Lost in Translation? The Impact of Increasing Funding on High School Graduation Rates of English Language Learners

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March 17, 2021

Abstract

Enrollment of English language learners in the public K-12 school system has increased by 28% over the last 20 years and continues to grow. California has the greatest share of English learners in the country and in 2013, passed the greatest change of its school funding system in 40 years: the Local Control Funding Formula (LCFF). This reform simplified how districts are funded by the state and emphasizes equity by distributing additional funding based on the number of students who are English learners, eligible for free or reduced-price meals, or in the foster care system. In this paper, we use a difference-in-differences design to estimate the effect of the LCFF on four-year graduation rates and dropout rates by examining the change in these metrics between districts in California and Colorado over the time period 2013 to 2019. Between California and Colorado, we find that California districts had on average a graduation rate 35.8 percentage points higher than Colorado districts over the same period. Additionally, comparing treated and untreated districts within California, we find that for every additional $1,000 that a district received in per-student base grant funding, the graduation rate of English learners increased by 7.3 percentage points and the dropout rate decreased by 5.8 percentage points. For every additional $1,000 that a district received in per-student concentration grant funding, the graduation rate increased on average by 5.7 percentage points. Districts that received supplemental grant funding above the median per-student amount had a graduation rate 40.6 percentage points higher and a dropout rate 27.9 percentage points lower than districts that were at or below the median. Overall, our results indicate that the LCFF was effective in improving outcomes of English language learners and open additional research questions into the strategies and efficacy of intervention among high-school-aged English learners.

1 Introduction

School finance reform broadly involves the funding that local education agencies, such as districts or schools, receive from the state government. The impact of such efforts in states including Maryland, Massachusetts and Texas have been studied by education researchers, economists and public policy analysts alike (Il Hwan 2015, Guryan 2001, Burrows 2015). Allotting additional funds to schools on a per-student basis in order to improve outcomes is both intuitive and reasonable for educational systems, which has now led to undertakings of increasing funding for high-needs students across the nation (Roberts 2019).

California is one recent state to make such an effort. The Local Control Funding Formula (LCFF) passed in 2013 and has been the most significant reform to the way in which K-12 schools in California are funded in over 40 years. Before the LCFF was signed into law by Governor Jerry Brown, districts primarily relied on general-purpose funding based on revenue limits and average daily attendance. Specialized services based on demographics of students in a district were provided through a complex and restricted system of over 50 "categorical programs." Categorical funding is allocated to a district for specific purposes, such as reducing class sizes or special education. Under this system, the state set the priorities and restrictions on how districts were able to spend these funds, giving the districts themselves very little flexibility with these areas of their budget.

With bipartisan support, the passage of the LCFF sought to streamline funding through a system of grade level-specific per-student base grants, which the majority of districts in California qualify for. The categorical program system was replaced with supplemental and concentration grants. This shift gave districts greater decision-making power over the targets of funding, allowing them to meet specific needs or demographics of certain areas.

The mechanics of the supplemental and concentration grants are also simpler than the previous categorical program method. For every student who is an English language learner, in foster care or eligible for free or reduced-price meals, the district receives 20% of the per-student base grant amount through the supplemental grants. If 55% of the students

in a district are classified high-needs, the district is eligible for concentration grants, which allocates an additional 50% of the per-student base grant amount for each student above the threshold. Students who are English language learners, in foster care or eligible for free or reduced-price meals are considered high-needs and drive concentration and supplemental funding for districts.

Table 1: **Local Control Funding Formula Per-Student Grant Amounts**

Grade Span	Base	Supplemental	Concentration
K - 3	$8,141	$1,628	$4,070
4 - 6	$7,484	$1,497	$3,742
7 - 8	$7,707	$1,541	$3,854
9 - 12	$9,163	$1,833	$4,581

English language learners are a population of particular interest and emphasis in California: California has the highest density of English language students in public schools in the country, with approximately 29% of English language learner students nationwide. The percentage of public school students designated English language learners in California is double the national average. In the 2012-2013 school year, immediately before LCFF was implemented, 21.6% of total enrollment in California public schools was made up of English learners, with 1.346 million students falling under this designation.

English language learners students are also at distinct risk of dropping out or not completing high school; in the year before LCFF was implemented, the 2012-2013 school year, only 63.1% of English learners who had entered high school four years earlier graduated and 21.6% dropped out. For the overall population of twelfth grades, 80.4% graduated and only 11.4% dropped out, making the graduation rate for English learners 17.3 percentage points lower and making the dropout rate twice as large compared to English-proficient students.

Both the economic and social consequences of not completing high school make these discrepancies particularly alarming. In addition to having higher unemployment rates, those without a high school diploma earn on average 19% than high school graduates and 53% less than workers with bachelor's degrees according to the Bureau of Labor Statistics. Addition-

ally, high school dropouts are more likely to have poor health and a shorter lifespan, as well as being more likely to engage in criminal behavior and require social services (Rumberger 2010).

Graduation rates for English language learners have generally increased since the passage of the LCFF, except for a slight drop in 2016. This is, broadly, the trend that motivates this paper: Is the relationship between the additional funding for English language learner students from the LCFF and the increase in high school graduation rates causal?

Using data from the California Department of Education and the Colorado Department of Education on funding and school demographics starting in 2009, we construct a difference-in-differences model between the two states. Colorado was selected because it also has a high share of English language learners in its public school population compared to the rest of the nation. Additionally, 83% of English language learners in Colorado speak Spanish at home, compared to 81.44% in California. In the time period we are interested in, Colorado has undergone no significant reform in the way in which districts are funded by the state. We exploit this variation between the states in order to assess the effect of targeted LCFF funding by treating pre-LCFF years as time zero and by considering Colorado as untreated compared to California.

We find that the LCFF increased graduation rates of English learners significantly through difference-in-differences comparisons between California and Colorado. Additionally, base grant funding from the LCFF has a statistically significant relationship with both dropout rates and graduation rate, as derived through an ordinary least squares regression. For every additional $1000 per student a district received, the dropout rate of English learners decreased by 5.8% on average and the graduation rate increased by 7.3% on average. This seems to indicate that funding from the LCFF indeed affected the educational outcomes of English language learners in California.

2 Literature Review

Much of the literature surrounding the efficacy of the Local Control Funding Formula has been driven by education policy researchers (Vasquez Heiling et al 2017, Contereras and Fujimoto 2019, Jimenez-Castellanos et al 2019, Zarate and Gandara 2019) and tends to take qualitative approaches. In particular, current LCFF literature focuses on document analysis of Local Control and Accountability Plans (LCAP); these are three-year plans and summaries written by school districts that describe, in part, improvement of services for English learners. Other emphases include services for students in the foster care system and students designated as low-income. Under the LCFF, local educational agencies are required to prepare this report annually to create community engagement and transparency around the spending of LCFF funding. This has made these documents especially popular among researchers who are looking to assess the impact of the LCFF on English language learner services.

