

Quantifying the statewide economic, fiscal and distributional impacts of Amendment 66

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Over the next few weeks Colorado voters will weigh in on Amendment 66, a measure designed to increase funding for the state's public preschool and K-12 education system (P-12) system. Over all, the measure is expected to raise \$950 million in new revenues in the first year by establishing a two-tier state income tax system. According to the Colorado Education Association, a major proponent of the amendment, the measure will support initiatives that "give students the skills and tools they need to compete for jobs, achieve their potential and to make a better life." Opponents argue the tax increases will harm Colorado by stifling economic growth.

In this brief we use an economic model developed by a research team at Colorado State University to take a closer look at how Amendment 66 could affect the state economy, looking at both short- and long-run effects.

The basic story of our analysis is that *should* Amendment 66 pass, the subsequent tax increases and new spending in P-12 public education will have important economic impacts statewide. Under higher personal income tax rates, household disposable income will decline, and ensuing reductions in overall spending will contract some sectors of the economy.

Yet there will be offsetting impacts when higher tax revenues are dedicated to increasing public P-12 education spending. First, it will stimulate economic activity in the state's education sector, as new teachers and educational professionals are hired. Second, previous research shows that when spending leads to higher high school graduation rates and better individual performance, then productivity and economic growth rates both increase. A critical issue is whether the positive impacts of more resources allocated to education offset the negative impacts of higher taxes.

Our analysis also considers how Amendment 66 will affect income distribution in the state. Over the past 15 years, Colorado's overall economy has grown substantially. Yet the state's lowest income households have actually witnessed declining average incomes (adjusted for inflation), while the top-earning households have seen the greatest average increases. Because Amendment 66 re-introduces a progressive tax structure, and because the associated spending hires more "middle class" workers, and because the program seeks to increase the skills and capabilities of high school graduates, the benefits accrue primarily to lower and middle-income earning households. The effect is to slightly narrow the income gap between high and low-earning households.

In quantitative terms we consider short-term and long-term effects.

Short-term effects (Tax and expenditure)

1. Higher income taxes will reduce economic activity in some sectors, especially retail and high services. The losses will be partially offset by increases in employment in education-related sectors. This will generate spin-off economic activity in retail and services, somewhat mitigating the losses in those sectors due to higher taxes. Overall, our analysis shows a short-term loss of 11,531 jobs (0.42 percent). (To put this in context, Colorado is expected to add about 60,000 jobs in 2013.)
2. Gross State Product falls by \$3.04 billion or 1.03 percent.

Long-term effects (Tax, expenditure and productivity)

1. Previous research shows that additional education spending can increase annual economic growth in the long run, depending on how it is spent. Under different assumptions about the effects of more spending on workforce productivity, we estimate that the change in total annual employment will range between -7,200 (-0.25 percent) and 4,771 (0.17 percent) relative to the baseline. Because the productivity impacts will not immediately transpire, these effects will take several years to be realized.
2. Because the proposed tax structure is progressive, Amendment 66 will disproportionately impact higher income households. Average incomes (after taxes) will increase for households making less than \$75,000 and decrease for those making more. This occurs because of new hiring in lower income categories, financed primarily by higher income households.

The remainder of this *Issues Brief* is structured as follows. In section 1 we briefly describe the state's current education funding system, and compare per pupil spending in Colorado with the rest of the nation. Section 2 discusses the various conceptual dimensions of increasing income tax rates and education spending on the level and distribution of economic activity in the state. Section 3 quantifies aggregate economic and fiscal impacts of Amendment 66, distinguishing between the short- and long-run effects. Section 4 examines how the Amendment will affect income distribution within Colorado. Section 5 concludes.

About Amendment 66

If approved, Amendment 66 will increase P-12 education funding by an estimated \$950 million in its first year. Under the measure the tax rate on taxable income under \$75,000 would increase from 4.63 percent to 5 percent. For individuals whose taxable income exceeds \$75,000 per year the tax rate would be 5 percent on the first \$75,000 and 5.9 percent on any taxable income above that amount.

In the following table we give some examples of how the tax increase would affect Colorado households, depending on their income. For example, a household with \$50,000 in taxable income would see their annual tax bill go up \$185 (0.37% of total income). A household with \$100,000 in taxable income would see a \$595 tax increase (about 0.6% of total income).

