ECONOMIC IMPACTS OF IMPROVED EDUCATIONAL PERFORMANCE AND THE IMPACTS OF ALTERNATIVE SOURCES OF EDUCATION FUNDING ON THE COLORADO ECONOMY

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This paper is the second of two parts. The first paper provided analysis quantifying the economic impacts of the new Public School Finance Act (created by SB 13-213) and Amendment 66, while this paper discusses the economic impacts of improved educational performance and analyzes different funding models.

Colorado Ballot Initiative 22 (Amendment 66) proposes increasing the Colorado individual income tax rate from the current 4.63% flat tax to a progressive tax of 5% for the first $75,000 earned and 5.9% for income in excess of $75,000. The corporate income tax rate under this initiative will remain at 4.63%. The proceeds of the income tax increase will generate an estimated $950 million per annum (adjusted for inflation) to be spent on pre-K-12 public education in Colorado (Senate Bill [SB] 13-213).

Multiple studies have attempted to quantify the economic benefits associated with improved education and increased funding. Some of these studies summarize the results of research that has been conducted, while others are longitudinal studies that follow student success over time. Several research studies focus on general investments in education, and others explore targeted investments, such as early childhood education or investments in technology. Results are often expressed as discounted lifetime "societal" benefits.

In breaking down various performance metrics, albeit greater attendance, grade-level performance on standardized tests, or lower classroom sizes, these impacts funnel to greater student achievement at the end of their pre-K-12 educational tenure as students enter the workforce or seek additional education.

Using the Regional Economic Models, Inc. (REMI) Tax-PI model, this paper was prepared to quantify the economic impacts of some of the benefits that may be attributable to improved education on the state of Colorado. The REMI model was built for Colorado and calibrated with Colorado revenues, expenditures, employment, and population. Pulling in examples of societal benefits from other studies, the research team explicitly modeled a reduction in dropout rates, leading to more high school graduates who earn higher salaries, are more productive workers, pay more taxes, command less public assistance, and have a lower presence in state prisons.

This paper quantifies a breakeven point, where educational benefits and spending outstrip the costs of the tax increase. This model examines three scenarios: a lower dropout rate, a higher graduation rate, and a higher college matriculation rate. Benefits may be scaled to some extent if it is believed wages or productivity will be higher based on measurable performance achievements of nondropouts and more graduates. Benefits from either lower dropout rates or higher graduation rates are observed in increased GDP, personal income, real disposable personal income, total employment, and private non-farm employment. The economic benefits of these changes in education are estimated to average $429-$532 million in additional state GDP between 2014 and 2040 (+0.1%) when compared to the baseline scenario. Additionally, personal income increases by an average of $171-$211 million (<1%) and total employment increases by 1,600-2,000 jobs (<1%) compared to baseline. When adding the impact of higher college matriculation rates to lower dropout or higher graduation rates, the economic benefits exceed many of the economic costs associated with the increased taxes, netting an additional $139 million in GDP on average between 2014 and 2040.

Last, this paper analyzes alternative taxes to fund pre-K-12 education, including a flat tax on individuals and corporations ranging from 5%–5.6%, or a one percentage point increase in the state sales tax rate (from 2.9% to 3.9%). From 2014–2040, these scenarios generate revenues ranging from an average of $849 million per year to $2.2 billion per year, but they also cause economic drag on the Colorado economy compared to a baseline scenario.

INTRODUCTION

In 2013, a partnership of public and private organizations joined together to provide Colorado lawmakers, policy makers, and business leaders with greater insight into the economic impact of public policy decisions that face the state and surrounding regions. The parties involved include the Common Sense Policy Roundtable, the Metro Denver Economic Development Corporation, and the Denver South Economic Development Partnership. The Business Research Division (BRD) of the Leeds School of Business at the University of Colorado Boulder was contracted by the consortium to provide third-party, nonbiased research that objectively analyzes the economic impacts of public policy. This consortium meets quarterly to discuss pressing economic issues impacting the state. For its first public policy issue, the consortium studied the economic impacts of Senate Bill 13-213 (Public School Finance Act) and Amendment 66 on the state's economy. The consortium licensed dynamic economic models from Regional Economic Models, Inc. (REMI) to study the economic impacts of policies. For this study, the BRD research team used the single-region, 70-sector, Tax-PI model built for Colorado and calibrated with Colorado revenues, expenditures, employment, and population.

Since embarking on the project, BRD researchers studied education in Colorado and met with principle stakeholders, including superintendents of school districts and the bill sponsor, Senator Michael Johnston. These stakeholders provided insight into the potential uses of new funding and how it might benefit education. The research team also met with representatives of the business community to hear their thoughts about the possible impacts of the school finance proposal on small business.

When modeling the impact of any policy change, a number of assumptions must be made. The model used for economic analysis illustrated scenarios of what could happen under the policy change, everything else held equal in the economy. Economies are inherently complex, and unanticipated shifts (e.g., technology, energy discoveries, recessions) cause the economy to grow faster or slower than anticipated. The collective wisdom shared with the research team helped shape the assumptions that are transparently presented in this report.

The first paper in this two-part series analyzed the economic impacts of the tax increase proposed in Amendment 66, as well as the education spending described in SB 13-213. This paper is a continuation of the first paper, delving into the estimated economic benefits of improved education on the state of Colorado based on literature and publicly available data that could be converted into economic impacts. This report identifies a breakeven point, where educational benefits and spending outstrip the costs of the tax increase. This paper begins by reviewing the performance metrics noted in SB 13-213, then describes the publicly available secondary data that the research team used to quantify the economic benefits associated with increased educational performance. The paper concludes with an analysis of alternative taxing measures that could be deployed for pre-k-12 education.

SB 13-213 Performance Metrics

A review of school finance in Colorado underscores the need for a revised funding model. The State has increasingly become the majority funder in many school districts as state laws inhibit the ability to raise funds locally. Literature exists that both supports and refutes the notion that education funding, particularly funding that targets early childhood education, results in personal and societal benefits. The literature reviewed for this study often compares no program to the existence of a program to assess the level of benefit. This legislation is largely intended to augment existing programs, thus resulting in *marginal* funding increases for program enhancements. This inhibits the ability to model economic benefits based on existing literature. Furthermore, the legislation itself lacks quantified objectives that would allow for economic measurement without making significant assumptions not supported by the legislative language.

An excerpt from SB 13-213 states,

> "THE GENERAL ASSEMBLY FINDS THAT THE PURPOSE OF INVESTING IN PUBLIC EDUCATION IS TO GENERATE SPECIFIC EDUCATIONAL OUTCOMES; AS SUCH, THE TWO MUST BE EVALUATED TOGETHER. IT IS NOT ENOUGH TO KNOW HOW MUCH IS INVESTED IN THE PRESCHOOL, ELEMENTARY, AND SECONDARY EDUCATION SYSTEM; IT IS MORE IMPORTANT TO KNOW HOW EFFECTIVE THE INVESTMENT IS IN ACHIEVING THE STANDARDS-BASED EDUCATION GOALS THE GENERAL ASSEMBLY HAS ESTABLISHED." (22-54.5-105 [2])

Furthermore, in section 22-54.5-105 (3), the bill elaborates,

> "THE DEPARTMENT MAY PREPARE THE REPORT OF THE RETURN ON THE INVESTMENT OF THE FUNDING PROVIDED BY THIS SECTION EITHER DIRECTLY OR BY CONTRACT WITH ONE OR MORE PROVIDERS. THE REPORT MUST ANALYZE THE RELATIONSHIP BETWEEN THE FUNDING INVESTMENTS MADE THROUGH THIS ARTICLE AND THE SUBSEQUENT LEVELS OF STUDENT ACADEMIC GROWTH AND ACHIEVEMENT, INCLUDING PROGRESS IN ELIMINATING THE GROWTH AND ACHIEVEMENT GAPS AMONG STUDENT GROUPS DISAGGREGATED BY RACE, AS MEASURED BY, AT A MINIMUM, THE STATEWIDE ASSESSMENTS, SCHOOL ATTENDANCE RATES, HIGH SCHOOL GRADUATION RATES, AND COLLEGE REMEDIATION RATES."

This paper quantifies academic growth and achievement in terms of economic benefits by examining select metrics mentioned in SB 13-213, as well as metrics noted in research papers. These metrics include a reduction in dropout rates, an increase in graduation rates, and an increase in college matriculation rates.

REDUCTION IN DROPOUTS

One benefit of increased educational performance may culminate in a decreased dropout rate and a higher graduation rate for Colorado public schools.

According to the Colorado Code of Regulations, the dropout rate is defined as

> "…the percentage of students in grades 7 through 12 who drop out of school in a given year between July 1 and June 30 and have not returned to an educational environment on or before the end of the school year or June 30. An educational environment is a public school within a School District or the Institute, nonpublic or private school, home-based education program (home school) pursuant to section 22-33-104.5, C.R.S., GED program, vocational education program, licensed eligible Facility, State-Operated Program, Detention Center, or other education program operated by the Department of Youth Corrections or Department of Corrections." CCR 301-1

By contrast, the graduation rate is calculated as

> "…the percentage of students from an end-of-year eighth grade cohort, adjusted for verified transfers in and out, who leave school as graduates, as defined by the School District or the Institute Charter School, in four years or less." CCR 301-1

In 2012, Colorado Department of Education (CDE) stated that the average dropout rate among Colorado schools stood at 2.9%, with 12,256 pupils recorded as dropping out. The percentage of dropouts and the absolute number of dropouts has improved each year over the past five years, equating to reductions between 403 and 2,503 per year as evidenced in Table 1.