Vasquez Heiling et al 2017, for instance, examines the LCAPs of a random selection of 20 districts of the 50 largest in the state, which represented 25% of California's overall student population and 27.5% of California's total English learner population. The texts were studied for themes and patterns, and noted that the majority of local educational agencies consulted District-Level English Learner Advisory Committees, which are district-level groups made up of parents and guardians of English learners, in order to set priorities. Vasquez Heiling et al also notes that the greatest outlets for additional EL funding through the LCFF have been curriculum and staffing: the Compton Unified School District, for example, allocated an additional $340,000 toward English language development teacher salaries, while the Oakland Unified School District directed an additional $250,000 toward online tools for students. Parent engagement was also emphasized. The San Francisco Unified School District set aside approximately $1 million to provide translation/interpretation services to families of English learners.

Likewise, Conteras and Fujimoto 2019 analyze the LCAPs of 13 school districts with

large Latino populations and find that all districts increased the availability of academically rigorous courses after the LCFF. They also note an increase in outreach to English learners and other historically disadvantaged groups, including targeted interventions to enroll in college preparatory classes and waivers for AP and SAT exams. Contreras and Fujimoto note that in Long Beach Unified, the fourth largest school district in California serving over 70,000 students, "close to two-thirds" of English learners felt encouragement to participate in AP classes. Additionally, quoting from the Long Beach School Culture Climate Survey, Contreras and Fujimoto add that high numbers of English learner students across all GPA categories "agree they felt supported by an adult at the school." Still, a data analysis on college readiness metrics shows that English language learners continue to lag behind their peers in state assessment performance. It is unclear whether this trend has seen any change since the LCFF's implementation. Likewise, in examining whether the LCFF has increased support of English language learner students, Zarate and Gandara 2019 consider the results to be inconclusive due to a lack of transparency in the LCAP documents.

More general school finance research suggests the categorical funding mechanism, used in California before LCFF and used in Colorado presently, leads to inadequate funding for English language learner students and adverse effects on equity overall (Ramirez et al 2011). Additionally, Ramirez et al 2011 finds that the negative impact of inadequate categorical funding increases with the proportion of English language learner students in the district.

In the broader view, the literature as a whole indicates that education finance reform and increasing school funding tends to have positive effects on equalizing spending between low-income and high-income districts and can improve outcomes for students from low-income or otherwise underserved backgrounds (Johnson and Persico 2014, Card and Payne 2002, Lafortune 2018, Jackson 2018). Jackson et al 2016 employs an instrumental variables framework in order to conclude that a 10% increase in per-student funding for 12 years of public school does lead to more education, higher wages and a decrease in adult poverty (though they examine court-ordered reforms, not legislative reforms like the LCFF).

Notably, Jackson 2018 conducts an analysis of economic literature on the impact of increasing funding on student outcomes, discussing trends both before and after the "credibility revolution" (citing Angrist and Pischke 2010) in empirical economics. Recent literature "overwhelmingly [supports] a causal relationship between increased school spending and student outcomes," across studies with different data, time periods, variation and techniques: in other words, money does indeed matter.

Still, because data analysis in LCFF research has been limited and due to the indeterminate and district-specific conclusions in the predominant document analysis, the question of whether the LCFF has led to improvements in quantitative metrics such as graduation and dropout rates of English learners remains largely unanswered. Additionally, as California is the state with the highest English language learner population, the outcome of its structural overhaul of state-to-district funding could have significant impacts on policy decisions around the nation. The English language learner population increased by over a million students since 2000, or about 28.1%, according to the U.S. Department of Education, with 43 states seeing increased enrollment. As the share of English learner students surges in the United States, it becomes increasingly important to understand which reforms help improve outcomes of the historically disadvantaged and to what extent.

3 Data Description

The data used to conduct this analysis is from the California Department of Education and the Colorado Department of Education, who both provide publicly available data on annual trends in graduation rates and enrollment. From the California Department of Education, we also draw on Local Control Funding Formula Snapshots. Using this data allows us to implement the empirical strategy outlined, which relies on taking cohort graduation rates as the dependent variable and funding by students, time, treatment group and difference-in-differences estimators at the intersection of time and treatment as the independent variables.

3.1 Graduation Rates

3.1.1 California Department of Education

The data on four-year graduation rates is organized by district and includes the subgroup (e.g. English learner), number of students in the cohort, number of graduates within the cohort and number of dropouts within the cohort. According to the California Department of Education, where this data is sourced from, the four-year cohort is derived from "the number of students who enter grade 9 for the first time adjusted by adding into the cohort any student who transfers in later during grade 9 or during the next three years and subtracting any student from the cohort who transfers out, emigrates to another country, transfers to a prison or juvenile facility, or dies during that same period." The California Department of Education also excludes districts with fewer than nine English learners in the cohort from the graduation data in order to protect student privacy.

Table 2: **Summary Statistics of the California EL Graduation Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Cohort Size	3,495	243.350	657.394	9	39	261.5	15,929
Number of Graduates	3,495	163.187	365.976	0	28	186	8,136
Cohort Graduation Rate	3,495	0.738	0.189	0.000	0.670	0.864	1.000

The adjusted cohort graduation rate (ACGR) data begins in the 2009-2010 school year and extends to the 2018-2019 school year, covering 11 years in total. Notably, the California Department of Education changed their methodology for calculating this data in 2016 in order to shorten the reporting timeline, address recommendations from the U.S. Department of Education and meet federal guidance about the ACGR published in 2017. According to the California Department of Education, the changes were:

- "No longer removing students from the cohort who transfer to adult education programs or community college."
- "No longer counting students who receive an adult education high school diploma as regular high school graduates."

- "No longer counting students who pass the California High School Proficiency Exam (CHSPE) as regular high school graduates."

In order to adjust the rates to justify comparing the data from before and after this change, these calculations were performed on the graduation rate data from 2016 onward:[1]

Number of Graduates = Regular High School Diploma Graduates + CHSPE Completer Count + Adult Education High School Diploma Earners
Number of Students In Cohort = Number of Students In Cohort - Number of Students Who Transfer to Adult Education Or Community College

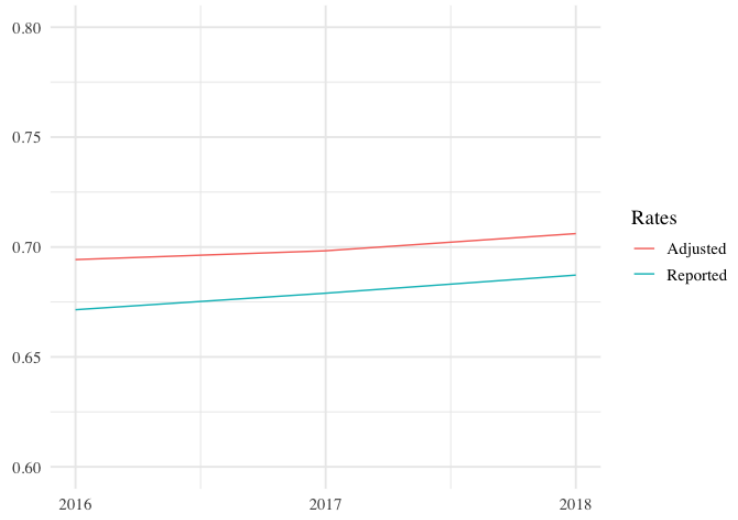

Figure 1: **Difference in Adjusted and Reported Four-Year Graduation Rates of English Language Learners**

Below is a table that demonstrates the difference between these adjusted and the state-reported values (i.e. according to the new methodology) and the difference between the graduation rates calculated according to these numbers.

[1]These categories on the right side of each equation are disjoint, so no students are double counted.