Taxable Income	Tax Increase	Share of Income
\$25,000	\$93	0.37%
\$50,000	\$185	0.37%
\$100,000	\$595	0.60%
\$250,000	\$2,500	1.00%

1. Colorado's current public P-12 education funding system

Colorado's public education system P-12 system has three primary funding streams. First, school districts levy a property tax, which is primarily assessed on residential units and businesses, collected by the county where the property is located and shared back with the district. Second, the state collects income and sales taxes, and shares the revenue back with school districts by formula. Finally, the US Department of Education provides some funding to public education. The Colorado Department of Education reports that in 2011-12, local sources accounted for 48 percent of total school revenues, state sources were 43 percent, and federal funds were 8 percent.

Colorado currently spends less educating students on a per pupil basis than the national average. Over all, Colorado education expenditures totaled about \$8.9 billion in 2011 according to the US Census Bureau. On a per student basis, this is \$8,724. Compared to other states, Colorado's per pupil spending ranks 40th. (The national average across states is \$10,844 per student.)¹

If Amendment 66 passes and Colorado increases education expenditures by \$950 million, then per pupil spending will rise to \$9850. At this level, Colorado would have ranked 26th nationally in 2011.

2. Assessing the economic and fiscal impacts of Amendment 66

Amendment 66 proposes to raise state personal income tax rates and use that revenue to increase funding for the state's P-12 educational system. Generally, higher income taxes slow economic activity because households have less money to spend. (Economists refer to this as "disposable" income; we will refer to it as "after tax" income.) For example, when a household pays higher income taxes they can afford fewer personal consumption goods such as groceries, vacations and transportation.

Further, because the proposed income tax is two-tiered, higher income households will be disproportionately impacted. In effect, the proposed tax system will change household income distribution in the state, an outcome that also impacts the state's economic structure.

The negative effects of higher taxes are offset, to some degree, when equivalent government spending increases lead to new jobs, and, in the case of education, improve worker productivity. With respect to new jobs, some of the revenue generated through Amendment 66 will be used to hire more teachers and educational professionals, with the goal of reducing classroom size and providing more individualized attention to students.

With respect to productivity, previous economic research indicates that smaller classroom sizes can increase student performance. It is well established in the economics literature that more educational attainment leads to higher incomes and faster economic growth. Thus, if the increased education expenditures increase workforce quality, it is plausible that the long-term impacts of the Amendment 66 may offset or even exceed the losses from higher taxes.

¹ Our comparative calculations are drawn from data provided by the US Census Bureau. Because the Census Bureau collects data from each state, it is possible to make comparisons. However, the Census Bureau definitions of revenues and expenditures can vary from those used by the state Department of Education in its own reporting. Accordingly, our reported expenditures per pupil are different than those provided directly by the state.

Another impact we consider is the effect of Amendment 66 on local government finances (eg, city and county revenues). One implication of reducing household after tax income is that less money can be spent on goods and services that are subject to local sales taxes, one of the primary funding mechanism for local governments in Colorado. We find this effect in our analysis.

The final dimension we consider is the effect on state-level income inequality. Over the past 30 years, most of the benefits from US economic growth have accrued to higher income households, and the same is true in Colorado. Indeed, over the past 15 years, the state's lowest income households have seen real incomes fall, while the highest income households have seen the largest gains. Because it introduces a two-tier tax system, and because most of the gains from increased education spending benefit lower- and middle-income households, Amendment 66 will slightly narrow the disparity in household incomes within the state.

Conceptual modeling framework

To fully understand the economic impact of Amendment 66 on the Colorado economy, we consider tax, spending and productivity growth impacts. In a sense, we want to compare the “negative” impacts of higher income tax rates against the “positive” impacts of increased education employment and a more educated workforce. We also look at its implications on income distribution.

To estimate the economic and fiscal impacts of Amendment 66 we use a computable general equilibrium (CGE) model for Colorado. The CGE model is built specifically for the state by a team of economists at Colorado State University, using detailed, up-to-date tax, employment and household data from a variety of national, state and local sources. The model is “calibrated” to the state economy as it exists today to generate the “baseline” economy. All simulation results are then compared to this baseline case. The research team has used variants of the model over the past 15 years to examine a wide range of local and state policy issues.² We consider two dimensions, or aspects, in our analysis. Aspect 1 is the short-term effect of higher taxes and increased government spending. Aspect 2 looks at the long-term effects of increased worker productivity.

