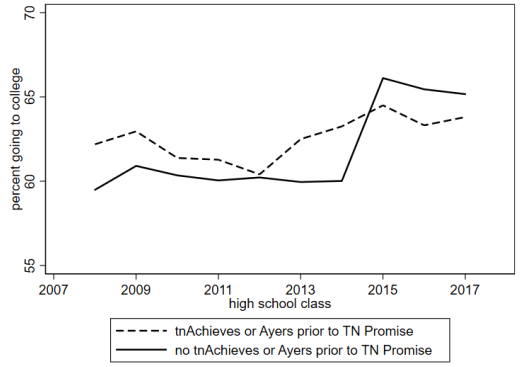
B. First-time, full-time enrollment by Tennessee higher education sector (IPEDS)



C. Percent of 18-19 year-old high school graduates enrolled in higher education ACS)



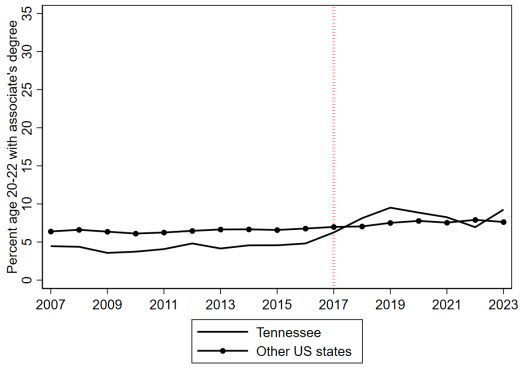
D. Percent of new high school graduates enrolling immediately in college (state administrative data)



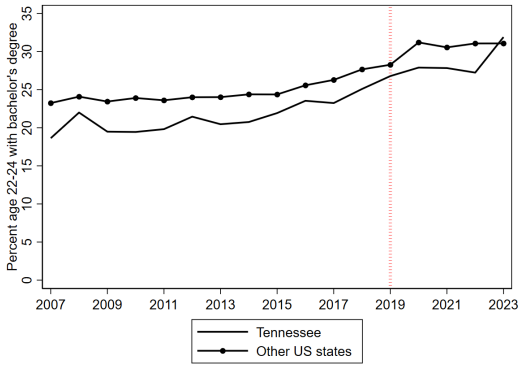
Notes: Authors' calculations. Panel A depicts, by 12th grade cohort, the percent of public high school graduates in counties where tuition-free community college was available through Knox Achieves, tnAchieves, or Tennessee Promise. Panel B plots the volume of first-time, full-time post-secondary enrollment in Tennessee public higher education institutions, by sector and year, according to IPEDS. Panel C plots the rate of post-secondary school attendance among 18-19 year-old high school graduates in the ACS, using Census person weights. "Tennessee" and "Other US state" location is assigned according to where respondents lived one year prior to taking the ACS. Panel D plots, by 12th grade cohort and pre-2015 availability of tuition-free community college, rates of seamless college enrollment observed in National Student Clearinghouse records linked to state administrative K-12 records.

Figure 2: Tennessee age 20 - 24 associate's degree attainment caught up with the U.S. after 2015.