Table 3: **Adjusted and State-Reported Values for Statewide Number of English Learner Graduates and Number in English Learner Cohort**

Year	Number of Graduates (Adjusted)	Number of Graduates (Reported)	Number in Cohort (Adjusted)	Number in Cohort (Reported)
2016-2017	48,871	48,738	70,391	72,583
2017-2018	50,978	50,847	73,004	74,886
2018-2019	50,249	50,108	71,163	72,913

3.1.2 Colorado Department of Education

The data on four-year graduation rates from Colorado is also organized by district and includes the subgroup (e.g. English learner), number of students in the cohort and number of graduates within the cohort.

The Colorado graduation data encompasses the same period as the California graduation data, which is the 2009-2010 school year through the 2018-2019 school year. There are 1,873 observations in the dataset.

Table 4: **Summary Statistics of the Colorado EL Graduation Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Cohort Size	1,873	37.089	139.619	0	0	12	2,224
Number of Graduates	1,873	22.442	83.811	0	0	9	1,525
EL Graduation Rate	1,150	0.711	0.268	0.000	0.556	1.000	1.000

3.2 Dropout Rates

3.2.1 California Department of Education

Like the graduation data, the data on dropout rates of English language learners is sourced from the California Department of Education and organized by district. It spans the years 2009 to 2019. There are 2,354 observations.

Note that we exclude the Colorado English learner dropout rate from our analysis because it does not meet assumptions necessary for the difference-in-differences strategy that we adopt.

Table 5: **Summary Statistics of the California EL Dropout Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Dropout Count	2,354	51.014	105.366	0.000	10.000	53.750	1,946.000
EL Dropout Rate	2,354	0.184	0.138	0.000	0.093	0.234	0.974

3.3 Enrollment

3.3.1 California Department of Education

The California enrollment data used is from the 2013-2014 school year to the 2018-2019 school year, and is mainly used in calculating the per-student LCFF funding amounts. The data is organized by school and was transformed to group schools by district. As of June 2015, California had 977 public school districts. There are 6,159 observations.

Table 6: **Enrollment of California K-12 Public Schools by District, 2013-2019**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Total Enrollment	6,159	6,061.675	21,966.250	2	363	5,883.5	653,826
Grade 12 Enrollment	6,159	479.165	1,659.293	0	0	355	43,450

3.3.2 Colorado Department of Education

The Colorado enrollment data is also from the 2013-2014 school year to the 2018-2019 school year. As of June 2015, Colorado had 181 public school districts. There are 1,116 observations.

Table 7: **Enrollment of Colorado K-12 Public Schools by District, 2013-2019**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Total Enrollment	1,116	4,831.498	12,712.190	3	215	2,343.8	91,998
Grade 12 Enrollment	1,116	353.857	910.245	0	16	166	6,787

3.4 Local Control Funding Formula Snapshots

The Local Control Funding Formula Snapshots from California include the amount of base grant funding, supplemental grant funding, concentration grant funding, total local revenue, net state aid, and the percentage of students designated as high needs used in the calculation of funding. This data spans from 2013 to 2019, which is the time period from when LCFF was established to the time it was fully funded, and is broken down by the Local Education Agency (LEA). In most cases, this is equivalent to a breakdown by district; the cases where it does not are charter schools, whose data has been collapsed into their respective districts or categorized on their own if they do not correspond to a traditional district. After performing this transformation, this data contains 6,031 observations.

Table 8: **Summary statistics of the LCFF Funding Snapshot Data (in dollars)**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Base Grant Funding	6,031	46,178,325	156,923,024	0	2,577,816	45,544,482	4,869,511,869
Supplemental Grant Funding	6,031	5,739,015	24,591,591	0	276,515.5	4,627,668	787,890,434
Concentration Grant Funding	6,031	3,096,975	19,832,400	0	0	1,563,052	661,953,795

Note that the maximum values in this table are driven by the Los Angeles Unified School District, which serves over 600,000 students.

4 Theoretical Discussion

In order to treat our difference-in-differences estimator as arguably causal, we will address two assumptions required for this specific strategy: that the granting of treatment is unrelated to the baseline metrics and that the treatment and control group exhibit parallel trends.

Since we examine a funding change that took place at a statewide legislative level, the issuance of funds is clearly not related to a difference in baseline metrics between California and Colorado. However, in comparing California and Colorado districts, we only include California districts that received a non-zero amount of base-grant funding from the LCFF, which makes this assumption important to discuss. California has 1,037 school districts as of the 2019-2020 school year, of which approximately 80 are designated as "basic aid." These districts are sometimes also referred to intuitively as "excess tax" districts because they are able to fund their revenue limit entirely through property taxes. Because of this, they receive no general purpose state funding and do not directly benefit from the LCFF. Then, because LCFF funding allocations are only based on revenue limits and have no dependency on school performance, we consider this condition as being met.

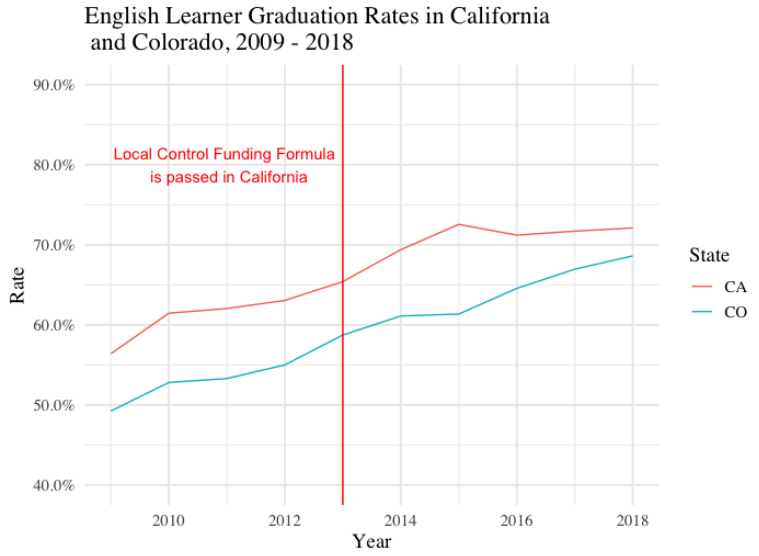

Figure 2: **English Language Learner Four-Year Graduation Rates in California and Colorado, 2009 - 2018**

The second assumption of parallel trends is critical to estimating credible difference-in-differences coefficients. In this condition, we seek to confirm that our treatment and control groups, California and Colorado respectively, saw similar trends in the four-year high school graduation rates of English learners in the period prior to the passage of the LCFF legislation. This allows us to posit that, in the absence of the reform, the change in the graduation rates from the baseline would have been identical or nearly identical for both states. When this holds, we can appropriately claim that the difference that we observe in the post-period can be attributed to the legislative variation.

We opt for a visual inspection of the pre-trends, beginning in the school year 2009-2010, which then includes four graduating classes before the change was enacted. Patterns in the statewide graduation rate of English language learners in California and Colorado are similar in the pre-treatment period, corresponding in both rises and slight dips. We deem that the parallel trend assumption holds.