² For example, the Colorado CGE model has been used to estimate the economic impact of HB10 1365, a law that requires the decommissioning of coal plants and use additional amounts of natural gas in the generation of electricity for Colorado consumers. The model has also been used to estimate the economic impact of the HB1281, HB1001 and 2013 (Senate Bill 252) that in combination requires meeting a Renewable Portfolio Standard of 25% by 2020. Our model has also been used to evaluate the impact of the current tax structure in Colorado and impacts of reduced tourism due to the recent flooding. The Fort Collins CGE model has been used to advise local policymakers on the costs and benefits of economic growth, the optimal zoning of land for either manufacturing or retail use, the impacts of raising the city sales tax rate and the impact of alternative energy policies. More information about the Colorado model is available from Harvey.cutler@colostate.edu.

Aspect 1. Simulating the impacts of higher income taxes and higher public P-12 education expenditures

Tax impacts of Amendment 66

Amendment 66 re-introduces a progressive personal income tax system to Colorado. Although all individuals with taxable income will face higher tax rates, the highest income earners will see a larger share of their income paid out in state income taxes. Because these increases reduce after-tax income, total household spending will decline, subsequently impacting the state's consumption economy. An important impact is that the economy's consumption sectors (eg, retail and services) will be particularly impacted. A subsequent impact is that households with family members losing their jobs will see their own incomes reduced, further exacerbating the negative impacts of higher tax rates.

In our model we examine the employment and household income impacts of higher taxes for different household "types," as delineated by income. In our simulations we adjust the state personal income tax rates for households as proposed by the Amendment. For the households earning less than \$75,000 per year we increase the state income tax to 5.0 percent. For households earning more than \$75,000 per year in taxable income we tax the first \$75,000 by 5.0 percent and any income above this amount at the 5.9 percent rate. The "negative" effects on the state economy are the differences in the economy under this new regime relative to the baseline case.

The proposed tax rate increases also affect local government finances. Specifically, because after tax household income is lower, Colorado residents will spend less on goods and services that are subject to local sales and use taxes, resulting in lower government revenues. We estimate these impacts.

Expenditure impacts of increased public P-12 education spending

The revenues raised by Amendment 66 will be used to fund new education initiatives designed to increase student performance and capabilities. One important goal is to reduce classroom sizes and increase the amount of one-on-one instruction, especially for students needing extra help. To meet this goal, school districts will use much of the extra funding to hire more teachers and educational professionals. As a result, employment in the education sector and its related activities will increase. Further, as new employees are hired, their incomes recirculate in the state economy. This new activity effectively offsets some of the aggregate consumption sector losses due to higher taxes, although it partially does so by redistributing income from higher income households to lower income households.

To simulate the expenditure effects of Amendment 66, we use the tax revenue generated to increase spending in the education sector of our state model. The short-run effect is to increase employment and earnings, especially for middle-income households. The resulting increase in expenditures will help local governments by increasing sales tax revenue.

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The proposed tax rate increases also affect local government finances. Specifically, because after tax household income is lower, Colorado residents will spend less on goods and services that are subject to local sales and use taxes, resulting in lower municipal and county government revenues.