A. Percent age 20-22 with associate's degrees



B. Percent age 22-24 with bachelor's degrees



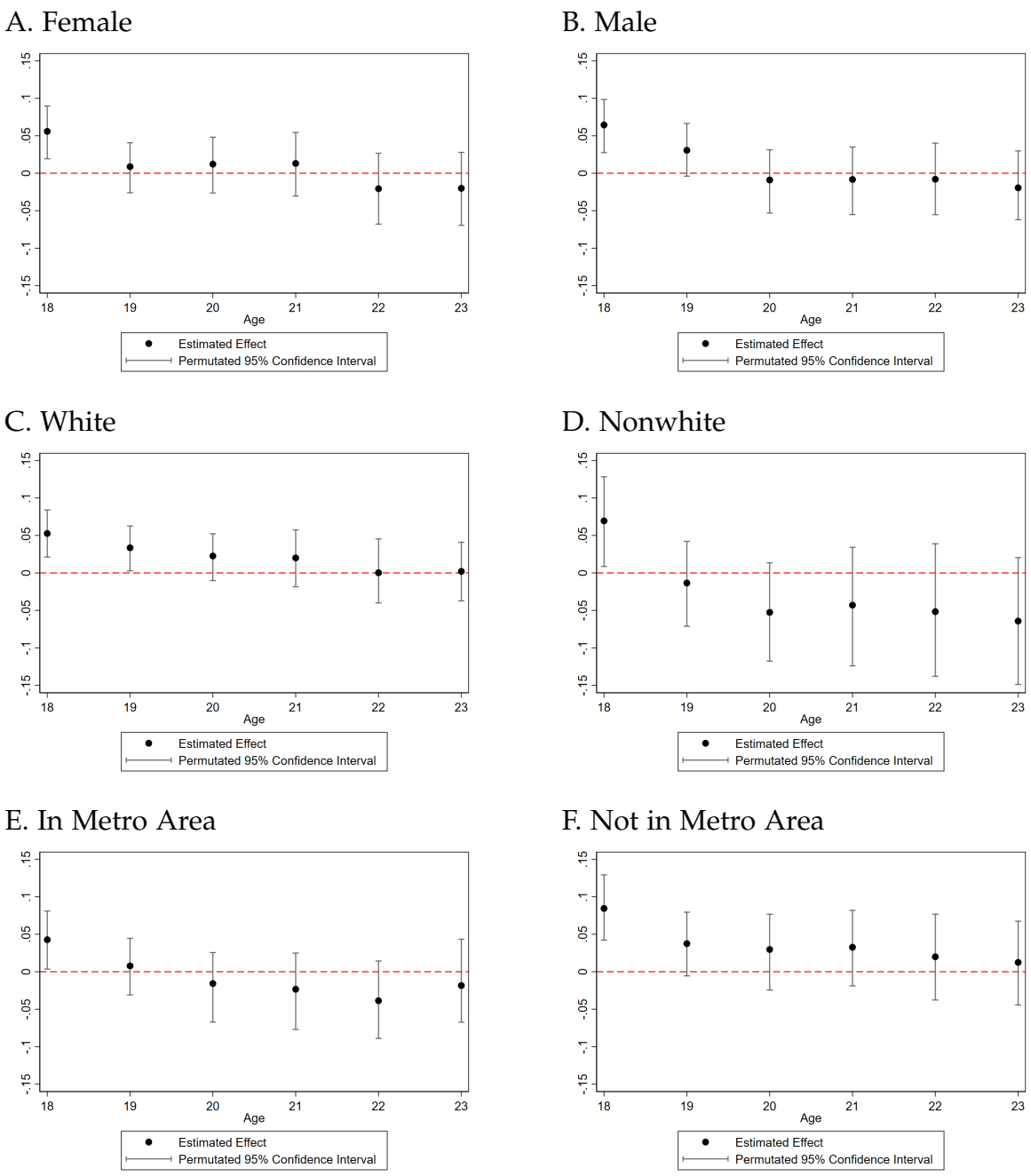
Notes: Authors' calculations using the ACS and person weights. "Tennessee" and "Other US state" location is assigned according to where respondents lived one year prior to taking the ACS.

Table 1: Estimated effects of tuition-free community college on post-secondary enrollment and degree completion, by age

	(1)	(2)	(3)	(4)	(5)	(6)
Age	18-19	19-20	20-21	21-22	22-23	23-24
			Post-secondary enrollment			
$Promise_{ast}$	0.059***	0.019	0.001	0.003	-0.014	-0.019
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
Control mean	0.610	0.620	0.559	0.477	0.362	0.270
Permutation p-value	0.000	0.150	0.956	0.834	0.470	0.262
			Some college, no degree			
$Promise_{ast}$	0.049***	0.013	-0.011	0.001	0.004	-0.009
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.003)
Control mean	0.473	0.569	0.554	0.472	0.367	0.307
Permutation p-value	0.000	0.352	0.392	0.984	0.782	0.666
			Associate's degree completion			
$Promise_{ast}$	0.004	0.015***	0.035***	0.038***	0.024**	0.0095
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Control mean	0.009	0.028	0.058	0.079	0.086	0.088
Permutation p-value	0.118	0.010	0.000	0.000	0.034	0.460
			Bachelor's degree completion			
$Promise_{ast}$	-1.1e-04	0.001	0.002	2.9e-04	0.006	0.028+
	(1.5e-04)	(4.0e-04)	(0.001)	(0.002)	(0.003)	(0.004)
Control mean	0.001	0.005	0.024	0.109	0.231	0.300
Permutation p-value	0.928	0.456	0.584	0.944	0.694	0.100
			Log income			
$Promise_{ast}$	0.051	0.076+	0.094**	0.080**	0.066+	0.080+
	(0.013)	(0.013)	(0.012)	(0.011)	(0.012)	(0.012)
Control mean	8.72	9.12	9.43	9.64	9.88	10.10
Permutation p-value	0.222	0.062	0.012	0.028	0.092	0.056
			Log occupation score			
$Promise_{ast}$	0.053	0.071**	0.083***	0.016	-0.004	0.017
	(0.012)	(0.009)	(0.007)	(0.007)	(0.006)	(0.006)
Control mean	9.345	9.619	9.832	10.00	10.19	10.32
Permutation p-value	0.122	0.016	0.004	0.594	0.878	0.634

