Resources or Rewards? The Impacts of School District Funding and Incentives on Student Outcomes

Clara Kyung* (JMP) and Haruka Uchida*

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Abstract

School funding and accountability are prevalent policy tools in public education, but their efficacy in improving student outcomes remains contested. We study the impacts of a statewide education reform in Texas that (1) changed the formula that links school district characteristics to funding, and, in a novel shift from test-based accountability, (2) introduced financial bonuses for districts based on high school graduates' attainment outcomes, including college enrollment and industry-based certification. Using policy-driven, between-district variation in district spending and incentives, we find that both spending and incentives improved the composite attainment outcome targeted by the bonus policy. Relative to funding increases, incentives produced comparable gains at a lower government cost. Effects on attainment are driven by industry-based certifications, with little effect on college enrollment. However, by focusing on high school graduates' outcomes, the bonus structure inadvertently incentivized districts to reduce graduation rates among 12th graders who were unlikely to meet the attainment criteria: incentives decreased graduation rates and increased dropout rates. Consequently, we find mixed evidence on college and career outcomes one year after 12th grade: neither district spending nor incentives affected the share of students who were employed or enrolled in college, but incentives increased earnings. Our results highlight both the potential promise and design challenges of attainment-based incentive policies.

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1 Introduction

Education policymakers have long debated how to most effectively improve students' later-life outcomes, such as postsecondary attainment and labor market success. In US public education, two prevalent policy levers that are used to achieve this goal are 1) increases in unconditional school funding that do not depend on student performance and 2) conditional rewards to schools that depend on student performance. Since the 1990s, the majority of US states have enacted at least one reform that increases the level of unconditional school funding (Lafortune et al., 2018), and since the No Child Left Behind Act of 2001, every US state has implemented a test-based accountability system.

Despite the prominence of these two policy tools, policymakers and researchers continue to debate their efficacy. Test-based accountability in particular has faced criticism for inducing undesirable educator behavior such as teaching to the test, effort triage, or even cheating (Jacob, 2005; Neal and Schanzenbach, 2010; Jacob and Levitt, 2004). These concerns have prompted a shift towards policies that reward schools based on students' attainment outcomes, such as college enrollment and completion of industry-recognized credentials: a growing number of US states tie rewards to these outcomes.[1] Yet little is known about the impacts of attainment-based incentive policies, or how their effects compare to unconditional funding increases. Understanding these effects is critical for designing policies that effectively improve students' long-term trajectories. The challenge with answering these questions is that attainment-based incentives are only recently emerging as a policy, and few settings have policy variation in both funding and attainment-based incentives that can be quantified on a comparable scale.

In this paper, we estimate the impacts of funding increases and attainment-based incentives on student outcomes by studying the impacts of a statewide reform in Texas that jointly (1) changed the formula that links school district characteristics to funding, and, in a novel shift from test-based accountability, (2) introduced financial bonuses for districts based on high school graduates' attainment outcomes, including college enrollment and industry-based certification. We construct simulated instruments that isolate changes in districts' (1) per-pupil expenditures driven by the funding formula change and (2) incentives to improve attainment outcomes due to the bonus policy. Under the assumption that districts with differential policy-induced changes in funding and

[1] Since No Child Left Behind, the majority of states now evaluate measures of college and career readiness—typically performance in AP coursework and on the SAT/ACT—in their accountability systems. As of 2025, eight states include measures of postsecondary outcomes. See Education Strategy's recent report on this here.

incentives would have followed similar trends in students' educational and labor market outcomes absent the reform, we identify the causal effects of both per-pupil spending and attainment-based incentives on these outcomes.

We find that both per-pupil expenditures and attainment-based incentives improve the composite attainment measure targeted by the bonus policy, defined as either enrolling in college, completing an associate's degree, completing an industry-based certification, or completing a level I/II community college certificate. The gains in the composite attainment measure are driven by industry-based certifications:[2] a $100 increase in per-pupil expenditures leads to a 3.2 percentage point increase in the share of 12th graders earning an industry-based certification, and a 1 S.D. increase in incentives leads to a 2.3 percentage point increase from a rate of 11% in the pre-reform year.[3] Consistent with the incentive structure, the positive effect of incentives on industry-based certification is driven by students who do not meet the other attainment criteria, i.e., those who would otherwise not generate a bonus for the district. In contrast, the positive effect of per-pupil expenditures is similar regardless of whether students meet the other attainment criteria. We find no significant effects of per-pupil expenditures and incentives on college enrollment, although we do not reject common effect sizes associated with per-pupil expenditures from the literature (Jackson and Mackevicius, 2024).

Using data on the realized bonus amounts that the state awarded to districts, as well as the total funding increases, we calculate the ex-post cost to the government of the change in unconditional funding and bonus funding. Scaling the effect sizes of funding and incentives by their respective costs, we find that incentives yield comparable improvements in the composite attainment outcome at a lower cost to the government than unconditional funding increases.

However, despite these improvements in students' attainment outcomes, by tying bonuses to graduates' outcomes, the incentive structure created an unintended incentive for districts to reduce graduation among 12th graders who were unlikely to meet the attainment criteria. By the third year following policy implementation, a 1 S.D. increase in incentives reduced graduation rates by 0.7 percentage points from a baseline rate of 95% in the pre-policy year. In contrast, funding increases

[2]Industry-based certifications (IBCs) are industry-recognized credentials developed by a third-party vendor. In order to earn an IBC, students must pass an exam administered by the vendor that developed the credential. In Texas, students typically take IBC exams as part of a Career & Technology Education (CTE) course or a sequence of CTE courses at their high school. We provide additional details on IBCs as well as examples of IBCs in Section 2.3.

[3]The magnitude of these estimates can depend on the assumptions about the fraction of money that gets spent on high school versus middle or elementary schools. In the main analyses we assume that districts allocate funding evenly across students in the district. If districts allocate relatively more of the funding to high school, then our estimates provide an upper bound. On the other hand, if districts allocate relatively less of the funding to high school, then our estimates provide a lower bound.

had little impact on graduation and dropout rates. This result demonstrates that the incentive structure—whether for attainment-based incentives or test-based incentives—can have important implications for which students ultimately benefit from the policy, highlighting the importance of incentive design.

Turning to the impact of the policy on measures of short-term college or career engagement and earnings, we find that neither per-pupil expenditures nor incentives had a significant impact on the share of 12th graders who are employed or enrolled in a two- or four-year college one year later, though the point estimate is positive. We also find that, by the third year after policy implementation, both per-pupil expenditures and incentives increase one-year later annual earnings of 12th graders. These positive impacts are driven by students who are not enrolled in college. Finally, given the large impacts of the policy on industry-based certifications, we investigate how much of the earnings gains can be explained by the policy's effect on industry-based certifications. Back-of-the-envelope calculations using estimated returns to industry-based certifications suggest that industry-based certifications can explain at most 8-10% of the policy's effect on earnings.

Our paper contributes most directly to two strands of literature. First, we add to a large literature on the impacts of school funding (Jackson and Mackevicius, 2024; Lafortune et al., 2018; Jackson et al., 2015; Candelaria and Shores, 2019; Johnson, 2015; Jackson et al., 2021; Hanushek, 1986). There is a growing consensus that funding improves student outcomes, including longer-run outcomes such as college enrollment and later-life earnings, but the extent to which funding matters is still debated (Jackson and Mackevicius, 2024). We build on this literature by studying a formula-based funding change that offers transparent policy variation and by examining impacts on a wider set of policy-relevant outcomes, including completion of an associate's degree and completion of an industry-based certification.

Second, we build on past work studying school accountability policies. These studies have largely focused on the impacts of test-based accountability policies and generally find improvements in overall test scores (Carnoy and Loeb, 2002; Hanushek and Raymond, 2005; Rockoff and Turner, 2010; Dee and Jacob, 2011; Reback et al., 2014; Deming et al., 2016) at the cost of potentially narrowing instructional focus (e.g., by teaching test-taking skills at the expense other important potentially untested skills) and incentivizing teachers to divert effort away from infra-marginal students towards students who are near the proficiency threshold (Booher-Jennings, 2005; Krieg, 2008; Neal and Schanzenbach, 2010; Deming et al., 2016; Ladd and Lauen, 2010).[4] Our paper is

[4]Other concerns include cheating on high-stakes exams by teachers (Jacob and Levitt, 2004), or educational triage,

most similar to recent studies that examine impacts of accountability policies which incentivize non-test-score outcomes such as high school graduation rates (Harris et al., 2023; Atchison et al., 2025; Carnoy, 2005). We contribute to this literature by testing the effects of a novel, outcomes-based accountability policy that provides direct financial incentives for longer-term attainment outcomes that have not been targeted by test-based accountability policies.

Finally, we contribute to both the funding literature and the accountability literature by comparing the efficacy of school funding and incentives within the same setting. The reform that we study allows us to make this comparison because of its joint introduction of changes to school districts' funding formula *and* incentives to improve attainment outcomes. Moreover, because the reform created incentives through explicit monetary payments, we are able to calculate the ex-post cost to the government of providing incentives, offering a way to compare the cost effectiveness (from the government's perspective) of incentives and unconditional funding.

Our paper speaks to a developing movement in accountability to incentivize outcomes beyond test scores. Since the Every Student Succeeds Act of 2015, states have increasingly begun to incentivize measures of college and career readiness in their accountability systems. Policymakers intend for these measures to tell a more accurate story of how well a school is preparing its students for later-life success.[5] While there are no standardized definitions of college and career readiness, measures typically include a range of attainment outcomes, such as attainment of an industry-based certification, completion of college credit, completion of AP/IB courses, and post-secondary enrollment. As of 2025, the majority of states evaluate some measure of college or career readiness in accountability, with eight states specifically evaluating postsecondary outcomes. Seven states have recently begun providing financial incentives to districts or schools for improving measures of college or career readiness.[6] Whether this emerging type of accountability system—one that provides financial incentives for districts to improve attainment outcomes—is effective in improving the targeted outcomes as well as later-life outcomes is an open empirical question. Our paper reveals a few lessons for this emerging policy: attainment-based incentives can improve the targeted attainment outcomes; there may be substantially different impacts across targeted outcomes; and the incentive structure can have important implications for which students benefit from the policy.

wherein low-performing students are prevented from taking the exam (Berry Cullen and Reback, 2006; Figlio and Getzler, 2006; Figlio, 2006; Gilligan et al., 2022).

[5] Connecticut's Commissioner of Education stated that the state's new accountability system, which included several additional measures of student success such as college enrollment, "will tell a deeper, truer story of how well a school is preparing its students for success in college, career and life." `https://www.edweek.org/policy-politics/connecticut-approves-new-school-accountability-system/2016/03`

[6] See Education Strategy's recent report on this here.

The remainder of the paper is structured as follows. In Section 2, we describe Texas' education reform. In Section 3, we describe our data. In Section 4, we present our model and empirical strategy. We present results on the impact of the reform on attainment-related outcomes in Section 5, and on measures of short-term college or career engagement and earnings in Section 6. In Section 7, we discuss the cost effectiveness of funding and incentives. Section 8 concludes.

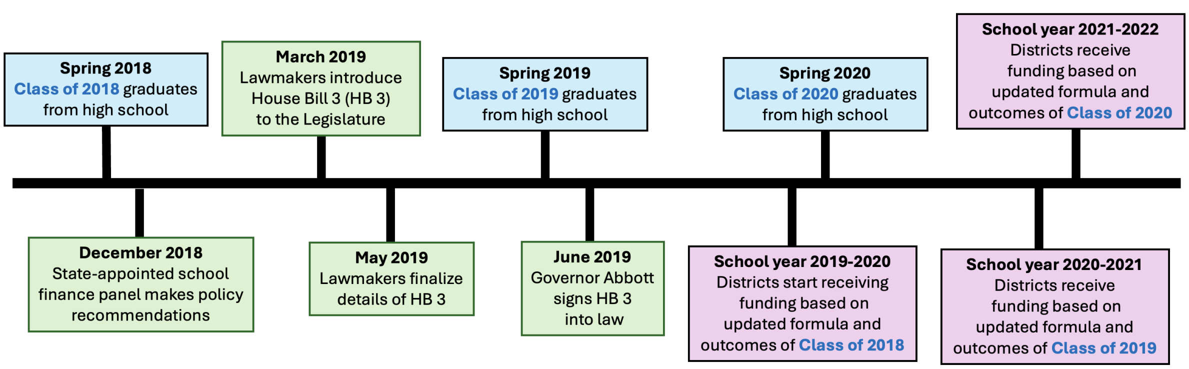
2 Policy background: Texas' education reform

We study the impact of funding and incentives on student outcomes by leveraging a recent education reform in Texas. This policy generated variation in both districts' funding and incentives to improve attainment outcomes by changing the formula which determines districts' funding and introducing annual bonuses for districts based on the outcomes of high school graduates respectively. We describe the timing of the policy in Section 2.1. We describe the changes to funding in Section 2.2 and the changes to incentives in Section 2.3.

2.1 Policy timing

Texas implemented House Bill 3 (HB 3)[7] in the 2019-20 school year. Henceforth, we use the terms "2019-20 school year" and "2020 school year" interchangeably. This applies to all school years. Figure 1 shows a timeline of the Bill's development and implementation.

Figure 1: House Bill 3 Timeline



The state government signed HB 3 into law in June 2019. The content of the reform was based on recommendations from a report[8] produced by a state-appointed school finance panel in

[7] https://legiscan.com/TX/bill/HB3/2019

[8] https://tea.texas.gov/finance-and-grants/state-funding/additional-finance-resources/commission-school-finance-documents/texas-commission-on-public-school-finance-final-report.pdf

December 2018. The panel made recommendations for school finance reform with the broad goal of improving students' postsecondary outcomes, especially those of disadvantaged students; creating a balance between the state and local share of funding; encouraging data-informed strategies for improving student outcomes; and increasing per-pupil funding.

Lawmakers first introduced the bill to the Legislature in March 2019, but did not finalize the details of the bill until May 2019. We therefore do not expect that districts would have responded to the policy in substantive ways prior to the 2019-20 school year. The first time that the text of the bill included specific language about annual bonuses based on high school graduates' outcomes was in May 2019.[9] Lawmakers included details about changes to formula funding in the first version of the bill in March 2019 but did not finalize key details until the enrolled version of the bill in May 2019.

2.2 How the policy affected school districts' funding

The policy changed the Tier I funding formula, the key formula that determines school districts' funding in Texas.[10] We use terms "Tier I funding" and "formula funding" interchangeably. Tier I funding comes from a combination of local tax revenue and state revenue. The three main inputs to the funding formula are: a per-student amount, attendance in different student categories (e.g., special education, disadvantaged),[11] and funding weights that are specific to student categories. The per-student amount guarantees a minimum level of funding per student. The attendance numbers by category determine the number of students for which a district receives funding. Note that every student's attendance counts in at least one of three basic attendance categories: career & technology education (CTE), special education, or regular (regular is defined as non-CTE, non-special education). A student may count in additional categories (e.g., high school, disadvantaged, bilingual) depending on their characteristics and/or program enrollment. Finally, the funding weights ensure that districts receive more funding for certain types of students.

The HB 3 reform made three types of changes to the Tier I funding formula. First, the reform equalized and increased on average the per-student amounts across districts. Prior to the reform, the per-student amount was a function of several district characteristics and ranged from $4,855

[9]The state-appointed panel did include specific language about annual bonuses based on high school graduates' outcomes in their December 2018 report, however.

[10]Nearly 70% of districts' operating revenues come from Tier I funding.

[11]Students may be in more than one category. For example, all students who are not in a CTE or special education program are counted as part of the regular program category. A non-CTE, non-special education disadvantaged student is counted in the regular program *and* the disadvantaged program category.

to \$9,014. The reform set the per-student amount to \$6,160 for all districts. Second, the HB 3 reform updated the set of student categories that determine *additional* funding beyond the basic funding calculated based on CTE, special education, and regular attendance. After the reform, gifted program students and high school students no longer generated additional funding for school districts.[12] The reform added dual language immersion, K-3 disadvantaged or bilingual, dyslexic, enrollment in dropout recovery, and living in a residential facility as characteristics and/or programs that generate additional funding. Finally, the reform updated the funding weights for certain student categories. The reform increased the weight for students enrolled in mainstream special education programs and expanded the weights for disadvantaged students to account for the severity of disadvantage in a student's census block.

The formula change meaningfully affected districts' funding: the average district experienced an increase in per-pupil Tier I funding of \$860 from 2019 to 2020, an increase of 13%.[13] Importantly, there was substantial variation in the size of the increase: the 25th percentile increase was around \$600 per student, while the 75th percentile increase was around \$1,100 per student. Overall, the formula change led to larger Tier I funding increases for small districts ($< 1,600$ average daily attendance), districts with higher shares of disadvantaged students, and districts with lower achievement levels. We refer to this set of changes described above as the "funding formula change" and provide more details in Appendix B.

2.3 How the policy affected school districts' incentives

The HB 3 reform created additional incentives for districts to improve high school graduates' attainment outcomes by providing annual bonuses to districts based on graduates' attainment outcomes. The state awards bonuses with a 2-year lag due to the nature of some of these outcomes being observed after graduation. Specifically, the reform incentivized districts to improve a composite outcome called "College, Career, or Military Readiness" (CCMR). A high school graduate meets CCMR if they are college-ready or career-ready.[14] Table 1 defines the college- and career-ready criteria.

[12] Note that these students still generate funding for districts because they are counted in one of the basic attendance categories.

[13] Note that this change is not equal to the policy-induced change because districts' student composition also changed from 2019 to 2020. We construct a measure of the change in Tier I funding that isolates the change due to the policy that we describe in Section 4.1

[14] Although military readiness, defined as enlisting in the US Armed Forces or the Texas National Guard after graduation, was part of the original bonus policy, the Texas Education Agency did not end up including it for the first 3 years of the policy due to data discrepancy issues. We therefore do not consider military readiness in our study.

Table 1: CCMR definition

	Definition
College-ready	Meets testing standards by October 31 of graduation year **and** enrolls in college by the fall after graduation **or** earns an associate's degree by Aug 31 of graduation year
Career-ready	Meets testing standards by October 31 of graduation year **and** earns either an industry-based certification (IBC) or a Level I/II certificate by Aug 31 of graduation year
CCMR	College-ready or career-ready

Notes. This table shows the definition of college and career readiness. Although "military readiness," defined as enlisting in the US Armed Forces or the Texas National Guard, was initially proposed as part of the policy, we omit it from this paper because it was not implemented during our study period.

In order to be "college-ready," a graduate must meet a set of testing standards and enroll in college by the fall after graduation, or earn an associate's degree by August 31 of their graduation year.[15] Students can meet the testing standards by passing both a math and a reading score threshold on the SAT, ACT, or Texas Success Initiative Assessment (TSIA). Passing the reading score threshold and the math score threshold would put a student at the 30th and 50th percentiles nationwide on the SAT respectively. We provide additional details on the testing standards in Appendix A.1. To meet the requirement to enroll in college, a student must enroll in any two- or four-year college in the US by the fall after high school graduation. To meet the requirement to earn an associate's degree, a student will typically enroll in dual credit courses during high school in order to earn the degree by August 31 of their high school graduation year.

In order to be "career-ready," a student must meet the same testing standards described above, and they must earn either an industry-based certification (IBC) or a Level I/II certificate by August 31 of their graduation year. An IBC is an industry-recognized credential that is developed by a third-party vendor which certifies that an individual possesses particular skills and knowledge in an area of professional work. In order to earn an IBC, students must pass an exam administered by the third-party vendor that developed the credential. High schools include these exams as part of either a Career & Technology Education (CTE) course or sequence of CTE courses. To meet the IBC requirement for career readiness, a student must earn one of the IBCs on an official list that is maintained by the Texas Education Agency, which consists of certifications from a broad range of

[15]For example, if a student graduates in May 2020 and earns an associate's degree in July 2020, they count as college-ready.

vendors, from Microsoft to the Texas State Florists' Association to Automotive Service Excellence (see Appendix A.2 for a list of the 10 most common IBCs and Appendix C.8 for a full list of IBCs).[16] A Level I/II certificate is a credential awarded by community colleges which takes 15-51 semester credit hours ($\approx$ 5-17 classes) to complete. To meet the Level I/II certificate requirement, a student may complete any certificate in a workforce education area. A key difference between IBCs and Level I/II certificates is cost: IBC exams typically cost significantly less compared to the tuition costs of Level I/II certificates. In addition, IBCs are perceived to be more up to date with skills demanded in the labor market because they are often developed by industry associations or even companies themselves.

The reform incentivized school districts by awarding an annual bonus for each high school graduate that meets the CCMR criteria above a minimum threshold share. The bonus is calculated separately for disadvantaged,[17] non-disadvantaged, and special education graduates. A graduate is either disadvantaged or non-disadvantaged, and on top of that may be in special education. Districts receive \$5,000 per economically disadvantaged graduate above 11%, \$3,000 per economically non-disadvantaged graduate above 24%, and \$2,000 per special education graduate. Figure A3 shows the disadvantaged and non-disadvantaged bonus functions for an example district that has 100 disadvantaged and 100 non-disadvantaged graduates. In this example, the district must have at least 11 disadvantaged and 24 non-disadvantaged graduates meeting CCMR in order to generate a disadvantaged and non-disadvantaged bonus, respectively.

These bonuses are meaningful in size. For the example district described in Figure A3, if all 100 disadvantaged and all 100 nondisadvantaged graduates meet CCMR, the district will receive \$673,000 in bonus funding. Normalizing by the number of graduates in the district, this represents $\$673,000/200 = \$3,365$ per graduate. This is large compared to the average Texas district's per-pupil operating expenditures of around \$10,000 per student in the 2018-19 school year. Although informative, the maximum potential bonus does not fully capture districts' incentive to respond to the bonus policy, given that few districts reach the maximum amount, and a district that reaches the maximum amount may not necessarily have strong incentives to improve graduates' outcomes.[18]

[16]Examples of IBCs on the official list include: Microsoft Azure AI Fundamentals, Texas State Florist's Association Level I Floral Certification, and Automotive Service Excellence Entry Level Automobile Maintenance and Light Repair.

[17]A student is classified as disadvantaged if they are eligible to participate in the national free or reduced-price lunch program.

[18]For example, consider a district that has high-achieving graduates who are likely to meet the bonus criteria regardless of the district's effort. This district will receive a large bonus, but it has low incentives to improve graduates' outcomes because any improvements will not meaningfully increase its bonus amount.

Instead, a district's incentive depends on the share of students who are marginal to meeting the bonus criteria and its baseline level of students meeting the criteria: these two characteristics together determine the extent to which improving student outcomes may increase the district's bonuses—along both the extensive margin of surpassing the minimum threshold, and the intensive margin from per-student bonuses. In Section 4.2, we describe how we use student-level data to construct a measure of districts' incentive to improve student outcomes.

There are restrictions related to when and how districts can spend their bonus funding. First, as described above, due to lags in postsecondary enrollment data releases, the bonus that districts receive today is determined by the outcomes of high school graduates two years prior. Therefore, the outcomes of high school graduates in a given academic year do not immediately affect school districts' funding. Another implication of the lag in bonus payments is that bonuses awarded in the first two years of the policy, 2020 and 2021, are determined by *pre-reform* graduates' outcomes. We can therefore think of the first two bonus payments as being part of the policy-induced increase in districts' unconditional funding, since they are not a result of districts' response to incentives. Second, districts must spend at least 55% of bonus funds on "CCMR preparation" activities for students in grades 8-12; there are no spending requirements for the remaining 45%. The list of activities that count as "CCMR preparation" is broad and is not highly limiting in practice.[19]

3 Data

We use detailed administrative data from the Texas Education Research Center (ERC), which links student-level K-12 public education records to higher education records within Texas, higher education records in other states, and quarterly earnings from Texas' unemployment insurance records.