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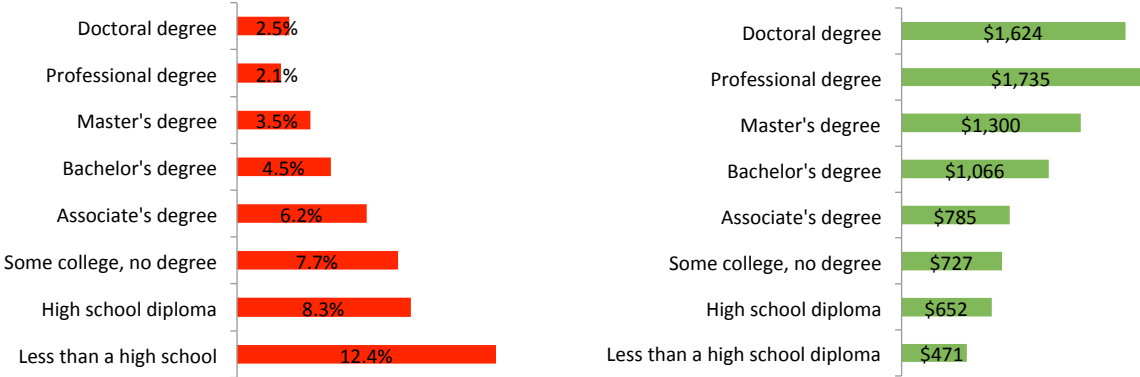
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Aspect 2. Simulating the “positive” impacts of increased worker and factor productivity

Previous research on how higher P-12 education expenditures impact economic activity examines a wide range of topics and presents a variety of conclusions. One common area of study examines how reduced classroom sizes impact student performance. Whitehurst and Chingos (2011) provide a review of the empirical findings, which are mixed. For example, some studies (eg, Krueger 1999) find a large impact, with class-size reductions, on the order of magnitude of 7-10 fewer students per class, having significant long-term effects on student achievement. According to Whitehurst and Chingos “the academic effects seem to be largest when introduced in the earliest grades, and for students from less advantaged family backgrounds.” Not all studies concur. For example, Hoxby (2000) concludes that reduced classrooms sizes do not lead to better student performance.

The positive relationship between income and educational attainment is well documented. According to the US Bureau of Labor Statistics, the median full-time wage and salary weekly earnings in 2012 for adults 25+ years of age with a bachelor’s degree, high school diploma and less than a high school diploma were \$1,066, \$652 and \$471, respectively (Chart 1). Unemployment rates fall with education as well. In 2012 the rate was 8.3 percent for high school diploma holders and 12.4 percent for those without. The unemployment rates for those with a bachelor’s degree were 4.5 percent. Put another way, high school graduates are less likely to be unemployed than workers without such a degree and earn 38 percent more each year.

Chart 1. 2012 Unemployment rates and median weekly earnings by educational attainment



Source: Bureau of Labor Statistics/Current Population Survey

Two (implied) purposes of Amendment 66 are to provide funding for initiatives that increase high school graduation rates and to make sure students are better prepared for post-secondary education and training programs. In 2010-11, Colorado’s 4-year high school graduation rate stood at 74 percent, according to the US Department of Education. For economic disadvantaged students, the rate was 62 percent. The average across all US states, by comparison, was 78 percent.

The research of student spending’s impacts on graduation rates is fairly limited. In preparing this paper we examined state-by-state variation in high school graduation rates as related to economic growth and per pupil expenditures. We find, on average, that high school graduation rates are higher in states that spend more per pupil. Applying our statistical results for Colorado, we suggest that higher per pupil spending as afforded by Amendment 66 could increase the state’s overall high-school graduation rate by about 2 percentage points. With higher educational attainment, Colorado workers will be more productive, which enhances the state’s economic competitive position and increases household earnings.

A related body of research looks at the effects of education on long-term economic growth. The evidence overwhelmingly suggests that average educational attainment is positively related to both the level and growth in per capita income. Restated, places with a higher educated population are richer than those with lower education levels and the gap between them is increasing over time.⁴

Labor productivity

To examine how increased educational spending will impact Colorado’s economy in the long-run we first look at its impacts on worker productivity. The basic idea is that as individual workers become more productive the overall economy strengthens. Our Colorado economic model allocates workers across 5 annual earnings (aka, labor) groups. Although not a perfect relationship, these groups are closely aligned

⁴ The “true” effects of spending on graduation rates are somewhat ambiguous in previous studies, although we find a positive correlation in our own statistical modeling. In our analysis below the modest positive productivity impacts we model depend only slightly on increased graduation rates; rather they are more driven by overall increases in workforce quality. The research looking at the relationship between educational attainment, worker productivity and growth is unequivocal—more education is good for growth.

with educational attainment--in our model higher income labor groups have higher average educational attainment for the head(s) of household.