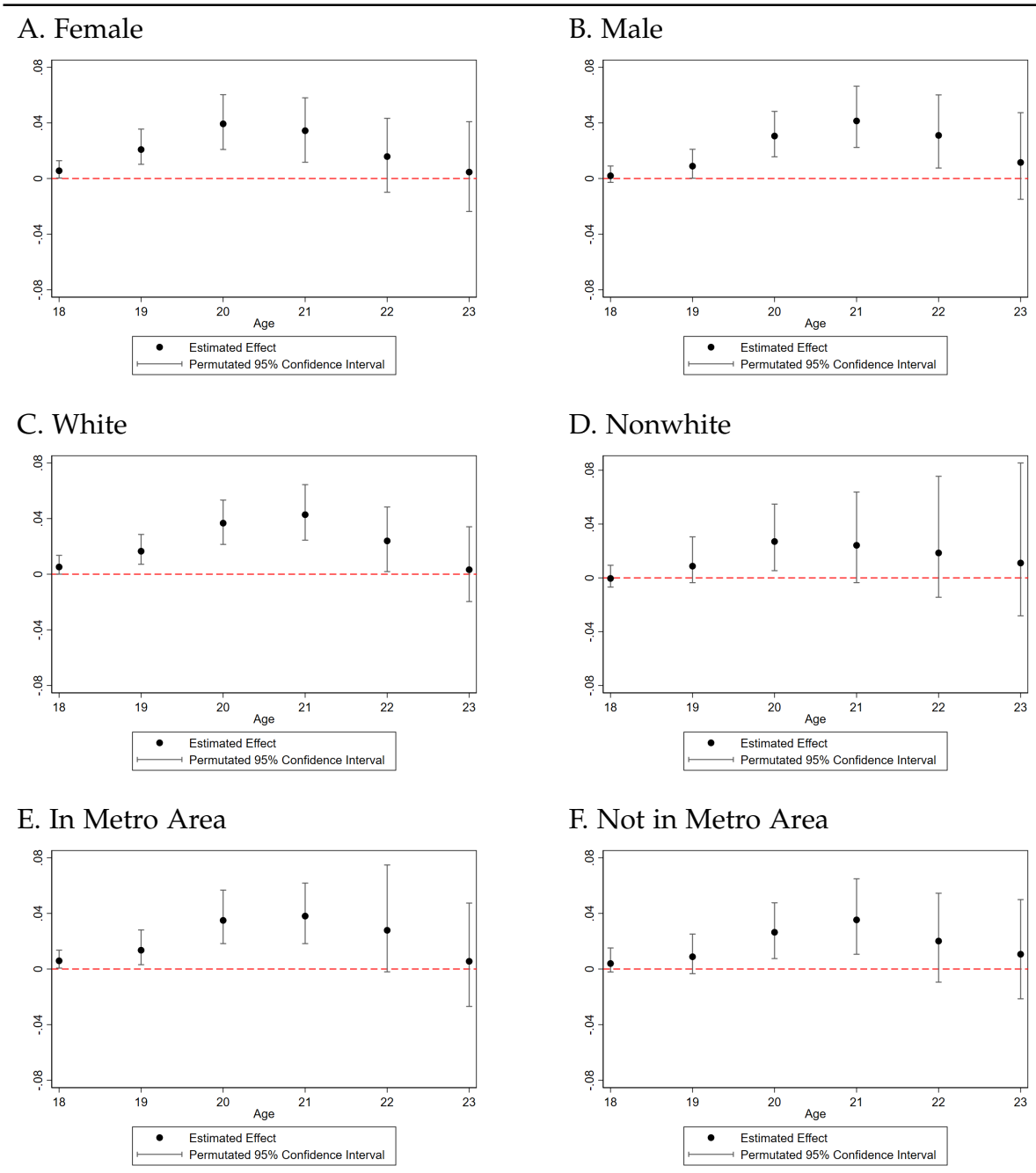
Authors' calculations using Equation 1 applied to the ACS. Clustered standard errors are in parentheses. $N = 1{,}734$ state-years. Statistical significance from permutation: +0.10 **0.05 ***0.01.