We use the ERC data for two purposes: to obtain data on outcomes of interest and to construct measures of districts' incentives to respond to the bonus policy. Our main outcomes of interest include the attainment outcomes targeted by the bonus policy: whether a student enrolls in college, whether a student earns an associate's degree, whether a student earns an industry-based certification, and whether a student earns a level I/II certificate. The link between the K-12 records and higher education is key for observing outcomes such as enrolling in college and earning an associate's degree. Additional outcomes of interest include annual employment and earnings, which we

[19]See the list of allowable expenses here: `https://tea.texas.gov/about-tea/news-and-multimedia/correspondence/taa-letters/house-bill-3-hb-3-implementation-ccmr-outcomes-bonus-allowable-expenses`

construct from the quarterly earnings records. To construct our measure of districts' incentives to respond to the bonus policy, we use student-level covariates (demographics and 9th grade math test scores) from the ERC microdata. We give more details on constructing our measure of districts' incentives in Section 4.2.

We supplement the ERC microdata with publicly available district-level financial documents, which we use to construct measures of districts' policy-induced funding change. These finance data include a detailed breakdown of each district's Tier I funding, from which we obtain the per-student amount, attendance in the categories which are inputs to the formula, and the funding weights for each category.[20] With knowledge of the pre-reform and post-reform formulas and data on student attendance,[21] we are able to construct measures of counterfactual Tier I funding under both the pre- and post-reform regimes for each year. We additionally link publicly available district-level revenue and expenditure data for districts' actual operating expenditures each school year.

3.1 Sample construction and summary statistics

For our main sample, we consider students who were first-time 12th graders in 2015-16 through 2021-22, representing four pre-reform and three post-reform cohorts. Although the policy targeted graduates, we consider first-time 12th graders because we are interested in students' outcomes whether they graduated or not. In the appendix, we show our main results on the sample of graduates. To construct our analysis sample, we drop extremely small districts that did not enroll at least ten 12th graders in every school year during our study period (this removes 10% of districts that enroll 12th graders). We drop districts that were ever subject to a small district sparsity adjustment during our study period as these districts face an altered funding formula. We also drop charter districts because they face a different funding formula. We drop districts that were not in operation during each year of our study in order to maintain a balanced panel of districts across time. Finally, to avoid skewing our estimates with extreme observations, we exclude districts with per-pupil expenditures below the 1st or above the 99th percentile in 2019 or 2020 as well as districts with a change in per-pupil expenditures from 2019 to 2020 that was below the 1st or above the 99th percentile.

Table 2 shows summary statistics for our sample, measured in the 2018-19 school year. We

[20]In principle, we can use the ERC microdata to obtain data on attendance in the relevant student categories, but we use the publicly available district-level finance data for increased accuracy

[21]Some student attendance categories are not reported in the finance data in certain years because they were not inputs to the funding formula in those years. We estimate attendance in these categories using the microdata from the ERC.

compute the summary statistics on district-level data and weight each observation by the number of 12th graders in 2018-19. Our final sample includes 728 districts enrolling 335,721 first-time 12th graders in the 2018-19 school year.

Table 2: Summary statistics

	Mean	S.D.	Min	Max
Met composite attainment outcome	0.64	0.10	0.30	1.00
Enrolled in college	0.60	0.10	0.24	0.94
Earned associate's degree	0.01	0.03	0.00	0.52
Earned IBC	0.11	0.09	0.00	0.64
Earned level I/II certificate	0.01	0.01	0.00	0.26
Enrolled or employed 1 year later	0.86	0.04	0.58	1.00
Annual earnings (2012 dollars) 1 year later	4,951	1,315	1,286	13,272
Per-pupil Tier I funding	6,716	472	5,206	10,133
Per-pupil current expenditures	9,582	888	6,781	13,669
Disadvantaged	0.59	0.22	0.02	1.00
Graduated	0.95	0.03	0.01	1.00
Dropped out	0.01	0.01	0.00	0.08
Cohort size	2,986	3,021	10	12,821
N district	728			

Notes. This table shows summary statistics for our sample of districts. Each variable is measured in 2018-19 and each district observation is weighted by the number of 12th graders in 2018-19.

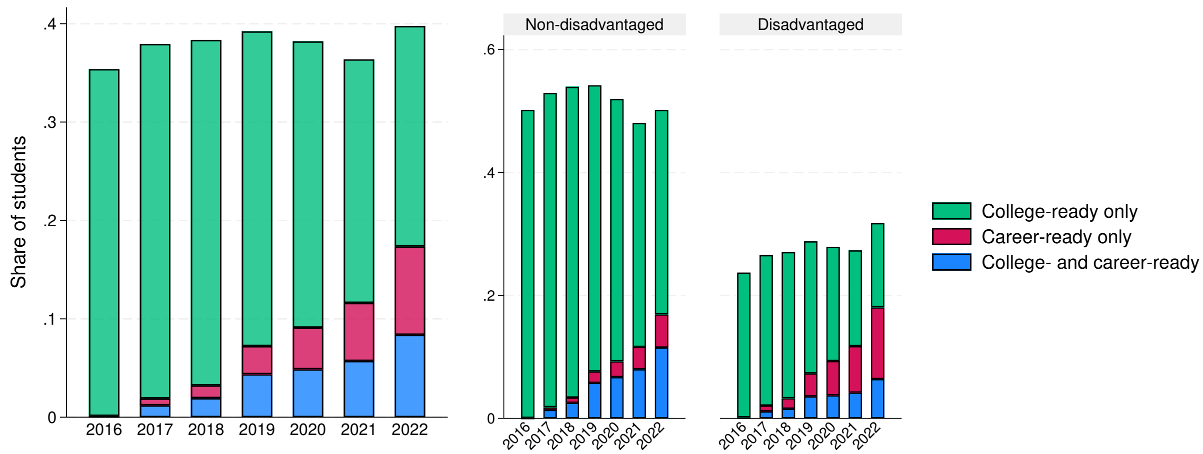
In Figure 2, we show statewide trends in college and career readiness (See Figure A6 for a further breakdown of the components). Panel (a) shows the share of 12th graders from 2016-2022 who are career-ready only, college-ready only, or both college- and career-ready. These categories are mutually exclusive. Panel (b) shows the same outcomes by students' disadvantaged status.

Figure 2a shows that overall, statewide rates of CCMR have remained stable over time, at around 37 percent. However, *how* students achieve CCMR has changed over time: the share of students meeting college readiness only has gone down while the share of students meeting career readiness only or both college and career readiness has increased. The increase in career readiness is quite dramatic: almost no students were career-ready in 2017, but in 2022, nearly 18 percent of students were career-ready. This is largely driven by an increase in industry-based certificates (Figure A6), as documented in past work (Giani et al., 2025).

Turning to Figure 2b, we notice two patterns: first, non-disadvantaged students' CCMR rates are consistently much higher than those of disadvantaged students. Around 50 percent of non-disadvantaged 12th graders meet CCMR whereas around 25 percent of disadvantaged 12th graders meet CCMR. Second, both groups of students have large increases in rates of career readiness.

Figure 2: Statewide trends in college- and career-readiness

(a) All students (b) By disadvantaged status



Notes. These figures show statewide trends in college- and career-readiness for 12th graders in the cohorts of 2016 through 2022. In (a), we show the statewide trends for all students. The 3 groups are mutually exclusive. In (b), we show the statewide trends for non-disadvantaged and disadvantaged students separately. For both (a) and (b), if a student meets the requirement to enroll in college or earn an IBC or a level I/II certificate but we do not observe information on whether they met the testing standards, we assume that the student meets CCMR.

4 Empirical Strategy

Our approach leverages policy-induced between-district variation in funding increases and incentives. We consider a district's incentive to improve the policy's targeted composite attainment measure: enrolling in college, earning a level I/II certificate, earning an industry-based certification, or earning an associate's degree. We focus on incentives for disadvantaged and non-disadvantaged students.[22] Our identification strategy relies on a common trends assumption: in the absence of the reform, students in districts with high vs low policy-induced funding increases and incentives would have had the same trends in outcomes. We first describe our model in Section 4.1 and our approach for estimating districts' incentives in Section 4.2. We show summary statistics on our two policy variables—policy-induced funding increases and incentives—in Section 4.3. Then, we discuss our identifying assumptions in Sections 4.4 and 4.5.

[22]Less than 1% of realized bonuses are from special education students.

4.1 Model

We start with the following model of student outcomes at district d in year t:

$$Y_{dt} = \beta_0 \ + \beta_1 \cdot E_{dt} + \beta_2 \cdot I_{dt} + \beta_3 \cdot X_{dt} + \beta_4^t \cdot T_d + \mu_d + \gamma_t + \nu_{dt} \tag{1}$$

where Y_{dt} is district d's outcome among its 12th grade cohort in year t (e.g., the fraction of 12th graders in year t who meet the composite attainment outcome that is targeted by the policy), E_{dt} is per-pupil current expenditures (PPE), and I_{dt} captures the financial incentive that districts have to improve students' attainment outcomes in year t. μ_d are district fixed effects, γ_t are time fixed effects, and ν_{dt} is an error term. We include a control X_{dt} which is a measure of prior achievement of district d's 12th grade cohort of year t. In estimation, we set X_{dt} to be the average grade 9 math score of the 12th grade cohort.[23] We also include a control T_d, which is the share of students that generate Title I Basic, Concentration, or Targeted Grant funding as measured in the pre-reform year. We allow the coefficient on T_d to vary by year as federal COVID funding increased the funding weight on this measure.[24]

Our parameters of interest are β_1 and β_2, the causal effects of per-pupil expenditures (E_{dt}) and incentives to improve attainment (I_{dt}) respectively. The usual challenges in recovering causal parameters from equation 1 are that (1) per-pupil expenditures are likely endogenous and (2) districts' financial incentives to improve students' educational attainment outcomes are typically unobserved. To tackle these issues, we leverage the fact that the reform (1) differentially increased districts' formula funding and (2) introduced explicit financial incentives for districts to improve attainment outcomes. While the policy was state-wide, we identify causal effects using between-district variation in exposure to the funding increases and incentives generated by the policy.

First, we identify the effect of per-pupil expenditures (E_{dt}) on student outcomes using the policy's funding formula change. Within-district across-year variation in realized per-pupil expenditures can include policy-induced changes and endogenous changes. We therefore construct a simulated instrument that isolates the policy-induced changes. For the purpose of exposition, we consider two time periods: $t = pre$ and $t = post$. Let $F_t(\cdot)$ be the funding formula that districts

[23] We add this control for additional precision, and show in Appendix E.1 that the results are not sensitive to removing this control.

[24] Texas allocated federal COVID funding to districts in proportion to their prior Title I funding.

face in year t. For district d, define the simulated funding instrument:

$$Z_{dt} = \begin{cases} F_{pre}(V_{d,pre}) & t = pre \\ F_{post}(V_{d,pre}) & t = post \end{cases} \tag{2}$$

where V_{dt} are district-level covariates that enter the funding formula. For a detailed list of the contents of V_{dt}, see Section B. In the pre-reform year, the instrument equals the district's actual formula funding. In the post-reform year, the instrument equals the district's counterfactual formula funding had the formula change been implemented in the pre-reform year. Because we hold the formula inputs V_{dt} constant at their pre-reform values, within-district across-time variation in Z_{dt} is driven entirely by the policy. We then use Z_{dt} to instrument for per-pupil expenditures with the first stage regression:

$$E_{dt} = \pi_1 \cdot Z_{dt} + \pi_2 \cdot I_{dt} + \pi_3 \cdot X_{dt} + \pi_4^t \cdot T_d + \pi_t + \alpha_d + u_{dt} \tag{3}$$

Second, to identify the effect of attainment-based incentives, we use the policy's introduction of financial bonuses for graduates' attainment outcomes. Let I_d reflect district d's expected financial gain in bonus payment from making slight improvements to graduates' attainment outcomes, measured using the pre-reform cohorts (we describe how I_d is constructed in the following subsection, 4.2). For district d, define the simulated incentive instrument:

$$I_{dt} = \begin{cases} 0 & t = pre \\ I_d & t = post \end{cases} \tag{4}$$

In the pre-reform year, the instrument equals 0, because the bonus policy had not been implemented yet. In the post-reform year, the instrument equals the district's expected financial gain from making slight improvements to graduates' attainment outcomes, had the bonus policy been implemented in the pre-reform year. Because we hold the relevant district characteristics at their pre-reform values, within-district across-year variation in I_{dt} is entirely driven by the policy.

4.2 Measuring districts' incentives

We now explain how we construct our estimates for a district's incentive to improve attainment outcomes, I_d. We use student-level data to calculate districts' expected gain in bonus from making slight improvements to pre-reform graduates' attainment. This depends on two district-level characteristics: the share of students who are marginal to meeting the bonus criteria and the baseline level of students meeting the criteria. Intuitively, these two characteristics together determine the extent to which improvements in student attainment increase the district's bonuses, operating through both the extensive margin of increasing the district's likelihood of surpassing the minimum threshold set by the bonus policy, and intensive margin from per-student bonuses.

Using our student-level data, we first estimate each student's probability of meeting the composite attainment outcome targeted by the incentive policy: enrolling in college, earning an associate's degree, earning an IBC, or earning a level I/II certificate. We run the following logit regression for student i in pre-reform cohort[25] c in district d in group $g \in$ {disadvantaged, non-disadvantaged}:

$$p_i \equiv Pr\{Y^g_{icd} = 1\} = G\big(\gamma^{g(i)}_{d(i)} + \delta^{g(i)}_{c(i)} + X^{g(i)\prime}_i \boldsymbol{\beta}^{g(i)}\big) \tag{5}$$

where Y^g_{icd} is an indicator for whether student i meets the composite attainment outcome. $G(.)$ is the logistic cumulative distribution function. $\gamma^{g(i)}_{d(i)}$ are district fixed effects, $\delta^{g(i)}_{c(i)}$ are cohort fixed effects, and $X^{g(i)}_i$ is a vector of covariates which includes a quadratic in i's 9th grade math scores fully interacted with demographics, an indicator for special education status, and an indicator for limited English proficiency status.[26]

Next, we consider the following thought experiment: how would a district's student outcomes evolve if the students were transferred to a district with a district-specific performance effect, $\hat{\Delta}^g$, on attainment that is one standard deviation higher? To do so, we add a hypothetical improvement $\hat{\Delta}^g$ to each student's probability of meeting the composite attainment outcome:

$$\tilde{p}_i \equiv G\big(\hat{\Delta}^g + \hat{\gamma}^{g(i)}_{d(i)} + \hat{\delta}^{g(i)}_{c(i)} + X^{g(i)\prime}_i \hat{\boldsymbol{\beta}}^{g(i)}\big) \tag{6}$$

where $\hat{\Delta}^g$ is a one standard deviation increase in the district fixed effects in equation (5), i.e., $\hat{\Delta}^g \equiv SD(\hat{\gamma}^{g(i)}_{d(i)})$.

Next, we calculate the hypothetical expected bonus for each district based on the improved

[25]We pool the pre-reform graduating cohorts of 2016 through 2019. We use all of the pre-reform cohorts instead of only 2019 in order to avoid issues due to mean reversion. If we used only the 2019 cohort, districts that received a negative shock to attainment rates in 2019 would have a higher value of the incentive. These districts would also tend to have larger increases in attainment rates from 2019 to 2020, potentially leading us to overestimate the effect of incentives on attainment.

[26]X^g_i also includes dummies for the grade in which a student took the grade 9 math test and dummies for whether a student is missing a grade 9 math score

student-level probabilities $\tilde{p}_i$ in equation (6). Let $B^g(.,.)$ be the bonus function for group $g \in \{\text{disadvantaged, non-disadvantaged}\}$, which calculates a district's total bonus amount generated by the graduates of g. This function has two inputs: (1) the number of graduates in the district who meet the bonus criteria and (2) the total number of graduates in the district.[27] Let $\mathcal{N}_d^g$ be the set of pre-reform graduates of group g in district d so that (1) the expected number of graduates who meet the bonus criteria with improvement is given by $\sum_{i \in \mathcal{N}_d^g} \tilde{p}_i$ and (2) the total number of graduates is given by $|\mathcal{N}_d^g|$. We calculate district d's hypothetical expected bonus from graduates of group g as:

$$\tilde{b}_d^g \approx \underbrace{B^g}_{\text{bonus function}} \left(\underbrace{\sum_{i \in \mathcal{G}_d^g} \tilde{p}_i}_{\substack{\text{expected number} \\ \text{meeting criteria} \\ \text{with improvement}}} , \underbrace{|\mathcal{G}_d^g|}_{\substack{\text{number of} \\ \text{graduates}}} \right)$$

We therefore obtain $\tilde{b}_d^{\text{disadvantaged}}$ and $\tilde{b}_d^{\text{non-disadvantaged}}$ for each district.[28]

Finally, we calculate the difference between the hypothetical expected bonus and the bonus that would have been awarded based on realized pre-reform outcome:

$$K_d^g = \underbrace{\tilde{b}_d^g}_{\substack{\text{hypothetical bonus} \\ \text{with improvement}}} - \underbrace{B^g\left(\sum_{i \in \mathcal{G}_d^g} Y_{icd}^g, |\mathcal{G}_d^g|\right)}_{\text{bonus based on realized outcomes}}$$

K_d^g is the district's associated dollar gain from improving the attainment outcomes of graduates of group g. To obtain our final incentive measure I_d, we add the gain from disadvantaged graduates and non-disadvantaged graduates and normalize by dividing by the total number of pre-reform 12th graders in the district N_d:

$$I_d \equiv \frac{K_d^{\text{disadvantaged}} + K_d^{\text{non-disadvantaged}}}{N_d}$$

I_d can also be expressed as a weighted average of the incentive from disadvantaged graduates and non-disadvantaged graduates.[29]

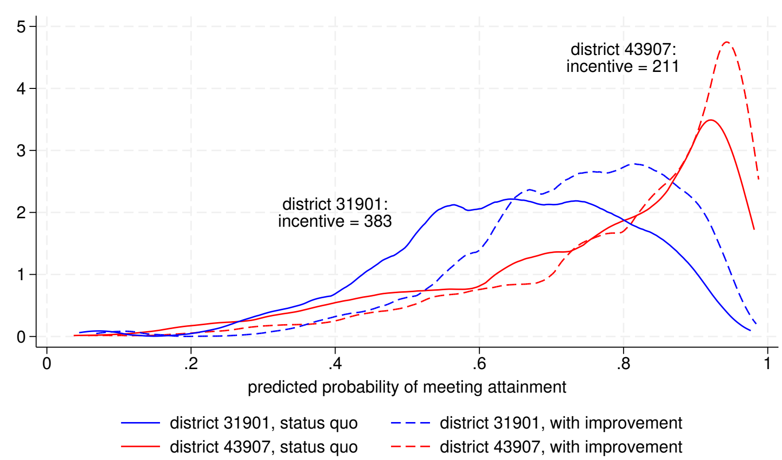
[27]The bonus function depends on both of these inputs because the total bonus amount depends on the number of graduates meeting the criteria above the policy-defined threshold share.

[28]Note that the bonus function is convex due to the minimum threshold so that $B^g(\mathbb{E}[\sum Y], N) \neq \mathbb{E}[B^g(\sum Y, N)]$. In practice, however, the vast majority of districts are above the thresholds so that their bonus function is linear.

[29]To see this, let N_d^g by the total number of pre-reform 12th graders in group g in district d. Construct $I_d^g \equiv \frac{K_d^g}{N_d^g}$,

The incentive measure I_d is such that districts with higher shares of students who are marginal to meeting the targeted attainment outcome have higher values of the incentive. This is due to the parametric restriction imposed by the logistic CDF in equation (5). Specifically, because marginal effects in a logit model are proportional to $p_i(1-p_i)$, high incentive districts are those with average $p_i(1-p_i)$ close to 0.25, the maximum value (which occurs when $p_i = 0.5$). Figure 3 illustrates the source of variation in incentives by plotting the density of pre-reform cohorts' attainment probabilities for two districts in our sample. District 31901 has a higher share of students who are marginal (i.e., p_i close to 0.5) to meeting the composite attainment outcome than district 43907: this can be seen by comparing the solid blue density with the solid red density. Consequently, for the same given improvement, district 31901's student-level probabilities shift relatively more than those of district 43907: this can be seen by comparing the shift from the solid blue to the dotted blue density with the shift from the solid red to the dotted red density. Because the improvement "makes a bigger difference" for district 31901, it has a higher incentive than district 43907 to improve students' attainment outcomes ($383 per 12th grader vs $211 per 12th grader, a 2.5 S.D. difference).

Figure 3: Illustration of the source of variation in incentives



Notes. This figure plots the density of pre-reform cohorts' attainment probabilities without and with improvement for two sample districts.

Ultimately, the scaling of our incentive measure I_d depends on the magnitude of the improvement that we consider. Our main specification considers an improvement equal to 1 standard

group g's incentive measure. Let p_d^g be the share of pre-reform graduates who are in group g: $p_d^g \equiv \frac{N_d^g}{N_d}$. Then, an alternative way to write our final incentive measure I_d is: $I_d = p_d^{\text{disadv}} \times I_d^{\text{disadv}} + p_d^{\text{non-disadv}} \times I_d^{\text{non-disadv}}$

deviation of the distribution of district fixed effects for attainment. For our main results, we assess whether our conclusions are sensitive to the choice of the magnitude of the improvement.

4.3 Summary statistics of the policy variables

We illustrate the district-level distribution of our two policy variables in Figure 4. For the purpose of discussing policy-induced changes in funding, define $Z_d \equiv Z_{d,2020} - Z_{d,2019}$, district d's formula-predicted *change* in funding. The policy increased per-pupil formula funding by around \$1,000[30] on average with a standard deviation of \$220. The policy generated incentives for districts to improve attainment outcomes by around \$300 per 12th grader, with a standard deviation of \$70 (Figure 4b). The policy variables capture economically meaningful magnitudes: the average Texas school district's per pupil operating expenditure (PPE) in 2018-19 was around \$10,000,[31] meaning that on average, the policy increased funding by around 10% of PPE. While a district's incentive and funding increase are positively correlated, with a correlation of 0.28, there is significant independent variation in the two variables (Figure 4c).