In Table 1 we describe the 5 labor groups in our model, based on state-level Quarterly Census of Employment and Wages (QCEW) data from the Colorado Department of Labor and Employment and the Public Use Microdata Sample (PUMS) from the US Census Bureau. For example, the state has about 296,683 workers in labor group 3, which earns between \$50,001 and \$70,000 per year. This labor group represented 12 percent of all state workers in 2010.

Labor Groups	Number of workers	
	per group	Share of all workers
$\$20,000 \geq L_1$	934,202	39%
$\$20,001 \leq L_2 \leq \$50,000$	809,202	34%
$\$50,001 < L_3 \leq \$70,000$	296,863	12%
$\$70,001 < L_4 \leq \$100,000$	201,700	8%
$\$100,001 < L_5$	158,033	7%

The foundation for this aspect of our simulations is that higher education spending will increase both high school graduation rates, and the likelihood of attending/finishing college. These anticipated effects are not dramatic, but they are important. As educational attainment increases, the number of workers in lower-earning income groups falls and the number in middle-income groups rises. As workers transition into a higher wage group, they are modeled to be more productive and generate more economic activity. We refer to this as the “human capital” effect.

Few previous studies directly link P-12 educational spending and labor force productivity. Accordingly, our modeling challenge is to determine the number of annual new graduates due to higher education expenditures. We accomplish this by using our estimated relationship between graduation rates and per pupil spending, predicting that the state will see an average of about 1,200 more high school graduates per year over the next 20 years relative to the baseline case.⁵ We model this cumulative effect by changing the composition of workers in the five labor groups to reflect the more educated workforce. Although this is speculative, our results are not highly sensitive to moderate deviations in this impact.

Factor productivity

A second important consideration is how P-12 spending impacts total factor productivity (TFP). TFP refers the ability of firms to coordinate the use of labor, physical capital and land in the production of goods and services. The basic interpretation is that if there is an increase in TFP, then businesses can produce a larger amount of output given a fixed amount of labor, physical capital and land. In other words, a TFP increase means that existing resources are used more productively, increasing the state’s relative competitive position in the global economy. As an example, it might be the case that more educated or skilled workers are better able to absorb and implement new technologies. Further, economic research shows that skilled workers increase the productivity of their colleagues. For example, Mas and Moretti (2009) find that supermarket workers get more productive when better workers are in their shift.

⁵ We make a 20-year projection of increased graduation numbers, applying our newly projected rate to expected enrollment growth in K-12. The 1,200 additional graduates we use represent the 10-year point.

A common approach economists use to measure education's impacts on TFP is to estimate how an additional year of schooling affects real GDP growth rates. Most previous studies make international comparisons, where educational attainment across countries can vary substantially. For example, Mankiw et al (1992) estimated an additional year of schooling increases GDP output levels between 6 and 15 percent in OECD countries, while Bassinini and Scarpeta (2002) estimated the impact to be around 6 percent. In separate studies of Australia, Benhabib and Spiegel (1994), Frantzen (2000) and Dorwick and Rodgers (2002) look at the TFP growth effects of an additional year of schooling, finding growth rates increase between 0.2 and 0.8 percentage points.

Since the high school graduation rate in Colorado is already 74 percent, it is implausible to expect that the additional spending under Amendment 66 would result in an average of one additional year of schooling statewide. Accordingly, the results suggested by previous research are not fully applicable in Colorado. Still, most evidence does suggest that more education increases TFP. To account for this we take a very conservative approach in our own modeling efforts, and make only a very small positive adjustment relative to previous research findings. Specifically, we offer our productivity estimates with a lower bound (0.1 percent increase in TFP) and an upper bound (0.4 percent increase).

3. Results: Total employment and income effects depend on magnitude of labor productivity changes

We conduct three simulations to examine the two aspects of Amendment 66. In the first simulation (Aspect 1, short-term) we look at the impact of increased personal income taxes and greater expenditures on education. In the second and third simulations we expand Aspect 1 by introducing low and high-productivity impacts, respectively. In this section we discuss impacts on total employment, gross state product (GSP) and local tax revenues. In the next section we look at how the Amendment will affect income distribution statewide.

The first simulation changes the personal income tax rates and increased government spending on P-12 education. It is a "short-term" effect in that we assume that the impact of increased educational spending has not had time to have an impact on productivity. In previous work, we find that the short-term impacts take about 2-3 years to be fully realized. These results appear in Table 2.