Figure 3: Promise may have increased enrollment at age 18 and decreased enrollment later on, particularly for Nonwhite students.



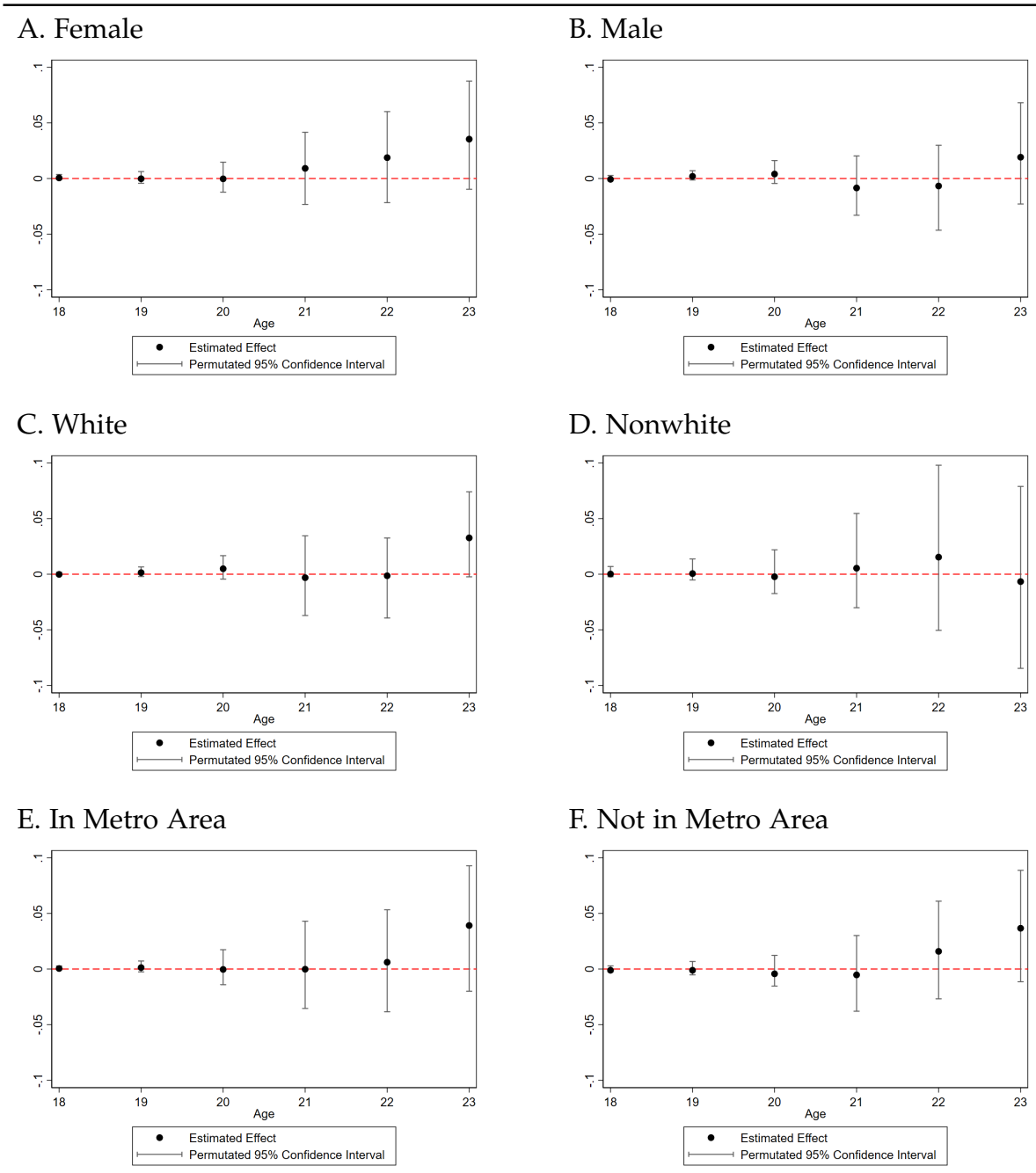
Notes: Authors' calculations using Equation 1 applied to the ACS. In each panel, each point represents a $\hat{\beta}$ estimate for the effect of $Promise_{ast}$ on post-secondary enrollment at age $a - a + 1$, with 95% confidence intervals derived from permutation. Subsamples are indicated in panel headings.