4.4 Identifying assumptions

We next discuss the identification assumptions necessary for our approach using equation (1) and equation (3) to recover the causal effects of per-pupil expenditures (PPE) and incentives. For the purpose of stating our assumptions, define the Δ_t operator as the difference relative to 2019, i.e., $\Delta H_{dt} \equiv H_{dt} - H_{d,2019}$ for any variable H. As in the previous section, define $Z_d \equiv Z_{d,2020} - Z_{d,2019}$, district d's change in formula funding due to the policy. We assume constant effects of per-pupil expenditures (E_{dt}) and incentives (I_{dt}). We make two additional identification assumptions. The first is that conditional on incentives (I_d) and controls, the predicted change in funding (Z_d) predicts the actual change in per-pupil expenditures (ΔE_{dt}):

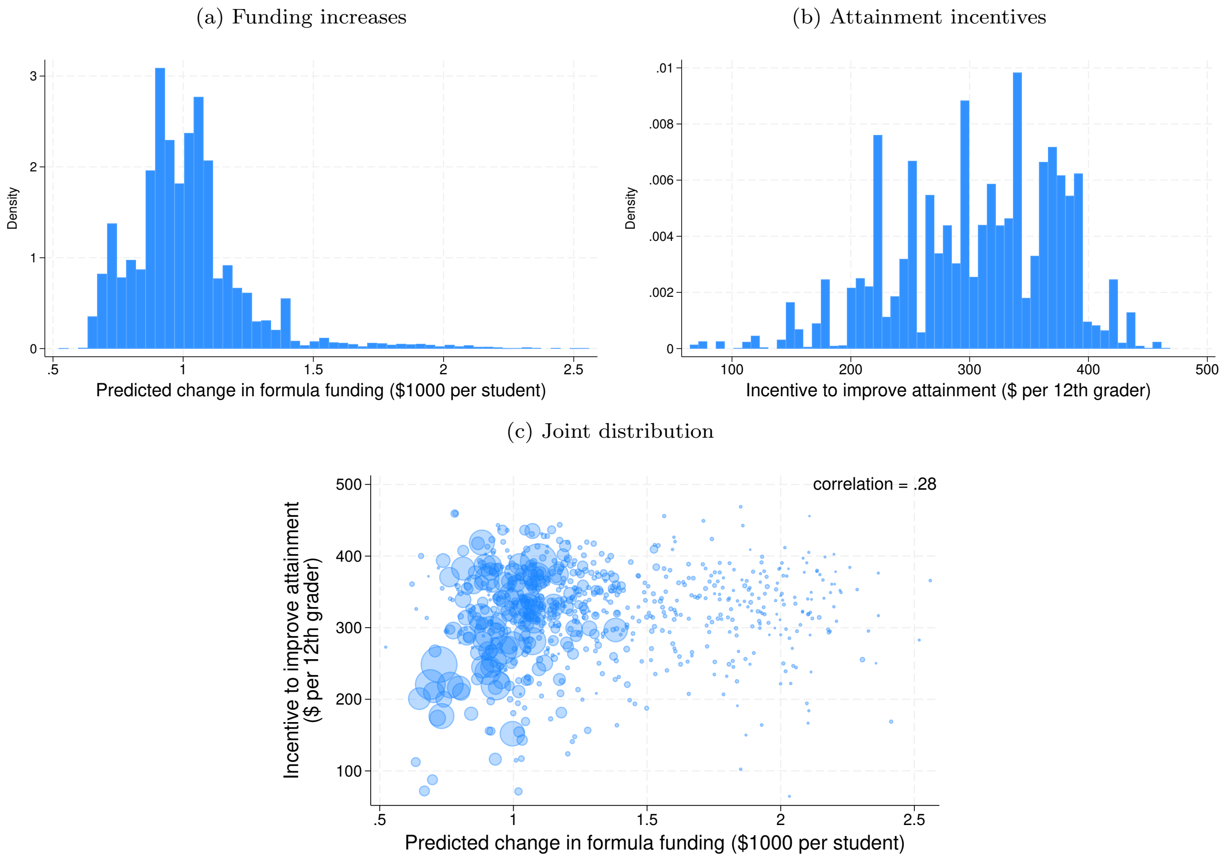
Assumption 1. *Instrument relevance.* $Cov(Z_d, \Delta E_{dt} | I_d, \Delta X_{dt}, T_d) \neq 0$

Second, we make a pair of common trends assumptions. We assume that conditional on incentives (I_d) and controls, the formula-predicted change in funding (Z_d) is uncorrelated with unob-

[30] We write "per student" rather than "per 12th grader" when speaking of formula funding and per-pupil expenditures. If we assume that districts spread funding and expenditures equally across all students, then the per-12th grader amounts are equal to the per-student amounts. In reality, districts tend to spend more resources on higher grades so that the per-student funding increases and expenditures likely underestimate the funding increases and expenditures experienced by 12th graders.

[31] `https://tea.texas.gov/reports-and-data/financial-reports/school-finance-reports-and-data/2008-2024-summarized-financial-data-03-17-2025.xlsx`

Figure 4: District-level estimated exposure to funding increases and attainment incentives



Notes. These figures show the distribution of policy-induced between-district variation in (a) increases in formula funding and (b) incentives to improve graduates' attainment outcomes. (c) shows the joint distribution of the two, with marker sizes proportional to the number of 12th graders in the district in 2018-19. Observations are at the district-level, weighted by the number of 12th graders in each district during the 2018-19 school year.

served shocks to attainment ($\Delta\varepsilon_{dt}$). Analogously, conditional on the formula-predicted change in funding (Z_d) and controls, incentives (I_d) are uncorrelated with unobserved shocks to attainment ($\Delta\varepsilon_{dt}$):

Assumption 2. *Instrument exclusion.* $Cov(Z_d, \Delta\varepsilon_{dt}|I_d, \Delta X_{dt}, T_d) = 0$ *and* $Cov(I_d, \Delta\varepsilon_{dt}|Z_d, \Delta X_{dt}, T_d) = 0$.

Another way to state this assumption is: if the reform had not happened (in which case $Z_d = I_d = 0$), districts with high vs low formula-predicted changes in funding and incentives would have exhibited the same trend in attainment. While we cannot directly test this assumption, we provide supporting evidence using pre-reform trends in the following section.

Under Assumptions 1 and 2, the coefficient β_1 in equation (1) with the first stage equation (3) identifies the causal effect of per-pupil expenditures, holding incentives and X_{dt} and T_d constant. The coefficient β_2 identifies the causal effect of incentives, holding expenditures and X_{dt} and T_d constant.

4.5 Estimation and assessment of the identifying assumptions

Given that schools may take time to react to the policy, we estimate the dynamic impacts of the policy change on outcomes 1, 2, and 3 years after implementation by estimating equation (1) separately for each post-reform year (2020, 2021, and 2022), using 2019 as the baseline year in each case. We use variation generated by the first (and unanticipated) year of policy implementation, so that our results trace out the dynamic impacts of the one-time, permanent policy change. In other words, for all post-reform years ($t \geq 2020$), we set $Z_{dt} = F_{2020}(V_{d,2019})$, $E_{dt} = E_{d,2020}$, $I_{dt} = I_d$, and $X_{dt} = X_{d,2020}$, while letting Y_{dt} correspond to the outcome year of interest in equations (1) and (3).

We first assess instrument relevance (Assumption 1). We find that a \$10 increase in predicted per-pupil formula funding (Z_{dt}) leads to a significant \$3 increase in per-pupil operating expenditures in the first year of policy implementation (Table 5a). Figure 5b plots this relationship graphically. The coefficients for the post-reform years correspond to estimates of π_1 in the first stage equation (3), where we trace out the dynamic effect of the one-time permanent funding formula change on per-pupil expenditures.[32] The coefficient for 2020 corresponds to the 0.3 coefficient on predicted formula funding in Table 5a. The effect of the one-time permanent formula change persists through 2022. While we do not use per-pupil expenditures from 2021 and 2022 in estimation, the fact that the effect of the formula change on per-pupil expenditures is roughly similar across post-reform years indicates that results will be qualitatively similar whether we use per-pupil expenditures from 2020 only vs from all post-reform years.[33] The coefficients for the pre-reform years serve as a placebo test for whether districts with high vs low formula-predicted funding changes were trending differently in per-pupil expenditures pre-reform. The pre-reform coefficients are statistically indistinguishable from zero, indicating that districts with high vs low formula-predicted funding changes were trending similarly in per-pupil expenditures prior to the policy.

Figure 6 plots estimates of π_2, the coefficient on incentives (I_{dt}), from the same regressions

[32] We estimate equation (3) for 2020, 2021, and 2022, using 2019 as the baseline year in each case. We use only values from 2019 and 2020 for the right hand side variables while letting per-pupil expenditures E_{dt} vary by year.

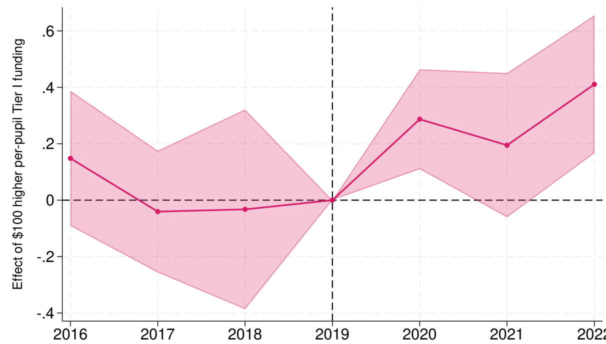
[33] For this placebo test, we estimate equation (3) for placebo post-reform years 2016, 2017, and 2018, using 2019 as the baseline pre-reform year in each case. We use only values from 2019 and 2020 for the right hand side variables while letting per-pupil expenditures E_{dt} vary by the placebo post-reform year.

Figure 5: First stage of formula funding instrument Z_{dt} on per-pupil expenditures

(a) First stage regression

	(1) PPE
Predicted formula funding	0.3033***
	(0.0873)
Incentive to improve attainment	0.3292
	(0.5338)
Title I and math control	×
N district	728
F-stat	12.07

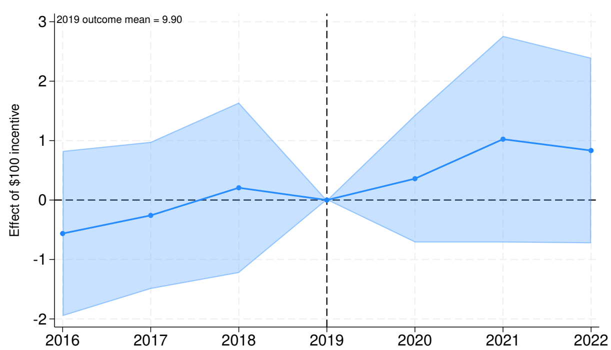
(b) First stage graphical representation



Notes. These exhibits describe the first stage of the funding change instrument, Z_d, on districts' change in per-pupil operating expenditures through (a) a graphical representation and (b) a regression table. In (a), each dot represents the estimate of π_1 from equation (3). We run equation (3) separately for each year. The regression results in (b) are from running equation (3) for $t = 2020$. For both (a) and (b), we run the regressions at the district level and weight each observation by the number of 12th graders in 2018-19.

estimated in figure 5b. The figure shows that districts with higher vs lower incentives to improve attainment were not trending differently in per-pupil expenditures pre-reform, nor did they have significantly different per-pupil expenditures post-reform.

Figure 6: Relationship between incentive variable I_{dt} and per-pupil expenditures



Notes. Each dot in this figure represents the estimate of π_2, the coefficient on the incentive exposure variable, from equation (3) estimated separately for each year, in each case using values from 2019 and 2020 for the right hand side variables of equation (3) while letting the outcome, per-pupil expenditures (E_{dt}), vary by year.

We next show evidence supporting the validity of the exclusion restriction (Assumption 2) through a placebo test (Table 3). We estimate the reduced form equation

$$Y_{dt} = \beta_0 \ + \beta_1 \cdot Z_{dt} + \beta_2 \cdot I_{dt} + \beta_3 X_{dt} + \beta_4^t T_d + \mu_d + \gamma_t + \nu_{dt} \tag{7}$$

for each placebo post-reform year (2016, 2017, and 2018), using 2019 as the baseline year in each case. We use only values from 2019 and 2020 for the right hand side variables in equation (7) while letting the outcome Y_{dt} vary by the placebo post-reform year. If the coefficients on Z_{dt} (I_{dt}) are statistically indistinguishable from 0, this indicates that districts that experienced larger vs smaller changes in formula funding (incentives) in the first year of the policy were not trending differently in average attainment in the years prior to the policy. Indeed, the coefficients on Z_{dt} and I_{dt} are close to zero and insignificant for each of the placebo post-reform years.

Table 3: Pre-trends test for funding and incentives on pre-reform attainment

	(1) 2016	(2) 2017	(3) 2018
Predicted formula funding (100s)	0.0005	-0.0003	0.0010
	(0.0012)	(0.0010)	(0.0010)
Incentive to improve attainment (100s)	-0.0008	-0.0014	0.0003
	(0.0076)	(0.0058)	(0.0052)
Title I and math control	×	×	×
N districts	728	728	728

Notes. This table shows estimates of β_1 and β_2 from equation (7). The outcome variable for each column is the district's average attainment level. We estimate a separate regression for each column: in column (1), we use 2016 as the placebo post-reform year, in column (2), 2017, and in column (3), 2018. In each column, we use 2019 as the baseline pre-reform year. For each regression, we use only values from 2019 and 2020 for the right hand side variables in (7) while letting the outcome Y_{dt} vary by the placebo post-reform year.

5 Impacts on students' attainment outcomes

In this section, we present the effects of per-pupil expenditure and incentives on several attainment-related outcomes. We begin in Section 5.1 with investigating impacts on the composite attainment outcome—enrolling in college, earning an associate's degree, earning an industry-based certification, or earning a level I/II certificate—that was targeted by the bonus policy. We further unpack these results in Section 5.2 by examining effects on each component of the composite outcome. Then, in Section 5.3, we turn to potential unintended consequences on a measure of attainment *not* targeted by the bonus policy: high school graduation rates.

5.1 Effects on the targeted composite attainment outcome

Table 4 shows the main results for the impacts of per-pupil expenditures and incentives on the composite attainment outcome targeted by the incentive policy. Column (1) shows 2SLS estimates of equation (1) for 1 year after policy implementation ($t = 2020$), column (2) shows estimates for 2 years after ($t = 2021$), and column (3) shows estimates for 3 years after ($t = 2022$). Each column draws a comparison with respect to 2019, the year prior to policy implementation.

Table 4: Effects of spending and incentives on attainment

	(1) 2020	(2) 2021	(3) 2022
Per-pupil expenditure (100s)	-0.0004	0.0116**	0.0150**
	(0.0030)	(0.0055)	(0.0068)
Incentive to improve attainment (100s)	0.0040	0.0108	0.0334***
	(0.0050)	(0.0110)	(0.0120)
Title I and math control	$\times$	$\times$	$\times$
N districts	728	728	728
Mean Y in 2019	0.6376	0.6376	0.6376
S.D. Y in 2019	0.0972	0.0972	0.0972

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on the targeted attainment outcome 1, 2, and 3 years after policy implementation, respectively. Per-pupil expenditure is instrumented with the policy change on formula funding.

In the first year following policy implementation, we find little evidence that increases in either per-pupil expenditures (PPE) or incentives significantly affected graduates' rates of meeting the targeted composite attainment outcome (column 1 of Table 4). However, we find that in subsequent years, both the policy-induced increases in PPE and financial incentives increased rates of meeting the composite attainment outcome. This may be due to subsequent cohorts being exposed to additional years of increased PPE and districts taking time to learn how to respond to the bonus policy. Column (3) shows that by the third year after policy implementation, a $100 increase in PPE increased attainment rates by 1.5 percentage points, and a $100 increase in a district's financial incentive to improve student attainment increased attainment rates by 3.3 percentage points. Put differently, moving up 1 S.D. in the distribution of incentives increases attainment rates by 3.3 pp $\times \frac{70}{100} = 2.3$ percentage points.

We note that the scaling of the impact of incentives depends on the magnitude of the improvement that we assume districts can make as described in Section 4.2. In the main results, we consider an improvement equal to 1 S.D. of the district-level fixed effects on the composite attainment outcome. We also estimate the policy's effect on the composite attainment outcome under 0.75 S.D. and 1.25 S.D. improvement scenarios in Table A11. Our conclusions remain qualitatively similar.

Given that the policy created distinct bonuses for disadvantaged and non-disadvantaged students, we further break down overall incentives into incentives that targeted disadvantaged students' attainment and those that targeted non-disadvantaged students' attainment. We find that districts with higher incentives to improve disadvantaged (non-disadvantaged) students' attainment outcomes had greater improvements in disadvantaged (non-disadvantaged) attainment outcomes (Table A1). We find limited evidence of cross-group effects: higher incentives to improve disadvantaged students' attainment had a smaller, statistically insignificant effect on non-disadvantaged students' attainment, and vice versa. Turning to per-pupil expenditures, we find generally larger impacts on attainment for disadvantaged students than non-disadvantaged students, consistent with past findings that spending matters more for less advantaged populations (Jackson and Mackevicius, 2024).

Given that the incentive policy tied bonuses to the outcomes of a district's graduates, we re-run the main specification using attainment rates among graduates as the dependent variable. We find that incentives significantly increased attainment conditional on graduating (Table A10), suggesting that the bonus policy led districts to improve the metric that it incentivized. We note that this result alone does not imply that incentives caused districts to improve outcomes for students who would have graduated in the absence of the policy, because the outcome variable subsets on students' graduation statuses, which is itself an endogenous outcome of the policy.

5.2 Breaking down the impacts on attainment

We further unpack the effects of school spending and incentives on attainment by investigating impacts on each of the components that make up the composite attainment outcome targeted by the bonus policy. Table 5 summarizes. We find that the effects of per-pupil expenditures on the composite attainment outcome are driven by an increase in the share of students earning industry-based certifications (IBC). By the second and third year of the reform, a \$100 increase in per-pupil expenditures increased the share of students earning an IBC by around 3 percentage points (columns 2-3 of Table 5, panel B). Higher spending increased IBC completion among both students who enrolled in college and among those who did not (see Table A2).

Incentive effects also appear to be driven by industry-based certifications: point estimates suggest that increasing a district's financial incentive to improve student attainment by \$100 led to

Table 5: Effects of spending and incentives on attainment components

	Panel A: Educational attainment					
	Enroll in college			Earn associate's degree		
	(1) 2020	(2) 2021	(3) 2022	(4) 2020	(5) 2021	(6) 2022
Per-pupil expenditure	-0.0031	-0.0002	-0.0002	-0.0016	-0.0013	-0.0013
	(0.0028)	(0.0036)	(0.0034)	(0.0011)	(0.0014)	(0.0016)
Incentive to improve attainment	-0.0006	0.0001	0.0014	0.0018	0.0029	0.0010
	(0.0050)	(0.0069)	(0.0060)	(0.0022)	(0.0029)	(0.0027)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.5981	0.5981	0.5981	0.0138	0.0138	0.0138
S.D. Y in 2019	0.1035	0.1035	0.1035	0.0254	0.0254	0.0254
	Panel B: Career-based attainment					
	Earn IBC			Earn level I/II certificate		
	(1) 2020	(2) 2021	(3) 2022	(4) 2020	(5) 2021	(6) 2022
Per-pupil expenditure	0.0089	0.0292***	0.0324**	0.0010	0.0006	0.0006
	(0.0056)	(0.0103)	(0.0142)	(0.0007)	(0.0008)	(0.0008)
Incentive to improve attainment	-0.0066	-0.0002	0.0332	-0.0023*	-0.0000	0.0003
	(0.0110)	(0.0239)	(0.0269)	(0.0012)	(0.0012)	(0.0013)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.1084	0.1084	0.1084	0.0061	0.0061	0.0061
S.D. Y in 2019	0.0930	0.0930	0.0930	0.0144	0.0144	0.0144

Notes. These table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on components of the targeted attainment outcome: college enrollment, completion of an associate's degree, completion of an industry-based certification, and completion of a level I/II certificate. Per-pupil expenditure is instrumented with the policy change on formula funding. Within each outcome, the first, second and third columns correspond to attainment outcomes observed for graduates 1, 2, and 3 years after policy implementation, respectively.

higher growth in the average rate of earning industry-based certificates by around 3.3 percentage points, although this is not statistically significant. Higher incentives primarily increased IBC completion among students who did not enroll in college, consistent with the bonus policy's incentive to increase the share of students who meet at least one of the attainment criteria (see Table A2). We find no evidence that incentives shifted students towards earning IBCs and away from enrolling in college.

We also consider the magnitude of effect sizes on rates of IBC completion under different improvement scenarios for the incentive variable in Table A12. Our conclusions remain qualitatively similar.

To better understand the implications of policy effects on IBC attainment, we classify IBCs into 13 career clusters following the categorizations of the Texas Education Agency[34] and Giani

[34] `https://tea.texas.gov/academics/college-career-and-military-prep/career-and-technical-education/aligned-ibcs-to-programs-of-study-crosswalk.pdf`

(2022): agriculture, architecture and construction, arts and A/V, business, education, health science, hospitality, human services, IT, manufacturing, public safety, transportation, and engineering (see Appendix C.8 for the full classification list). We find that the effects of per-pupil expenditure on IBCs are driven by significant increases in certifications for agriculture and natural resources, architecture and construction, and manufacturing (Figure A7). Point estimates suggest that the effects of incentives on IBCs are mostly driven by increases in architecture and construction, business, and public safety, but these are not statistically significant.

Turning to the impact of spending on college enrollment, a common outcome of interest in the school funding literature, we find little evidence that policy-induced increases in per-pupil expenditures (PPE) or incentives to improve attainment outcomes affected districts' college enrollment rates. By the third year of the policy, we reject effect sizes larger than 0.7 percentage points for college enrollment per \$100 increase in PPE, or, extrapolating linearly, 7 percentage points per \$1000 increase in PPE.[35] Usual estimates from the literature are smaller than 7 percentage points; hence we do not reject them (Jackson and Mackevicius, 2024).

5.3 Unintended effects on high school graduation and dropout

In this section, we test the impact of the policy on a key attainment-related outcome that was not targeted by the policy: high school graduation rates. By tying bonuses to graduates' outcomes,[36] the bonus structure incentivizes districts to reduce graduation among students who are unlikely to meet the composite attainment standard.[37]

We test the implications of the bonus structure by examining the policy's impacts on the share of students who graduate from high school within one or two years after the first year of entering 12th grade. We further classify students into four mutually exclusive and exhaustive categories based on their status after the first year of 12th grade: (1) graduated, (2) dropped out, (3) repeated 12th

[35] 12th graders in 2022 were exposed to increased PPE for three years. We may therefore think of the estimated PPE impact for 2022 as the impact of a policy that increases PPE by \$100 for three years. So, we reject effect sizes larger than 0.7 percentage points for college enrollment for a policy that increases per-pupil expenditures by \$100 for three years.

[36] Districts receive a per-student bonus for every graduate that meets the bonus criteria above the threshold shares defined by the policy. Districts therefore receive higher bonus amounts if a higher share of their graduates meets the criteria. It is possible for districts to inflate the share of graduates meeting the bonus criteria by manipulating the number of graduates.

[37] Specifically, there are two channels through which this incentive can occur. First, for schools near the attainment rate minimum threshold that is necessary to meet in order to receive the bonus, retaining such students or their dropout reduces the denominator of graduates for that year and mechanically raises the attainment rate. Second, if a student has a higher chance of meeting the attainment criteria with another year of schooling, then the district has a higher chance of receiving a bonus generated from that student by retaining them for an additional year.

grade the following year, or (4) alternative exit status, which includes students who moved out of state after the start of the school year, transfers to private schools, and uncategorized dropouts. Among first-time 12th graders in the pre-reform year 2019, one year after entering 12th grade, around 95% are graduates, 1% dropped out, 2% repeat a grade, 2% have another exit status one year later.

Table 6 summarizes funding and incentive effects on graduation rates. We find evidence of unintended consequences: incentives reduced the share of students who graduate within one or two years after entering 12th grade. Increasing a district's financial incentive by \$100 reduced the share of students who graduate within one year after entering 12th grade by 1 percentage point from a baseline rate of around 94.7%. Put differently, moving up 1 S.D. in the distribution of incentives decreased graduation rates by 1 pp $\times \frac{70}{100} = 0.7$ percentage points. We find similar effects for graduation within two years after entering 12th grade, with a \$100 increase in incentives reducing within-two-year graduation by 1 percentage point from a baseline rate of around 96%. In contrast, estimates from the third year following implementation suggest that funding increases graduation within two years by 0.4 percentage points although point estimates from the second year are small in magnitude and negative.