Over all, we find that the short-run impacts result in a loss of 11,531 jobs (0.42% decline in total employment). The sectors most adversely impacted are high services (- 2,867 jobs) and retail (-2,577 jobs). This is due to the fact that the tax increases reduce the amount of money households can spend on goods and services. Recall that the service and retail job losses are net effects, combining the losses from reduced household spending due to higher income taxes with the gains from spinoff spending from job gains in the education sectors. GSP falls by a little over \$3 billion. Tax revenue for local municipalities falls by \$67.4 million or 0.74%.

Table 2: Aggregate Impacts of the Three Simulations

	1. Increased Taxes and Spending (short-term)		2. Tax and Spend and Low Productivity (long-run)		3. Tax and Spend and High Productivity (long-run)	
	Absolute Change	Percent Change	Absolute Change	Percent Change	Absolute Change	Percent Change
Total Employment	-11,531	-0.42%	-7,216	-0.26%	4,771	0.17%
Local tax revenue (millions of \$)	-67.4	-0.74%	-32.1	-0.35%	8.1	0.09%
Gross State Product (millions of \$)	-3,040.2	-1.03%	-531.7	-0.18%	1,481.7	0.50%

Our second simulation (Table 2) combines the tax increase with the human capital and lower bound TFP effects. We refer to this as the “long-run” impact, whereby the full effects of increased P-12 funding have been actualized. It is difficult to determine exactly how long this will take; our work provides an annual average once the productivity changes have been realized. In this scenario total employment falls by 7,216 and GSP falls by \$531.7 million.

The third simulation combines the tax increase with the human capital and the upper bound TFP effects. This is also a long-run impact where the full effects of the increase in P-12 funding have been actualized. Employment now increases by 4,771 workers and GSP increases by \$1.4 billion (0.50 percent). Local tax revenue increases by \$8.1 million in this scenario.

Overall, the three simulation results underscore the importance of the productivity impacts of the additional spending. When productivity is unchanged or increases by only a small amount, then the long-run impacts on aggregate output and employment are negative, although small. Under higher, yet reasonable assumptions about productivity increases, the long-term impacts turn positive, although still small.

Looking at our analysis in the over all context of the state economy, the long-term impacts (positive or negative) are not substantial in either direction. This implies that Amendment 66 will neither be a drain on the state economy nor a substantial catalyst for economic growth.

4. Results: Amendment 66 and subsequent increased educational spending will provide greatest benefit to Colorado’s lowest earning households; wealthiest households adversely impacted

Over the last 30 years income inequality has increased dramatically in both Colorado and the US. Since 1990, US real GDP has grown by more than 72 percent. Yet over this time the lowest income households have seen declines or modest income growth at best, while higher earning households have accrued most of the gains from overall growth. Recent evidence suggests a similar story in Colorado. According to the Center for Budget and Policy Priorities, incomes for the top-20 percent of households in Colorado grew by 13.9 percent from the late 1990s to the mid-2000s. Conversely, the poorest households saw a 11.7% reduction in income over the same time period.

Although there are myriad reasons why this is occurring, recent economic research shows tax policy changes can affect income distribution. In this section we use our model to examine how Amendment 66 affects income distribution in each of the three simulations.

Because Amendment 66 re-introduces a two-tier personal income tax in Colorado, the vast majority of additional income tax revenue will be collected from higher income households, so after tax income falls most for these groups. However, because the revenues are used to increase education spending, including hiring additional teachers and education professionals, middle-income groups actually see an increase in *aggregate* disposable income, despite higher taxes. With this additional income, consumption increases for a wide range of goods and services, with much flowing into the retail and service sectors. This serves to offset some of the losses described above in these same sectors due to higher taxes.

These sectors also primarily employ people earning less than \$75,000, so total income for these households increases still more. The effect is that resources are allocated away from people earning above \$75,000 and reallocated toward people earning less than that.

One important feature of the Colorado CGE model in examining policy changes is that it “maps” the labor impacts (eg, job and wage changes, by labor group) into household income groups. In particular, each job (delineated by industry) is associated with a household (delineated by income). Thus, we are able to see how differential income tax rates and job losses and gains affect various households.