Figure 4: Promise had more potent effects on associate's degree attainment for White than Nonwhite students



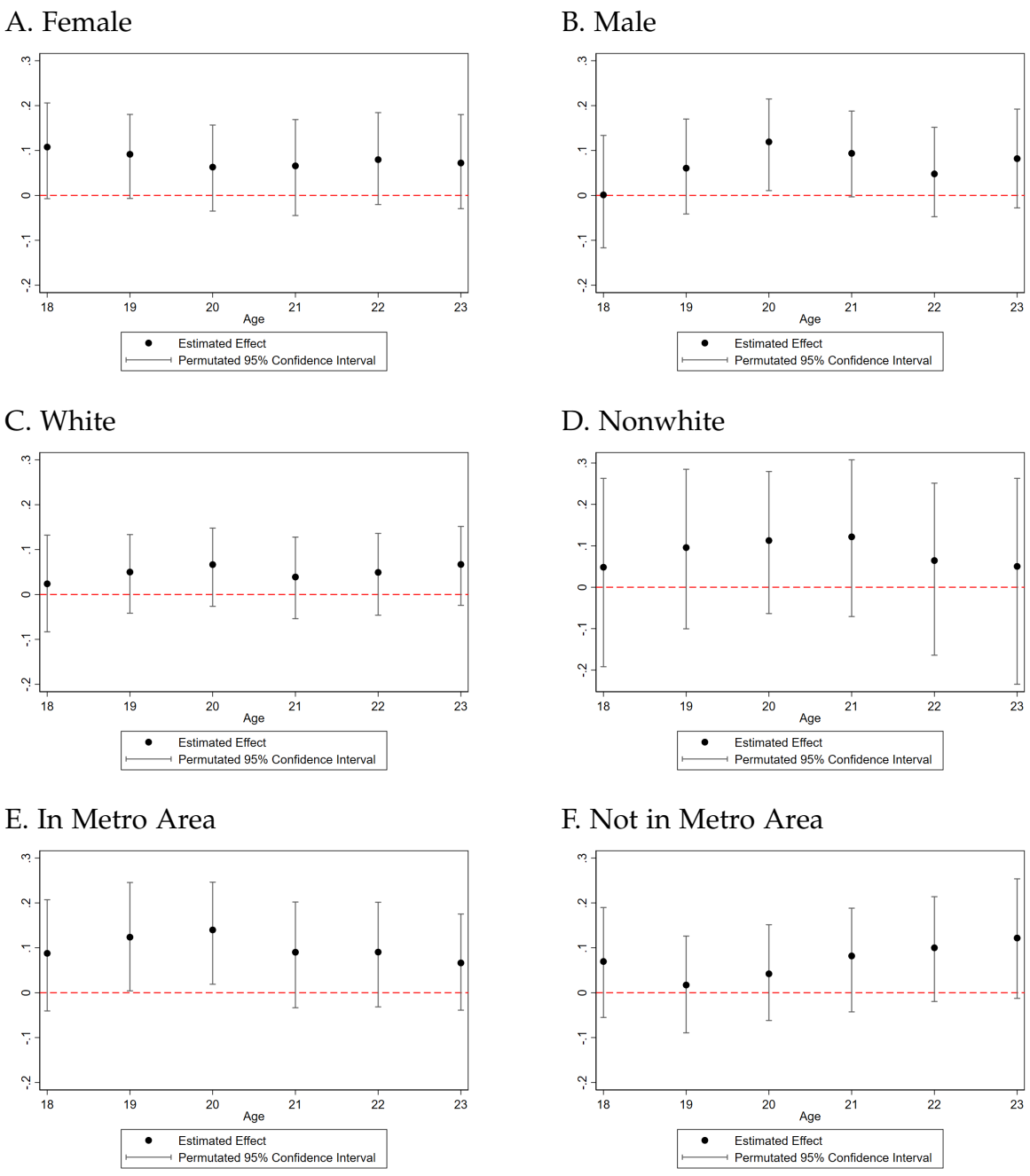
Notes: Authors' calculations using Equation 1 applied to the ACS. In each panel, each point represents a $\hat{\beta}$ estimate for the effect of $Promise_{ast}$ on associate's degree attainment at age $a - a + 1$, with 95% confidence intervals derived from permutation. Subsamples are indicated in panel headings.