Table 6: Effects of spending and incentives on high school graduation rates

	Within one year after 12th grade			Within two years after 12th grade		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0038	-0.0003	0.0022	0.0047	-0.0001	0.0040*
	(0.0031)	(0.0024)	(0.0022)	(0.0031)	(0.0020)	(0.0023)
Incentive to improve attainment	-0.0068	-0.0089*	-0.0099**	-0.0066	-0.0100**	-0.0116**
	(0.0046)	(0.0052)	(0.0047)	(0.0045)	(0.0041)	(0.0050)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.9469	0.9469	0.9469	0.9603	0.9603	0.9603
S.D. Y in 2019	0.0308	0.0308	0.0308	0.0268	0.0268	0.0268

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on a district's share of first-time 12th graders who graduate high school within (a) one or (b) two years after the first year of 12th grade. Columns within each outcome correspond to 1, 2, and 3 years after policy implementation, respectively. Per-pupil expenditure is instrumented with the policy change on formula funding.

A first-time 12th grader who does not graduate may continue to be held back in high school or drop out. Table A3 summarizes effects on dropping out and repeating 12th grade. We find that incentives increased dropouts: by the third year following policy implementation, a \$100 increase in incentives increased dropout rates by around 0.2 percentage points, from a baseline of 1 percent.

We find little evidence that incentives increased the share of students who repeat 12th grade.

We further inspect the one-year-later outcomes of first-time 12th graders who repeat 12th grade (Table A4). First, we do not find evidence that incentives affected the rate of first-time 12th graders who repeated 12th grade and dropped out the following year, nor the rate of first-time 12th graders who repeated 12th grade and graduated the following year.[38] However, we find that incentives increased the rate of first-time 12th graders who repeated 12th grade and graduated the following year *and* met the attainment criteria by 0.1 percentage points per $100 incentive from a baseline of around 0.2 percentage points (Table A5). This increase in meeting the attainment criteria is partially driven by IBCs: a $100 higher incentive increased the rate of first-time 12th graders who were retained and graduated the following year *and* earned an IBC by 0.03 percentage points from a baseline of around 0.1 percentage points.

6 Impacts on short-term college and career outcomes

In this section, we present the effects of per-pupil expenditures and attainment-based incentives on short-term college and career outcomes. We begin in Section 6.1 with impacts on whether students are enrolled in college (2-year or 4-year) or employed 1 year after 12th grade. In Section 6.2, we present results on 1-year-later labor market earnings. In Section 6.3, we estimate the extent to which the impacts on earnings can be explained by the policy's effects on industry-based certifications that we document in Section 5.2.

6.1 Effects on enrolled-or-employed 1 year after 12th grade

We find that neither per-pupil expenditures nor attainment-based incentives affected the share of first-time 12th graders who are enrolled in college or employed 1 year after 12th grade (Panel A of Table 7). The overall effect masks offsetting changes across margins of joint outcomes: incentives decreased the share of 12th graders who were both enrolled *and* employed 1 year later, increased the share who were enrolled but not employed, and had no significant impact on the share of 12th graders who were not employed but not enrolled (Table A6). This suggests that incentives shifted some students who otherwise would have combined college enrollment and employment toward focusing exclusively on enrollment.

[38] Some students are missing in the data in the following year, potentially due to uncategorized dropouts or moves. We find that incentives increased the rate of first-time 12th graders who were retained and either dropped out or were missing the following year. However, we are not able to distinguish individuals who are missing because they

Table 7: Effects of spending and incentives one year after the first year of 12th grade

	Panel A: Share enrolled or employed		
	(1)	(2)	(3)
	2020	2021	2022
Per-pupil expenditure	0.0035*	0.0008	0.0012
	(0.0018)	(0.0016)	(0.0016)
Incentive to improve attainment	-0.0034	0.0033	0.0044
	(0.0031)	(0.0029)	(0.0027)
Title I and math control	×	×	×
N districts	728	728	728
Mean Y in 2019	0.8563	0.8563	0.8563
S.D. Y in 2019	0.0449	0.0449	0.0449
	Panel B: Annual earnings		
	(1)	(2)	(3)
	2020	2021	2022
Per-pupil expenditure	107.76**	-9.64	111.00**
	(49.26)	(37.71)	(48.50)
Incentive to improve attainment	-108.06	225.67***	278.65***
	(82.29)	(65.97)	(99.71)
Title I and math control	×	×	×
N districts	728	728	728
Mean Y in 2019	4,951.06	4,951.06	4,951.06
S.D. Y in 2019	1,315.24	1,315.24	1,315.24

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on (a) the share of 12th graders who are enrolled in college or employed 1 year later and (b) 1-year-later annual earnings, 1, 2, and 3 years after policy implementation, respectively. Per-pupil expenditure is instrumented with the policy change on formula funding.

We further decompose effects by whether students earned an industry-based certification (IBC). To do so, we consider mutually exclusive outcomes by whether a student earns an IBC, is employed, or is enrolled, revealing further heterogeneity (Table A7). The reduction in enrolled-*and*-employed is driven by students who do not obtain an IBC. In contrast, among those who earn an IBC, incentives increased the share of students are employed but not enrolled 1 year later, with little change in the share that is enrolled-and-employed or neither-enrolled-nor-employed. Taken together, these results are consistent with a mechanism in which incentives encourage some students to earn an IBC and transition directly into employment, while others—those not earning an IBC—shift from combining employment and college toward focusing solely on college enrollment.

dropped out from those who moved out of state.

6.2 Effects on labor market earnings one year after 12th grade

Turning to the impact of the funding and incentives on earnings, we find that incentives increased students' 1-year-later annual earnings:[39] in the 2nd and 3rd years after policy implementation, a 100 dollar increase in incentives increases students' 1-year-later annual earnings by around 250 dollars (2012 US dollars), from a baseline of 5,000 dollars in the pre-reform year (Panel B of Table 7). In other words, a one standard deviation increase in incentives increased 1-year-later annual earnings by around 160 to 190 dollars. When we decompose the earnings effect by students' college enrollment, we find that the incentive effects on earnings are entirely driven by students who did not enroll in college one year later (Table A8). Per-pupil expenditures also increased earnings among students who do not enroll.

Since the policy was implemented only five years before this study, we are unable to test the impacts of the policy on later-life labor market outcomes such as earnings several years after high school graduation. Future work may assess longer-term effects on earnings once the students' outcomes are realized.

6.3 Explaining earnings effects with industry-based certifications

Given the large impact of the policy on industry-based certifications (documented in Section 5.2), we ask to what extent the increases in industry-based certifications (IBCs) may explain the labor market impacts, specifically the earnings impacts. Policy impacts on IBCs may translate to improvements in labor market outcomes if IBCs serve as a signal of productivity to employers, thus increasing the rate of employment, or reflect human capital accumulation that students undergo during the process of attaining an IBC. We begin by estimating the relationship between earning an IBC and annual earnings among the pre-reform graduating cohorts of 2017 and 2018 for up to 6 years after high school graduation.[40] We start from 2017 because this is the first year that data on IBCs is available.

Past work finds a positive correlation between earning an IBC and later-life earnings (Giani, 2022). Whether the correlation is an underestimate or overestimate of the causal impact of IBCs on labor market outcomes is ex-ante ambiguous because the effect likely operates through multiple margins: IBCs may add value particularly for those who would otherwise hold no credential at all,

[39] We calculate annual earnings beginning in Q3 of the 12th grade year. For example, if a student is in 12th grade during the 2019-20 school year, we compute 1-year-later annual earnings by summing earnings in Q3 2020 through Q2 2021.

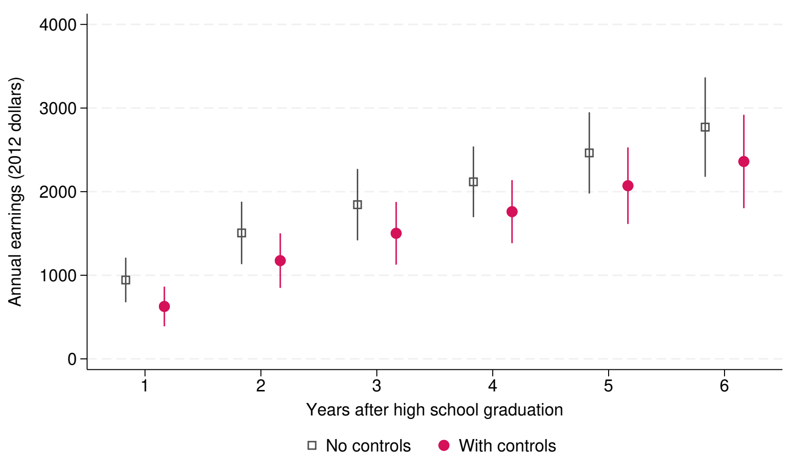
[40] We exclude students who enrolled in a college outside of Texas as they are unlikely to be in the UI records.

but at the same time may also divert students away from pursuing additional valuable credentials or degrees.[41] With this in mind, we assess the relationship between IBCs and labor markets with a selection-on-observables approach leveraging our rich administrative data. We estimate, for student i who graduates from school s in year $t \in \{2017, 2018\}$:

$$Y_i = \tau_0 + \tau_1 \mathbb{1}\{\text{has IBC}\}_i + \tau_3 X_i + \delta_{s(i)} + \gamma_{t(i)} + \epsilon_i \tag{8}$$

where Y_i is i's annual earnings, $\mathbb{1}\{\text{has IBC}\}_i$ an indicator for whether i earned an IBC during high school, and X_i is a rich set of controls: student demographics (ethnicity-by-gender, special education, limited English proficiency status) and second-order polynomials in lagged achievement (9th grade math test scores) fully interacted with demographics. $\delta_{s(i)}$ are school fixed effects and $\gamma_{t(i)}$ are cohort fixed effects. We estimate equation (8) separately for each year of post-graduation annual earnings. This approach therefore isolates within-cohort, within-year variation conditional on demographics and observed achievement.

Figure 7: Earnings returns to industry-based certifications



Notes. This figure shows the relationship between whether a high school graduate earned an IBC during high school and annual earnings in 2012 dollars up to 6 years after high school graduation. We impute earnings of zero for those who are not employed. Markers correspond to the coefficients on an indicator for earning an IBC, from regressing the corresponding outcome (gray squares) without controls or (pink circles) with student-level covariates, district fixed effects, and cohort fixed effects (equation 8).

Figure 7 illustrates our estimates of τ_1. The gray markers show estimates that omit X_i and $\delta_{s(i)}$ from equation (8) and the pink markers show estimates using the full set of controls. We

[41] See Mountjoy (2022) for estimating the effects along each of these margins separately in the setting of community colleges.

find evidence of significant returns from earning an IBC on annual earnings: one year after 12th grade, IBCs are associated with a $700 increase in annual earnings (in 2012 dollars) relative to a baseline of $5,400 among those who did not earn an IBC. Taken together with the point estimate for the effect of incentives on IBCs, this implies that the effect of incentives on earnings 1 year after graduation operating through IBCs is $23 per $100 incentive.[42] In other words, the effects of incentives on IBCs can explain around 8-10% of the incentive effect on earnings in the second and third year following policy implementation.[43] We caveat this exercise by noting that earnings 1 year after 12th grade likely do not capture all of the relevant channels associated with later-life improvements, particularly as those who are induced into college enrollment can exhibit a reduction in earnings during these earlier years. Additionally, this exercise requires the strong assumptions that the returns to IBCs stay constant pre- vs post-reform[44] and that students who earn IBCs pre- vs post-reform have similar average returns to IBCs.

7 Policy effects and government costs

Policy changes in funding and incentives differ not only in their impacts on student outcomes, but also in their cost to the government. Intuitively, the funding policy generates a cost regardless of district performance, while the incentive policy only generates costs for sufficient performance. In this section, we scale each of the estimated funding and policy effects with the respective policy costs. We use the estimates corresponding to the third year following policy implementation.

We begin with quantifying the gross costs of each policy. For funding increase, we take the sum of district-level, policy-induced changes in formula funding described in Section 4.1, which was $1,012 per first-time 12th grader.[45] For the gross cost of the attainment-based incentives, we include the financial bonus amount that the government awards districts for meeting the bonus criteria, which was $510 per first-time 12th grader. This is likely an underestimate of the true cost of implementing the policy, given other potential costs such as those associated with collecting, storing, and processing the data necessary to determine whether a district met the incentive criteria.

We then divide each effect size by the associated government costs. Figure 8 summarizes. For

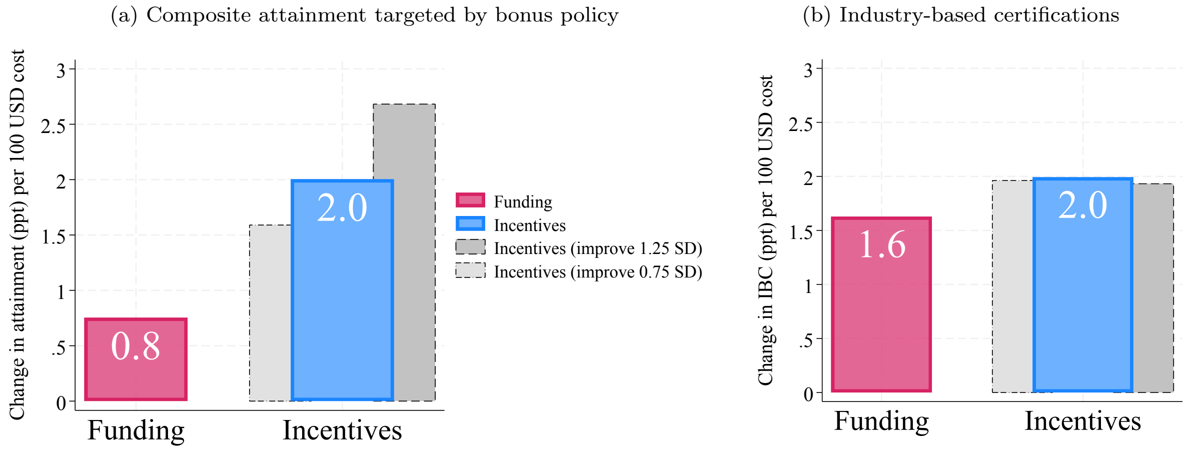
[42] $\underbrace{\$700}_{\text{estimated returns to IBC}} \times \underbrace{0.033}_{\text{effect of incentives on IBC completion}} \approx \$23$ per $100 incentive

[43] Note that we estimated equation (8) on graduates, whereas we estimated impacts on earnings in Panel B of Table 7 on first time 12th graders.

[44] The most common IBCs pre- vs post-reform are not the same, so the return to the average IBC pre- vs post-reform likely changed.

[45] To obtain this figure, we assume that the funding increases were spread equally across grades.

Figure 8: Funding and incentive impacts per government cost



Notes. This figure shows the implied effects of unconditional funding and incentives per \$100 per-12th grader cost to the government on (a) the composite attainment measure targeted by the bonus policy and (b) industry-based certifications. The government cost of unconditional funding is the policy-predicted increase in formula funding per student. We assume that funding is spread equally across grades so that the per-student amount can be thought of as a per-12th grader amount. The government cost of incentives is the bonus funding paid out based on the outcomes of 2022 graduates. We also show implied effects of incentives per \$100 per-12th grader cost to the government under 0.75 S.D. and 1.25 S.D. improvement scenarios.

attainment, we find that the funding policy improved attainment by 1.6 percentage points per \$100 per-pupil funding and 2 percentage points per \$100 bonus funding. In other words, incentives generated similar effects as unconditional funding with a 20% lower government cost. The exact magnitude of incentive effects depends on the magnitude of school improvements that we consider when quantifying the financial gain districts have from improving student outcomes: however, we find that the qualitative conclusion that incentives generated a larger per-cost effect on attainment persists whether we consider alternative magnitudes of improvements.

8 Conclusion

The US has largely utilized funding reforms and test-based accountability policies to improve student outcomes, but debates over the most effective policy tools continue among both policymakers and researchers. Recent discussions increasingly ask whether directly targeting attainment outcomes such as college enrollment offers a more promising path, and these inquiries have manifested in a growing number of state policies that incorporate attainment-based incentives. However, little is currently known about the impacts of such policies. This paper studies the impacts of a novel accountability policy that directly incentivized school districts for their graduates' educational attainment outcomes, and the effects of increasing districts' per-pupil funding.

We find that both incentives and funding increased the share of 12th graders meeting the composite attainment outcome targeted by the policy. Comparing effects relative to government costs, we find that attainment-based incentives can deliver comparable improvements in this composite outcome as funding at a lower government cost. At the same time, by tying bonuses to high school graduates' outcomes, the bonus policy inadvertently incentivized districts to reduce graduation among students who were unlikely to meet the attainment criteria. We find that the attainment-based incentives reduced high school graduation rates and increased dropout rates. Ultimately, these competing effects on attainment and high school graduation lead to mixed evidence on student outcomes 1 year later.

Taken together, our results highlight the potential promise of attainment-based incentives in improving student outcomes, but also emphasize the importance of incentive structure design—not only for outcomes that the policy aims to improve, but also for shaping which students the policy ultimately serves.

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Appendix

A Additional details on bonus policy

A.1 TSI requirements

Table A1 describes the score thresholds on the Texas Success Initiative Assessment (TSIA), SAT, and ACT that students must pass in order to meet the TSI requirements. The first row contains the reading score thresholds and the second row contains the math score thresholds. For the ACT, students must also pass a composite score threshold in order to meet the reading and math requirements.

Figure A1: TSI score thresholds. Source: Texas Education Agency.

TSIA	SAT	ACT
>= 351 on Reading	>= 480 on the Evidence-Based Reading and Writing (EBRW)	>= 19 on English and >= 23 Composite
>= 350 on Mathematics	>= 530 on Mathematics	>= 19 on Mathematics and >= 23 Composite

The average statewide TSIA reading score for the high school graduates of 2017-18 was 351 and the average math score was 344. The average statewide SAT EBRW score for the high school graduates of 2017-18 was 520 and the average math score was 512. The average statewide ACT English was 19.6 and the average math score was 20.6. The average composite score was 20.6.

A.2 Common industry-based certifications (IBCs)

Figure A2 shows the 10 most common IBCs earned by the graduating cohort of 2019. About X % of graduates earn more than one IBC. For these students, we list their IBC as the first one that they earn.

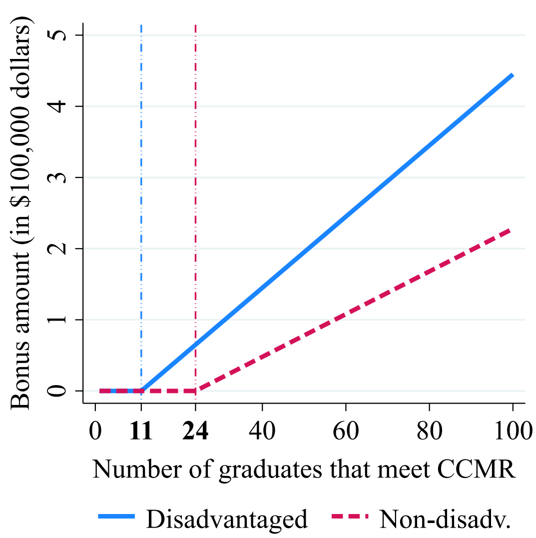
Figure A2: Source: Texas Education Agency.

Industry-based certification (IBC)	Share of all IBCs earned
Microsoft Office Specialist Word	13.19%
National Center for Construction Education and Research Core Level I	8.06%
Texas Health & Human Services Certified Nurse Aide	7.26%
Microsoft Office Specialist: Microsoft Word Expert (Word 2019)	5.32%
American Welding Society D1.1 Structural Steel	4.79%
Adobe Certified Professional in Visual Design Using Adobe Photoshop	4.21%
Texas Department of Licensing and Regulation Cosmetology Operator License	3.83%
National Healthcareer Association Certified Clinical Medical Assistant	3.43%
Texas Department of Public Safety Non-Commissioned Security Officer Level II License	2.90%
National Restaurant Association ServSafe Manager	2.80%

Notes. This table shows the 10 most common IBCs earned by the graduating cohort of 2018-19.

A.3 Bonus schedule

Figure A3: Bonus schedule for example district



Notes. This figure shows a CCMR bonus schedule that corresponds to a district with exactly 100 disadvantaged and 100 non-disadvantaged graduates, as explained in Section 2.3. The vertical lines correspond to the percentage thresholds at which the district receives a bonus for each additional graduate meeting CCMR.

B Additional details on funding formula change

In this section, we provide additional details about the Tier I funding formula and how the reform affected it.

First, it is helpful to write the Tier I formula as a weighted sum:

$$F_{dt}^{T1} = A_{dt} \times \sum_{k \in \mathcal{K}} \omega_{kt} ADA_{dt,k} \tag{A1}$$

where F_{dt}^{T1} is the dollar amount of district d's Tier I funding in year t, A_{dt} is a base per-student amount, $\mathcal{K}$ is the set of student categories which are inputs to the formula, ω_{kt} is the funding weight for category k, and $ADA_{dt,k}$ is the average daily attendance of students in category k.

The "Before HB 3" column in Table A4 shows the components of the Tier I formula before the reform. We focus here on the formula for non-charter districts. The first column, "Per-student amount," is A_{dt} in equation A1. We do not write out the dollar amount because it varies across districts. The second column, "Weight," corresponds to the ω_k's in A1. The set of programs in the "Program" column corresponds to $\mathcal{K}$ in A1. There are two programs, High School and Career & Technology Advanced, which have their own per-student amounts which are constant across districts. There are also additional components of the formula which cannot easily be written in the form of equation A1.

The "After HB 3" column in Table A4 shows the components of the Tier I formula after the reform. As we describe in section 2.2 of paper, the reform changed the Tier I formula in three ways: 1) equalizing the per-student amount across districts, 2) changing the set of student categories, $\mathcal{K}$, which are included in the formula, and 3) modifying some of the weights on existing categories. Two of the categories in Table A4, the Teacher Incentive Allotment and the Mentor Program Allotment, were created by statute in 2019-20 but were not funded in the first year of the reform.

We also describe in more detail the formula for the per-student amount, A_{dt}, prior to the reform. Prior to the formula change, a district d's per-student amount in year t was given by:

$$A_{dt} = \underbrace{\underbrace{\$5,140 \times comp\_tax_{dt}}_{\text{district basic allotment}} \times (1 + 0.71 \times CEI_d)}_{\text{adjusted basic allotment}} \times (1 + size\_adj_{dt})$$

Every district starts with a per-student amount of \$5,140. This amount is then adjusted by multiplying by the district's compressed maintenance and operations (M&O) tax rate, $comp\_tax_{dt}$. Most

Figure A4: Tier 1 Formula, Before and After HB 3

Before HB 3			After HB 3		
Per-student amount	Weight	Program	Per-student amount	Weight	Program
A_{dt}	1	Regular program	\$6,160	1	Regular program
-	-	-	variable		Small and Mid-sized Allotment
A_{dt}	1	Special Education Regular	A'_{dt}	1	Special Education Regular
A_{dt}	1.1	Special Education Mainstream	A'_{dt}	1.15	Special Education Mainstream
-	-	-	\$6,160	0.1	Dyslexia
A_{dt}	0.2	State Compensatory Education	\$6,160	0.225-0.275	State Compensatory Education
A_{dt}	2.41	State Compensatory Education Pregnancy-related	\$6,160	2.41	State Compensatory Education Pregnancy-related
-	-	-	\$6,160	0.2	State Compensatory Education Residential Facility
\$275	1	High School	-	-	-
A_{dt}	0.1	Bilingual Program	\$6,160	0.1	Bilingual Program
-	-	-	\$6,160	0.15	Bilingual LEP Dual Language Program
-	-	-	\$6,160	0.05	Bilingual non-LEP Dual Language Program
A_{dt}	1.35	Career & Technology Regular	\$6,160	1.35	Career & Technology Regular
\$50	1	Career & Technology Advanced	\$50	1	Career & Technology Advanced
-	-	-	\$50	1	Career & Technology P-TECH
-	-	-	\$50	1	Career & Technology New Tech Network
A_{dt}	0.1	Public Education Grant	\$6,160	0.1	Public Education Grant
-	-	-	\$6,160	0.1	Early Education
A_{dt}	0.12	Gifted & Talented	-	-	-
-	-	-	variable		CCMR bonus
-	-	-	\$6,160	0.04	Fast growth allotment
-	-	-	variable		Teacher Incentive Allotment
-	-	-	variable		Mentor Program Allotment
-	-	-	\$9.72	1	School Safety Allotment
variable		Transportation Allotment	variable		Transportation Allotment
variable		New Instructional Facility Allotment	variable		New Instructional Facility Allotment
-	-	-	\$275	1	Dropout Recovery

Notes. This table shows the components of the Tier I funding formula before and after the HB 3 reform.

districts had $comp\_tax_{dt} = 1$, but a small fraction of districts have $comp\_tax_{dt} < 1$. This adjusted per-student amount is called the district basic allotment. Then, a cost of education index (CEI) adjustment is applied to 71% of the district basic allotment. The CEI is constant over time and ranges from 0 to 0.2 across districts. These indices were set in 1991 and were intended to account for the fact that it is costlier to provide education in certain districts.