In the following tables we disaggregate the total impacts presented above to examine how seven different household income groups will be impacted by Amendment 66. We present a unique table for each of the three scenarios. The first column of each table identifies the household income group, while the second and third columns describe how the “average” household in each income group will be impacted (level and percentage changes, respectively).

The Colorado model examines several different measures of total household income. Our interest here is income households have available to spend after they pay state and federal income taxes (disposable income). To make our results easily interpretable, we divide total after tax income impacts by the number of households in each category to calculate the level and rate of change in real per household after tax income.

In Table 3 we present the short-term distributional impacts from scenario 1 (increased tax and spending; no productivity gains). Here we see that the largest losses accrue to the highest earning households. HH7, which are households that make over \$100,000, see their disposable income fall by \$1,701 per family. From another perspective, the typical HH7 household is paying \$1,701 to better fund P-12 education. On average, HH6 households are paying \$773 per household to better fund P-12 education.

Table 3: Impacts on Real Per Household Disposable Income: (Scenario 1: Tax and Spending increases, short-run)

Change in Real Per Household After Tax Income		
Household Groups	Absolute Change	Percent Change
Annual Income Earned		
HH1 ≤ \$10,000	\$22	0.1%
\$10,001 < HH2 ≤ \$20,000	\$62	0.3%
\$20,001 < HH3 ≤ \$40,000	-\$37	-0.1%
\$40,001 < HH4 ≤ \$50,000	-\$73	-0.2%
\$50,001 < HH5 ≤ \$70,000	\$41	0.1%
\$70,001 < HH6 ≤ \$100,000	-\$773	-0.7%
\$100,001 < HH7	-\$1,701	-1.2%

The impact on the other household groups tells the story from a different perspective. As noted above, some of the additional tax revenue that is collected under Amendment 66 will be used to hire new teachers and educational professionals and raise salaries for existing teachers. Therefore, there are people that benefit from this policy even though they pay higher state income taxes. This is clear in HH5, which sees an after tax income per household increase by \$41. Most of the new jobs in education as well the higher wages for existing educational workers occur in this group. Even though they are paying higher income taxes, the average wage gains offset the income tax effect.

The average household in HH3 and HH4 see after tax income fall by \$38 and \$73 per household, respectively. This change is much smaller than the effects on HH6 and HH7 because these households have much less taxable income. Further, the workers in HH3 and HH4 see some benefits of the increased expenditures from HH5 on retail, services and other sectors. We see that HH1 and HH2 experience a small increase disposable income per household since there is an increase in the number of jobs for the lowest wage group (L1) in the economy. Once again, we see the impacts of higher productivity coupled with the expansionary impacts of higher government spending offsetting some of the losses due to higher taxes. Since there are many workers in the L1 group that reside in HH1 and HH2, these household groups see a slight increase in disposable income.

In Table 4 we present the long-run distributional impacts from scenario 3 (increased tax and spending; low productivity gains). In this simulation we see that all household groups except HH7 now have more income to spend after taxes. As an example, people earning between \$20,000 and \$40,000 can now spend an additional \$199 dollars per year due to the fiscal policy change. This impact is due to the effect of increases in labor and total factor productivity.

Finally, Table 5 presents the scenario 3 results, with tax, spending and high productivity impacts. We now see that all household groups except HH7 now have more after tax money to spend. This finding is attributable to the fact that the productivity gains from increased P-12 education expenditures accrue primarily to lower and middle-income workers.

Table 4: Impacts on Real Per Household Disposable Income (Scenario 2: Tax and Spending increases, Low Productivity Increase, long-term)

Change in Real Per Household After Tax Income		
Household Groups		
Annual Income Earned	Absolute Change	Percent Change
HH1 ≤ \$10,000	\$106.21	0.5%
\$10,001 < HH2 ≤ \$20,000	235.21	1.0%
\$20,001 < HH3 ≤ \$40,000	198.58	0.6%
\$40,001 < HH4 ≤ \$50,000	238.70	0.5%
\$50,001 < HH5 ≤ \$70,000	508.60	0.8%
\$70,001 < HH6 ≤ \$100,000	8.63	0.0%
\$100,001 < HH7	-419.94	-0.3%