Figure 5: Promise has imprecisely positive effects on bachelor's degree attainment within 5 - 6 years of high school.



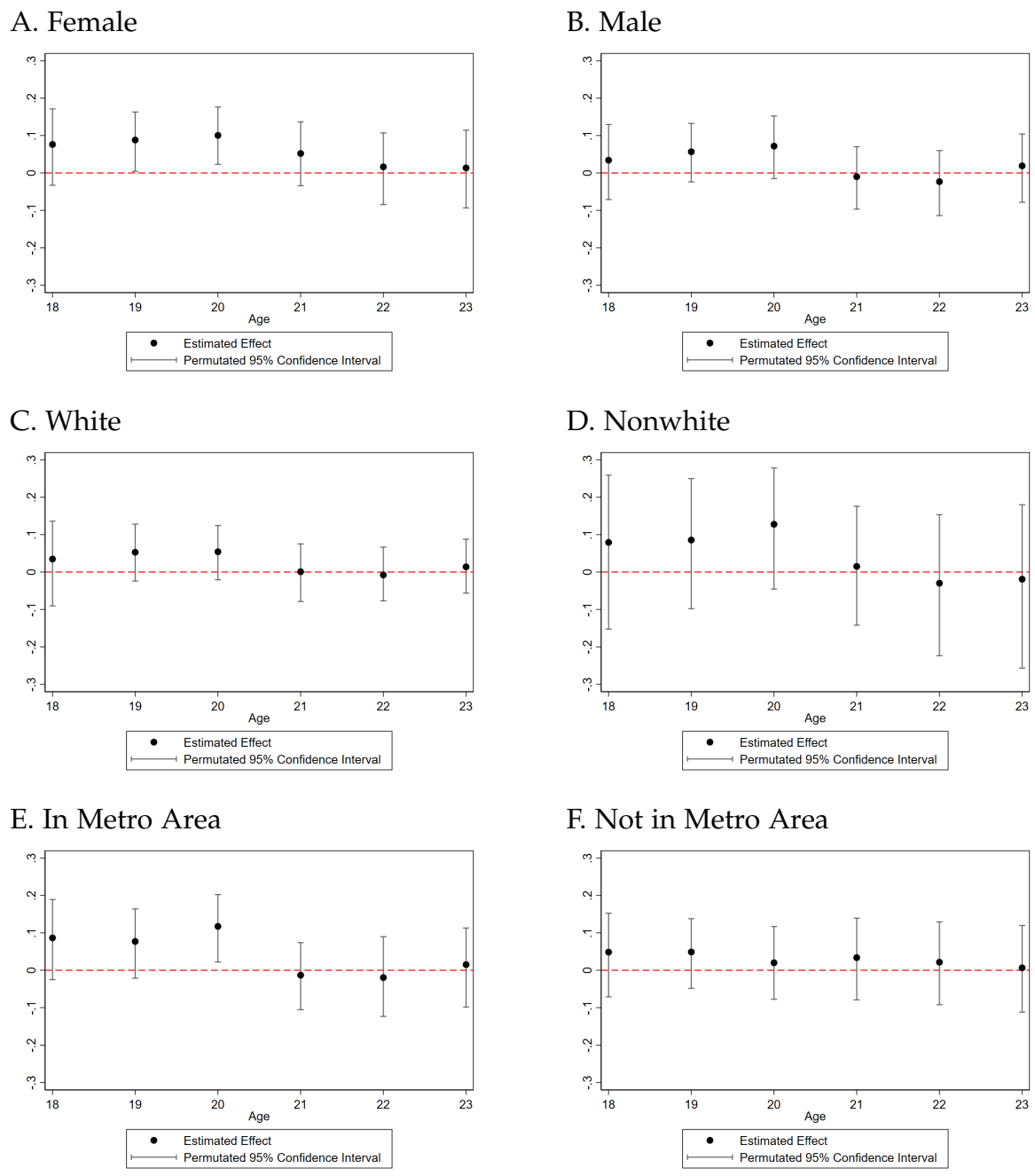
Notes: Authors' calculations using Equation 1 applied to the ACS. In each panel, each point represents a $\hat{\beta}$ estimate for the effect of $Promise_{ast}$ on bachelor's degree attainment at age $a - a + 1$, with 95% confidence intervals derived from permutation. Subsamples are indicated in panel headings.