The resulting per-student amount is called the adjusted basic allotment. Finally, a size adjustment is applied. For districts with average daily attendance exceeding 5,000 students, $size\_adj_{dt} = 0$. For small districts with average daily attendance less than 1,600 students, $size\_adj_{dt} = 0.0004 \times (1,600 - ADA_{dt})$ for districts larger than 300 square miles and $size\_adj_{dt} = 0.00025 \times (1,600 - ADA_{dt})$ for districts smaller than 300 square miles. For mid-size districts with average daily attendance between 1,600 and 5,000 students, $size\_adj_{dt} = 0.000025 \times (5,000 - ADA_{dt})$.

After the reform, the per-student amount was set to \$6,160 for all districts, but the funding for special education programs is still calculated using an adjusted allotment. The formula for the post-reform adjusted allotment is:

$$A'_{dt} = \$6,160 \times comp\_tax_{dt} \times (1 + size\_adj'_{dt})$$

The size adjustment is calculated differently than before. For districts with average daily attendance exceeding 5,000 students, $size\_adj'_{dt} = 0$. For small districts with average daily attendance less than 1,600 students, $size\_adj'_{dt} = 0.00047 \times (1,600 - ADA_{dt})$ for districts that are the only district in their county and $size\_adj_{dt} = 0.0004 \times (1,600 - ADA_{dt})$ otherwise. For mid-size districts with average daily attendance between 1,600 and 5,000 students, $size\_adj_{dt} = 0.000025 \times (5,000 - ADA_{dt})$.

C Data Cleaning Steps

C.1 yearCCMR dataset

We first create a dataset that contains all graduates and 12th grade students from the school years 2015-16 to 2021-22 using 3 separate files. First, using the graduate files, we get the earliest recorded graduation year and district for each student. This cleaned graduation data is at the student level. Second, using the attendance files, we keep every student-year observation where the student is recorded as being in 12th grade. For students with multiple districts in a given year, we keep the first district that they appear in. We also create an indicator for whether the student is a first time 12th grader. This cleaned attendance data is at the student-year level. Finally, using the dropout files, we keep all students who were in 12th grade and we get the earliest recorded year and district of dropout. This cleaned dropout data is at the student level.

We merge these 3 cleaned datasets. First, we merge the graduation data and the attendance data. For students who have information from both the graduation data and the attendance data in a given year, we keep the information from the graduation data if there are any conflicts. Across all years of our sample, <1% of student-year observations were found in the graduation data but not the attendance data (40% of these unmatched observations are students who graduated before grade 12). 7.8% of student-year observations were found in the attendance data but not the graduation data. These represent students who were in grade 12 but did not graduate during that year. We then merge the dropout data to the merged graduate + grade 12 dataset. We are able to match 88% of the students in the dropout data to the merged graduate + grade 12 dataset. For these matched students, we keep the information from the merged graduate + grade 12 file if there are any conflicts with the information in the dropout data. For the few students who are found in both the dropout and the graduate data, we code them as having graduated. (Note: only 8% of the dropouts in our sample ever graduate from high school.)

Our final dataset, "yearCCMR," is at the student-year level. For a given year, we have students who graduated from high school, students who were in grade 12 but did not graduate, and students who were in grade 12 and dropped out. A student can only have one graduation year and one dropout year, but they can be in grade 12 in more than one year.

C.2 Data for CCMR indicators

In order to determine whether every graduate met CCMR, we use data on SAT/ACT/TSIA scores, college enrollment data, associate's degree completion data, industry-based certification data, and level I/II certificate completion data.

SAT/ACT/TSIA Data

We obtain information on SAT/ACT/TSIA scores from the THECB Texas Success Initiative (TSI) reports and the THECB admissions files. The TSI reports are annual reports that have information on every student currently enrolled in a public 2y or 4y Texas postsecondary institution. These reports indicate whether a student met the TSI requirements, and if so, how. There are two ways to meet the TSI requirements: either through an exemption or by passing a score on the Texas Success Initiative Assessment (TSIA). We observe a variable for whether a student met any of the exemptions. For students whose schools report them as having a SAT/ACT exemption, we observe their SAT/ACT math and reading scores. For students who take the TSIA, we observe their math and reading score, and we can determine if they passed the TSI math and reading requirements through the TSIA. We combine SAT/ACT/TSIA information from all years of the TSI report. In other words, we assume that if a student has SAT/ACT/TSIA scores in any year of the TSI report, they took the test before Oct 31 of the calendar year of their high school graduation.

The admissions files have information on every student who applies to a TX 4y public university. We have information on total SAT and composite ACT scores of students who submit scores when applying. Note that the TSI requirements are math- and reading-specific. However, the admissions files do not contain math- and reading-specific test scores. Therefore, we define a pseudo total SAT cutoff and a pseudo composite ACT cutoff. In the admissions data, we code a student as meeting the math and reading TSI requirements if they pass either of these pseudo cutoffs. We the max score across all admissions years. In other words, we assume that if a student has SAT/ACT scores in an admissions report from any year, they took the test before Oct 31 of the calendar year of their high school graduation.

Using this information, we create variables for whether a student met the TSI math requirements and whether a student met the TSI reading requirements. We code a student as meeting the TSI math (reading) requirements if they met the SAT/ACT math (reading) exemption or the TSIA math (reading) exemption or the pseudo cutoff on the SAT/ACT. We code a student as meeting the overall TSI requirements if they meet both the math and reading requirements.

College enrollment

We have information on yearly college enrollment for all students who graduated from a public high school in Texas. For every high school graduate, we determine if they were enrolled in a college (of any type in any state) in the year following high school graduation. We also create indicators for whether a graduate was enrolled in a college during the fall semester following high school and within 2 years of graduating from high school.

Associate's degree completion

We have information on all associate's degrees awarded by Texas postsecondary institutions. For every student in the yearCCMR data (graduates, grade 12s, and dropouts), we determine if they earned an associate's degree by the end of high school.

Industry-based certification completion

Districts began to report industry-based certification completions starting in the 2016-2017 school year. Districts can back-report IBC completers, so that is why we have positive rates of IBC completion in 2015-16. For every student, we determine whether they completed an industry-based certification by the end of high school.

Level I/II certificate completion

We have information on all level I/II certificates awarded by Texas postsecondary institutions. For every student in the yearCCMR data (graduates, gr 12s, and dropouts), we determine if they earned a level I/II certificate by the end of high school.

C.3 Additional student outcomes

We merge in additional data on students' college applications & admissions and earnings. We obtain the college application and admission data from the THECB admissions reports. These reports include all students who apply to a Texas 4y public university. For the high school graduates in our yearCCMR dataset, we create an indicator for whether the student applied to a Texas 4y public university for admission in the year following high school graduation. The indicator equals 1 if the student is found in the admissions data in the year after high school graduation; it equals

0 otherwise. We also create variables for the number of applications submitted, the number of admissions, the number of rejections, and the whether the student applied within 2 years of high school graduation. For all students who are not high school graduates in the yearCCMR data, we set the value of these admission- and application-related variables to missing.

We obtain the earnings data from the TWC quarterly wage reports. We convert quarterly earnings to annual by calculating total earnings in a calendar year. We convert earnings to 2012 real dollars. For every high school graduate in the yearCCMR dataset, we create variables for earnings 1 and 2 years after high school graduation, where available. For all students who are not high school graduates in the yearCCMR data, we set the value of the earnings-related variables to missing.

C.4 Student-level covariates

We merge in several student-level covariates for all students in the yearCCMR dataset: demographic information (sex, ethnicity, disadvantaged status, special education status, and other program participation), absenteeism in grade 9 and 10, and standardized STAAR Algebra I test scores (typically taken in grade 9). We take a student's highest Algebra I test score in the event that they took the test multiple times. We drop students who are missing basic demographic information on sex, ethnicity, and disadvantaged status.

C.5 District-level data

Finally, we merge in several district-level variables.

- district average standardized test scores
- district-level demographics (share disadvantaged, share Hispanic, share Black, share in grades 9-12)
- district-level program and course participation (share participating in advanced courses, share participating in dual credit courses, share participating in any CTE courses, share LEP)
- district-level average daily attendance in Tier 1 formula categories
- district-level finance data (operating revenues and operating expenditures, Tier 1 total funding amounts, Tier 1 funding amounts by formula component)

C.6 Computing CCMR bonus amounts

For every district in every year, we first compute the number of disadvantaged graduates and nondisadvantaged graduates. These determine the minimum number of disadvantaged and nondisadvantaged graduates that must meet CCMR in order for the district to receive a disadvantaged and nondisadvantaged CCMR bonus respectively.

We then calculate the number of disadvantaged graduates, nondisadvantaged graduates, and special education graduates that meet CCMR. The disadvantaged bonus is given by $5,000 times the number of disadvantaged graduates meeting CCMR above the minimum threshold of 11%, the nondisadvantaged bonus is given by $3,000 times the number of nondisadvantaged graduates meeting CCMR above the minimum threshold of 24%, and the special education bonus is given by $2,000 times the number of special education graduates meeting CCMR. The district's total bonus is given by adding the disadvantaged, nondisadvantaged, and special education CCMR bonus.

When we compute CCMR bonus amounts as part of the process of constructing measures of districts' attainment-based incentives as described in Section 4.2, we compute bonus amounts assuming that a student who meets any of the attainment-related criteria also meets the testing standards.

C.7 Predicted increase in Tier 1 funding

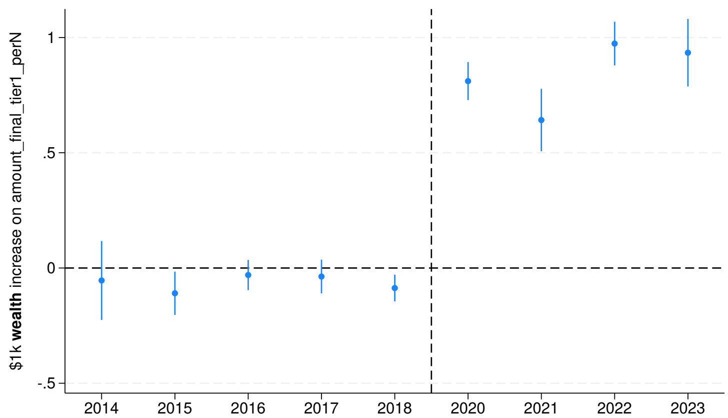
To predict a district's increase in Tier 1 funding due to the policy based on 2019 student attendance, we need student attendance numbers in 2019 for all of categories in the 2020 Tier 1 formula.

The majority of the categories in the post-reform Tier 1 formula are also part of the pre-reform Tier 1 formula. We obtain 2018-2019 student attendance numbers in these categories directly from publicly available summary of finance data. There are some categories in the post-reform Tier 1 formula that are not part of the pre-reform Tier 1 formula. We estimate 2018-2019 student attendance numbers these categories using the attendance microdata in the Texas ERC. The attendance categories that we estimate are: early childhood disadvantaged or bilingual, dual language program bilingual, and dropout recovery/residential facility. There is one category that we are unable to estimate, dyslexic students, and we are therefore unable to include this category in our funding instrument.

Finally, we know the functional form and the parameters of the new Tier 1 funding formula. We apply the post-reform formula to student attendance in 2019 to obtain the Tier 1 funding amount that the district would have received if the reform had been implemented in 2019. We subtract the district's actual Tier 1 funding in 2019 from this amount to obtain the predicted increase in Tier 1 funding due to the policy based on 2019 student attendance. We convert this to a per-student measure by dividing by the number of students in the district in 2019.

Figure A5 shows that our predicted funding instrument Z_d predicts districts' actual formula funding.

Figure A5: First stage of Tier I funding on funding instrument (Z_d)



Notes. This figure shows coefficients from a regression of actual per-pupil Tier I funding on the funding instrument and the incentive variable interacted with indicators for year, year fixed effects, and district fixed effects. The pre-reform year 2019 is the omitted year.

C.8 Classifying industry based certifications

Below we provide the classifications for each industry-based certification that we apply, following the categorizations of the Texas Education Agency[46] and Giani (2022). The second column of the table contains the name of the IBC and the last column contains the career cluster to which we assign the IBC. Some IBCs can be classified into more than one career cluster; for these, we rely on Giani (2022)'s classifications as well as our own judgment calls.

[46] `https://tea.texas.gov/academics/college-career-and-military-prep/career-and-technical-education/aligned-ibcs-to-programs-of-study-crosswalk.pdf`

IBC Code	IBC Title	Program of Study Code	Program of Study Title	Assigned Classification
10	Adobe Certified Professional In Visual Effects and Motion Graphics Using Adobe After Effects	29	Graphic Design and Multimedia Arts	Arts and A/V
10	Adobe Certified Professional In Visual Effects and Motion Graphics Using Adobe After Effects	64	Printing and Imaging	Arts and A/V
11	Adobe Certified Professional Animate	29	Graphic Design and Multimedia Arts	Arts and A/V
12	Adobe Certified Associate Creative Cloud	17	Digital Communications	Arts and A/V
12	Adobe Certified Associate Creative Cloud	29	Graphic Design and Multimedia Arts	Arts and A/V
12	Adobe Certified Associate Creative Cloud	64	Printing and Imaging	Arts and A/V
13	Adobe Certified Associate Creative Suite 6	17	Digital Communications	Arts and A/V
13	Adobe Certified Associate Creative Suite 6	29	Graphic Design and Multimedia Arts	Arts and A/V
13	Adobe Certified Associate Creative Suite 6	64	Printing and Imaging	Arts and A/V
14	Adobe Certified Associate Flash	29	Graphic Design and Multimedia Arts	Arts and A/V
14	Adobe Certified Associate Flash	52	Web Development	Arts and A/V
15	Adobe Certified Professional in Graphic Design and Illustration Using Adobe Illustrator	29	Graphic Design and Multimedia Arts	Arts and A/V
15	Adobe Certified Professional in Graphic Design and Illustration Using Adobe Illustrator	64	Printing and Imaging	Arts and A/V
16	Adobe Certified Professional in Print and Digital Media Publication Using Adobe InDesign	17	Digital Communications	Arts and A/V
16	Adobe Certified Professional in Print and Digital Media Publication Using Adobe InDesign	29	Graphic Design and Multimedia Arts	Arts and A/V
16	Adobe Certified Professional in Print and Digital Media Publication Using Adobe InDesign	64	Printing and Imaging	Arts and A/V
17	Adobe Certified Professional in Visual Design Using Adobe Photoshop	17	Digital Communications	Arts and A/V
17	Adobe Certified Professional in Visual Design Using Adobe Photoshop	29	Graphic Design and Multimedia Arts	Arts and A/V
17	Adobe Certified Professional in Visual Design Using Adobe Photoshop	64	Printing and Imaging	Arts and A/V
18	Adobe Certified Professional in Digital Video Using Adobe Premiere Pro	17	Digital Communications	Arts and A/V
18	Adobe Certified Professional in Digital Video Using Adobe Premiere Pro	29	Graphic Design and Multimedia Arts	Arts and A/V
18	Adobe Certified Professional in Digital Video Using Adobe Premiere Pro	64	Printing and Imaging	Arts and A/V
19	Adobe Certified Professional in Visual Design	17	Digital Communications	Arts and A/V
19	Adobe Certified Professional in Visual Design	29	Graphic Design and Multimedia Arts	Arts and A/V
19	Adobe Certified Professional in Visual Design	64	Printing and Imaging	Arts and A/V
20	Adobe Certified Associate Web Design Specialist	52	Web Development	IT
30	Adobe Certified Expert After Effects	17	Digital Communications	Arts and A/V
30	Adobe Certified Expert After Effects	29	Graphic Design and Multimedia Arts	Arts and A/V
30	Adobe Certified Expert After Effects	64	Printing and Imaging	Arts and A/V
31	Adobe Certified Expert Illustrator	17	Digital Communications	Arts and A/V
31	Adobe Certified Expert Illustrator	29	Graphic Design and Multimedia Arts	Arts and A/V
31	Adobe Certified Expert Illustrator	64	Printing and Imaging	Arts and A/V
32	Adobe Certified Expert InDesign	17	Digital Communications	Arts and A/V
32	Adobe Certified Expert InDesign	29	Graphic Design and Multimedia Arts	Arts and A/V
32	Adobe Certified Expert InDesign	64	Printing and Imaging	Arts and A/V
33	Adobe Certified Expert Photoshop	17	Digital Communications	Arts and A/V
33	Adobe Certified Expert Photoshop	29	Graphic Design and Multimedia Arts	Arts and A/V
33	Adobe Certified Expert Photoshop	64	Printing and Imaging	Arts and A/V
34	Adobe Certified Expert Web Premiere Pro	52	Web Development	IT
40	Aerospace Manufacturing Certification	8	Aviation Maintenance	Transportation
100	API 1104 Welding Pipelines and Related Facilities	5	Applied Agricultural Engineering	Manufacturing
100	API 1104 Welding Pipelines and Related Facilities	60	Welding	Manufacturing
101	Apple App Development with Swift	47	Programming and Software Development	IT
102	Apple Final Cut Pro X	17	Digital Communications	Arts and A/V
102	Apple Final Cut Pro X	29	Graphic Design and Multimedia Arts	Arts and A/V
103	Apple iWork	11	Business Management	Business
104	Apple Logic Pro X	17	Digital Communications	Arts and A/V
120	ASE Auto Transmission	7	Automotive	Transportation
121	ASE Entry-Level Automobile Automatic Transmission/Transaxle (AT)	7	Automotive	Transportation
130	ASE Automobile Service Technology	7	Automotive	Transportation
131	ASE Entry-Level Automobile Service Technology	7	Automotive	Transportation
140	ASE Brakes	7	Automotive	Transportation
141	ASE Entry-Level Automobile Brakes (BR)	7	Automotive	Transportation
150	ASE Electrical/Electronic Systems	7	Automotive	Transportation
151	ASE Entry-Level Automobile Electronic/Electrical Systems (EE)	7	Automotive	Transportation
160	ASE Engine Performance	7	Automotive	Transportation
160	ASE Engine Performance	16	Diesel and Heavy Equipment	Transportation
161	ASE Entry-Level Automobile Engine Performance (EP)	7	Automotive	Transportation
161	ASE Entry-Level Automobile Engine Performance (EP)	16	Diesel and Heavy Equipment	Transportation
170	ASE Engine Repair	7	Automotive	Transportation

171	ASE Entry-Level Automobile Engine Repair (ER)	7	Automotive	Transportation
171	ASE Entry-Level Automobile Engine Repair (ER)	16	Diesel and Heavy Equipment	Transportation
181	ASE Heating, Ventilation, AC (HVAC)	7	Automotive	Transportation
182	ASE Entry-Level Automobile Heating and Air Conditioning (AC)	7	Automotive	Transportation
190	ASE Maintenance Light Repair	7	Automotive	Transportation
190	ASE Maintenance Light Repair	16	Diesel and Heavy Equipment	Transportation
191	ASE Entry Level Automobile Maintenance and Light Repair (MR)	7	Automotive	Transportation
191	ASE Entry Level Automobile Maintenance and Light Repair (MR)	16	Diesel and Heavy Equipment	Transportation
200	ASE Manual Drive Train Axles	7	Automotive	Transportation
201	ASE Entry-Level Automobile Manual Drive Train and Axles (MD)	7	Automotive	Transportation
210	ASE Mech Elec Components	7	Automotive	Transportation
211	ASE Entry-Level Collision Mechanical and Electrical Components (ME)	7	Automotive	Transportation
220	ASE Non-Structural Analysis Damage Repair	7	Automotive	Transportation
220	ASE Non-Structural Analysis Damage Repair	16	Diesel and Heavy Equipment	Transportation
221	ASE Entry-Level Collision Non-Structural Analysis and Damage Repair (SR)	7	Automotive	Transportation
221	ASE Entry-Level Collision Non-Structural Analysis and Damage Repair (SR)	16	Diesel and Heavy Equipment	Transportation
230	ASE Painting & Refinishing	7	Automotive	Transportation
230	ASE Painting & Refinishing	16	Diesel and Heavy Equipment	Transportation
231	ASE Entry-Level Collision Painting and Refinishing (PR)	7	Automotive	Transportation
231	ASE Entry-Level Collision Painting and Refinishing (PR)	16	Diesel and Heavy Equipment	Transportation
240	ASE Refrigerant Recovery and Recycling	7	Automotive	Transportation
240	ASE Refrigerant Recovery and Recycling	16	Diesel and Heavy Equipment	Transportation
250	ASE Structural Analysis Damage Repair	7	Automotive	Transportation
250	ASE Structural Analysis Damage Repair	16	Diesel and Heavy Equipment	Transportation
251	ASE Entry-Level Collision Structural Analysis and Damage Repair	7	Automotive	Transportation
251	ASE Entry-Level Collision Structural Analysis and Damage Repair	16	Diesel and Heavy Equipment	Transportation
260	ASE Suspension and Steering	7	Automotive	Transportation
261	ASE Entry-Level Automobile Suspension and Steering (SS)	7	Automotive	Transportation
270	ASE Truck Technician Brakes	16	Diesel and Heavy Equipment	Transportation
271	ASE Entry-Level Medium/Heavy Truck, Brakes (TB)	16	Diesel and Heavy Equipment	Transportation
280	ASE Truck Technician Diesel Engines	16	Diesel and Heavy Equipment	Transportation
281	ASE Entry-Level Medium/Heavy Truck, Diesel Engines (DE)	16	Diesel and Heavy Equipment	Transportation
290	ASE Truck Technician Drive Trains	16	Diesel and Heavy Equipment	Transportation
300	ASE Truck Technician Electronic Systems	16	Diesel and Heavy Equipment	Transportation
301	ASE Entry-Level Medium/Heavy Truck, Electrical/Electronic Systems (TE)	16	Diesel and Heavy Equipment	Transportation
310	ASE Truck Technician HVAC	16	Diesel and Heavy Equipment	Transportation
320	ASE Truck Technician Suspension Steering	16	Diesel and Heavy Equipment	Transportation
321	ASE Entry-Level Medium/Heavy Truck, Suspension and Steering (TS)	16	Diesel and Heavy Equipment	Transportation
330	Associate of (ISC)	15	Cybersecurity	IT
330	Associate of (ISC)	42	Networking Systems	IT
331	Autodesk Certified Professional or User AutoCAD	22	Engineering	Engineering
331	Autodesk Certified Professional or User AutoCAD	6	Architectural Design	Engineering
332	Autodesk Certified Professional or User AutoCAD Civil 3D	22	Engineering	Engineering
332	Autodesk Certified Professional or User AutoCAD Civil 3D	6	Architectural Design	Engineering
333	Autodesk Certified Professional or User Autodesk Revit Building Systems	22	Engineering	Engineering
333	Autodesk Certified Professional or User Autodesk Revit Building Systems	6	Architectural Design	Engineering
334	Autodesk Certified Professional or User Revit Architecture	22	Engineering	Engineering
334	Autodesk Certified Professional or User Revit Architecture	6	Architectural Design	Engineering
335	Autodesk Certified Professional or User Revit MEP Electrical	22	Engineering	Engineering
335	Autodesk Certified Professional or User Revit MEP Electrical	6	Architectural Design	Engineering
336	Autodesk Certified Professional or User Inventor	22	Engineering	Engineering
340	AWS D1.1 Structural Steel	5	Applied Agricultural Engineering	Manufacturing
340	AWS D1.1 Structural Steel	39	Manufacturing Technology	Manufacturing
340	AWS D1.1 Structural Steel	60	Welding	Manufacturing
350	AWS D9.1 Sheet Metal Welding	5	Applied Agricultural Engineering	Manufacturing
350	AWS D9.1 Sheet Metal Welding	60	Welding	Manufacturing
351	AWS Certified Welder	5	Applied Agricultural Engineering	Manufacturing
351	AWS Certified Welder	60	Welding	Manufacturing
360	AWS SENSE Level 1: Entry Welder	5	Applied Agricultural Engineering	Manufacturing
360	AWS SENSE Level 1: Entry Welder	39	Manufacturing Technology	Manufacturing
360	AWS SENSE Level 1: Entry Welder	60	Welding	Manufacturing
361	Barber Operator License	13	Cosmetology and Personal Care Services	Human services
362	Basic Structure Fire Protection	21	Emergency Services	Public safety
365	C++ Certified Associate Programmer	29	Graphic Design and Multimedia Arts	IT
365	C++ Certified Associate Programmer	47	Programming and Software Development	IT
366	Certified Aerospace Technician	61	Drone (Unmanned Flight)	Transportation
366	Certified Aerospace Technician	8	Aviation Maintenance	Transportation
366	Certified Aerospace Technician	56	Aviation (Flight)	Transportation
367	Certified Associate in Project Management (CAPM)	54	Construction Management and Inspection	Business
367	Certified Associate in Project Management (CAPM)	11	Business Management	Business
368	Certified Cardiographic Technician	32	Healthcare Diagnostics	Health science