TABLE 1: COLORADO DROPOUT STATISTICS, 2007-2012

Year	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Number of Dropouts	15,524	14,975	13,147	12,744	12,256
Percent Change in Dropouts	-13.9%	-3.5%	-12.2%	-3.1%	-3.8%
Absolute Change in Dropouts	-2,503	-549	-1,828	-403	-488

Source: Colorado Department of Education.

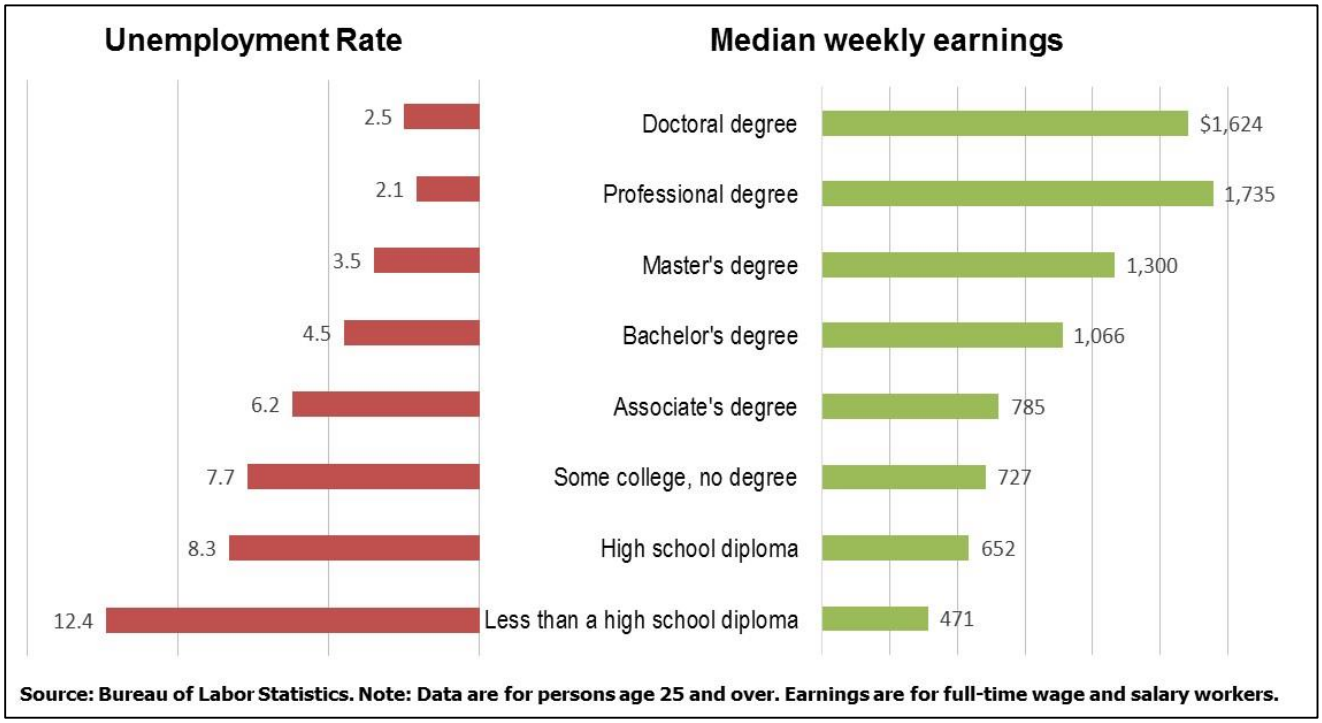
According to data prepared by the National Center for Education Statistics, New Hampshire recorded the lowest national dropout rate in the 2009-10 school year, at 1.2%. A dropout rate just below 1.2% would make Colorado the best in the nation. Assuming that the state can continue to improve at the pace achieved in 2011-2012 (~500 dropouts), it would take 15 years to bring the rate below 1.2%.[1] The benefits of a decreased dropout rate may include higher earnings, greater productivity, decreased social assistance, and lower incarceration rates.

Research shows greater lifetime earnings and lower unemployment rates for individuals who earn a high school diploma compared to individuals who do not. The Bureau of Labor Statistics reported lower unemployment rates and higher median weekly earnings of $652 in 2012 for individuals with a high

[1]This does not include an adjustment for the growth in school-age children enrolled in public P-12 education in Colorado.

school diploma versus $471 for individuals with less than a high school diploma—a difference of $181 per week. Annualized, this number is $9,412 in 2012 dollars.

FIGURE 1: EARNINGS AND UNEMPLOYMENT RATES BY EDUCATIONAL ATTAINMENT



Source: Bureau of Labor Statistics. Note: Data are for persons age 25 and over. Earnings are for full-time wage and salary workers.

Unadjusted for inflation, 500 fewer dropouts would yield $4.7 million in additional earnings per year in perpetuity. Over the period 2014-2020, this is an additional $1.4 billion in earnings, or approximately $2.5 billion when adjusted for inflation.

TABLE 2: WAGE BENEFITS OF A HIGH SCHOOL DIPLOMA FROM A LOWER DROPOUT RATE, 2014-2018

Year	2014	2015	2016	2017	2018
Beginning Number of Dropouts	12,256	11,756	11,256	10,756	10,256
Single Year Additional Graduates	500	500	500	500	500
Cumulative Additional Graduates	500	1,000	1,500	2,000	2,500
Ending Number of Dropouts	11,756	11,256	10,756	10,256	9,756
Dropout Rate	2.79%	2.68%	2.56%	2.44%	2.32%
HS Diploma Weekly Earnings[a]	$652	$652	$652	$652	$652
Less than HS Diploma Weekly Earnings[a]	$471	$471	$471	$471	$471
Earnings Difference[a]	$181	$181	$181	$181	$181
Difference x 52 Weeks[a]	$9,412	$9,412	$9,412	$9,412	$9,412
Real Potential Ann. Earnings Differential[a]	$4,706,000	$9,412,000	$14,118,000	$18,824,000	$23,530,000

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to earnings. Table illustrates the first five years of the assumptions between 2014 and 2040.

Greater educational attainment results not only in higher wages for the individuals, but workers are presumably more productive, lowering the cost of production and increasing output per worker. Potential earnings increase by 38.4% when the earnings of dropouts and high school graduates are compared. However, the expected change in the number of graduates to the total baseline employment

in Colorado increases at a rate of only 0.015% per year. The accumulation of additional graduates increases productivity linearly throughout the forecast horizon, resulting in a productivity change equal to $26.4 million in the first year and $563.7 million in 2040.

TABLE 3: PRODUCTIVITY BENEFITS OF A HIGH SCHOOL DIPLOMA FROM A LOWER DROPUTOUT RATE, 2014-2018

Year	2014	2015	2016	2017	2018
Weekly Earnings Change[a]	0.3843	0.3843	0.3843	0.3843	0.3843
Additional Graduates/Baseline Employment	0.0001	0.0003	0.0004	0.0005	0.0007
Increased Productivity	0.0001	0.0001	0.0002	0.0002	0.0003
Productivity Change x Baseline Output (Millions)	$26.4	$53.7	$81.7	$110.4	$139.8

[a]2012 dollars. Table illustrates the first five years of the assumptions between 2014 and 2040.

The positive impacts on social assistance are accounted for by increased earnings and productivity. The following information demonstrates the positive impact educational performance may have on social assistance expenditures. Higher income results in lower social assistance. The State of Colorado reported spending $6.4 billion ($1,233 per capita) on social assistance in 2011 and $6.7 billion ($1,318 per capita) on social assistance in 2012 (these figures are not reported by income or education). The Bureau of Labor Statistics reports average income from public assistance nationally by income cohort. For income cohorts that align with less than a high school education, public assistance, supplemental security income, and food stamps range between $475 and $1,566 per year, or an average of $1,040. Public assistance for the higher wage earners averaged $385 in 2012 for a differential of $655. Other forms of social assistance quantified average unemployment and workers' compensation between $78 and $384 per year, although the table also includes veterans' benefits.

TABLE 4: PUBLIC ASSISTANCE, SUPP. SECURITY INCOME, & FOOD STAMPS BY INCOME COHORT, 2012

Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	20000 To $29,999	$30,000 to $39,999	$40,000 to $49,999	$50,000 to $69,999	$70,000 and More
$475	$1,566	$1,377	$1,029	$753	$625	$396	$370	$150

Source: Bureau of Labor Statistics, Consumer Expenditure Survey.

Unadjusted for inflation, 500 fewer dropouts would yield $327,500 in additional social assistance savings per year in perpetuity. Over the period 2014-2020, this is an additional $98.3 million in savings, or approximately $165.5 million when adjusted for inflation.

TABLE 5: SOCIAL ASSISTANCE REDUCTION IN BENEFITS FROM A LOWER DROPOUT RATE, 2014-2018

Year	2014	2015	2016	2017	2018
Public Assistance, Supplemental Security Income, Food Stamps[a]	$655	$655	$655	$655	$655
Inflation-Adjusted Public Assistance	$675	$695	$716	$737	$759
Single Year Additional Graduates	500	500	500	500	500
Cumulative Additional Graduates	500	1,000	1,500	2,000	2,500
Real Potential Social Assistance Differential	$327,500	$655,000	$982,500	$1,310,000	$1,637,500
Potential Social Assistance Differential	$337,325	$694,890	$1,073,604	$1,474,417	$1,898,311

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to public assistance costs. Table illustrates the first five years of the assumptions between 2014 and 2040.

Increased funding may also increase student performance, lowering the necessity of college remediation. The following excerpts are from the Colorado Department of Higher Education's *2012 Legislative Report on Remedial Education*.