5 Empirical Strategy

We exploit the passage of LCFF immediately before the 2013-2014 school year as a source of variation in the funding to school districts with high-needs students. Then, we use this as a threshold using a difference-in-differences design, considering the years 2009-2010 to 2012-2013 as time 0 and years after this as time 1. We consider two groups: Colorado school districts and California school districts that received LCFF funding. Colorado is utilized as our untreated group, while California is our treatment group.

We then create an interaction term between the indicator variables of treatment and time, which is our difference-in-differences estimator. That is, we show how the change in English learner graduation and dropout rates for districts in California differed from those for districts in Colorado over the same period. We estimate three sets of regressions to identify this effect across states.

5.1 Difference-in-Differences Estimation

Our first regression estimates the effect of time, treatment and the interaction between these terms, with no other factors.

$$\text{EL Dropout Rate} = \beta_{D0} + \beta_{D1}\text{Treated} + \beta_{D2}\text{Time} + \beta_{D3}\text{Treated * Time} + \varepsilon_D \quad (1)$$

$$\text{EL Graduation Rate} = \beta_{G0} + \beta_{G1}\text{Treated} + \beta_{G2}\text{Time} + \beta_{G3}\text{Treated * Time} + \varepsilon_G \quad (2)$$

We also estimate these values for overall graduation rates between California and Colorado.

5.1.1 Difference-in-Differences Estimation Including Log-Transformed Cohort Size

Since California districts tend to be larger and have higher absolute numbers of English learners than Colorado, we also perform a difference-in-differences regression that includes the log of the English learner cohort size to decrease the risk of this demographic variance biasing our estimate. We transform the cohort size with a logarithm because it is highly right-skewed: the median value is 68 and the mean is 198.1, which is because of some of the particularly large districts in California, such as Los Angeles Unified.

The treated and time variables are the same as above in these equations.

$$\begin{aligned}\text{EL Dropout Rate} = {} & \beta_{DSize0} + \beta_{DSize1}\text{Treated} + \beta_{DSize2}\text{Time} + \beta_{DSize3}\text{Treated * Time} \\ & + \beta_{DSize4}\text{Log Cohort Size} + \varepsilon_{DSize}\end{aligned} \quad (3)$$

$$\begin{aligned}\text{EL Graduation Rate} = {} & \beta_{GSize0} + \beta_{GSize1}\text{Treated} + \beta_{GSize2}\text{Time} + \beta_{GSize3}\text{Treated * Time} \\ & + \beta_{GSize4}\text{Log Cohort Size} + \varepsilon_{DSize}\end{aligned} \quad (4)$$

5.1.2 Difference-in-Differences Estimation Including Estimates by Year

In our last difference-in-differences estimation, we add additional nuance to time. Since the LCFF funding was increased each year from its implementation in 2013 until it reached its full level of funding in 2018, we are interested in the effect of the passing of time over this period.

We add indicator variables for each year from 2013: Year 1 is 1 for 2013 and 0 for all other years, Year 2 is 1 for 2014 and 0 for all other years, Year 3 is 1 for 2015 and 0 for all other years, etc. Thus, years from before 2013 are coded as 0 in all of these variables. Treated remains the same as our previous regressions, in which California takes a value of 1 and Colorado takes a value of 0. We include interaction terms between treatment and time for each year.

$$\begin{aligned}\text{EL Dropout Rate} = \beta_{DYear0} + \sum_{n=1}^{6}(\beta_{DYear_i} Year_i + \beta_{DYear_ix} Year_i * Treated) \\ + \beta_{DYear7}\text{Treated} + \varepsilon_{DYear}\end{aligned} \tag{5}$$

$$\begin{aligned}\text{EL Graduation Rate} = \beta_{GYear0} + \sum_{n=1}^{6}(\beta_{GYear_i} Year_i + \beta_{GYear_ix} Year_i * Treated) \\ + \beta_{GYear7}\text{Treated} + \varepsilon_{GYear}\end{aligned} \tag{6}$$

5.2 OLS Estimation

We also make use of ordinary least squares regression in order to examine the relationship between the amount LCFF funding a district receives and our metrics of interest within California.

5.2.1 On Effect of Per-Student LCFF Grant Funding

Here, our funding variables are separated by category: base grant, concentration and supplement grant. We also divide total funding in each category by the enrollment to obtain

funding levels per pupil. Dividing by 1000 gives us these values in units of thousands of dollars.

$$\begin{aligned}\text{EL Dropout Rate} = {} & \beta_{DFunding0} + \beta_{DFunding1}\text{Per-Student Base Grant Amount} \\ & + \beta_{DFunding2}\text{Per-Student Concentration Grant Amount} \\ & + \beta_{DFunding3}\text{Per-Student Supplemental Grant Amount} + \varepsilon_{DFunding}\end{aligned} \tag{7}$$

$$\begin{aligned}\text{EL Graduation Rate} = {} & \beta_{GFunding0} + \beta_{GFunding1}\text{Per-Student Base Grant Amount} \\ & + \beta_{GFunding2}\text{Per-Student Concentration Grant Amount} \\ & + \beta_{GFunding3}\text{Per-Student Supplemental Grant Amount} + \varepsilon_{GFunding}\end{aligned} \tag{8}$$

5.2.2 On Effect of Level of Treatment of LCFF Funding

We finally generalize the amount of funding received by creating simple treatment groups: districts that received above the median level of per-student base grant funding are considered "high treatment" and are coded as 1 in the "Above Median Base Grant" variable. Districts below or at the median are coded as 0. The same logic holds for concentration grant funding and supplemental grant funding.

$$\begin{aligned}\text{EL Dropout Rate} = {} & \beta_{DMedian0} \\ & + \beta_{DMedian1}\text{Above Median Base Grant} \\ & + \beta_{DMedian2}\text{Above Median Concentration} \\ & + \beta_{DMedian3}\text{Above Median Supplemental} + \varepsilon_{DMedian}\end{aligned} \tag{9}$$

$$\begin{aligned}\text{EL Graduation Rate} = {} & \beta_{GMedian0} \\ & + \beta_{GMedian1}\text{Above Median Base Grant} \\ & + \beta_{GMedian2}\text{Above Median Concentration} \\ & + \beta_{GMedian3}\text{Above Median Supplemental} + \varepsilon_{GMedian}\end{aligned} \tag{10}$$

6 Results/Evidence

6.1 Within California

Our OLS results examine the effect of different levels of funding received by treated school districts within California and allow us a foundation from which to assess and verify the trends we find between Colorado and California. These results from within California support a positive relationship between increasing LCFF funding and increasing four-year graduation results while decreasing dropout rates among the same cohort.

Districts that received above the median amount of per-student base grant funding and per-student supplemental grant funding exhibited higher rates of graduation and lower rates of dropout at a statistically significant level.

Table 9: **OLS Estimate of Impact of Level of Treatment on Graduation and Dropout Rates (Within California)**

	Dependent variable:	
	EL Dropout Rate	EL Graduation Rate
	(1)	(2)
Above Median Per-Student Base Grant Funding	-0.059^{***}	0.046^{***}
	(0.007)	(0.008)
Above Median Per-Student Concentration Grant Funding	-0.057	-0.034
	(0.055)	(0.076)
Above Median Per-Student Supplemental Grant Funding	-0.279^{***}	0.406^{***}
	(0.049)	(0.069)
Constant	0.529^{***}	0.364^{***}
	(0.026)	(0.032)
Observations	1,629	2,206
R^2	0.162	0.090
Adjusted R^2	0.161	0.089
Residual Std. Error	0.137 (df = 1625)	0.195 (df = 2202)
F Statistic	104.762^{***} (df = 3; 1625)	72.646^{***} (df = 3; 2202)

In particular, districts that received above the median amount of per-student base grant funding had on average a graduation rate 4.6 percentage points higher and a dropout rate 5.9 percentage points lower than a district that received at or below the median. Districts that received above the median amount of per-student supplemental grant funding had on average a graduation rate 40.6 percentage points higher and a dropout rate 27.9 percentage points lower than a district that received at or below the median.