369	Certified Coding Associate	31	Health Informatics	Health science
370	Certified Dental Assistant	33	Healthcare Therapeutic	Health science
380	Certified EKG Technician	32	Healthcare Diagnostics	Health science
380	Certified EKG Technician	33	Healthcare Therapeutic	Health science
381	Certified Electronics Systems Associate	20	Electrical	Architecture and construction
381	Certified Electronics Systems Associate	49	Renewable Energy	Architecture and construction
382	Certified Engineering Technician - Audio Systems	None	None	Manufacturing
383	Certified Fundamentals Cook	14	Culinary Arts	Hospitality
384	Certified Fundamentals Pastry Cook	14	Culinary Arts	Hospitality
385	Certified Hospitality & Tourism Management Professional	14	Culinary Arts	Hospitality
385	Certified Hospitality & Tourism Management Professional	38	Lodging and Resort Management	Hospitality
385	Certified Hospitality & Tourism Management Professional	51	Travel, Tourism, and Attractions	Hospitality
386	Certified Insurance Service Representative	1	Accounting and Financial Services	Business
386	Certified Insurance Service Representative	40	Marketing and Sales	Business
390	Certified Nurse Aide (CNA)	33	Healthcare Therapeutic	Health science
390	Certified Nurse Aide (CNA)	43	Nursing Science	Health science
391	Certified Occupational Therapy Assistant	33	Healthcare Therapeutic	Health science
391	Certified Occupational Therapy Assistant	59	Medical Therapy	Health science
392	Certified Ophthalmic Technician	33	Healthcare Therapeutic	Health science
400	Certified Patient Care Technician (CPCT)	33	Healthcare Therapeutic	Health science
400	Certified Patient Care Technician (CPCT)	43	Nursing Science	Health science
401	Certified Personal Trainer	25	Exercise Science and Wellness	Health science
402	Certified Respiratory Therapist	59	Medical Therapy	Health science
410	Certified SOLIDWORKS Associate	22	Engineering	Engineering
410	Certified SOLIDWORKS Associate	6	Architectural Design	Engineering
411	Certified Surgical Technologist	33	Healthcare Therapeutic	Health science
420	Certified Veterinary Assistant, Level 1	4	Animal Science	Agriculture, Food, Natural Resources
430	Child Development Associate (CDA)	19	Early Learning	Education
430	Child Development Associate (CDA)	26	Family and Community Services	Education
439	Cisco Certified Design Associate	42	Networking Systems	IT
440	Cisco Certified Network Associate- Cloud (CCNA Cloud)	42	Networking Systems	IT
450	Cisco Certified Network Associate Security (CCNA Security)	15	Cybersecurity	IT
450	Cisco Certified Network Associate Security (CCNA Security)	42	Networking Systems	IT
451	Cisco Certified Network Associate- Cyber Ops (CCNA Cyber Ops)	15	Cybersecurity	IT
452	Cisco Certified Network Associate - Data Center (CCNA Data Center)	15	Cybersecurity	IT
452	Cisco Certified Network Associate - Data Center (CCNA Data Center)	42	Networking Systems	IT
453	Cisco Certified Network Associate- Service Provider (CCNA SP)	42	Networking Systems	IT
460	Cisco Certified Entry Networking Technician (CCENT)	15	Cybersecurity	IT
460	Cisco Certified Entry Networking Technician (CCENT)	42	Networking Systems	IT
470	Certified Clinical Medical Assistant	32	Healthcare Diagnostics	Health science
470	Certified Clinical Medical Assistant	33	Healthcare Therapeutic	Health science
470	Certified Clinical Medical Assistant	43	Nursing Science	Health science
470	Certified Clinical Medical Assistant	59	Medical Therapy	Health science
478	Commercial/Non-Commercial Pesticide Applicator	45	Plant Science	Agriculture, Food, Natural Resources
479	Community Health Workers	26	Family and Community Services	Human services
479	Community Health Workers	30	Health and Wellness	Human services
480	CompTIA A+ Certification	15	Cybersecurity	IT
480	CompTIA A+ Certification	35	Information Technology Support and Services	IT
480	CompTIA A+ Certification	42	Networking Systems	IT
481	CompTIA IT Fundamentals+	15	Cybersecurity	IT
481	CompTIA IT Fundamentals+	35	Information Technology Support and Services	IT
481	CompTIA IT Fundamentals+	42	Networking Systems	IT
481	CompTIA IT Fundamentals+	47	Programming and Software Development	IT
490	CompTIA Network+	15	Cybersecurity	IT
490	CompTIA Network+	42	Networking Systems	IT
500	CompTIA Security+	15	Cybersecurity	IT
508	Cosmetology Esthetician License	13	Cosmetology and Personal Care Services	Human services
509	Cosmetology Manicurist License	13	Cosmetology and Personal Care Services	Human services
510	Cosmetology Operator License	13	Cosmetology and Personal Care Services	Human services
511	Educational Aide I	19	Early Learning	Education
511	Educational Aide I	50	Teaching and Training	Education
512	Entrepreneurship and Small Business	3	Agribusiness	Business
512	Entrepreneurship and Small Business	11	Business Management	Business
512	Entrepreneurship and Small Business	23	Entrepreneurship	Business
512	Entrepreneurship and Small Business	40	Marketing and Sales	Business
512	Entrepreneurship and Small Business	65	Retail Management	Business
512	Entrepreneurship and Small Business	51	Travel, Tourism, and Attractions	Business
520	Electrical Apprenticeship Certificate Level 1	20	Electrical	Architecture and construction
530	Emergency Medical Technician - Basic	32	Healthcare Diagnostics	Public safety
530	Emergency Medical Technician - Basic	33	Healthcare Therapeutic	Public safety
530	Emergency Medical Technician - Basic	59	Medical Therapy	Public safety
530	Emergency Medical Technician - Basic	21	Emergency Services	Public safety

531	ArcGIS Desktop Associate 19-001	62	Geospatial Engineering and Land Surveying	IT
531	ArcGIS Desktop Associate 19-001	35	Information Technology Support and Services	IT
532	FAA Aviation Maintenance Technician General	8	Aviation Maintenance	Transportation
533	FAA Aviation Maintenance Technician Airframe	8	Aviation Maintenance	Transportation
534	FAA Part 107 Remote Drone Pilot	61	Drone (Unmanned Flight)	Transportation
534	FAA Part 107 Remote Drone Pilot	56	Aviation (Flight)	Transportation
535	FANUC Robot Operator 1	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
536	Feedyard Technician in Cattle Care and Handling	4	Animal Science	Agriculture, Food, Natural Resources
537	Feedyard Technician in Machinery Operation, Repair and Maintenance	5	Applied Agricultural Engineering	Agriculture, Food, Natural Resources
538	Google Analytics Individual Qualification	40	Marketing and Sales	Business
538	Google Analytics Individual Qualification	65	Retail Management	Business
538	Google Analytics Individual Qualification	52	Web Development	Business
539	Google Cloud Certified Professional - Cloud Architect	42	Networking Systems	IT
540	ISCET Certified Electronics Technicians	20	Electrical	Manufacturing
540	ISCET Certified Electronics Technicians	48	Refining and Chemical Processes	Manufacturing
540	ISCET Certified Electronics Technicians	49	Renewable Energy	Manufacturing
540	ISCET Certified Electronics Technicians	61	Drone (Unmanned Flight)	Manufacturing
540	ISCET Certified Electronics Technicians	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
540	ISCET Certified Electronics Technicians	63	Industrial Maintenance	Manufacturing
540	ISCET Certified Electronics Technicians	8	Aviation Maintenance	Manufacturing
541	Landscape Irrigator	45	Plant Science	Agriculture, Food, Natural Resources
542	Licensed Dental Hygienist	33	Healthcare Therapeutic	Health science
543	Licensed Dietetic Technician	30	Health and Wellness	Human services
544	Licensed Veterinary Technician	4	Animal Science	Agriculture, Food, Natural Resources
545	Licensed Vocational Nurse	43	Nursing Science	Health science
546	Limited Medical Radiologic Technologist	32	Healthcare Diagnostics	Health science
547	Medical Coding and Billing Specialist	31	Health Informatics	Health science
548	ManageFirst Professional	14	Culinary Arts	Hospitality
548	ManageFirst Professional	38	Lodging and Resort Management	Hospitality
549	Mastercam Associate Certification	6	Architectural Design	Architecture and construction
550	Medical Laboratory Assistant	9	Bio-Medical Science	Health science
550	Medical Laboratory Assistant	32	Healthcare Diagnostics	Health science
550	Medical Laboratory Assistant	33	Healthcare Therapeutic	Health science
551	Microsoft Office Specialist Excel	3	Agribusiness	Business
551	Microsoft Office Specialist Excel	1	Accounting and Financial Services	Business
551	Microsoft Office Specialist Excel	11	Business Management	Business
552	Microsoft Office Specialist Word	11	Business Management	Business
560	Microsoft Office Specialist: Microsoft Excel Expert (Excel 2019)	3	Agribusiness	Business
560	Microsoft Office Specialist: Microsoft Excel Expert (Excel 2019)	1	Accounting and Financial Services	Business
560	Microsoft Office Specialist: Microsoft Excel Expert (Excel 2019)	11	Business Management	Business
570	Microsoft Office Specialist: Microsoft Word Expert (Word 2019)	11	Business Management	Business
580	Microsoft Office Specialist 2016 Master	11	Business Management	Business
581	Microsoft Office Specialist (MOS) Master-2013 (Track 1)	11	Business Management	Business
582	Microsoft Office Specialist (MOS) Master-2013 (Track 2)	11	Business Management	Business
583	Microsoft Office Specialist (MOS) Master-2013 (Track 3)	11	Business Management	Business
590	Microsoft Technology Associate (MTA) Cloud Fundamentals	47	Programming and Software Development	IT
591	Microsoft Technology Associate (MTA) Database Administration Fundamentals	47	Programming and Software Development	IT
592	Microsoft Technology Associate (MTA) HTML5 App Development Fundamentals	52	Web Development	IT
593	Microsoft Technology Associate (MTA) Intro Programming Using HTML and CSS	52	Web Development	IT
594	Microsoft Technology Associate (MTA) Intro Programming Using Java	52	Web Development	IT
595	Microsoft Technology Associate (MTA) Intro Programming Using JavaScript	52	Web Development	IT
596	Microsoft Technology Associate (MTA) Intro Programming Using Python	47	Programming and Software Development	IT
597	Microsoft Technology Associate (MTA) Mobility and Device Fundamentals	15	Cybersecurity	IT
597	Microsoft Technology Associate (MTA) Mobility and Device Fundamentals	42	Networking Systems	IT
598	Microsoft Technology Associate (MTA) Networking Fundamentals	42	Networking Systems	IT
599	Microsoft Technology Associate (MTA) Security Fundamentals	15	Cybersecurity	IT
599	Microsoft Technology Associate (MTA) Security Fundamentals	42	Networking Systems	IT
600	Industrial Technology Maintenance (ITM) - Basic Mechanical Systems	63	Industrial Maintenance	Manufacturing
600	Industrial Technology Maintenance (ITM) - Basic Mechanical Systems	8	Aviation Maintenance	Manufacturing
601	Industrial Technology Maintenance (ITM) - Basic Pneumatic Systems	63	Industrial Maintenance	Manufacturing
601	Industrial Technology Maintenance (ITM) - Basic Pneumatic Systems	8	Aviation Maintenance	Manufacturing
602	Industrial Technology Maintenance (ITM) - Electrical Systems	49	Renewable Energy	Manufacturing
602	Industrial Technology Maintenance (ITM) - Electrical Systems	63	Industrial Maintenance	Manufacturing
602	Industrial Technology Maintenance (ITM) - Electrical Systems	8	Aviation Maintenance	Manufacturing
603	Industrial Technology Maintenance (ITM) - Electronic Control Systems	49	Renewable Energy	Manufacturing
603	Industrial Technology Maintenance (ITM) - Electronic Control Systems	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
604	Industrial Technology Maintenance (ITM) - Maintenance Operations	63	Industrial Maintenance	Manufacturing
604	Industrial Technology Maintenance (ITM) - Maintenance Operations	8	Aviation Maintenance	Manufacturing
605	Industrial Technology Maintenance (ITM) - Maintenance Piping	46	Plumbing and Pipefitting	Manufacturing
606	Industrial Technology Maintenance (ITM) - Maintenance Welding	5	Applied Agricultural Engineering	Manufacturing
606	Industrial Technology Maintenance (ITM) - Maintenance Welding	60	Welding	Manufacturing
607	Industrial Technology Maintenance (ITM) - Process Control Systems	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
610	NCCER Carpentry Level I	12	Carpentry	Architecture and construction
611	NCCER Carpentry Level II	12	Carpentry	Architecture and construction
612	NCCER Commercial Carpenter	12	Carpentry	Architecture and construction
613	NCCER Construction Site Safety Technician	54	Construction Management and Inspection	Architecture and construction

620	NCCER Construction Technology Certification Level I	12	Carpentry	Architecture and construction
620	NCCER Construction Technology Certification Level I	20	Electrical	Architecture and construction
620	NCCER Construction Technology Certification Level I	34	HVAC and Sheet Metal	Architecture and construction
620	NCCER Construction Technology Certification Level I	41	Masonry	Architecture and construction
620	NCCER Construction Technology Certification Level I	54	Construction Management and Inspection	Architecture and construction
620	NCCER Construction Technology Certification Level I	60	Welding	Architecture and construction
630	NCCER Core	5	Applied Agricultural Engineering	Architecture and construction
630	NCCER Core	12	Carpentry	Architecture and construction
630	NCCER Core	20	Electrical	Architecture and construction
630	NCCER Core	34	HVAC and Sheet Metal	Architecture and construction
630	NCCER Core	41	Masonry	Architecture and construction
630	NCCER Core	46	Plumbing and Pipefitting	Architecture and construction
630	NCCER Core	54	Construction Management and Inspection	Architecture and construction
630	NCCER Core	44	Oil and Gas Exploration and Production	Architecture and construction
630	NCCER Core	48	Refining and Chemical Processes	Architecture and construction
630	NCCER Core	49	Renewable Energy	Architecture and construction
630	NCCER Core	39	Manufacturing Technology	Architecture and construction
630	NCCER Core	60	Welding	Architecture and construction
630	NCCER Core	63	Industrial Maintenance	Architecture and construction
640	NCCER Electrical Level I	20	Electrical	Architecture and construction
641	NCCER Electrical Level II	20	Electrical	Architecture and construction
642	NCCER Commercial Electrician	20	Electrical	Architecture and construction
650	NCCER Electronic System Technician Level I	20	Electrical	Architecture and construction
650	NCCER Electronic System Technician Level I	48	Refining and Chemical Processes	Architecture and construction
650	NCCER Electronic System Technician Level I	49	Renewable Energy	Architecture and construction
651	NCCER Electronic System Technician Level II	20	Electrical	Architecture and construction
651	NCCER Electronic System Technician Level II	49	Renewable Energy	Architecture and construction
660	NCCER Heating, Ventilation, Air Conditioning Level I	34	HVAC and Sheet Metal	Architecture and construction
670	NCCER Industrial Maintenance Mechanic Level I	63	Industrial Maintenance	Manufacturing
680	NCCER Instrumentation Level I	44	Oil and Gas Exploration and Production	Manufacturing
680	NCCER Instrumentation Level I	48	Refining and Chemical Processes	Manufacturing
690	NCCER Masonry Level I	41	Masonry	Architecture and construction
691	NCCER Masonry Level II	41	Masonry	Architecture and construction
700	NCCER Millwright Level I	63	Industrial Maintenance	Manufacturing
701	NCCER Millwright Level II	63	Industrial Maintenance	Manufacturing
710	NCCER Painting: Commercial and Residential Level I	12	Carpentry	Architecture and construction
720	NCCER Pipefitting Level I	46	Plumbing and Pipefitting	Architecture and construction
730	NCCER Plumbing Level I	46	Plumbing and Pipefitting	Architecture and construction
731	NCCER Plumbing Level II	46	Plumbing and Pipefitting	Architecture and construction
740	NCCER Sheet Metal Level I	34	HVAC and Sheet Metal	Architecture and construction
750	NCCER Weatherization Technician Level I	54	Construction Management and Inspection	Architecture and construction
760	NCCER Welding Level I	5	Applied Agricultural Engineering	Manufacturing
760	NCCER Welding Level I	39	Manufacturing Technology	Manufacturing
760	NCCER Welding Level I	60	Welding	Manufacturing
761	Non-Commissioned Security Officer Level II License	36	Law Enforcement	Public safety (law and public service)
770	Oracle Certified Associate Java SE 8 Programmer	29	Graphic Design and Multimedia Arts	IT
770	Oracle Certified Associate Java SE 8 Programmer	15	Cybersecurity	IT
770	Oracle Certified Associate Java SE 8 Programmer	47	Programming and Software Development	IT
770	Oracle Certified Associate Java SE 8 Programmer	52	Web Development	IT
780	Oracle Database SQL Certified Associate	47	Programming and Software Development	IT
781	Orthopedic Exercise Specialty Certification	59	Medical Therapy	Health science
782	Orthopedic Technologist	33	Healthcare Therapeutic	Health science
782	Orthopedic Technologist	59	Medical Therapy	Health science
783	OSHA 30 Hour Construction	12	Carpentry	Architecture and construction
783	OSHA 30 Hour Construction	20	Electrical	Architecture and construction
783	OSHA 30 Hour Construction	34	HVAC and Sheet Metal	Architecture and construction
783	OSHA 30 Hour Construction	41	Masonry	Architecture and construction
783	OSHA 30 Hour Construction	46	Plumbing and Pipefitting	Architecture and construction
783	OSHA 30 Hour Construction	54	Construction Management and Inspection	Architecture and construction
784	OSHA 30 Hour General	5	Applied Agricultural Engineering	Architecture and construction
784	OSHA 30 Hour General	12	Carpentry	Architecture and construction
784	OSHA 30 Hour General	20	Electrical	Architecture and construction
784	OSHA 30 Hour General	34	HVAC and Sheet Metal	Architecture and construction
784	OSHA 30 Hour General	41	Masonry	Architecture and construction
784	OSHA 30 Hour General	46	Plumbing and Pipefitting	Architecture and construction
784	OSHA 30 Hour General	54	Construction Management and Inspection	Architecture and construction
784	OSHA 30 Hour General	64	Printing and Imaging	Architecture and construction
784	OSHA 30 Hour General	44	Oil and Gas Exploration and Production	Architecture and construction
784	OSHA 30 Hour General	48	Refining and Chemical Processes	Architecture and construction
784	OSHA 30 Hour General	49	Renewable Energy	Architecture and construction