- Forty percent (40%) of students in the Colorado high school graduating class of 2011 who enrolled in a state public college or university were either assessed as needing remediation or enrolled in a remedial course in at least one academic subject.
- Of the total 9,862 students needing remediation, 7,853 were identified by way of their test scores; the additional 2,009 students were identified by way of their enrolling in a remedial course.
- Sixty-six (66%) of students enrolled in a two-year college and 24% of students at a four-year institution needed remediation.
- Most students required remediation in math (51%), followed by writing (31%) and reading (18%).
- More than a third of students needing math remediation were assigned to the lowest level course.
- Most students needing remediation in reading and writing needed only a single semester of remedial help before being ready for college work.

In a Department of Higher Education publication on frequently asked questions related to remediation, the department asserts,

> "Students and their families bear the brunt of the costs. For 2011-12, the estimated total cost of remedial instruction is $58.4 million, with $39.3 million in student tuition and $19.1 million in state funding for the institutions providing the remedial courses. By law, two-year colleges provide most remedial courses."

Without the methodology for calculating the $58.4 million spent on remedial instruction, the research team utilized data reported by the Department of Higher Education that show resident tuition for 30 credit hours ranges from $1,680 to $13,590. Thus, the average, unweighted 3-credit course costs $568.

TABLE 6: COMPARISON OF RESIDENT UNDERGRADUATE TUITION RATES, FY2012-13

Institution	FY 2012-13 Resident Tuition (30 CHRS)	Estimated Cost per 3-Credit Course
University of Colorado Boulder	$8,056	$806
University of Colorado Colorado Springs	$7,050	$705
University of Colorado Denver	$7,980	$798
Colorado State University	$6,875	$688
Colorado State University - Pueblo	$5,494	$549
Fort Lewis College	$4,800	$480
University of Northern Colorado	$5,464	$546
Adams State University	$3,816	$382
Colorado Mesa University	$6,102	$610
Metropolitan State University of Denver	$4,304	$430
Western State Colorado University	$4,627	$463
Colorado School of Mines	$13,590	$1,359
Colorado Community College System	$3,383	$338
Aims Community College	$2,021	$202
Colorado Mountain College	$1,680	$168

Source: Tuition from the Colorado Department of Education, calculations by BRD staff.

Unadjusted for inflation, reducing the need for just one remedial course for 9,862 Colorado high school graduates entering college yields $5.6 million in savings per year. Over the period 2014-2020, this is an additional $151.2 million in savings, or approximately $234.9 million when adjusted for inflation.[2] This reduction is not necessarily household savings that is spent on other goods and services, but largely a transfer to another course to fulfill graduation requirements.

TABLE 7: REMEDIATION REDUCTION BENEFITS FROM LOWER DROPOUT RATES, 2014-2018

Year	2014	2015	2016	2017	2018
Average 3-Credit Course[a]	$568	$568	$568	$568	$568
Inflation-Adjusted 3-Credit Course	$585	$603	$621	$639	$658
Single Year Reduction in Remediation	9,862	9,862	9,862	9,862	9,862
Real Potential Remediation Differential	$5,601,616	$5,601,616	$5,601,616	$5,601,616	$5,601,616
Potential Remediation Differential	$5,769,664	$5,942,754	$6,121,037	$6,304,668	$6,493,808

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to tuition. Table illustrates the first five years of the assumptions between 2014 and 2040.

Another benefit produced by fewer student dropouts includes the reduction in incarceration rates. According to the Colorado Department of Corrections, the average cost per inmate totaled $31,440 in FY2012, down from $32,344 in 2011. Approximately 32% of inmates are categorized as having less than a high school diploma or GED. Comparatively, according to the American Community Survey, only 10.2% of Colorado's population 25 years and older have less than a high school degree. Inmates totaled 22,009 in 2012—meaning an estimated 7,042 did not have a high school degree or GED equivalent, or nearly 2% of the 25 and older population without a high school diploma.

[2]Assumes inflation of 3%, despite recent trend of education prices growing faster than prices for all goods and services.

Unadjusted for inflation, reducing the number of individuals incarcerated yields $94.3 million in savings over the period 2014-2020, or approximately $158.9 million when adjusted for inflation.

TABLE 8: CRIME REDUCTION BENEFITS FROM LOWER DROOUT RATES, 2014-2018

Year	2014	2015	2016	2017	2018
Cost per Inmate[a]	$31,440	$31,440	$31,440	$31,440	$31,440
Inflation-Adjusted 3-Credit Course	$32,383	$33,355	$34,355	$35,386	$36,448
Single Year Additional Graduates	500	500	500	500	500
Cumulative Additional Graduates	500	1,000	1,500	2,000	2,500
Single Year Reduction in Inmates	10	10	10	10	10
Cumulative Reduction in Inmates	10	20	30	40	50
Real Annual Corrections Differential[a]	$314,400	$628,800	$943,200	$1,257,600	$1,572,000
Annual Corrections Differential	$323,832	$667,094	$1,030,660	$1,415,440	$1,822,379

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to costs per inmate. Table illustrates the first five years of the assumptions between 2014 and 2040.

This analysis assumes that positive impacts begin to accrue in year 1. Higher educational attainment is manifested in higher wages, greater worker productivity, decreases in social assistance, and reductions in incarceration rates.[3] These four combined impacts related to decreased dropout rates result in increases in employment, income, and output between 2014 and 2040 compared to baseline, with GDP increasing on average by $429.5 million (+0.1%).

TABLE 9: SUMMARY OF PRODUCTIVITY GAINS, 2014–2040, AVERAGE CHANGE FROM BASELINE SCENARIO

Category	Units	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 2014-2040
Total Employment	Thousands (Jobs)	0.5	1.3	2.0	2.2	1.6
	Percentage Change	0.0	0.0	0.0	0.0	0.0
Private Non-Farm Employment	Thousands (Jobs)	0.4	1.1	1.7	1.8	1.4
	Percentage Change	0.0	0.0	0.0	0.0	0.0
Gross Domestic Product	Millions of Fixed (2012) Dollars	101.3	282.9	482.7	584.9	429.5
	Percentage Change	0.0	0.1	0.1	0.1	0.1
Personal Income	Millions of Fixed (2012) Dollars	41.7	117.6	197.2	234.8	171.1
	Percentage Change	0.0	0.0	0.0	0.0	0.0
Real Disposable Personal Income	Millions of Fixed (2012) Dollars	33.6	93.8	157.3	188.4	138.0
	Percentage Change	0.0	0.0	0.0	0.0	0.0
Population	*Thousands*	0.2	0.6	1.0	1.1	0.7
	Percentage Change	0.0	0.0	0.0	0.0	0.0

[3]Modeled as a change in Industry Sales/Exogenous Production without Employment, Investment, and Compensation (amount), a change in "Wage Bill" (amount), and a Category Prison Population, All Ages, All Groups (number).

INCREASED GRADUATION RATES

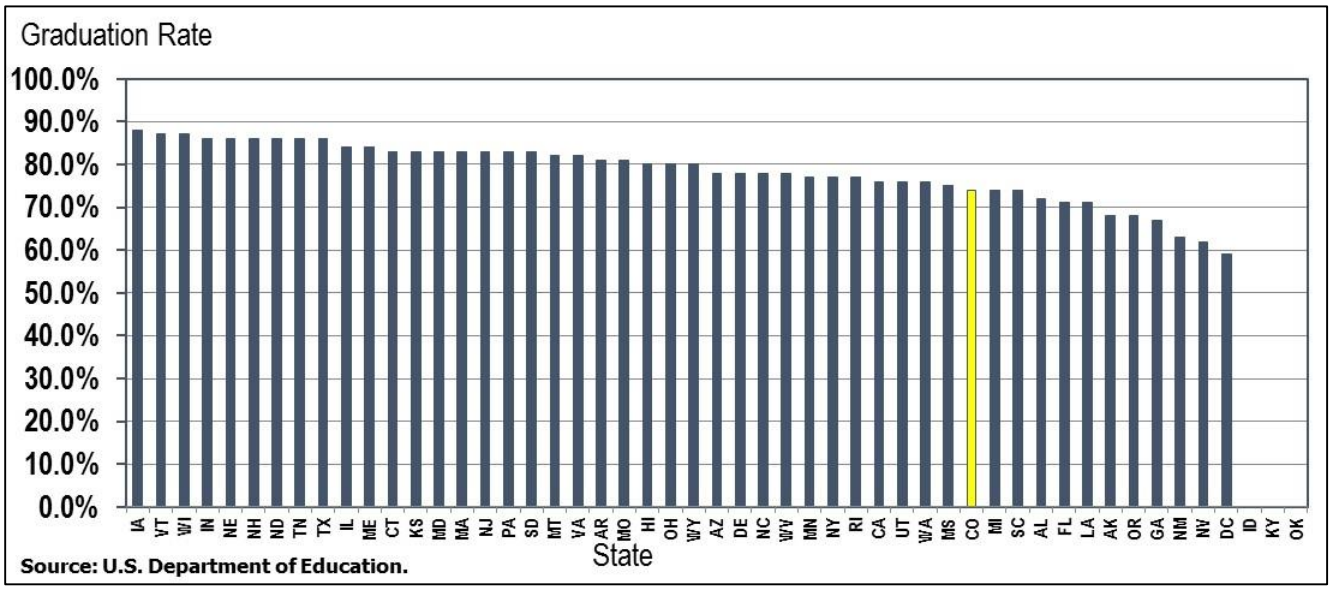
This section examines the economic impacts of increased educational performance measured by increased graduation rates instead of decreased dropout rates. As previously mentioned, the Colorado Code of Regulations defines high school graduation rates as

> "…the percentage of students from an end-of-year eighth grade cohort, adjusted for verified transfers in and out, who leave school as graduates, as defined by the School District or the Institute Charter School, in four years or less." CCR 301-1

In essence, the graduation rate measures not only graduation, but on-time completion as well.