Table 5: Impacts on Real Per Household Disposable Income (Scenario 3: Tax and Spending increases, High Productivity Increase, long-term)

Change in Real Per Household After Tax Income		
Household Groups		
Annual Income Earned	Absolute Change	Percent Change
HH1 ≤ \$10,000	\$137.59	0.65%
\$10,001 < HH2 ≤ \$20,000	292.55	1.25%
\$20,001 < HH3 ≤ \$40,000	275.97	0.78%
\$40,001 < HH4 ≤ \$50,000	338.99	0.73%
\$50,001 < HH5 ≤ \$70,000	645.33	1.07%
\$70,001 < HH6 ≤ \$100,000	237.73	0.23%
\$100,001 < HH7	-81.78	-0.06%

Other impacts not considered here

In this study we looked at an admittedly limited set of impacts. While we have attempted to quantify many of the employment and income effects, there are some other potential areas we did not consider. In a recent paper,⁶ Jack Strauss, an economist at CU-Denver reviews the literature on how education spending affects outcomes of interest we don't explicitly model in this analysis. Some examples include:

- *Lower crime rates.* Previous research shows that an individuals' propensity to commit a crime decreases as their education and earnings increase. Substantial reductions in crime can decrease public outlays for both public protection and corrections.
- *Lower unemployment and welfare costs.* As one's education increases, the likelihood they are unemployed and/or in poverty declines. At the state-level, higher average educational attainment can lead to lower spending on unemployment compensation and human services, such as TANF and Medicaid.

⁶ Strauss, Jack, The Economic Gains to Colorado of Amendment 66 (September 17, 2013). Available at SSRN: <http://ssrn.com/abstract=2327342> or <http://dx.doi.org/10.2139/ssrn.2327342>

- *Lower healthcare costs.* The likelihood that an individual smokes, drinks or is obese declines with their education. These maladies all impose significant costs to Coloradoans.

5. Summary and Conclusions

Should Amendment 66 pass, the subsequent tax increases and new spending in P-12 public education will have important economic impacts statewide. Under higher personal income tax rates, household disposable income will decline, and ensuing reductions in overall spending will contract some sectors of the economy.

But the tax increases do not occur in a vacuum; all of the money raised by Amendment 66 is dedicated to increasing public P-12 education spending. This additional spending will have two effects. First, it will stimulate economic activity in the state's education sector, as new teachers and educational professionals are hired. Their spending will create still more jobs. Over all, we estimate the combination of higher taxes and increased education spending this lead to 11,531 fewer jobs in Colorado, in the short-run. This represents about 0.4 percent of total state employment (Colorado is expected to add about 60,000 total jobs in 2014).

These losses can be partially or fully offset, however, by increases in worker productivity as related to higher education spending. Previous research shows that when spending leads to higher high school graduation rates and better individual performance, then productivity and economic growth rates both increase. In this analysis we make conservative assumptions about how spending will affect productivity and find that many or all of the employment and disposable income losses due to higher taxes will be offset by growth in other sectors in the long-run. Under a low-productivity increase assumption, our results suggest that the state will see 7,216 fewer jobs in the long-run. Under a reasonable high-productivity increase assumption, we actually predict a slight increase in long-run employment (4,771). One important implication is that the statewide impacts of the spending depend largely on how *effectively* this money is used.

Our analysis also considers the differential impacts of Amendment 66 across household income groups. Over the past 15 years, Colorado's overall economy has grown substantially. Yet this growth has not been equally distributed across households. Over this time frame the state's lowest income households have actually witnessed declining real incomes, while the top-earnings households have seen the greatest increases.

Because Amendment 66 re-introduces a progressive tax structure, and because the associated spending hires more "middle class" workers, and because the program seeks to increase the skills and capabilities of high school graduates, the benefits accrue primarily to lower and middle-income earning households.

Finally, the work we do here offers the most careful modeling of the issue to date. However, it does not consider all of the potential benefits. For example, previous research suggests more educated people are healthier and demand fewer public services, such as unemployment compensation, Medicaid and income assistance programs, such as TANF and food stamps. Estimating these impacts is a more speculative endeavor, and beyond the scope of this analysis.

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