The difference is especially large for the above median per-student supplemental funding – recall that the supplemental grant amount is equal to 20% of the base grant amount a district receives multiplied by the district's percentage of students who are English learners, eligible for free or reduced-price meals and foster youth. Then, districts receiving above the median amount of per-student supplemental funding are more likely to have larger populations of English learners, which could indicate that the districts who felt the effects of the LCFF most strongly were the districts with relatively high shares of English learners.

There is no significant effect caused by above median per-student concentration grant funding; concentration grant funding is equal to 50% of the base grant amount a district received multiplied by the percentage of students designated high-needs above 55%.

We come to a similar finding for per-student base grant amounts when we look at the funding in thousands of dollars as our units; for every $1,000 additional dollars a district received in per-student base grant funding, the graduation rate increased by 7.3 percentage points and the dropout rate decreased by 5.8 percentage points on average.

However, our per-student supplemental grant funding has adverse impacts on these metrics when considered with these units. For every $1,000 additional dollars a district received in per-student supplemental grant funding, the graduation rate decreased by 11.8 percentage points and the dropout rate increased by 5.2 percentage points on average. An explanation for this could be that there is a trade-off between maximizing funding received and minimizing the cohort size of high-needs students to better target efforts: Districts may need some critical mass of English language learners in order to see significant change, but

if the cohort size is too large, it may be overwhelming for the educational agency to meet student needs.

Table 10: **OLS Estimate of LCFF Dollars on English Learner Dropout and Graduation Rates (Within California)**

	Dependent variable:	
	Dropout Rate	Graduation Rate
In thousands of dollars	(1)	(2)
Per-Student Base Grant Funding	-0.058^{***}	0.073^{***}
	(0.003)	(0.004)
Per-Student Concentration Grant Funding	-0.010	0.057^{***}
	(0.014)	(0.018)
Per-Student Supplemental Grant Funding	0.052^{**}	-0.118^{***}
	(0.022)	(0.027)
Constant	0.561^{***}	0.281^{***}
	(0.021)	(0.029)
Observations	1,534	1,998
R^2	0.213	0.135
Adjusted R^2	0.211	0.133
Residual Std. Error	0.127 (df = 1530)	0.188 (df = 1994)
F Statistic	137.673^{***} (df = 3; 1530)	103.434^{***} (df = 3; 1994)
Note:		*p<0.1; **p<0.05; ***p<0.01

6.2 Comparing Colorado and California

Then, we look at the difference in changes in English learner graduation and English learner dropout rates between districts in California and in Colorado over the same time period.

In our first regression on graduation rates, we have indicator variables for treatment, time and the interaction between treatment and time. On average, California districts had a graduation rate 39.3 percentage points higher than Colorado districts, but for both groups, graduation rates decreased across our time threshold. After 2013, graduation rates were on

average 30.4 percentage points lower than those before 2013. Our estimate of the coefficient of the interaction of time and treatment is positive at 0.358.

Table 11: **Difference-in-Differences Estimates on Graduation Rates of English Language Learners in California and Colorado**

	Dependent variable:
	EL Graduation Rate
Treated	0.393^{***}
California vs. Colorado	(0.011)
Time	-0.304^{***}
Pre- and Post-2013	(0.013)
Treated * Time	0.358^{***}
	(0.014)
Constant	0.311^{***}
	(0.010)
Observations	4,523
R^2	0.632
Adjusted R^2	0.631
Residual Std. Error	0.201 (df = 4519)
F Statistic	$2{,}582.834^{***}$ (df = 3; 4519)

Note:
*p<0.1; **p<0.05; ***p<0.01

This indicates that the treatment positively affected English learners in districts in California compared to Colorado over the same time period. We estimate these coefficients for overall graduation rates between districts in California and Colorado but find no statistically significant effects; the table for this regression can be found in the appendix.

We also include the logarithm of the English learner cohort size to our regression to see if the difference-in-differences estimator is overestimated due to the fact that California has larger districts and thus larger numbers of English learner students.

Table 12: **Difference-in-Differences Estimates on Graduation Rates of English Learners in California and Colorado, Including Log-Transformed Cohort Size**

	Dependent variable:
	EL Graduation Rate
Treated	0.448^{***}
	(0.012)
Time	-0.304^{***}
	(0.013)
Treated * Time	0.354^{***}
	(0.014)
Log of EL Cohort Size	-0.022^{***}
	(0.002)
Constant	0.361^{***}
	(0.011)
Observations	4,523
R^2	0.640
Adjusted R^2	0.640
Residual Std. Error	0.199 (df = 4518)
F Statistic	$2{,}008.238^{***}$ (df = 4; 4518)

Note:
*p<0.1; **p<0.05; ***p<0.01

The directions of the effects remain the same and the impact on the magnitude of the effects caused by including the log of the cohort size are small; in the estimates of this model, districts in California that received LCFF funding saw on average a 35.4 percentage point increase in the graduation rate of English language learners as compared to the unchanged districts in Colorado over our years of interest. (In our previous regression, this value was 35.8.)

The cohort size has a statistically significant negative effect on graduation rate, implying that districts with higher numbers of English learners have lower graduation rates than

districts with lower numbers of English learners on average.

Finally, since the LCFF funding amount was reached by gradually increasing the amount of funding a district received between the years 2013 and 2018, we also construct a model including indicator variables for each year after the passage of the LCFF to determine if the effect was even across our time period.

Looking at only California first, it appears that the graduation rates increased steadily, with the peak of the effect in the 2015-2016 year. After this, the effect tapers off. The figure below demonstrates the relative sizes of these yearly effects.

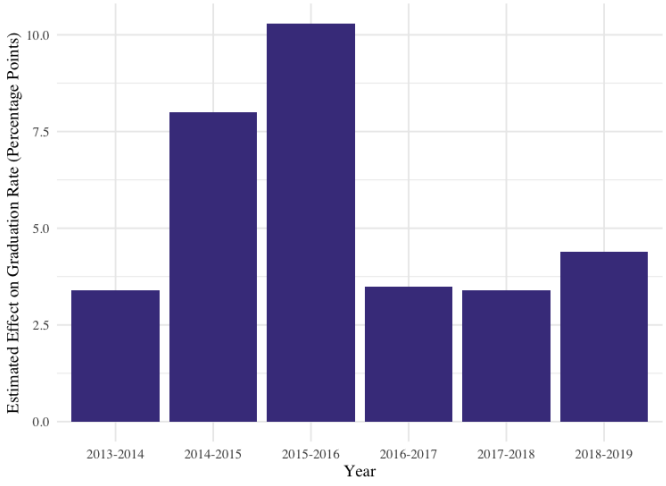

Figure 3: **Relative Effects of Each Time Period on Graduation Rate (Within California)**