The U.S. Department of Education reports graduation rates by state by academic year. For the 2010-11 academic year, Colorado's graduation rate of 74% ranked the state 37th among 48 reporting states and Washington D.C. In comparison, Iowa recorded the highest graduation rate (88%), while Washington D.C. recorded the lowest graduation rate (59%).

FIGURE 2: REGULATORY COHORT GRADUATION RATES, BY STATE, 2010-11



The Colorado Department of Education reports a similar, but slightly higher on-time graduation rate of 75.4% in the 2011-12 academic year. This rate was an increase of 1.5 percentage points over 2010-11, graduating 45,879 students out of the 60,885 base.[4,5] Using this calculation, 15,006 students did not graduate on time, if at all.

Colorado would need to graduate an additional 7,700 students per year to have the best graduation rate in the country.[6] Assuming that the state can continue to improve at the pace achieved in 2011-2012 (1.5

[4]The 2010-11 academic year recorded 45,846 graduates on a base of 62,039 students for a graduation rate of 73.9%. The completion rate totaled 76.8%.

[5]The completion rate is slightly higher, at 78.2%, includes GED and non-diploma certificates.

[6]Not adjusting for growing enrollment over time.

percentage points), it would take nine years to bring the rate above 88%.[7] The benefits of a higher graduation rate may include higher earnings, greater productivity, decreased social assistance, and lower incarceration rates.

As previously discussed, research shows greater lifetime earnings and lower unemployment rates for individuals who earn a high school diploma compared to individuals who do not. The Bureau of Labor Statistics reported lower unemployment rates and higher median weekly earnings of $652 in 2012 for an individual with a high school diploma compared to $471 for individuals with less than a high school diploma—a difference of $181 per week. Annualized, this number is $9,412 in 2012 dollars.

Unadjusted for inflation, the additional 913 graduates would yield $8.6 million in additional earnings per year in perpetuity. Over the period 2014-2020, this is an additional $1.9 billion in earnings, or approximately $3 billion when adjusted for inflation.

TABLE 10: WAGE BENEFITS OF A HIGH SCHOOL DIPLOMA FROM AN INCREASE IN GRADUATION RATES, 2014-2018

Year	2014	2015	2016	2017	2018
Enrollment Base	60,885	60,885	60,885	60,885	60,885
Number of High School Graduates	46,792	47,706	48,619	49,532	50,445
Number of High School Nongraduates	14,093	13,179	12,266	11,353	10,440
Modeled Change in Graduates	913	1,827	2,740	3,653	4,566
Graduation Rate	76.9%	78.4%	79.9%	81.4%	82.9%
Change in Graduation Rate	1.5%	1.5%	1.5%	1.5%	1.5%
High School Diploma Weekly Earnings[a]	$652	$652	$652	$652	$652
Less than HS Diploma Weekly Earnings[a]	$471	$471	$471	$471	$471
Earnings Difference[a]	$181	$181	$181	$181	$181
Difference x 52 Weeks[a]	$9,412	$9,412	$9,412	$9,412	$9,412
Inflation-Adj. Difference x 52 Weeks	$9,985	$10,285	$10,593	$10,911	$11,238
Real Annual Earnings Differential[a]	$8,595,744	$17,191,489	$25,787,233	$34,382,977	$42,978,722
Annual Earnings Differential	$9,119,225	$18,785,604	$29,023,758	$39,859,294	$51,318,841

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to earnings. Table illustrates the first five years of the assumptions between 2014 and 2040.

Greater educational attainment results not only in higher wages for the individuals, but workers who are presumably more productive, which lowers the cost of production and increases output per worker. Potential earnings are increased by 38.4% when the earnings of dropouts and high school graduates are compared. However, the expected change in the number of graduates to the total baseline employment in Colorado increases at a rate of only 0.027% per year. The accumulation of additional graduates increases productivity linearly throughout the forecast horizon, resulting in a productivity change equal to $48.3 million in the first year, and $617.8 million in the last year.

[7]This does not include an adjustment for the growth in school-age children enrolled in public P-12 education in Colorado.

TABLE 11: PRODUCTIVITY BENEFITS OF A HIGH SCHOOL DIPLOMA FROM AN INCREASE IN GRADUATION RATES, 2014-2018

Year	2014	2015	2016	2017	2018
Weekly Earnings Change[a]	0.3843	0.3843	0.3843	0.3843	0.3843
Additional Graduates/Baseline Employment	0.027%	0.0005	0.0008	0.0010	0.0012
Increased Productivity	0.010%	0.0203%	0.0296%	0.0384%	0.0468%
Productivity Change x Baseline Output (Millions)	$48.3	$98.0	$149.1	$201.6	$255.4

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to tuition. Table illustrates the first five years of the assumptions between 2014 and 2040.

As stated in the dropout analysis, higher income results in lower social assistance. For perspective, the State of Colorado reported spending $6.4 billion ($1,233 per capita) on social assistance in 2011 and $6.7 billion ($1,318 per capita) on social assistance in 2012, although these figures are not reported by income or education. The Bureau of Labor Statistics reports average income from public assistance nationally by income cohort. For income cohorts that align with less than a high school education, public assistance, supplemental security income, and food stamps range between $475 and $1,566 per year, or an average of $1,040. Public assistance for the higher wage earners average $385 in 2012 for a differential of $655. Other forms of social assistance quantified average unemployment and workers' compensation between $78 and $384 per year, although the figure also includes veterans' benefits.

TABLE 12: PUBLIC ASSISTANCE, SUPP. SECURITY INCOME, & FOOD STAMPS BY INCOME COHORT, 2012

Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	20000 to $29,999	$30,000 to $39,999	$40,000 to $49,999	$50,000 to $69,999	$70,000 and More
$475	$1,566	$1,377	$1,029	$753	$625	$396	$370	$150

Source: Bureau of Labor Statistics, Consumer Expenditure Survey.

Unadjusted for inflation, 913 fewer dropouts would yield $598,000 in additional social assistance savings per year in perpetuity. Over the period 2014-2020, this is an additional $123.8 million in savings, or approximately $201.9 million when adjusted for inflation.

TABLE 13: SOCIAL ASSISTANCE REDUCTION BENEFITS FROM AN INCREASE IN GRADUATION RATES, 2014-2018

Year	2014	2015	2016	2017	2018
Public Assistance, Supplemental Security Income, Food Stamps[a]	$655	$655	$655	$655	$655
Inflation-Adjusted Public Assistance	$675	$695	$716	$737	$759
Single Year Additional Graduates	913	913	913	913	913
Cumulative Additional Graduates	913	1,827	2,740	3,653	4,566
Real Potential Social Assistance Differential	$598,195	$1,196,390	$1,794,585	$2,392,781	$2,990,976
Potential Social Assistance Differential	$616,141	$1,269,250	$1,960,992	$2,693,096	$3,467,360

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to public assistance costs. Table illustrates the first five years of the assumptions between 2014 and 2040.

Another benefit of higher graduation rates includes a decline in incarceration rates. According to the Colorado Department of Corrections, the average cost per inmate totaled $31,440 in FY2012, down from $32,344 in 2011. Approximately 32% of inmates range from illiterate in English to literate, but without a high school diploma or GED. According to the American Community Survey, 10.2% of

Colorado's population 25 years and older have less than a high school degree. Inmates totaled 22,009 in 2012—meaning an extrapolated 7,042 did not have a high school degree or GED equivalent, or 2% of the 25 and older population without a high school diploma. Unadjusted for inflation, reducing the number of individuals incarcerated yields $118.9 million in savings over the period 2014-2020, or approximately $193.9 million when adjusting for inflation.

TABLE 14: CRIME REDUCTION BENEFITS FROM AN INCREASE IN GRADUATION RATES, 2014-2018

Year	2014	2015	2016	2017	2018
Cost per Inmate[a]	$31,440	$31,440	$31,440	$31,440	$31,440
Inflation-Adjusted 3-Credit Course	$32,383	$33,355	$34,355	$35,386	$36,448
Single Year Additional Graduates	913	913	913	913	913
Cumulative Additional Graduates	913	1,827	2,740	3,653	4,566
Single Year Reduction in Inmates	18.27	18	18	18	18
Cumulative Reduction in Inmates	18	37	55	73	91
Real Annual Corrections Differential[a]	$574,267	$1,148,535	$1,722,802	$2,297,069	$2,871,337
Annual Corrections Differential	$591,495	$1,218,480	$1,882,552	$2,585,372	$3,328,666

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to costs per inmate. Table illustrates the first five years of the assumptions between 2014 and 2040.

This analysis assumes that positive impacts begin to accrue in year 1. Higher educational attainment is manifested in higher wages, greater worker productivity, decreases in social assistance, and reductions in incarceration rates.[8] These combined impacts related to higher graduation rates result in increases in employment, income, and output between 2014 and 2040 compared to the baseline, with GDP increasing on average by $532 million (+0.1%).