Figure 6: Promise-eligible cohorts have higher income in their early 20s, particularly men and metro-area residents.



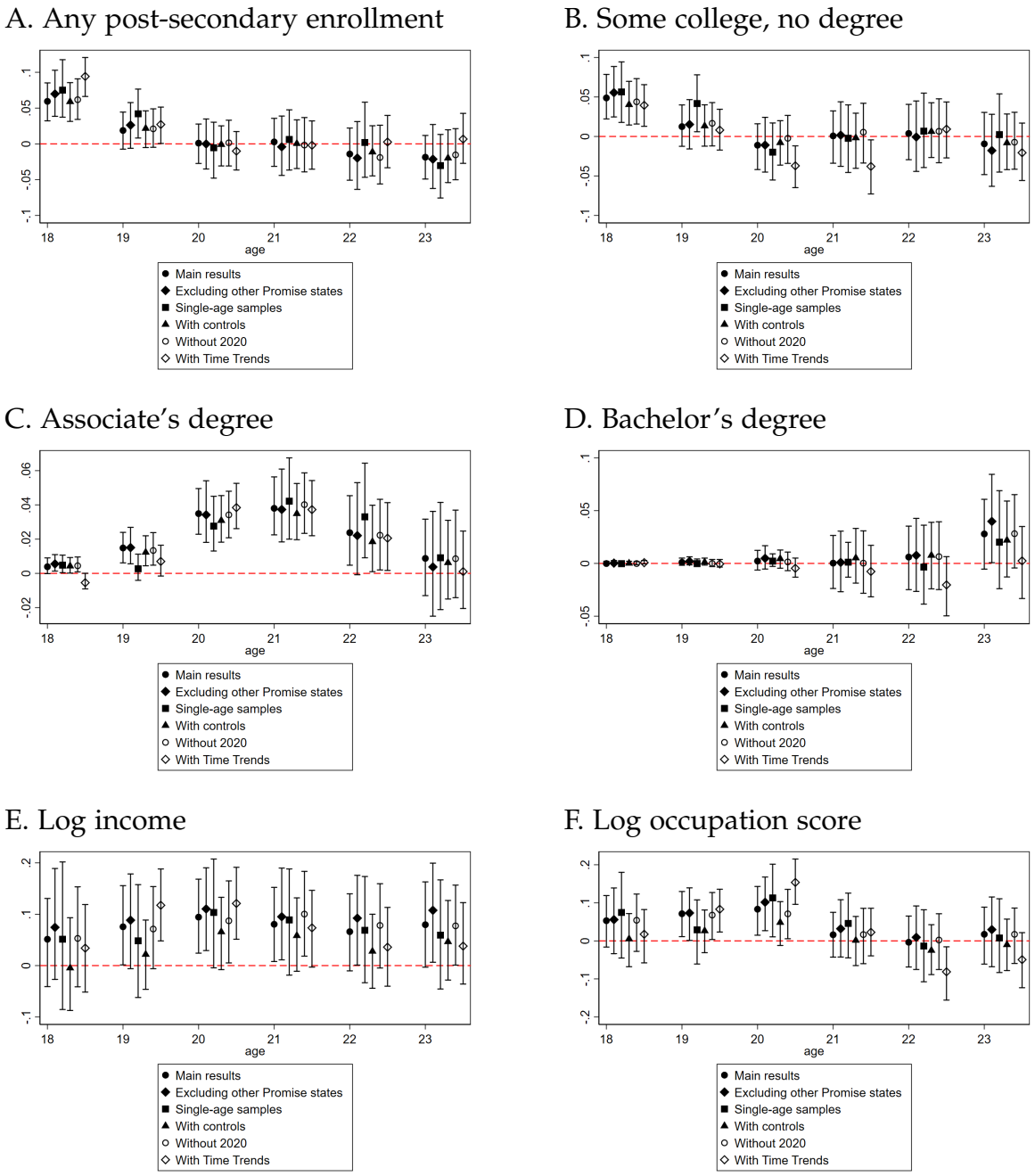
Notes: Authors' calculations using Equation 1 applied to the ACS. In each panel, each point represents a $\hat{\beta}$ estimate for the effect of $Promise_{ast}$ on log income at age $a - a + 1$ (in 2023 dollars), with 95% confidence intervals derived from permutation. Subsamples are indicated in panel headings.