Table 13: OLS Estimate of Effect of Staggered Dispersal of Funds on Graduation Rates Within California

	Dependent variable:
	EL Graduation Rate
First year after LCFF passage (2013-2014)	0.034***
	(0.011)
Second year after LCFF passage (2014-2015)	0.080***
	(0.011)
Third year after LCFF passage (2015-2016)	0.103***
	(0.011)
Fourth year after LCFF passage (2016-2017)	0.035***
	(0.011)
Fifth year after LCFF passage (2017-2018)	0.034***
	(0.011)
Sixth year after LCFF passage (2018-2019)	0.044***
	(0.011)
Constant	0.704***
	(0.005)
Observations	3,495
R^2	0.032
Adjusted R^2	0.030
Residual Std. Error	0.186 (df = 3488)
F Statistic	19.307*** (df = 6; 3488)
Note:	*p<0.1; **p<0.05; ***p<0.01

Then, comparing California and Colorado and including our treated and interaction variables again, we see a similar though less dramatic trend: the difference before California and Colorado over the same time period increased in the first three years of the LCFF and peaked in the third year (2015-2016).[2]

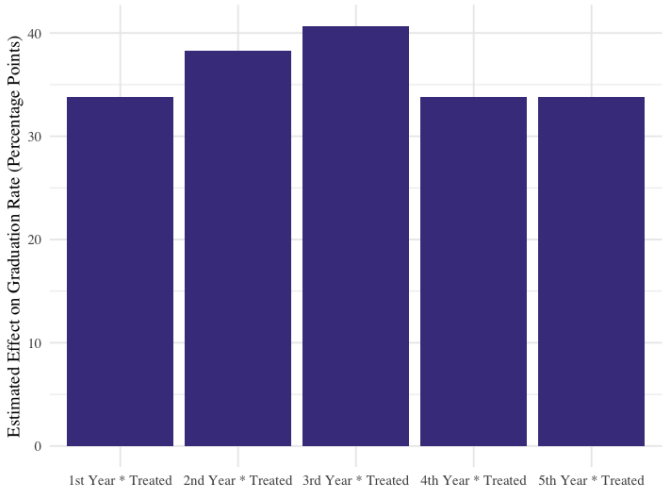

Figure 4: **Relative Effects of Treatment * Year on Graduation Rate (Between California and Colorado**

[2]Note that the interaction term between the sixth year (2018-2019) and treatment was removed because of collinearity.

Table 14: Difference-in-Differences Estimates of EL Graduation Rates By Year

	Dependent variable:
	EL Graduation Rate
First year after LCFF passage (2013-2014)	-0.304^{***}
	(0.021)
Second year after LCFF passage (2014-2015)	-0.304^{***}
	(0.021)
Third year after LCFF passage (2015-2016)	-0.303^{***}
	(0.021)
Fourth year after LCFF passage (2016-2017)	-0.304^{***}
	(0.021)
Fifth year after LCFF passage (2017-2018)	-0.303^{***}
	(0.021)
Sixth year after LCFF passage (2018-2019)	0.044^{***}
	(0.012)
Treated (CO vs. CA)	0.393^{***}
	(0.011)
Treated * First Year	0.338^{***}
	(0.024)
Treated * Second Year	0.383^{***}
	(0.024)
Treated * Third Year	0.407^{***}
	(0.024)
Treated * Fourth Year	0.338^{***}
	(0.024)
Treated * Fifth Year	0.338^{***}
	(0.024)
Constant	0.311^{***}
	(0.010)
Observations	4,523
R^2	0.635
Adjusted R^2	0.634
Residual Std. Error	0.200 (df = 4510)
F Statistic	653.209^{***} (df = 12; 4510)
Note:	*p<0.1; **p<0.05; ***p<0.01

7 Conclusion

California passed a new school funding formula, the Local Control Funding Formula, in 2013 with improving services for English learners as one of its primary goals. This piece of legislation greatly simplified the way in which districts are funded by the state and emphasizes equity by distributing both general funding and funding based on the number and percentage of students who are English learners, eligible for free or reduced-price meals, or in the foster care system. According to recent literature on the LCFF that analyzes how districts are spending this money, many districts have now allocated additional funds toward services such as English learner development teacher salaries and translation services for families of English learners.

In this paper, we analyzed data from the California and Colorado Departments of Education in order to estimate the effect of this additional funding from the LCFF on graduation and dropout rates in California. We discussed both OLS estimates within the state of California and difference-in-differences estimates between California and Colorado to examine how changes in these metrics in districts in California differed from those for districts in Colorado during the same time period.

We found that LCFF funding did indeed have a positive relationship with improving student outcomes. For every additional $1,000 that a district received in per-student base grant funding, the graduation rate of English learners increased by 7.3 percentage points and the dropout rate decreased by 5.8 percentage points. Additionally, for every additional $1,000 that a district received in per-student concentration grant funding, the graduation rate increased on average by 5.7 percentage points. Districts that received supplemental grant funding above the median per-student value saw even stronger results: on average, these districts had a graduation rate 40.6 percentage points higher and a dropout rate 27.9 percentage points lower than districts that were at or below the median.

Between California and Colorado, we found that California districts had on average a graduation rate 35.8 percentage points higher than Colorado districts. The effect was 35.4

percentage points higher for graduation rates when we included the log of English learner cohort size as a dependent variable. Additionally, the effect of these funds gradually increased at the beginning of the period before peaking in the third year after the passage of the LCFF.

Overall, our results support that the LCFF had a positive effect on increasing four-year graduation rates of English learners. These results open new questions and point to possible future areas of research as well. One curious result, for instance, is the sensitivity of graduation rates to additional funding compared to dropout rates, as demonstrated by the OLS estimates within the state of California. With each additional $1,000 received in per-student base grant funding, the percentage point increase in graduation rates is 20.55% higher than in dropout rates. While there are options outside of graduating in four years or dropping out, we would expect that a large enough number of students would act among these two choices that the differential in the treatment's impact would not be as dramatic as it is.

Additionally, these results are surprising in that the LCFF funding was able to have such a significant impact on older students almost immediately after districts started receiving their allocations. The cohort which saw the largest comparative increase, the class of 2017, would have been freshmen at the time of LCFF's passage. Literature on English language learners tends to note that intervention with English language learners is generally most effective the earlier it takes place. Thompson 2017 describes a key "reclassification window" that takes place during elementary school and finds that students who are not reclassified as English proficient by this time are then less likely to ever be reclassified. Saunders et al 2008 comes to a similar finding in the Los Angeles Unified School District in a study of predictors of high school graduations. Students who were designated as English language learners in 9th grade were less likely to graduate in four years than students who had been reclassified before this time at a rate of 33% compared to 58% respectively. This body of research on the importance of early support for English language learners seems to run contradictory to our findings.

Because of this, an important future research topic could involve using our results to identify the districts who were most successful in improving these metrics and analyzing both their budgets and their Local Control and Accountability Plans. Similarities in strategy, staff composition or demographics of such districts could influence policy at a local or state-level to better support high-school-aged English language learners.

In closing, the number of English language learners in K-12 public schools systems across the country have surged in the last 20 years and continues to trend upward. This additional diversity in our schools can make it difficult for educators to support historically disadvantaged groups without adequate assistance and funding. California's switch to the Local Control Funding Formula improved important English language learner student outcomes across the state and, as the supply of these students continues to rise nationwide, it is crucial to continue to identify and implement effective measures to support these pupils.