TABLE 15: SUMMARY OF PRODUCTIVITY GAINS FROM AN INCREASE IN GRADUATION RATES, 2014–2040, AVERAGE CHANGE FROM BASELINE SCENARIO

Category	Units	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 2014-2040
Total Employment	Thousands (Jobs)	0.9	2.3	2.4	2.3	2.0
	Percentage Change	0.0	0.1	0.1	0.0	0.0
Private Non-Farm Employment	Thousands (Jobs)	0.8	1.9	2.0	1.9	1.7
	Percentage Change	0.0	0.1	0.0	0.0	0.0
Gross Domestic Product	Millions of Fixed (2012) Dollars	184.9	503.5	603.1	631.2	532.0
	Percentage Change	0.1	0.1	0.1	0.1	0.1
Personal Income	Millions of Fixed (2012) Dollars	76.1	209.7	248.2	247.8	211.1
	Percentage Change	0.0	0.1	0.1	0.0	0.0
Real Disposable Personal Income	Millions of Fixed (2012) Dollars	61.0	166.6	196.9	199.8	169.8
	Percentage Change	0.0	0.1	0.1	0.0	0.0
Population	*Thousands*	0.3	1.0	1.4	1.1	0.8
	Percentage Change	0.0	0.0	0.0	0.0	0.0

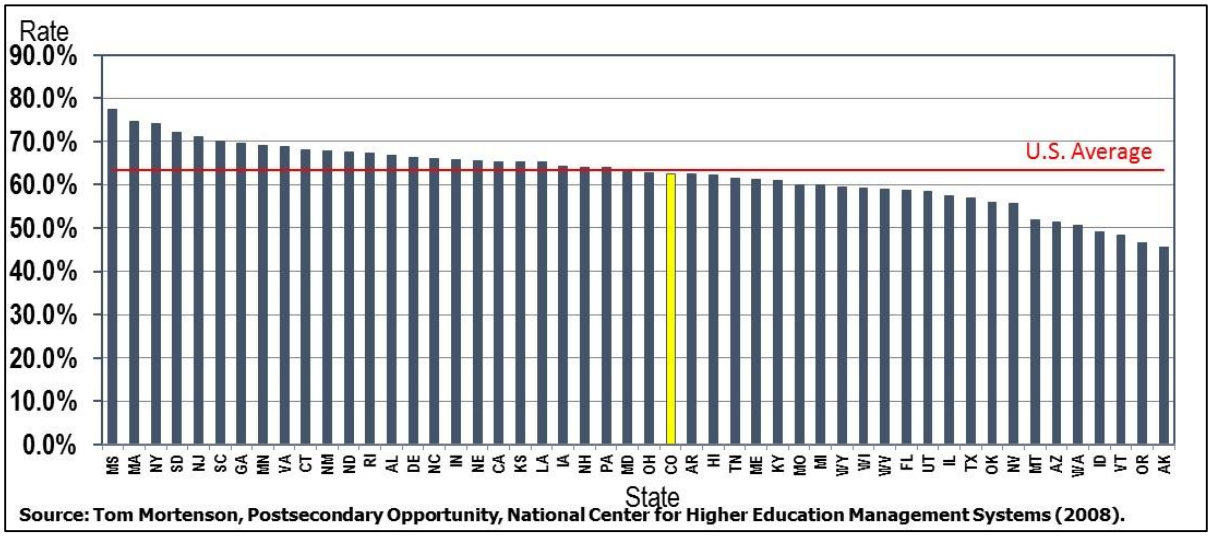
Improving the graduation rate to about 95%–99% at a faster rate than what is currently observed would yield economic benefits in excess of the economic costs in terms of value added, GDP, and employment.

[8]Modeled as a change in Industry Sales / Exogenous Production without Employment, Investment, and Compensation (amount), a change in "Wage Bill" (amount), and a change in Category Prison Population, All Ages, All Groups (number).

INCREASED MATRICULATION RATES

This section evaluates the economic impacts of increased educational performance in terms of higher college graduation rates. The impacts from higher matriculation rates may be summed with the impacts from either an increased graduation rate or decreased dropout rate. Data from the National Center for Higher Education Management Systems reported Colorado is slightly below average in the percentage of Colorado students going directly to college from high school.

FIGURE 3: COLLEGE-GOING RATES OF HIGH SCHOOL GRADUATES DIRECTLY FROM HIGH SCHOOL, 2008



Source: Tom Mortenson, Postsecondary Opportunity, National Center for Higher Education Management Systems (2008).

Excerpts from the Colorado Department of Higher Education's *2013 Legislative Report on the Postsecondary Progress and Success of High School Graduates* describes the 2011 graduating class:

- Fifty-seven percent of the 2011 high school graduating class enrolled in a postsecondary institution in Colorado or another state within 6 months of graduating.
- Seventy-one percent of the 2011 cohort enrolled at a four-year institution (in or out of state) and 29% enrolled at a two-year college.
- Of the 2011 graduates enrolling in college, nearly 79% elected to attend a Colorado college or university.

By improving the college matriculation rate 15 percentage points, Colorado would improve to the best quintile of states. The benefits of a higher matriculation rate may include higher earnings and greater productivity, as well as greater spending on higher education.

As previously discussed, research shows greater lifetime earnings and lower unemployment rates for higher levels of educational attainment. In 2012, the Bureau of Labor Statistics reported lower unemployment rates and higher median weekly earnings of $1,066 for individuals with a bachelor's degree and $785 for individuals with an associate's degree. Individuals with less than a high school diploma earned median incomes of $652. Annualized, in 2012 dollars, this difference is $21,528 for a bachelor's degree compared to a high school diploma, and $6,916 for an associate's degree compared to a high school diploma.

The gradual increase in the matriculation rate amounts in 688 additional college-bound students per year. Upon graduating, the weighted median income differential would be $11.9 million in additional earnings per year in perpetuity. Over the period 2014-2020, this is an additional $2.9 billion in earnings, or approximately $4.9 billion when accounting for inflation.

TABLE 16: WAGE BENEFITS OF A HIGHER COLLEGE MATRICULATION RATE, 2014-2018

Year	2014	2015	2016	2017	2018
High School Graduates[a]	45,879	45,879	45,879	45,879	45,879
Graduates Enrolling in Postsecondary Education	26,839	27,527	28,216	28,904	29,592
Graduates Not Enrolling in Postsecondary Education	19,040	18,352	17,663	16,975	16,287
Change in Enrollment	688	1,376	2,065	2,753	3,441
Matriculation Rate	58.5%	60.0%	61.5%	63.0%	64.5%
Change in Matriculation Rate	1.5%	1.5%	1.5%	1.5%	1.5%
Additional Bachelor's Degree	487	974	1,462	1,949	2,436
Additional Associate's Degree	201	402	603	804	1,005
Additional Bachelor's Degree Earnings[a]	$1,066	$1,066	$1,066	$1,066	$1,066
Additional Associates Degree Earnings[a]	$785	$785	$785	$785	$785
High School Diploma Weekly Earnings[a]	$652	$652	$652	$652	$652
Weighted Ave. Difference x 52 Weeks[a]	$17,261	$17,261	$17,261	$17,261	$17,261
Real Potential Annual Earnings Differential ($Millions)	$11.9	$23.8	$35.6	$47.5	$59.4

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to earnings. Table illustrates the first five years of the assumptions between 2014 and 2040.

Greater educational attainment results not only in higher wages for the individuals, but workers who are presumably more productive, lowering the cost of production and increasing output per worker. For the additional college graduates, the weighted median potential earnings increase by 50.9% when going from a high school diploma to an associate's or bachelor's degree. However, the expected change in the number of graduates to the total baseline employment in Colorado increases at a rate of only 0.027% per year. The accumulation of additional graduates increases productivity linearly throughout the forecast horizon, resulting in a productivity change equal to $48.1 million in the first year and $337.2 million in the last year.

TABLE 17: PRODUCTIVITY BENEFITS OF A HIGHER COLLEGE MATRICULAITON RATE, 2014-2018

Year	2014	2015	2016	2017	2018
Weekly Earnings Change[a]	0.5091	0.5091	0.5091	0.5091	0.5091
Additional Graduates/Baseline Employment	0.020%	0.0004	0.0006	0.0008	0.0010
Increased Productivity	0.010%	0.0208%	0.0311%	0.0415%	0.0519%
Productivity Change x Baseline Output (Millions)	$48.2	$96.4	$144.5	$192.7	$240.9

[a]2012 dollars. Note: When applicable, a 3% inflation rate was applied to earnings. Table illustrates the first five years of the assumptions between 2014 and 2040.

This analysis assumes that positive impacts begin to accrue in year 1. Higher educational attainment resulting from an increased college matriculation rate is manifested in higher wages and greater worker productivity.[9] These combined impacts related to higher matriculation rates result in increases in employment, income, and output between 2014 and 2040 compared to baseline, with GDP increasing on average by $416 million (+0.1%).

[9]Modeled as a change in Industry Sales / Exogenous Production without Employment, Investment, and Compensation (amount), a change in "Wage Bill" (amount), and Education Spending - Higher Ed. - Base Year 2012.

TABLE 18: SUMMARY OF PRODUCTIVITY GAINS FROM AN INCREASE IN MATRICULATION RATES, 2014–2040, AVERAGE CHANGE FROM BASELINE SCENARIO

Category	Units	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 2014-2040
Total Employment	Thousands (Jobs)	1.3	2.7	2.5	2.4	2.2
	Percentage Change	0.0	0.1	0.1	0.1	0.1
Private Non-Farm Employment	Thousands (Jobs)	0.9	2.0	1.8	1.7	1.6
	Percentage Change	0.0	0.1	0.0	0.0	0.0
Gross Domestic Product	Millions of Fixed (2012) Dollars	201.9	458.9	465.2	462.9	416.0
	Percentage Change	0.1	0.1	0.1	0.1	0.1
Personal Income	Millions of Fixed (2012) Dollars	103.9	254.3	272.8	282.0	247.9
	Percentage Change	0.0	0.1	0.1	0.1	0.1
Real Disposable Personal Income	Millions of Fixed (2012) Dollars	83.3	200.9	215.7	226.2	198.2
	Percentage Change	0.0	0.1	0.1	0.1	0.1
Population	*Thousands*	0.6	2.1	3.2	3.6	2.7
	Percentage Change	0.0	0.0	0.0	0.1	0.0

When coupling either the decreased dropout rate or increased graduation rate (mutually exclusive) with an increased matriculation rate, the economic benefits exceed the economic cost of the tax increase.