784	OSHA 30 Hour General	2	Advanced Manufacturing and Machinery Mechanics	Architecture and construction
784	OSHA 30 Hour General	39	Manufacturing Technology	Architecture and construction
784	OSHA 30 Hour General	60	Welding	Architecture and construction
784	OSHA 30 Hour General	63	Industrial Maintenance	Architecture and construction
784	OSHA 30 Hour General	7	Automotive	Architecture and construction
784	OSHA 30 Hour General	8	Aviation Maintenance	Architecture and construction
784	OSHA 30 Hour General	16	Diesel and Heavy Equipment	Architecture and construction
784	OSHA 30 Hour General	18	Distribution and Logistics	Architecture and construction
784	OSHA 30 Hour General	56	Aviation (Flight)	Architecture and construction
784	OSHA 30 Hour General	58	Maritime	Architecture and construction
785	OSHA Hazardous Waste Operations and Emergency Response	21	Emergency Services	Public safety
786	Patient Care Technician	33	Healthcare Therapeutic	Health science
786	Patient Care Technician	43	Nursing Science	Health science
790	Pharmacy Technician	33	Healthcare Therapeutic	Health science
800	Phlebotomy Technician	32	Healthcare Diagnostics	Health science
800	Phlebotomy Technician	33	Healthcare Therapeutic	Health science
800	Phlebotomy Technician	43	Nursing Science	Health science
810	Intuit QuickBooks Certified User	1	Accounting and Financial Services	Business
811	ServSafe Manager	14	Culinary Arts	Hospitality
812	Texas State Florist's Association Knowledge Based Floral Certification	45	Plant Science	Agriculture, Food, Natural Resources
813	Texas State Florist's Association Level I Floral Certification	45	Plant Science	Agriculture, Food, Natural Resources
814	Texas State Florist's Association Level II Floral Certification	45	Plant Science	Agriculture, Food, Natural Resources
815	Tradesman Plumber - Limited	46	Plumbing and Pipefitting	Architecture and construction
816	Certified Professional Programmer	29	Graphic Design and Multimedia Arts	IT
816	Certified Professional Programmer	47	Programming and Software Development	IT
820	Wastewater Collections	24	Environmental and Natural Resources	Agriculture, Food, Natural Resources
830	Water Operators, Class D	24	Environmental and Natural Resources	Agriculture, Food, Natural Resources
831	WD Certified Web Design	52	Web Development	IT
832	Google Cloud Certified Professional- G Suite	11	Business Management	Business
833	IAED Emergency Telecommunicator	21	Emergency Services	Public safety
833	IAED Emergency Telecommunicator	36	Law Enforcement	Public safety
834	ISA Certified Control Systems Technician	44	Oil and Gas Exploration and Production	Manufacturing
834	ISA Certified Control Systems Technician	48	Refining and Chemical Processes	Manufacturing
835	Mastercam Associate Certification Mill Design and Toolpaths	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
835	Mastercam Associate Certification Mill Design and Toolpaths	39	Manufacturing Technology	Manufacturing
836	Mastercam Certified Professional Mill Level 1	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
836	Mastercam Certified Professional Mill Level 1	39	Manufacturing Technology	Manufacturing
837	Mastercam Professional Level Certification	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
837	Mastercam Professional Level Certification	39	Manufacturing Technology	Manufacturing
838	Microsoft Technology Associate (MTA) Software Development Fundamentals	47	Programming and Software Development	IT
839	Microsoft Technology Associate (MTA) Windows Operating System Fundamentals	35	Information Technology Support and Services	IT
840	Microsoft Technology Associate (MTA) Windows Server Administration Fundamentals	35	Information Technology Support and Services	IT
841	Certified Logistics Technician (CLT)	18	Distribution and Logistics	Transportation
841	Certified Logistics Technician (CLT)	58	Maritime	Transportation
842	Certified Production Technician (CPT) 4.0	39	Manufacturing Technology	Manufacturing
843	Machining CNC Mill Operations Level I	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
843	Machining CNC Mill Operations Level I	39	Manufacturing Technology	Manufacturing
844	Machining CNC Mill Programming Setup and Operations Level I	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
844	Machining CNC Mill Programming Setup and Operations Level I	39	Manufacturing Technology	Manufacturing
845	CNC Lathe Operations	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
845	CNC Lathe Operations	39	Manufacturing Technology	Manufacturing
846	CNC Lathe Set Up and Operations	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
846	CNC Lathe Set Up and Operations	39	Manufacturing Technology	Manufacturing
847	Machining Drill Press Level I	39	Manufacturing Technology	Manufacturing
848	Machining Grinding Level I	39	Manufacturing Technology	Manufacturing
849	Machining Milling Level I	39	Manufacturing Technology	Manufacturing
850	Machining Measurement, Material, and Safety Level I	5	Applied Agricultural Engineering	Manufacturing
850	Machining Measurement, Material, and Safety Level I	39	Manufacturing Technology	Manufacturing
860	Real Estate Sales Agent License	40	Marketing and Sales	Business
870	Refrigerant Handling (EPA 608)	34	HVAC and Sheet Metal	Architecture and construction
880	Registered Dental Assistant X-Ray Certification	33	Healthcare Therapeutic	Health science
890	Registered Diagnostic Medical Sonographer - Abdomen	32	Healthcare Diagnostics	Health science
891	Registered Diagnostic Medical Sonographer - Obstetrics and Gynecology	32	Healthcare Diagnostics	Health science
900	Registered Nurse	43	Nursing Science	Health science
910	Registered Technologist - Cardiac-Interventional Radiography	32	Healthcare Diagnostics	Health science
911	Registered Technologist - Computed Tomography	32	Healthcare Diagnostics	Health science
912	Registered Technologist - Magnetic Resonance Imaging	32	Healthcare Diagnostics	Health science
913	Registered Technologist - Mammography	32	Healthcare Diagnostics	Health science
914	Registered Technologist - Nuclear Medicine Technology	32	Healthcare Diagnostics	Health science
915	Registered Technologist - Radiography	32	Healthcare Diagnostics	Health science
916	Registered Technologist - Sonography	32	Healthcare Diagnostics	Health science
917	Registered Technologist - Vascular Sonography	32	Healthcare Diagnostics	Health science
918	Registered Technologist - Vascular-Interventional Radiography	32	Healthcare Diagnostics	Health science
930	Registered Vascular Technology	32	Healthcare Diagnostics	Health science

931	Medical Laboratory Technician	9	Bio-Medical Science	Health science
931	Medical Laboratory Technician	32	Healthcare Diagnostics	Health science
932	Accounting - Basic	1	Accounting and Financial Services	Business
933	Accounting Foundations	1	Accounting and Financial Services	Business
934	Administrative Assisting	11	Business Management	Business
934	Administrative Assisting	28	Government and Public Administration	Business
934	Administrative Assisting	37	Legal Studies	Business
935	Agricultural Biotechnology	4	Animal Science	Agriculture, Food, Natural Resources
935	Agricultural Biotechnology	45	Plant Science	Agriculture, Food, Natural Resources
936	Agriculture Mechanics	5	Applied Agricultural Engineering	Agriculture, Food, Natural Resources
937	Audio-Visual Communications - Job Ready	17	Digital Communications	Arts and A/V
937	Audio-Visual Communications - Job Ready	29	Graphic Design and Multimedia Arts	Arts and A/V
938	Autodesk Associate (Certified User) 3ds MAX	6	Architectural Design	Arts and A/V
938	Autodesk Associate (Certified User) 3ds MAX	29	Graphic Design and Multimedia Arts	Arts and A/V
939	Autodesk Associate (Certified User) AutoCAD	22	Engineering	Engineering
939	Autodesk Associate (Certified User) AutoCAD	6	Architectural Design	Engineering
940	Autodesk Associate (Certified User) Fusion 360	22	Engineering	Engineering
940	Autodesk Associate (Certified User) Fusion 360	6	Architectural Design	Engineering
941	Autodesk Associate (Certified User) Inventor for Mechanical Design	22	Engineering	Engineering
942	Autodesk Associate (Certified User) Revit Architecture	22	Engineering	Engineering
942	Autodesk Associate (Certified User) Revit Architecture	6	Architectural Design	Engineering
943	Autodesk Associate (Certified User) Revit for Electrical	22	Engineering	Engineering
943	Autodesk Associate (Certified User) Revit for Electrical	6	Architectural Design	Engineering
944	Autodesk Associate (Certified User) Revit for Structural Design	22	Engineering	Engineering
944	Autodesk Associate (Certified User) Revit for Structural Design	6	Architectural Design	Engineering
945	Autodesk Certified Professional Fusion 360	22	Engineering	Engineering
945	Autodesk Certified Professional Fusion 360	6	Architectural Design	Engineering
946	Autodesk Certified Professional in AutoCAD for Design and Drafting	22	Engineering	Engineering
946	Autodesk Certified Professional in AutoCAD for Design and Drafting	6	Architectural Design	Engineering
947	Autodesk Certified Professional in Inventor for Mechanical Design	22	Engineering	Engineering
948	Autodesk Certified Professional in Revit for Architectural Design	22	Engineering	Engineering
948	Autodesk Certified Professional in Revit for Architectural Design	6	Architectural Design	Engineering
949	Autodesk Certified Professional in Revit for Electrical Design	22	Engineering	Engineering
949	Autodesk Certified Professional in Revit for Electrical Design	6	Architectural Design	Engineering
950	Autodesk Certified Professional in Revit for Structural Design	22	Engineering	Engineering
950	Autodesk Certified Professional in Revit for Structural Design	6	Architectural Design	Engineering
951	BASF Plant Science Certification	45	Plant Science	Agriculture, Food, Natural Resources
952	Biotechnician Assistant Credentialing Exam (BACE)	9	Bio-Medical Science	Health science
953	Broadcasting and Journalism	17	Digital Communications	Arts and A/V
954	Business Information Processing	35	Information Technology Support and Services	IT
955	C-101 Certified Industry 4.0 Associate - Basic Operations	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
955	C-101 Certified Industry 4.0 Associate - Basic Operations	39	Manufacturing Technology	Manufacturing
956	C-103 Certified Industry 4.0 Associate - Robot System Operations	22	Engineering	Manufacturing
956	C-103 Certified Industry 4.0 Associate - Robot System Operations	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
956	C-103 Certified Industry 4.0 Associate - Robot System Operations	39	Manufacturing Technology	Manufacturing
957	C-200 Certified Industry 4.0 Automation Systems Specialist I - 201 Electrical Systems 1	20	Electrical	Manufacturing
957	C-200 Certified Industry 4.0 Automation Systems Specialist I - 201 Electrical Systems 1	49	Renewable Energy	Manufacturing
957	C-200 Certified Industry 4.0 Automation Systems Specialist I - 201 Electrical Systems 1	63	Industrial Maintenance	Manufacturing
958	C-200 Certified Industry 4.0 Automation Systems Specialist I - 202 Electric Motor Control Systems 1	63	Industrial Maintenance	Manufacturing
959	C-200 Certified Industry 4.0 Automation Systems Specialist I - 204 Motor Control Troubleshooting 1	63	Industrial Maintenance	Manufacturing
960	C-200 Certified Industry 4.0 Automation Systems Specialist I - 208 Programmable Controller Troubleshooting 1	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
961	C-200 Certified Industry 4.0 Automation Systems Specialist I - 215 Robotic Operations 1	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
962	C-200 Certified Industry 4.0 Automation System Specialist I - 216 Robotic System Integration 1	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
963	Certified Entry-Level Python Programmer (PCEP)	29	Graphic Design and Multimedia Arts	IT
963	Certified Entry-Level Python Programmer (PCEP)	47	Programming and Software Development	IT
964	Certified Manufacturing Associate	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
964	Certified Manufacturing Associate	39	Manufacturing Technology	Manufacturing
965	Certified Technician-Supply Chain Automation (CT-SCA)	63	Industrial Maintenance	Manufacturing
966	Certified Web and Mobile App Developer Apprentice	52	Web Development	IT
967	Certified Web Animator Associate	52	Web Development	IT
968	Cisco 100-490 RSTECH Supporting Cisco Routing and Switching Network Devices	15	Cybersecurity	IT
968	Cisco 100-490 RSTECH Supporting Cisco Routing and Switching Network Devices	42	Networking Systems	IT
969	Cisco 200-201 CBROPS - Understanding Cisco Cybersecurity Operations Fundamentals	15	Cybersecurity	IT
970	Cisco CCNA (200-301) Implementing and Administering Cisco Solutions	15	Cybersecurity	IT
970	Cisco CCNA (200-301) Implementing and Administering Cisco Solutions	42	Networking Systems	IT
971	Cloud Essentials+	35	Information Technology Support and Services	IT
972	Commercial Foods	14	Culinary Arts	Hospitality
973	Commercial/Noncommercial Pesticide Applicator "Vegetation Management" License	45	Plant Science	Agriculture, Food, Natural Resources
974	CompTIA Linux+	47	Programming and Software Development	IT
975	CompTIA Server+	42	Networking Systems	IT
976	Computer Networking Fundamentals - Job Ready	15	Cybersecurity	IT
976	Computer Networking Fundamentals - Job Ready	42	Networking Systems	IT
977	Computer Repair Technology - Job Ready	35	Information Technology Support and Services	IT
978	Culinary Meat Selection & Cookery Certification	27	Food Science and Technology	Hospitality
978	Culinary Meat Selection & Cookery Certification	14	Culinary Arts	Hospitality

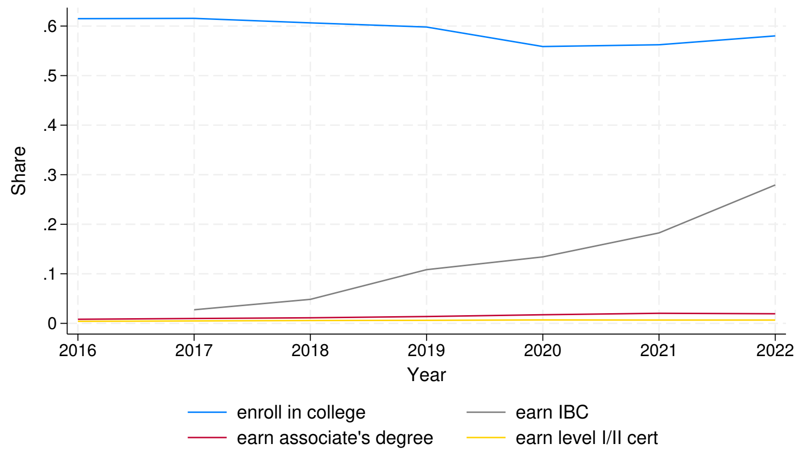
979	Cybersecurity Fundamentals	15	Cybersecurity	IT
980	CyberSecurity Fundamentals: An ISACA Certificate	15	Cybersecurity	IT
981	Diesel Technology - Job Ready	16	Diesel and Heavy Equipment	Transportation
982	Digital Video Production Foundations	17	Digital Communications	Arts and A/V
983	Early Childhood Education and Care - Advanced	19	Early Learning	Education
984	Early Childhood Education and Care - Basic	19	Early Learning	Education
985	ECG Technician	32	Healthcare Diagnostics	Health science
985	ECG Technician	33	Healthcare Therapeutic	Health science
986	Elanco Fundamentals of Animal Science Certification	4	Animal Science	Agriculture, Food, Natural Resources
987	Elanco Veterinary Medical Applications Certification	4	Animal Science	Agriculture, Food, Natural Resources
988	Emergency Medical Responder	21	Emergency Services	Public safety
989	Engineering Technology Foundations	22	Engineering	Engineering
990	Equine Management & Evaluation Certification	4	Animal Science	Agriculture, Food, Natural Resources
991	Facebook Digital Marketing Associate Certification	23	Entrepreneurship	Business
991	Facebook Digital Marketing Associate Certification	40	Marketing and Sales	Business
992	FESTO Certified Industry 4.0 Associate Fundamentals	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
993	Food Protection Manager Certification	14	Culinary Arts	Hospitality
994	Food Safety & Science Certification	27	Food Science and Technology	Hospitality
994	Food Safety & Science Certification	14	Culinary Arts	Hospitality
995	General Management	11	Business Management	Business
995	General Management	38	Lodging and Resort Management	Business
995	General Management	28	Government and Public Administration	Business
995	General Management	37	Legal Studies	Business
996	Google IT Support Professional Certificate	35	Information Technology Support and Services	IT
997	Graphic Production Technology - Job Ready	29	Graphic Design and Multimedia Arts	Arts and A/V
997	Graphic Production Technology - Job Ready	64	Printing and Imaging	Arts and A/V
998	HBI Pre-Apprenticeship Certificate Training (PACT), Brick Masonry	41	Masonry	Architecture and construction
999	HBI Pre-Apprenticeship Certificate Training (PACT), Building Construction Technology	54	Construction Management and Inspection	Architecture and construction
1000	HBI Pre-Apprenticeship Certificate Training (PACT), Basic Carpentry	12	Carpentry	Architecture and construction
1001	HBI Pre-Apprenticeship Certificate Training (PACT), Core	12	Carpentry	Architecture and construction
1001	HBI Pre-Apprenticeship Certificate Training (PACT), Core	20	Electrical	Architecture and construction
1001	HBI Pre-Apprenticeship Certificate Training (PACT), Core	34	HVAC and Sheet Metal	Architecture and construction
1001	HBI Pre-Apprenticeship Certificate Training (PACT), Core	41	Masonry	Architecture and construction
1001	HBI Pre-Apprenticeship Certificate Training (PACT), Core	46	Plumbing and Pipefitting	Architecture and construction
1001	HBI Pre-Apprenticeship Certificate Training (PACT), Core	54	Construction Management and Inspection	Architecture and construction
1002	HBI Pre-Apprenticeship Certificate Training (PACT), Basic Electrical	20	Electrical	Architecture and construction
1003	HBI Pre-Apprenticeship Certificate Training (PACT), Green Core	12	Carpentry	Architecture and construction
1004	HBI Pre-Apprenticeship Certificate Training (PACT), Heating, Ventilation and Air Conditioning	34	HVAC and Sheet Metal	Architecture and construction
1005	Heavy Equipment Maintenance and Repair - Job Ready	16	Diesel and Heavy Equipment	Transportation
1006	Horticulture - Landscaping - Job Ready	45	Plant Science	Agriculture, Food, Natural Resources
1007	Hospitality Management - Lodging - Job Ready	38	Lodging and Resort Management	Hospitality
1008	Insurance and Coding Specialist	31	Health Informatics	Health science
1009	Residential Plans Examiner - R3	54	Construction Management and Inspection	Architecture and construction
1010	Lean Six Sigma Green Belt Certification	22	Engineering	Engineering
1011	LEED Green Associate	6	Architectural Design	Architecture and construction
1011	LEED Green Associate	54	Construction Management and Inspection	Architecture and construction
1013	Machining CNC Milling Skills Level II	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
1013	Machining CNC Milling Skills Level II	39	Manufacturing Technology	Manufacturing
1015	Machining CNC Turning Level II	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
1015	Machining CNC Turning Level II	39	Manufacturing Technology	Manufacturing
1017	Manufacturing Technology	39	Manufacturing Technology	Manufacturing
1018	MB-920: Microsoft Dynamics 365 Fundamentals Finance and Operations Apps	1	Accounting and Financial Services	Business
1018	MB-920: Microsoft Dynamics 365 Fundamentals Finance and Operations Apps	11	Business Management	Business
1019	Medical Assistant	32	Healthcare Diagnostics	Health science
1019	Medical Assistant	33	Healthcare Therapeutic	Health science
1019	Medical Assistant	43	Nursing Science	Health science
1020	Microsoft Office Specialist: Microsoft Access Expert (Access 2019)	1	Accounting and Financial Services	Business
1020	Microsoft Office Specialist: Microsoft Access Expert (Access 2019)	11	Business Management	Business
1021	Nationally Certified Medical Coding and Billing Specialist	31	Health Informatics	Health science
1022	Nationally Registered Certified EKG Technician	32	Healthcare Diagnostics	Health science
1022	Nationally Registered Certified EKG Technician	33	Healthcare Therapeutic	Health science
1023	Natural Resources Systems	24	Environmental and Natural Resources	Agriculture, Food, Natural Resources
1024	NCCER Industrial Maintenance Support Mechanic	63	Industrial Maintenance	Manufacturing
1025	NCCER Industrial Millwright	63	Industrial Maintenance	Manufacturing
1026	NCCER Industrial Pipefitter	46	Plumbing and Pipefitting	Architecture and construction
1027	Precision Machining - Job Ready	39	Manufacturing Technology	Manufacturing
1028	Pre-Engineering/Engineering Technology - Job Ready	22	Engineering	Engineering
1029	Pre-Professional Certification in Culinary Arts	14	Culinary Arts	Hospitality
1030	Pre-Professional Certification in Early Childhood Education	19	Early Learning	Education
1031	Pre-Professional Certification in Food Science Fundamentals	27	Food Science and Technology	Hospitality
1031	Pre-Professional Certification in Food Science Fundamentals	14	Culinary Arts	Hospitality
1032	Pre-Professional Certification in Nutrition, Food, and Wellness	25	Exercise Science and Wellness	Health science
1032	Pre-Professional Certification in Nutrition, Food, and Wellness	30	Health and Wellness	Health science

1033	Principles of Floral Design Certification	45	Plant Science	Agriculture, Food, Natural Resources
1034	Principles of Small Engine Technology Certification	7	Automotive	Transportation
1035	Production Agriculture - Job Ready	3	Agribusiness	Agriculture, Food, Natural Resources
1035	Production Agriculture - Job Ready	4	Animal Science	Agriculture, Food, Natural Resources
1035	Production Agriculture - Job Ready	45	Plant Science	Agriculture, Food, Natural Resources
1036	Certified Professional Photographer	29	Graphic Design and Multimedia Arts	Arts and A/V
1037	Project Management Institute (PMI) Project Management Ready	11	Business Management	Business
1038	Retail Merchandising - Job Ready	40	Marketing and Sales	Business
1039	Small Animal Science and Technology	4	Animal Science	Agriculture, Food, Natural Resources
1040	Small Engine Technology	7	Automotive	Transportation
1041	Certified Billing and Coding Specialist (CBCS)	31	Health Informatics	Health science
1042	Stukent Social Media Marketing Certification	40	Marketing and Sales	Business
1043	Texas Certified Landscape Associate (TCLA)	45	Plant Science	Agriculture, Food, Natural Resources
1044	Texas Certified Nursery Professional	45	Plant Science	Agriculture, Food, Natural Resources
1045	Travel and Tourism	51	Travel, Tourism, and Attractions	Hospitality
1046	Volunteer Income Tax Assistance/Tax Counseling Certification: Advanced	1	Accounting and Financial Services	Business
1047	Volunteer Income Tax Assistance/Tax Counseling Certification: Basic	1	Accounting and Financial Services	Business
1048	Volunteer Income Tax Assistance/Tax Counseling Certification: Volunteer for Elderly	1	Accounting and Financial Services	Business
1049	Web Design - Job Ready	52	Web Development	IT
1050	Welding - Job Ready	5	Applied Agricultural Engineering	Manufacturing
1050	Welding - Job Ready	39	Manufacturing Technology	Manufacturing
1050	Welding - Job Ready	60	Welding	Manufacturing
1051	Autodesk Certified Professional in Civil 3D for Infrastructure Design	22	Engineering	Engineering
1051	Autodesk Certified Professional in Civil 3D for Infrastructure Design	6	Architectural Design	Engineering
1052	Business of Retail: Certified Specialist	40	Marketing and Sales	Business
1052	Business of Retail: Certified Specialist	65	Retail Management	Business
1053	Certified SOLIDWORKS Associate (CSWA) - Academic	22	Engineering	Engineering
1053	Certified SOLIDWORKS Associate (CSWA) - Academic	6	Architectural Design	Engineering
1054	Certified SOLIDWORKS Associate (CSWA) - Electrical	22	Engineering	Engineering
1054	Certified SOLIDWORKS Associate (CSWA) - Electrical	6	Architectural Design	Engineering
1055	Certified SOLIDWORKS Associate (CSWA) - Mechanical Design	22	Engineering	Engineering
1056	Certified SOLIDWORKS Associate (CSWA) - Simulation	22	Engineering	Engineering
1056	Certified SOLIDWORKS Associate (CSWA) - Simulation	6	Architectural Design	Engineering
1057	Certified SOLIDWORKS Associate (CSWA) - Sustainability	22	Engineering	Engineering
1057	Certified SOLIDWORKS Associate (CSWA) - Sustainability	6	Architectural Design	Engineering
1058	Certified SOLIDWORKS Professional (CSWP) - Academic	22	Engineering	Engineering
1058	Certified SOLIDWORKS Professional (CSWP) - Academic	6	Architectural Design	Engineering
1059	Certified SOLIDWORKS Professional (CSWP) - Additive Manufacturing	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
1059	Certified SOLIDWORKS Professional (CSWP) - Additive Manufacturing	39	Manufacturing Technology	Manufacturing
1060	Certified SOLIDWORKS Professional (CSWP) - CAM	2	Advanced Manufacturing and Machinery Mechanics	Manufacturing
1060	Certified SOLIDWORKS Professional (CSWP) - CAM	39	Manufacturing Technology	Manufacturing
1061	Certified SOLIDWORKS Professional (CSWP) - Mechanical Design	22	Engineering	Engineering
1062	Certified SOLIDWORKS Professional (CSWP) - Model Based Definition	22	Engineering	Engineering
1062	Certified SOLIDWORKS Professional (CSWP) - Model Based Definition	6	Architectural Design	Engineering
1063	Certified SOLIDWORKS Professional (CSWP) - Simulation	22	Engineering	Engineering
1063	Certified SOLIDWORKS Professional (CSWP) - Simulation	6	Architectural Design	Engineering
1064	Certified SOLIDWORKS Professional (CSWPA) - Drawing Tools	22	Engineering	Engineering
1064	Certified SOLIDWORKS Professional (CSWPA) - Drawing Tools	6	Architectural Design	Engineering
1065	Certified User: Programmer	29	Graphic Design and Multimedia Arts	IT
1065	Certified User: Programmer	47	Programming and Software Development	IT
1066	CodeHS Cybersecurity Levelm 1 Certification	15	Cybersecurity	IT
1067	CodeHS Python Level 1 Certification	29	Graphic Design and Multimedia Arts	IT
1067	CodeHS Python Level 1 Certification	47	Programming and Software Development	IT
1067	CodeHS Python Level 1 Certification	52	Web Development	IT
1068	CodeHS Web Design Level 1 Certification	52	Web Development	IT
1069	Customer Service and Sales: Certified Specialist	40	Marketing and Sales	Business
1069	Customer Service and Sales: Certified Specialist	65	Retail Management	Business
1070	Ducks Unlimited Ecology Conservation & Management Certificaton	24	Environmental and Natural Resources	Agriculture, Food, Natural Resources
1071	Employment Ready Certification - Air Conditioning	34	HVAC and Sheet Metal	Architecture and construction
1072	Employment Ready Certification - Electrical	34	HVAC and Sheet Metal	Architecture and construction
1073	Employment Ready Certification - Gas Heat	34	HVAC and Sheet Metal	Architecture and construction
1074	Employment Ready Certification - Heat Pumps	34	HVAC and Sheet Metal	Architecture and construction
1075	Employment Ready Certification - Light Commercial Air Conditioning	34	HVAC and Sheet Metal	Architecture and construction
1076	Heating, Electrical, & Air Conditioning Technology (H.E.A.T.)	34	HVAC and Sheet Metal	Architecture and construction
1077	Information Technology Specialist: HTML and CSS	52	Web Development	IT
1078	Information Technology Specialist: HTML5 Application Development	52	Web Development	IT
1079	Information Technology Specialist: Java	15	Cybersecurity	IT
1079	Information Technology Specialist: Java	47	Programming and Software Development	IT