8 References

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9 Appendix

Table 1: **Local Control Funding Formula Per-Student Grant Amounts**

Grade Span	Base	Supplemental	Concentration
K - 3	$8,141	$1,628	$4,070
4 - 6	$7,484	$1,497	$3,742
7 - 8	$7,707	$1,541	$3,854
9 - 12	$9,163	$1,833	$4,581

Table 2: **Summary statistics of the LCFF Funding Snapshot Data (in dollars)**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Base Grant Funding	6,031	46,178,325	156,923,024	0	2,577,816	45,544,482	4,869,511,869
Supplemental Grant Funding	6,031	5,739,015	24,591,591	0	276,515.5	4,627,668	787,890,434
Concentration Grant Funding	6,031	3,096,975	19,832,400	0	0	1,563,052	661,953,795

Table 3: **Summary Statistics of the California EL Graduation Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Cohort Size	3,495	243.350	657.394	9	39	261.5	15,929
Number of Graduates	3,495	163.187	365.976	0	28	186	8,136
Cohort Graduation Rate	3,495	0.738	0.189	0.000	0.670	0.864	1.000

Table 4: **Summary Statistics of the California Overall Graduation Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Cohort Size	4,869	1,683.053	4,339.112	11	213	1,930	101,334
Number of Graduates	4,869	1,376.674	3,266.657	0	159	1,638	70,496
Graduation Rate	4,869	0.822	0.189	0.000	0.801	0.936	1.000

Table 5: **Adjusted and State-Reported Values for Statewide Number of English Learner Graduates and Number in English Learner Cohort**

Year	Number of Graduates (Adjusted)	Number of Graduates (Reported)	Number in Cohort (Adjusted)	Number in Cohort (Reported)
2016-2017	48,871	48,738	70,391	72,583
2017-2018	50,978	50,847	73,004	74,886
2018-2019	50,249	50,108	71,163	72,913

Table 6: **Summary Statistics of the Colorado EL Graduation Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Cohort Size	1,873	37.089	139.619	0	0	12	2,224
Number of Graduates	1,873	22.442	83.811	0	0	9	1,525
EL Graduation Rate	1,150	0.711	0.268	0.000	0.556	1.000	1.000

Table 7: **Summary Statistics of the Colorado Overall Graduation Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Cohort Size	1,873	336.004	870.814	0	16	165	6,899
Number of Graduates	1,873	259.966	687.209	0	14	127	5,545
Graduation Rate	1,834	0.825	0.161	0.000	0.771	0.929	1.000

Table 8: **Summary Statistics of the California EL Dropout Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Dropout Count	2,354	51.014	105.366	0.000	10.000	53.750	1,946.000
EL Dropout Rate	2,354	0.184	0.138	0.000	0.093	0.234	0.974

Table 9: **Summary Statistics of the Colorado EL Dropout Rate Data**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
EL Dropout Count	1,857	10.716	48.791	0	0	2	635
EL Dropout Rate	1,456	0.024	0.057	0.000	0.000	0.032	1.000

Table 10: **Enrollment of California K-12 Public Schools by District, 2013-2019**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Total Enrollment	6,159	6,061.675	21,966.250	2	363	5,883.5	653,826
Grade 12 Enrollment	6,159	479.165	1,659.293	0	0	355	43,450

Table 11: **Enrollment of Colorado K-12 Public Schools by District, 2013-2019**

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Total Enrollment	1,116	4,831.498	12,712.190	3	215	2,343.8	91,998
Grade 12 Enrollment	1,116	353.857	910.245	0	16	166	6,787

Table 12: **OLS Estimate of Impact of Level of Treatment on Graduation and Dropout Rates (Within California)**

	Dependent variable:	
	EL Dropout Rate	EL Graduation Rate
	(1)	(2)
Above Median Per-Student Base Grant Funding	-0.059^{***}	0.046^{***}
	(0.007)	(0.008)
Above Median Per-Student Concentration Grant Funding	-0.057	-0.034
	(0.055)	(0.076)
Above Median Per-Student Supplemental Grant Funding	-0.279^{***}	0.406^{***}
	(0.049)	(0.069)
Constant	0.529^{***}	0.364^{***}
	(0.026)	(0.032)
Observations	1,629	2,206
R^2	0.162	0.090
Adjusted R^2	0.161	0.089
Residual Std. Error	0.137 (df = 1625)	0.195 (df = 2202)
F Statistic	104.762^{***} (df = 3; 1625)	72.646^{***} (df = 3; 2202)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 13: **OLS Estimate Effect of LCFF Dollars on English Learner Dropout and Graduation Rates (Within California)**

	Dependent variable:	
	Dropout Rate	Graduation Rate
In thousands of dollars	(1)	(2)
Per-Student Base	-0.058^{***}	0.073^{***}
Grant Funding	(0.003)	(0.004)
Per-Student Concentration	-0.010	0.057^{***}
Grant Funding	(0.014)	(0.018)
Per-Student Supplemental	0.052^{**}	-0.118^{***}
Grant Funding	(0.022)	(0.027)
Constant	0.561^{***}	0.281^{***}
	(0.021)	(0.029)
Observations	1,534	1,998
R^2	0.213	0.135
Adjusted R^2	0.211	0.133
Residual Std. Error	0.127 (df = 1530)	0.188 (df = 1994)
F Statistic	137.673^{***} (df = 3; 1530)	103.434^{***} (df = 3; 1994)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 14: **Difference-in-Differences Estimates on Graduation Rates of English Language Learners in California and Colorado**

	Dependent variable:
	EL Graduation Rate
Treated	0.393^{***}
California vs. Colorado	(0.011)
Time	-0.304^{***}
Pre- and Post-2013	(0.013)
Treated * Time	0.358^{***}
	(0.014)
Constant	0.311^{***}
	(0.010)
Observations	4,523
R^2	0.632
Adjusted R^2	0.631
Residual Std. Error	0.201 (df = 4519)
F Statistic	$2{,}582.834^{***}$ (df = 3; 4519)

Note:
*p<0.1; **p<0.05; ***p<0.01

Table 15: **Difference-in-Differences Estimates on Graduation Rates of English Learners in California and Colorado, Including Log-Transformed Cohort Size**

	Dependent variable:
	EL Graduation Rate
Treated	0.448^{***}
	(0.012)
Time	-0.304^{***}
	(0.013)
Treated * Time	0.354^{***}
	(0.014)
Log of EL Cohort Size	-0.022^{***}
	(0.002)
Constant	0.361^{***}
	(0.011)
Observations	4,523
R^2	0.640
Adjusted R^2	0.640
Residual Std. Error	0.199 (df = 4518)
F Statistic	$2{,}008.238^{***}$ (df = 4; 4518)

Note:
*p<0.1; **p<0.05; ***p<0.01

Table 16: **OLS Estimate of Effect of Staggered Dispersal of Funds on Graduation Rates Within California**