NET ECONOMIC BENEFITS

This paper quantifies a breakeven point, where educational benefits and spending outstrip the costs of the tax increase. The net economic benefits of total employment, GDP, and personal income are positive when examining the combined impacts from the individual income tax increase, increased education spending, increased graduation rate, and an increased matriculation rate. The impacts remain negative for private non-farm employment and real disposable personal income.

TABLE 19: SUMMARY OF NET ECONOMIC BENEFITS, 2014–2040, AVERAGE CHANGE FROM BASELINE SCENARIO

Category	Units	Years 1-5	Years 6-10	Years 11-15	Years 16-20	Years 2014-2040
Total Employment	Thousands (Jobs)	12.7	10.0	7.6	3.9	6.7
Private Non-Farm Employment	Thousands (Jobs)	-4.8	-7.0	-8.8	-11.5	-9.4
Gross Domestic Product	Millions of Fixed (2012) Dollars	162.6	358.5	358.4	63.6	139.0
Personal Income	Millions of Fixed (2012) Dollars	302.8	373.2	323.9	64.8	139.4
Real Disposable Personal Income	Millions of Fixed (2012) Dollars	-899.6	-1,072.4	-1,321.3	-1,734.0	-1,469.9
Population	Thousands	-4.7	-13.3	-21.1	-29.5	-22.8

There are other benefits that may be realized, but were not quantified in this report due to a lack of objective data. These may include the cost savings that may be realized by some parents whose children attend state-sponsored preschool or kindergarten.[10] Other benefits may include lower early childhood remediation costs, freeing up money for the schools to spend elsewhere.

[10] An excerpt from SB 13-213 states that the preschool program is established to serve at-risk students "due to significant family risk factors, who are in need of language development, or who are receiving services from the Department of Human Services." (22-28-104.1)

TAXES

Amendment 66 calls for a progressive individual income tax, stepping from 5% to 5.9% at the $75,000 income threshold. This section studies various revenue models.

Individual income taxes, corporate income taxes, and sales and use taxes collectively accounted for 96% of the Colorado general fund in fiscal year (FY) 2013. When expanding the scope to other statutory sources and uses of funds noted in the Colorado Comprehensive Annual Financial Report for fiscal year 2012, individual income taxes, corporate income taxes, and sales and use taxes accounted for 44.6% of Colorado governmental funds, while federal grants and contracts accounted for an additional 35.4% of Colorado governmental funds.

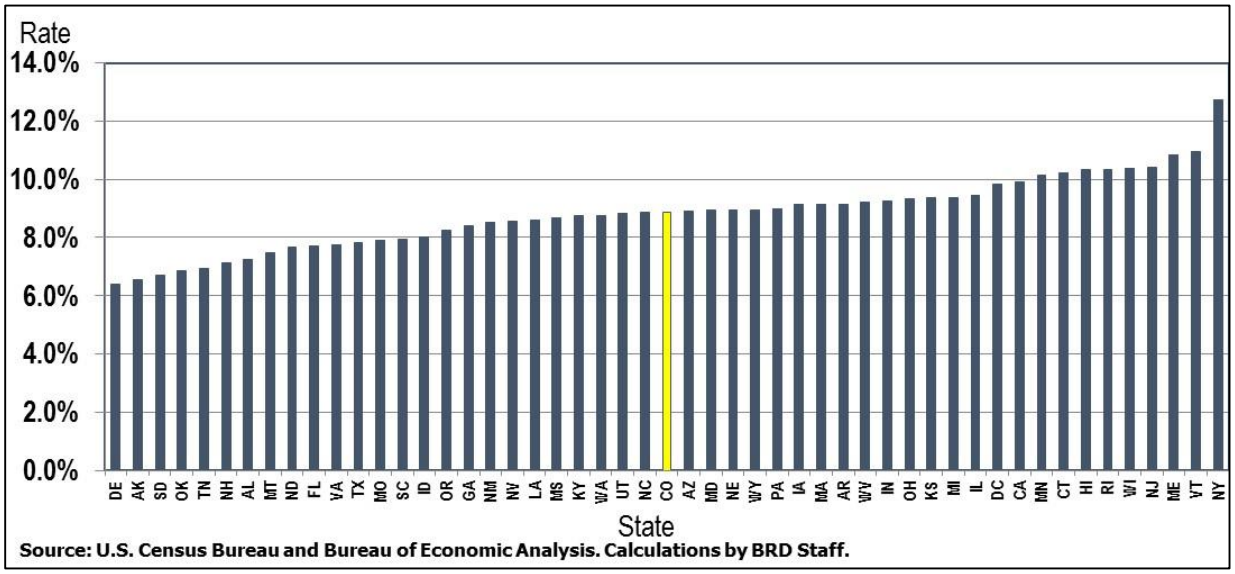
Given the magnitude of the requested funding for education, income, sales, and property taxes are likely the only three areas that provide a broad enough base to absorb such an increase in funding. The Office of State Planning and Budgeting forecasts severance tax of $219 million in FY 2013, an increase of 58% from FY 2012. This severance tax amount represents less than one-fourth the amount requested in Amendment 66, and severance taxes are much more volatile than sales, income, and property taxes.

Property is taxed by local government, with schools, counties, municipalities, and special districts the largest beneficiaries (in order by size). According to the Colorado Department of Local Affairs, Division of Property Taxation, revenue generated by property taxes in 2012 totaled $6.9 billion, driven off $89.3 billion in assess property values—an imputed rate of 7.8%. Average school levies totaled 39.129, average county levies totaled 19.507, average municipal levies totaled 7.748, and average special district levies totaled 2.995. If the State had a 1% tax on assessed property values, this would generate $893.2 million in taxes—a number close to what is requested in Amendment 66. This would equate to a $239 property tax increase on a $300,000 home and an $870 property tax increase on a $300,000 commercial property.

One suggested source of additional revenue could be the taxation of goods purchased over the internet (e-commerce). A 2009 paper by Donald Bruce, William Fox, and LeAnn Luna at the University of Tennessee estimated tax losses by state related to e-commerce. According to the authors, Colorado's 2012 tax losses amount to an estimated $172.7 million. Taxing consumer e-commerce purchases is an unlikely option given the current legal status of e-commerce taxation.

Analyzing data from the Census Bureau on state and local tax collections in 2011 compared to data from the Bureau of Economic Analysis on personal income allows for insight on tax intensity by state. Colorado ranks 25th highest in the country in terms of the percentage of personal income collected in the form of state and local sales taxes, personal income taxes, and property taxes. The ranking for the individual components may be found in Appendix 2.

FIGURE 4: STATE RANK OF THE RATIO OF TOTAL STATE AND LOCAL SALES, PROPERTY, AND INCOME TAXES TO PERSONAL INCOME, 2011



Colorado ranks 6th lowest in the country (when including Washington D.C. in the sample) in terms of the state tax rate (currently at 2.9%). However, when accounting for local taxes, Colorado ranks relatively high at an average local tax rate of 4.49%. Colorado's combined state tax rate is 7.39% (state tax rate plus the average local tax rate) and is the 15th-highest combined rate in the United States. Colorado has a minimum local tax rate of 0% and a maximum local tax rate of 7.5%.

FIGURE 5: STATE SALES TAX RATES

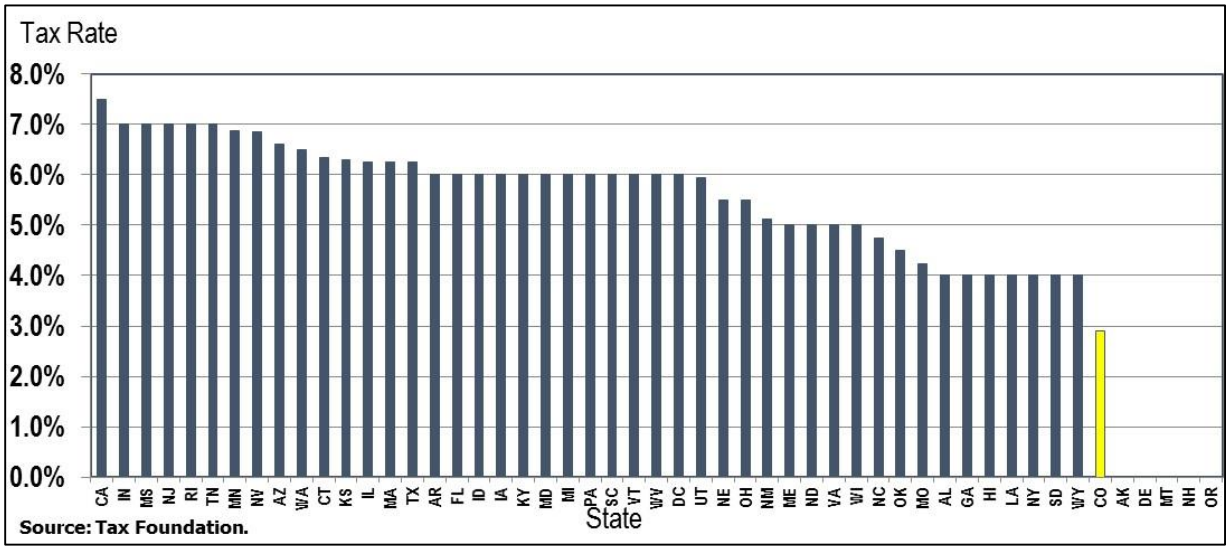
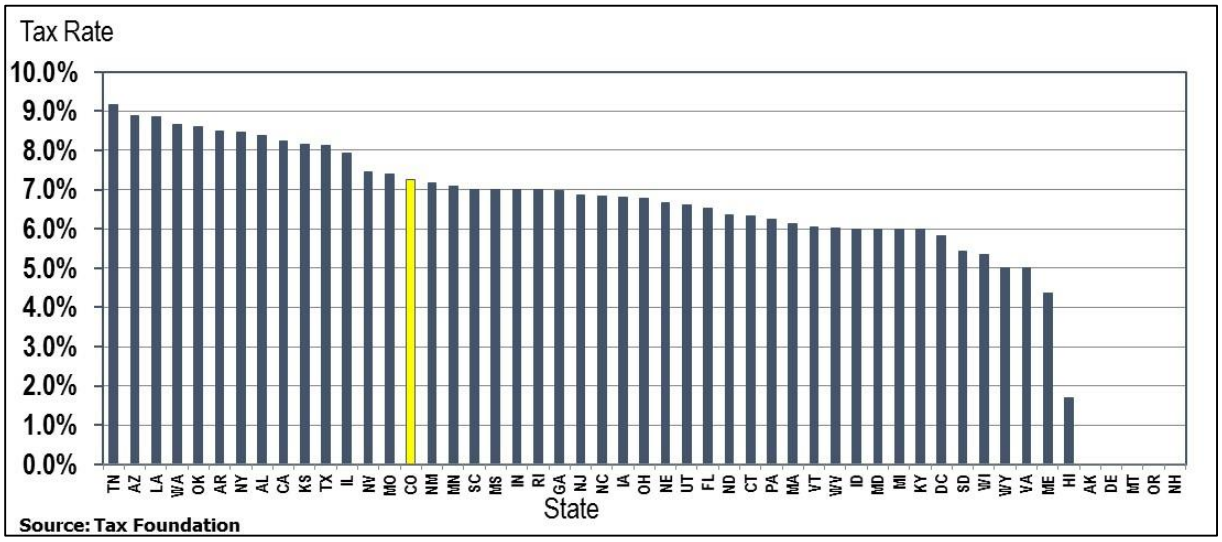