Figure 7: Promise eligibility coincides with better jobs, but only over ages 19 - 21 and in metro areas.



Notes: Authors' calculations using Equation 1 applied to the ACS. In each panel, each point represents a $\hat{\beta}$ estimate for the effect of $Promise_{ast}$ on log occupation score at age $a - a + 1$ (in 2023 dollars), with 95% confidence intervals derived from permutation. Subsamples are indicated in panel headings.

Figure 8: Results are similar under alternate specifications and samples.



Notes: Authors' calculations using Equation 1 applied to the ACS. In each panel, each point represents a $\hat{\beta}$ estimate for the effect of $Promise_{ast}$ on the outcome indicated in panel headings, with 95% confidence intervals derived from permutation. Main results from Table 1 are depicted with circles. Diamonds represent Equation 1 results from samples excluding other states with statewide Promise programs. Squares represent Equation 1 results with single-age samples rather than $[a, a+1]$ samples. Triangles represent Equation 1 results that include controls for state-year averages describing age 25 - 65 ACS respondents' unemployment, labor force non-participation, college attainment, race, Hispanic ethnicity, median income, inter-state mobility, and median age. Hollow circles represent Equation 1 results excluding 2020 ACS respondents. Finally, hollow diamonds represent Equation 1 results with additional controls for state-specific time trends.

Table 2: Falsification test: Estimated effects of tuition-free community college at age 22 on post-secondary enrollment, degree completion, and labor market outcomes, by age

	(1)	(2)	(3)	(4)	(5)	(6)
Age	23-24	24-25	25-26	26-27	27-28	28-29
			Post-secondary enrollment			
$Promise_{ast}$	-0.015	-0.002	0.005	-0.003	0.006	0.011
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)
Control mean	0.270	0.219	0.187	0.165	0.146	0.131
Permutation p-value	0.204	0.858	0.688	0.834	0.588	0.478
			Some college, no degree			
$Promise_{ast}$	0.006	0.006	-0.005	-0.014	-0.011	0.007
	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Control mean	0.307	0.283	0.269	0.260	0.256	0.252
Permutation p-value	0.582	0.626	0.764	0.306	0.458	0.710
			Associate's degree completion			
$Promise_{ast}$	0.006	0.013	0.011	0.004	0.009	0.017
	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Control mean	0.089	0.092	0.096	0.097	0.098	0.100
Permutation p-value	0.446	0.144	0.212	0.610	0.350	0.202
			Bachelor's degree completion			
$Promise_{ast}$	0.023**	0.018	0.021	0.021	0.013	-0.014
	(0.005)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Control mean	0.301	0.328	0.346	0.357	0.363	0.369
Permutation p-value	0.0420	0.132	0.112	0.156	0.456	0.494
			Log income			
$Promise_{ast}$	0.039	0.049^{+}	0.047^{+}	0.038	0.042	0.050
	(0.011)	(0.013)	(0.012)	(0.014)	(0.013)	(0.012)
Control mean	10.10	10.28	10.42	10.49	10.55	10.60
Permutation p-value	0.180	0.068	0.086	0.192	0.164	0.178
			Log occupation score			
$Promise_{ast}$	0.018	0.020	0.017	-0.020	-0.008	-0.017
	(0.007)	(0.008)	(0.007)	(0.008)	(0.009)	(0.007)
Control mean	10.32	10.41	10.48	10.53	10.56	10.59
Permutation p-value	0.442	0.332	0.492	0.436	0.754	0.648

Authors' calculations using Equation 1 applied to the ACS. Clustered standard errors are in parentheses. $N = 1{,}734$ state-years. Statistical significance from permutation: $+$0.10 **0.05 ***0.01.