	Dependent variable:
	EL Graduation Rate
First year after LCFF passage (2013-2014)	0.034***
	(0.011)
Second year after LCFF passage (2014-2015)	0.080***
	(0.011)
Third year after LCFF passage (2015-2016)	0.103***
	(0.011)
Fourth year after LCFF passage (2016-2017)	0.035***
	(0.011)
Fifth year after LCFF passage (2017-2018)	0.034***
	(0.011)
Sixth year after LCFF passage (2018-2019)	0.044***
	(0.011)
Constant	0.704***
	(0.005)
Observations	3,495
R^2	0.032
Adjusted R^2	0.030
Residual Std. Error	0.186 (df = 3488)
F Statistic	19.307*** (df = 6; 3488)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 17: **Difference-in-Differences Estimates of EL Graduation Rates By Year**

	Dependent variable:
	EL Graduation Rate
First year after LCFF passage (2013-2014)	-0.304^{***}
	(0.021)
Second year after LCFF passage (2014-2015)	-0.304^{***}
	(0.021)
Third year after LCFF passage (2015-2016)	-0.303^{***}
	(0.021)
Fourth year after LCFF passage (2016-2017)	-0.304^{***}
	(0.021)
Fifth year after LCFF passage (2017-2018)	-0.303^{***}
	(0.021)
Sixth year after LCFF passage (2018-2019)	0.044^{***}
	(0.012)
Treated (CO vs. CA)	0.393^{***}
	(0.011)
Treated * First Year	0.338^{***}
	(0.024)
Treated * Second Year	0.383^{***}
	(0.024)
Treated * Third Year	0.407^{***}
	(0.024)
Treated * Fourth Year	0.338^{***}
	(0.024)
Treated * Fifth Year	0.338^{***}
	(0.024)
Constant	0.311^{***}
	(0.010)
Observations	4,523
R^2	0.635
Adjusted R^2	0.634
Residual Std. Error	0.200 (df = 4510)
F Statistic	653.209^{***} (df = 12; 4510)
Note:	*p<0.1; **p<0.05; ***p<0.01

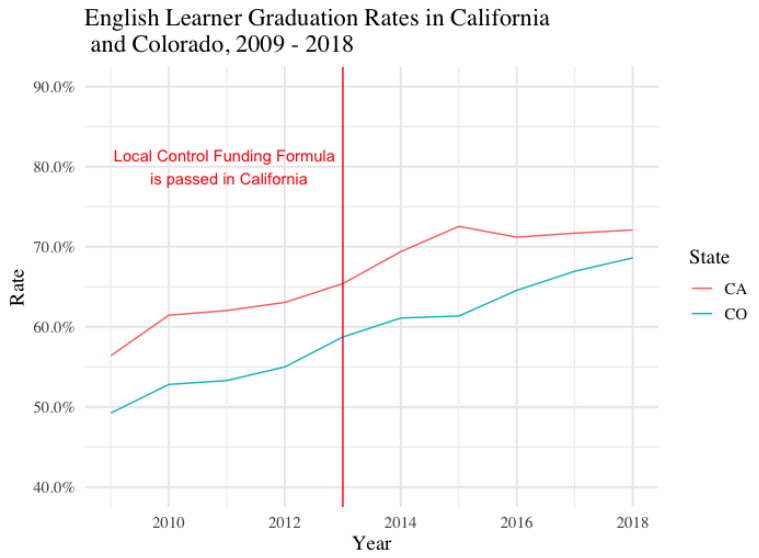

Figure 1: **English Language Learner Four-Year Graduation Rates in California and Colorado, 2009 - 2018**

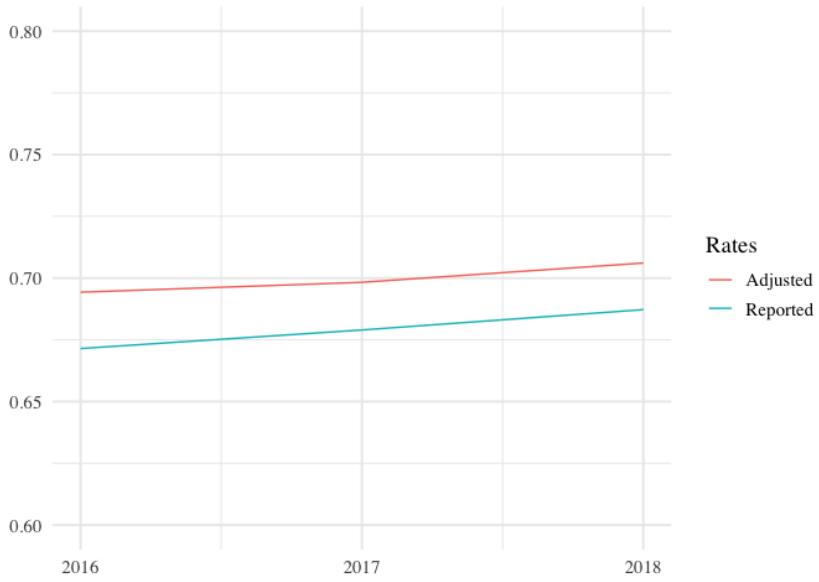

Figure 2: **Difference in Adjusted and Reported Four-Year Graduation Rates of English Language Learners**

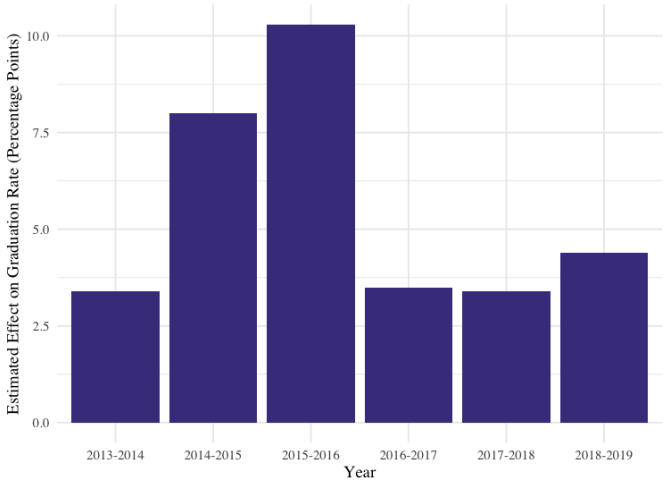

Figure 3: **Relative Effects of Each Time Period on Graduation Rate (Within California)**

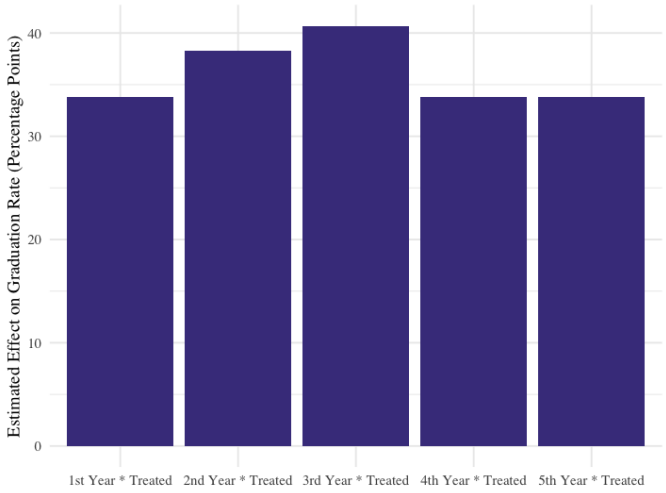

Figure 4: **Relative Effects of Treatment * Year on Graduation Rate (Between California and Colorado**