FIGURE 6: COMBINED STATE AND LOCAL SALES TAX RATES



Using the REMI model, a 5% flat tax on individuals and corporations would yield approximately $443 million in additional revenue per year in the first five years, and an average of $848.7 million over the period 2014−2040 when compared to baseline. When the tax rate is increased to 5.3% and 5.6%, the revenues go up markedly, increasing an average of $1,536.8 million and $2,224.9 million over the forecast horizon, respectively. Comparatively, a sales tax of 1% would generate an average of $1,604 million over the period compared to the baseline scenario.

TABLE 20: ALTERNATIVE INCOME TAX RATES, 2014-2040

Category	Units	Fiscal Years 1-5[a]	Fiscal Years 6-10	Fiscal Years 11-15	Fiscal Years 16-20	Fiscal Years 2014-2040
5% Flat Tax[b]	Millions of Current Dollars	$443.4	$620.7	$780.0	$972.9	$848.7
5.3% Flat Tax[b]	Millions of Current Dollars	$802.8	$1,123.9	$1,412.4	$1,761.6	$1,536.8
5.6% Flat Tax[b]	Millions of Current Dollars	$1,162.3	$1,627.1	$2,044.9	$2,550.5	$2,224.9
5%/5.9% Tax[c]	Millions of Current Dollars	$934.5	$1,311.9	$1,654.0	$2,067.2	$1,801.4
3.9% Sales Tax	Millions of Current Dollars	$850.6	$1,190.2	$1,479.5	$1,834.2	$1,604.2

[a]Fiscal year 1 (i.e., fiscal year 2014) is only one half calendar year 2014, reducing the average for years 1-5.
[b]A flat tax on both individual income and corporate income.
[c]Amendment 66 proposal, which includes a tax on individual income and excludes corporate income.

All scenarios in isolation, not accounting for how the additional revenue is spent, have a drag on the Colorado economy.

TABLE 21: GDP IMPACT OF ALTERNATIVE TAX RATES, 2014-2040

Category	Units	Fiscal Years 1-5 [a]	Fiscal Years 6-10	Fiscal Years 11-15	Fiscal Years 16-20	Fiscal Years 2014-2040
5% Flat Tax[b]	Millions of Current Dollars	-$561.5	-$744.2	-$922.8	-$1,127.4	-$962.2
5.3% Flat Tax[b]	Millions of Current Dollars	-$1,016.6	-$1,348.1	-$1,671.7	-$2,042.4	-$1,743.2
5.6% Flat Tax[b]	Millions of Current Dollars	-$1,471.7	-$1,951.8	-$2,420.1	-$2,956.8	-$2,523.5
5%/5.9% Tax[c]	Millions of Current Dollars	-$1,202.9	-$1,693.4	-$2,311.6	-$3,126.2	-$2,602.2
3.9% Sales Tax	Millions of Current Dollars	-$1,114.6	-$1,683.1	-$2,100.3	-$2,530.2	-$2,141.1

[a]Fiscal year 1 (i.e., fiscal year 2014) is only one half calendar year 2014, reducing the average for years 1-5.
[b]A flat tax on both individual income and corporate income.
[c]Amendment 66 proposal, which includes a tax on individual income and excludes corporate income.

CONCLUSION

Many research papers cite the economic benefits attributable to improved education. However, it is suppositional to infer how these benefits may be manifested in the Colorado economy based on incremental additional funding. This paper presents a scenario in which the state's dropout rate or the graduation rate becomes the best in the nation, and analyzes the resulting economic benefits of increased income, increased productivity, decreased social assistance, and decreased incarceration. The paper also examines benefits from an increased college matriculation rate as students' foundational math, writing, and reading improve over time. Additional benefits may be present, but unquantifiable based on available secondary data. Examples of other benefits may include the impacts that stronger foundational math, reading, and writing proficiency may have on students' field-of-study selection in post-high school education, as well as in career development. Benefits will also likely accrue from parents' ability to work while their children attend pre-k and full-day kindergarten. Other research points to the impacts of better teachers on lifetime earnings, or decreases in the costs to crime victims' families. Quantifying these additional impacts on the state of Colorado is conjecture beyond the scope of the project. The lack of quantified metrics to measure the return on investment on the increased funding, or quantified measurements of improved educational performance, left the research team to study and hypothesize what benefits may manifest in Colorado. To that end, it is important that such measures of ROI be quantified for apt implementation and measurement.

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APPENDIX 1: LITERATURE REVIEW

The following papers were reviewed in order to gain insight into the societal and economic impacts of improved education.

Education Spending, Inequality, and Economic Growth: Evidence from US States

(Goodspeed 2000)
In a paper published in July 2000, Goodspeed empirically studied the impacts of education on economic growth. He started with the standard growth model, augmenting the model to include the following factors: spending, taxes, and distribution of income, as well as education spending and inequality. Goodspeed found that education spending has a positive impact on economic growth while income taxes (individual and corporate) have a negative or no impact on growth.

Education-Finance Reform and the Distribution of Education Resources

(Murray, Evans and Schwab 1998)
In a 1998 paper that examined school finance reform in 16 states between 1971 and 1996, it was found that within-state inequality in spending declined by 19% to 34%. Higher state taxes financed more spending in the poorest school districts (11% higher in the poorest districts, 8% higher in the median districts), while spending in the richest school districts were unchanged. Inequality in funding stemming from local property tax bases was noted as a catalyst for reform, while aggregate state funding (not specific funding sources such as income or sales taxes) was analyzed for results.

A Dozen Economic Facts About K-12 Education

(Greenstone, et al. 2012)
Researchers at the Hamilton Project present some economic facts on the state of education in America with a focus on the K-12 school system. Framed into three chapter—Education Improves People's Lives, The United States is Losing Its Lead in Education, and There Is Promise for Raising Educational Achievement—the report includes statistics demonstrating the correlation between education and lifetime earnings, and the lack of correlation between per pupil spending and test scores. Individuals with less education earn less money, are more likely to be institutionalized, less likely to be married, and have shorter life expectancy. Other data show that parents with more education spend more time with their children, childhood poverty rates are observably lower based on the mother's education level, and interventions raise achievement.

Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers

(Reynolds, et al. Winter 2002)
Using data from the ongoing Chicago Longitudinal Study, which investigates the life-course development of more than 1,500 children from low-income families, a cost-benefit analysis was conducted of federally funded Title I Chicago Child-Parent Centers. The authors examined the benefits of preschool participation, school-age participation, and extended program participation in reducing remedial services, reducing criminal justice system expenditures, reducing child welfare system expenditures, averting other costs to victims, and increasing earning and taxing capacity. The results indicate that the benefits of the preschool program to society exceed the costs by a factor of $7.14 per dollar invested (1998 dollars); the extended intervention program yielded returned of $6.11 per dollar invested; and the school-age program returned $1.66 per dollar invested.

Proven Benefits of Early Childhood Interventions

(Karoly, Kilburn and Cannon 2005)

The RAND Corporation research team conducted a critical review of studies that examine the benefits, including economic benefits, of early childhood intervention programs. Of the 20 reviewed programs, 19 showed favorable impacts, and 15 demonstrated "strong" evidence due to the measured impacts over time. The report noted that not all outcomes may be translated into dollars; however, the economic impacts may be represented in terms of higher lifetime earnings, higher tax revenues, lower crime rates, and lower demand for social welfare. The studies examined estimated returns of investment ranging from $1.80 to $17.07 for each dollar spent on the program.

Short-Lived Gains or Enduring Benefits? The Long-Term Impact of Full-Day Kindergarten

(Plucker and Zapf 2005)

The Center for Evaluation and Education Policy reviewed literature in 2005 regarding the short-term and the long-term impacts of full-day kindergarten. The findings of the few longitudinal studies conducted in schools and school districts across the United States are promising; however, there is a lack of sound research regarding the duration of benefits experienced by full-day kindergarten students.