1080	Information Technology Specialist: JavaScript	15	Cybersecurity	IT
1080	Information Technology Specialist: JavaScript	47	Programming and Software Development	IT
1080	Information Technology Specialist: JavaScript	52	Web Development	IT
1081	Information Technology Specialist: Networking	15	Cybersecurity	IT
1081	Information Technology Specialist: Networking	42	Networking Systems	IT
1082	Microsoft 365 Fundamentals	15	Cybersecurity	IT
1082	Microsoft 365 Fundamentals	35	Information Technology Support and Services	IT
1082	Microsoft 365 Fundamentals	42	Networking Systems	IT
1083	Microsoft Azure AI Fundamentals	47	Programming and Software Development	IT
1084	Microsoft Azure Data Fundamentals	42	Networking Systems	IT
1084	Microsoft Azure Data Fundamentals	47	Programming and Software Development	IT
1084	Microsoft Azure Data Fundamentals	52	Web Development	IT
1085	Microsoft Security, Compliance, and Identity Fundamentals	15	Cybersecurity	IT
1085	Microsoft Security, Compliance, and Identity Fundamentals	35	Information Technology Support and Services	IT
1085	Microsoft Security, Compliance, and Identity Fundamentals	42	Networking Systems	IT
1086	TRIO Electrical Pre-Apprenticeship (EPP) Certification	20	Electrical	Architecture and construction
1087	Agrilife Veterinary Assistant Certificate	4	Animal Science	Agriculture, Food, Natural Resources

D Additional results

Figure A6: Statewide trends in attainment-related CCMR components



Notes. This figure shows statewide trends in the attainment-related outcomes targeted by the bonus policy for the 12th grade cohorts of 2016 through 2022. Data on IBCs begins in 2017.

D.1 Reduced form figures

To be added soon.

D.2 Heterogeneity by student disadvantaged status

The policy created distinct incentives for districts' disadvantaged and non-disadvantaged students. In particular, the per-student financial return (gross of costs) from a college- or career-ready disadvantaged student was higher than from a non-disadvantaged student (see Section 2.3 for details). We therefore investigate whether impacts on attainment differed by students' disadvantaged statuses. To do so, we separate out the incentive that districts faced due to the policy for its disadvantaged graduates from the incentive associated with its non-disadvantaged students. Table A1 summarizes.

Table A1: Effects of school spending and incentives on attainment by disadvantaged status

	Panel A: Attainment by non-disadvantaged students					
	2020		2021		2022	
	(1)	(2)	(3)	(4)	(5)	(6)
Per-pupil expenditure	-0.003	-0.002	0.010*	0.010*	0.003	0.003
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
Incentive to improve nondisadv. attainment	0.021**	0.027**	0.021	0.025	0.068***	0.070***
	(0.009)	(0.012)	(0.013)	(0.016)	(0.013)	(0.016)
Incentive to improve disadv. attainment		-0.012		-0.008		-0.004
		(0.011)		(0.018)		(0.016)
Title I and math control	×	×	×	×	×	×
N district	721	721	721	721	721	721
Mean Y in 2019	0.75	0.75	0.75	0.75	0.75	0.75
Mean disadv incentive	4.16	4.16	4.16	4.16	4.16	4.16
Mean nondisadv incentive	1.62	1.62	1.62	1.62	1.62	1.62

	Panel B: Attainment by disadvantaged students					
	2020		2021		2022	
	(1)	(2)	(3)	(4)	(5)	(6)
Per-pupil expenditure	-0.001	-0.000	0.014**	0.013**	0.020**	0.018**
	(0.004)	(0.004)	(0.006)	(0.006)	(0.008)	(0.008)
Incentive to improve disadv. attainment	0.031***	0.039***	0.038**	0.033	0.078***	0.065**
	(0.010)	(0.013)	(0.018)	(0.021)	(0.025)	(0.027)
Incentive to improve nondisadv. attainment		-0.013		0.009		0.020
		(0.013)		(0.020)		(0.024)
Title I and math control	×	×	×	×	×	×
N district	727	727	727	727	727	727
Mean Y in 2019	0.55	0.55	0.55	0.55	0.55	0.55
Mean disadv incentive	4.16	4.16	4.16	4.16	4.16	4.16
Mean nondisadv incentive	1.62	1.62	1.62	1.62	1.62	1.62

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on the targeted attainment outcome among (a) non-disadvantaged and (b) disadvantaged students. Columns correspond to attainment outcomes 1, 2, and 3 years after policy implementation, respectively.

D.3 Effects on industry-based certifications by college enrollment

Table A2: Effects on IBC completion by college enrollment group

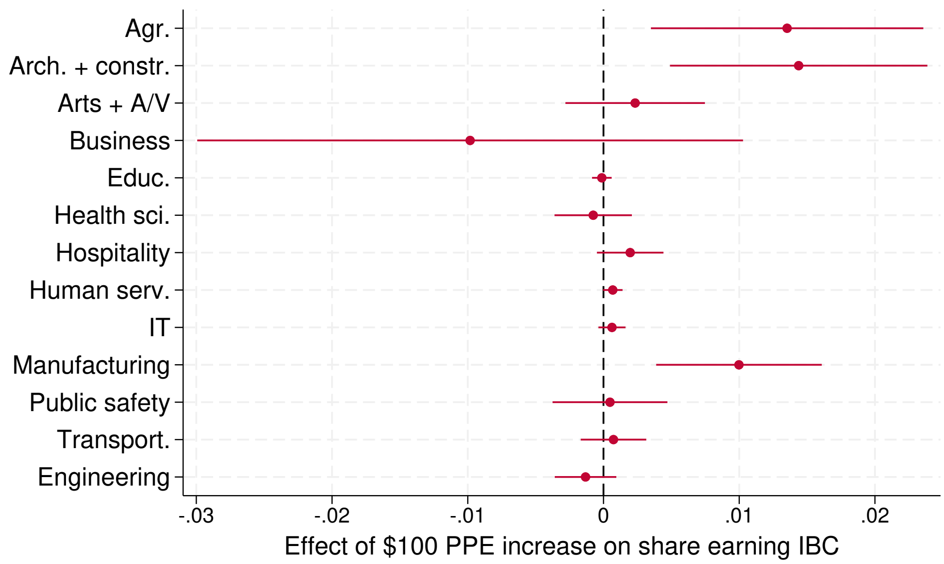
	IBC + enroll			IBC + do not enroll		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0067*	0.0179***	0.0180**	0.0022	0.0114**	0.0144**
	(0.0038)	(0.0063)	(0.0085)	(0.0024)	(0.0045)	(0.0062)
Incentive to improve attainment	-0.0117	-0.0109	0.0003	0.0051	0.0107	0.0328***
	(0.0079)	(0.0151)	(0.0160)	(0.0041)	(0.0094)	(0.0120)
Title I and math control	×	×	×			
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0716	0.0716	0.0716	0.0368	0.0368	0.0368
S.D. Y in 2019	0.0615	0.0615	0.0615	0.0385	0.0385	0.0385

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on rate of 12th graders earning an IBC 1, 2, and 3 years after policy implementation, respectively. We break down the effect on IBC completion by whether a student enrolled in a two- or four-year college in the following year. Per-pupil expenditure is instrumented with the policy change on formula funding.

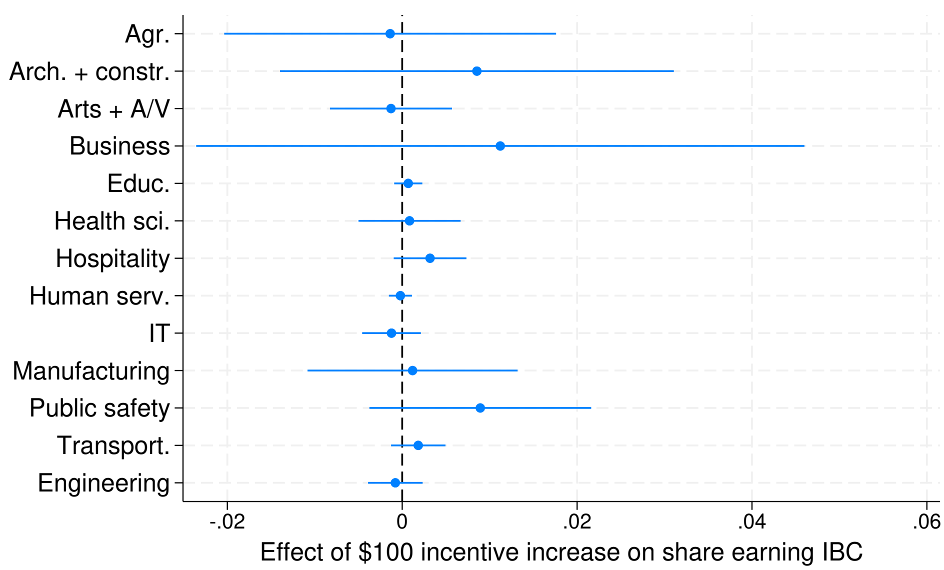
D.4 Effects on industry-based certifications by career cluster

Figure A7: Effects of per-pupil expenditure and incentives on IBCs by career cluster

(a) Per-pupil expenditure



(b) Incentives



Notes. This table shows the effects of policy-induced increases in (a) per-pupil expenditures and (b) incentives to improve attainment outcomes, on the share of a district's graduates who earn an industry-based license in the corresponding category. Each marker within a subfigure is a coefficient estimate from its own regression. All estimates control for Tier 1 and math scores as described in Section 4.5. Per-pupil expenditure is instrumented with the policy change on formula funding.

D.5 Graduation-related outcomes

Table A3: Dropout, repetition, and alternative exit status of first-time 12th graders

	Drop out			Repeat 12th grade		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0006	-0.0002	-0.0001	-0.0001	-0.0003	0.0023**
	(0.0005)	(0.0007)	(0.0005)	(0.0008)	(0.0011)	(0.0011)
Incentive to improve attainment	0.0004	0.0015	0.0023**	0.0020	0.0011	0.0008
	(0.0012)	(0.0014)	(0.0010)	(0.0018)	(0.0031)	(0.0023)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0110	0.0110	0.0110	0.0233	0.0233	0.0233
S.D. Y in 2019	0.0096	0.0096	0.0096	0.0134	0.0134	0.0134
	Alternative exit status					
	(1)	(2)	(3)			
	2020	2021	2022			
Per-pupil expenditure	-0.0043	0.0007	-0.0044*			
	(0.0030)	(0.0018)	(0.0024)			
Incentive to improve attainment	0.0044	0.0063*	0.0069			
	(0.0040)	(0.0036)	(0.0051)			
Title I and math control	×	×	×			
N districts	728	728	728			
Mean Y in 2019	0.0188	0.0188	0.0188			
S.D. Y in 2019	0.0231	0.0231	0.0231			

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives on share of first time 12th graders who dropped out, repeated 12th grade, or have an alternative exit status. Students with alternative exit status neither graduated nor dropped out nor were found in the data one year later. Columns correspond to outcomes 1, 2, and 3 years after policy implementation, respectively.

Table A4: One-year later outcomes of 12th grade repeaters

	Graduate following year			Alternative exit status		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0008	0.0002	0.0017**	-0.0006*	-0.0002	0.0006
	(0.0006)	(0.0008)	(0.0008)	(0.0004)	(0.0004)	(0.0004)
Incentive to improve attainment	0.0001	-0.0012	-0.0016	0.0014	0.0019**	0.0022***
	(0.0011)	(0.0021)	(0.0015)	(0.0009)	(0.0009)	(0.0008)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0128	0.0128	0.0128	0.0085	0.0085	0.0085
S.D. Y in 2019	0.0090	0.0090	0.0090	0.0057	0.0057	0.0057
	Drop out following year					
	(1)	(2)	(3)			
	2020	2021	2022			
Per-pupil expenditure	-0.0003	-0.0003	0.0000			
	(0.0003)	(0.0002)	(0.0002)			
Incentive to improve attainment	0.0005	0.0004	0.0002			
	(0.0006)	(0.0005)	(0.0004)			
Title I and math control	×	×	×			
N districts	728	728	728			
Mean Y in 2019	0.0020	0.0020	0.0020			
S.D. Y in 2019	0.0027	0.0027	0.0027			

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives on the share of first time 12th graders who were retained and either graduated, had alternative exit status, or dropped out the following year. Having one-year-later alternative exit status means that the student neither graduated nor dropped out one year later. Columns correspond to outcomes 1, 2, and 3 years after policy implementation, respectively.

Table A5: One-year later graduation and attainment outcomes of non-graduates

	Graduate + meet attainment			Graduate + earn IBC		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0000	0.0002	0.0003	-0.0000	-0.0001	0.0001
	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)	(0.0001)
Incentive to improve attainment	0.0005	-0.0002	0.0009**	0.0003	0.0001	0.0003*
	(0.0004)	(0.0006)	(0.0004)	(0.0002)	(0.0004)	(0.0002)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0022	0.0022	0.0022	0.0007	0.0007	0.0007
S.D. Y in 2019	0.0025	0.0025	0.0025	0.0014	0.0014	0.0014

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives on the share of first time 12th graders who were retained and graduated having met the composite outcome the following year, on the share of first time 12th graders who were retained and graduated having earned an IBC the following year. Columns correspond to outcomes 1, 2, and 3 years after policy implementation, respectively.

D.6 Enrollment × Employment outcomes

Table A6: Breakdown of enrollment and employment outcomes

	Enrolled and employed			Enrolled and not employed			Employed and not enrolled		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2020	2021	2022	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0012	-0.0010	-0.0000	-0.0044**	0.0007	-0.0002	0.0066**	0.0010	0.0014
	(0.0025)	(0.0032)	(0.0033)	(0.0021)	(0.0020)	(0.0022)	(0.0032)	(0.0030)	(0.0028)
Incentive to improve attainment	-0.0056	-0.0137**	-0.0115**	0.0051	0.0137***	0.0128***	-0.0028	0.0032	0.0030
	(0.0046)	(0.0059)	(0.0057)	(0.0044)	(0.0035)	(0.0044)	(0.0052)	(0.0057)	(0.0051)
Title I and math control	×	×	×	×	×	×	×	×	×
N districts	728	728	728	728	728	728	728	728	728
Mean Y in 2019	0.3861	0.3861	0.3861	0.2120	0.2120	0.2120	0.2582	0.2582	0.2582
S.D. Y in 2019	0.0638	0.0638	0.0638	0.0738	0.0738	0.0738	0.0817	0.0817	0.0817

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives on the share of first time 12th graders who, 1 year later, were enrolled in college and employed, enrolled in college but not employed, and employed but not enrolled. Columns correspond to outcomes 1, 2, and 3 years after policy implementation, respectively.

D.7 Enrollment × Employment × IBC outcomes

Table A7: Breakdown of enrollment and employment and IBC outcomes

	Panel A: Enrolled and employed					
	Earn IBC			No IBC		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0046*	0.0138***	0.0144**	-0.0034	-0.0147***	-0.0144**
	(0.0026)	(0.0046)	(0.0062)	(0.0034)	(0.0056)	(0.0064)
Incentive to improve attainment	-0.0066	-0.0076	0.0055	0.0010	-0.0061	-0.0170
	(0.0051)	(0.0104)	(0.0114)	(0.0055)	(0.0120)	(0.0120)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0459	0.0459	0.0459	0.3402	0.3402	0.3402
S.D. Y in 2019	0.0386	0.0386	0.0386	0.0727	0.0727	0.0727
	Panel B: Employed and not enrolled					
	Earn IBC			No IBC		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0020	0.0088***	0.0117***	0.0046	-0.0078*	-0.0103**
	(0.0016)	(0.0033)	(0.0045)	(0.0029)	(0.0041)	(0.0049)
Incentive to improve attainment	0.0043	0.0087	0.0261***	-0.0072*	-0.0055	-0.0231***
	(0.0029)	(0.0068)	(0.0089)	(0.0042)	(0.0077)	(0.0087)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0246	0.0246	0.0246	0.2336	0.2336	0.2336
S.D. Y in 2019	0.0262	0.0262	0.0262	0.0780	0.0780	0.0780
	Panel C: Enrolled and not employed					
	Earn IBC			No IBC		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0020	0.0041**	0.0036	-0.0064**	-0.0033	-0.0038
	(0.0015)	(0.0019)	(0.0026)	(0.0027)	(0.0024)	(0.0033)
Incentive to improve attainment	-0.0051	-0.0033	-0.0052	0.0101	0.0171***	0.0180**
	(0.0032)	(0.0051)	(0.0051)	(0.0063)	(0.0058)	(0.0071)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	0.0256	0.0256	0.0256	0.1863	0.1863	0.1863
S.D. Y in 2019	0.0257	0.0257	0.0257	0.0702	0.0702	0.0702

Notes. This table breaks down the impacts on each outcome in Table A6 by whether students earned an IBC or not. Columns correspond to outcomes 1, 2, and 3 years after policy implementation, respectively.

D.8 Decomposing earnings effects by enrollment

Table A8: Effects of school spending and incentives on earnings

	Wage, enroll			Wage, do not enroll		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	3.91	-11.93	7.69	103.86**	2.29	103.31**
	(23.06)	(30.44)	(32.04)	(46.50)	(43.56)	(49.85)
Incentive to improve attainment	-52.82	-83.60	-35.24	-55.25	309.27***	313.89***
	(42.45)	(58.92)	(59.02)	(73.46)	(85.25)	(102.19)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728
Mean Y in 2019	2,402.98	2,402.98	2,402.98	2,548.07	2,548.07	2,548.07
S.D. Y in 2019	536.11	536.11	536.11	1,064.76	1,064.76	1,064.76

Notes. This table decomposes the effects of policy-induced increases in per-pupil expenditures and incentives on 1-year-later annual earnings of first time 12th graders by whether students enrolled in college or not. Columns correspond to outcomes 1, 2, and 3 years after policy implementation, respectively.

E Robustness

E.1 Controls

Table A9: Effects of school spending and incentives on attainment (without math control)

	(1)	(2)	(3)
	2020	2021	2022
Δ PPE	-0.017	0.102*	0.150**
	(0.032)	(0.058)	(0.075)
Incentive to improve attainment	0.056	0.107	0.324**
	(0.050)	(0.111)	(0.128)
Share gen. Title 1 B,C,T, 2019	-0.009	-0.023	-0.006
	(0.007)	(0.018)	(0.020)
N	728	728	728
F-stat Z	9.66	9.66	9.66
FS coef on Z	0.28	0.28	0.28
Mean Y in 2019	0.62	0.62	0.62
Mean ΔY	-0.02	-0.00	0.05
Mean incentive	0.31	0.31	0.31

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on the targeted attainment outcome, as in Table 6, but without controlling for lagged math achievement. Columns correspond to attainment outcomes 1, 2, and 3 years after policy implementation, respectively.

E.2 Among graduates only

Table A10: Effects of spending and incentives on attainment

	(1)	(2)	(3)
	2020	2021	2022
Per-pupil expenditure	-0.0004	0.0118**	0.0152**
	(0.0032)	(0.0055)	(0.0069)
Incentive to improve attainment	0.0061	0.0114	0.0363***
	(0.0053)	(0.0105)	(0.0123)
Share Title I B,C,T	-0.0188***	-0.0316*	-0.0141
	(0.0071)	(0.0165)	(0.0189)
Avg. gr 9 math	0.0710***	0.0280	0.0405
	(0.0202)	(0.0373)	(0.0413)
N districts	727	727	727
Mean Y in 2019	0.6570	0.6570	0.6570
S.D. Y in 2019	0.0953	0.0953	0.0953

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on the targeted attainment outcome 1, 2, and 3 years after policy implementation, respectively. Per-pupil expenditure is instrumented with the policy change on formula funding. Estimates are on graduates only.

E.3 Sensitivity to different improvement scenarios

Table A11: Effects of school spending and incentives on attainment

	0.75 SD improvement			1.25 SD improvement		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	-0.0002	0.0117**	0.0152**	-0.0006	0.0114**	0.0149**
	(0.0029)	(0.0055)	(0.0068)	(0.0030)	(0.0055)	(0.0068)
Incentive to improve attainment	0.0045	0.0139	0.0447***	0.0037	0.0089	0.0265***
	(0.0067)	(0.0150)	(0.0163)	(0.0040)	(0.0087)	(0.0095)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on the targeted attainment outcome 1, 2, and 3 years after policy implementation, respectively. Per-pupil expenditure is instrumented with the policy change on formula funding. We show estimates under two alternative improvement scenarios for the incentive variable.

Table A12: Effects of school spending and incentives on IBCs

	0.75 SD improvement			1.25 SD improvement		
	(1)	(2)	(3)	(4)	(5)	(6)
	2020	2021	2022	2020	2021	2022
Per-pupil expenditure	0.0089	0.0292***	0.0322**	0.0089	0.0293***	0.0327**
	(0.0056)	(0.0102)	(0.0140)	(0.0056)	(0.0104)	(0.0143)
Incentive to improve attainment	-0.0089	0.0002	0.0466	-0.0052	-0.0004	0.0253
	(0.0147)	(0.0322)	(0.0360)	(0.0088)	(0.0190)	(0.0214)
Title I and math control	×	×	×	×	×	×
N districts	728	728	728	728	728	728

Notes. This table shows the effects of policy-induced increases in per-pupil expenditures and incentives to improve attainment outcomes on the rate of 12th graders earning IBCs 1, 2, and 3 years after policy implementation, respectively. Per-pupil expenditure is instrumented with the policy change on formula funding. We show estimates under two alternative improvement scenarios for the incentive variable.