Full-Day versus Half-Day Kindergarten: In Which Program Do Children Learn More?

(Lee, et al. 2006)

Researchers based out of the University of Michigan presented interesting research on the differences between Full-Day and Half-Day Kindergarten programs across the United States. Using a comparative evaluation approach, the research focused on the cognitive outcomes in literacy and mathematics. With this research they found that Full-Day education proves to be more beneficial than Half-Day education; however, the benefits of Full-Day education are not double that of the Half-Day Kindergarten programs, as Full-Day programs normally spend approximately 30% longer covering topics. Also, Black children, kindergarten repeaters, and less affluent families are more likely to attend Full-Day Kindergarten programs. The students entering Full-Day Kindergarten programs tend to come in with lower literacy and achievement scores, but tend to graduate Kindergarten with comparable test scores. The researchers further believe that this difference (0.93 SD in literacy and 0.75 SD in math) is understated because of the fact that the time between assessments is less than a school year.

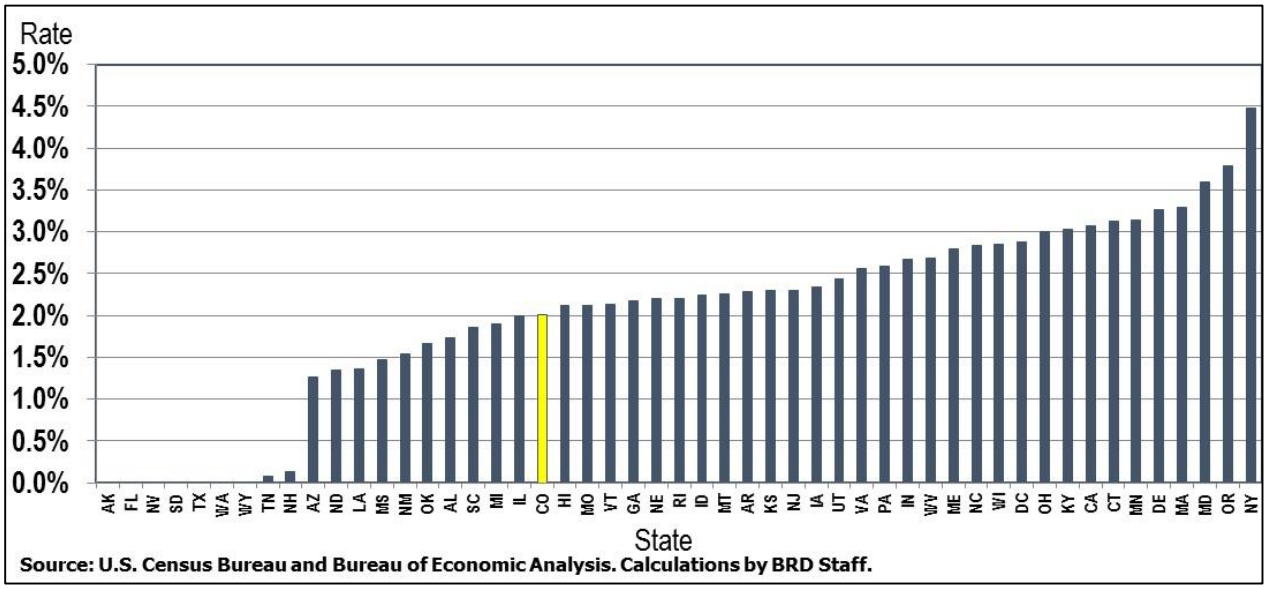
Valuing Teachers

(Hanushek, 2011)

Dr. Hanushek out of Stanford University estimated the economic benefits associated with teacher effectiveness. The study estimates students' lifetime earnings associated with teacher quality, from negative earnings if they are poor teachers to positive earnings if they are good teachers. According to the study, "a good, but not great, teacher increases each student's lifetime earnings by $10,600."

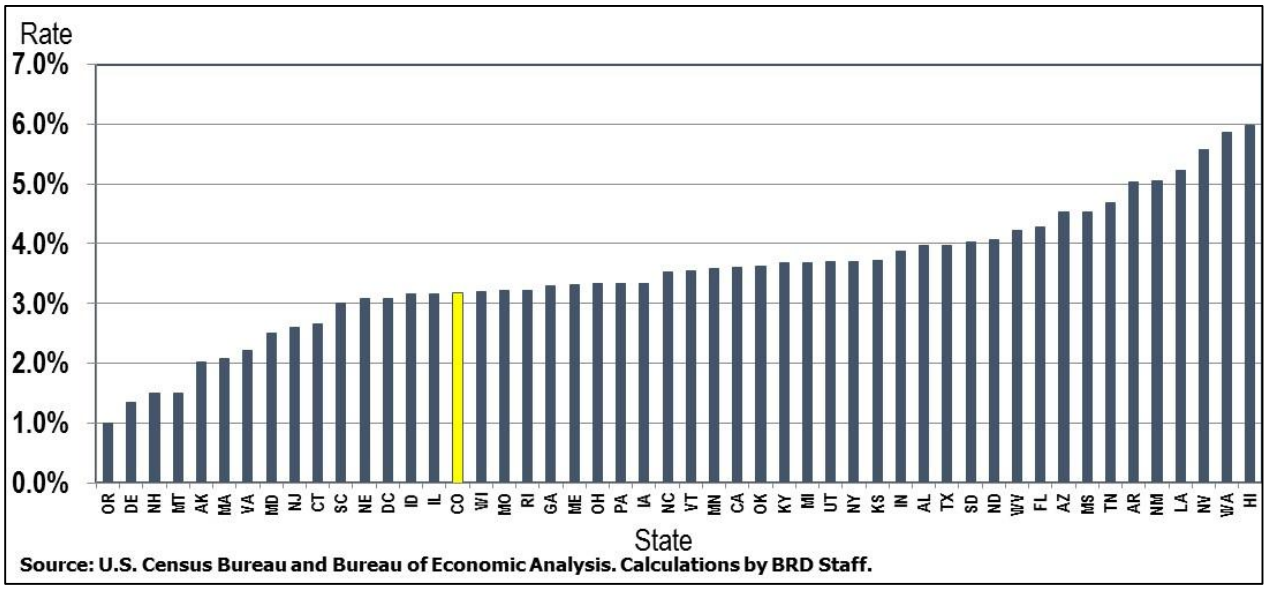
APPENDIX 2: STATE RANKINGS OF RATIO OF STATE AND LOCAL TAXES COLLECTED BY SOURCE TO PERSONAL INCOME

FIGURE 7: STATE RANK OF THE RATIO OF TOTAL PERSONAL INCOME TAXES TO PERSONAL INCOME, 2011



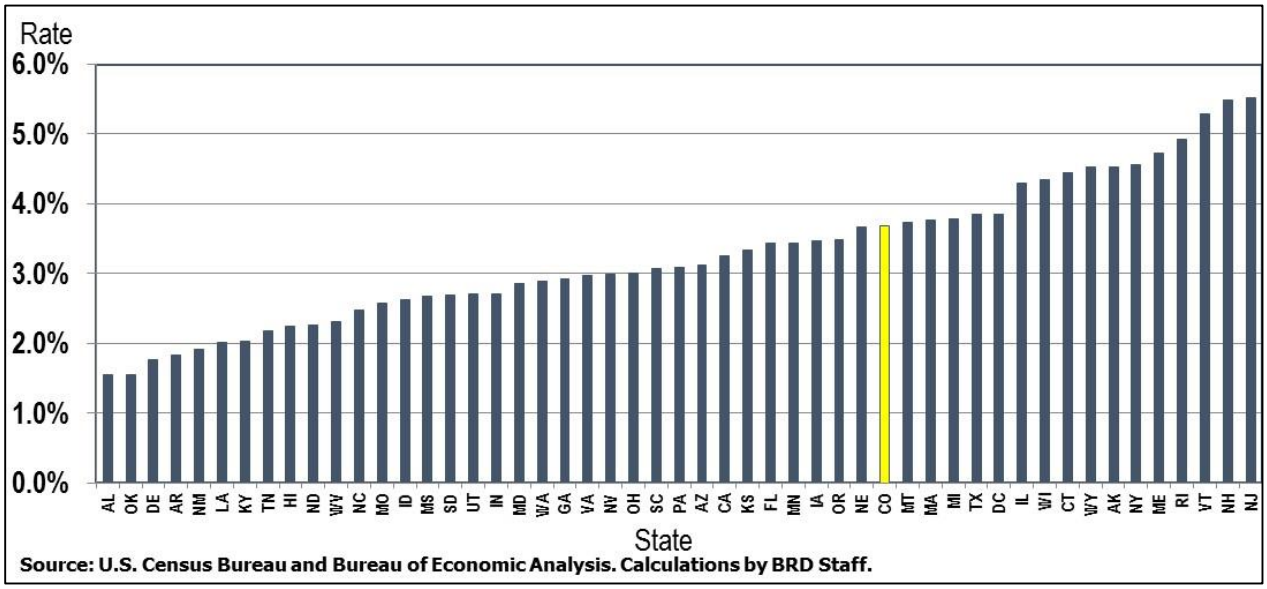
Source: U.S. Census Bureau and Bureau of Economic Analysis. Calculations by BRD Staff.

FIGURE 8: STATE RANK OF THE RATIO OF TOTAL STATE AND LOCAL SALES TAXES TO PERSONAL INCOME, 2011



Source: U.S. Census Bureau and Bureau of Economic Analysis. Calculations by BRD Staff.

FIGURE 9: STATE RANK OF THE RATIO OF TOTAL STATE AND LOCAL PROPERTY TAXES TO PERSONAL INCOME, 2011



Source: U.S. Census Bureau and Bureau of Economic Analysis. Calculations by BRD Staff.