Economic Impact of Restricting Housing Growth to No More Than 1% In Colorado

A Closer Look at the Economic and Fiscal Impacts of Initiative 66 and Why Housing Matters For the State's Economic Future.

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COMMON SENSE
Policy Roundtable

COLORADO CONCERN

DENVER SOUTH
ECONOMIC DEVELOPMENT PARTNERSHIP

colorado association of REALTORS®

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Exhibit A

About the REMI Partnership

A partnership of public and private organizations announced in July 2013 the formation of a collaboration to provide Colorado lawmakers, policy makers, business leaders, and citizens, with greater insight into the economic impact of public policy decisions that face the state and surrounding regions. The parties involved include the Colorado Association of REALTORS®, the Colorado Bankers Association, Colorado Concern, Common Sense Policy Roundtable and Denver South Economic Development Partnership. This consortium meets monthly to discuss pressing economic issues impacting the state and to prioritize and manage its independent research efforts.

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Summary

Based upon the projected household growth and recent housing development history, the 10-county front range region covering Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer and Weld, is projected to add an average of around 35,000 and 43,200 new housing units per year over the next ten years. This amounts to an average annual growth rate of 1.8% or 2.3%.

Under the proposed citizen led Initiative 66, titled "A Limit on Local Housing Growth," the 10-county region described above, would not be able to see new residential housing grow at a rate above 1%. Through rules not specified in the initiative, county governments would be required to develop a way to restrict growth to meet the 1% growth cap across all its local cities, overriding their current local control over housing permitting.

The difference between the number of units that would be allowed to be built under the 1% cap compared to the baseline projections would result in somewhere around 158,000 to 240,000 fewer new housing units over the next 10 years. This amounts to a 45% to 55% reduction in new units. The resulting decline in new residential housing investment would be around $53.7 Billion to $80 Billion and cause the total number of jobs in the state to decline by 35,000 to 55,000 per year over the next 10 years. 58.5% of all job loss would occur outside of the construction sector as other professional and real estate services and retail spending goes away.

Overview

HOUSING MATTERS

While providing a roof to sleep under, the amount of money spent on housing typically represents a household's single largest monthly expense. At the same time, the combined contribution of residential fixed investment and consumption of housing related services equals around 15.5% of the US economy (National Association of Home Builders, 2018). Here in Colorado, rental prices and home prices have soared in recent years, far outpacing income growth. Coming out of the last recession there were larger numbers of vacant houses allowing the state's growing population to fill into existing communities without a significant amount of new construction. In 2010 for every 10 new households across 10 front range counties, the region only added 3 to 4 new houses. But in 2016, as vacancy rates have dropped, for every 10 new households across the front-range, 10 to 12 new housing units were built, indicating significant pressure on the supply of housing. You can see the relationship of household growth to housing unit and permit growth in the figure below.
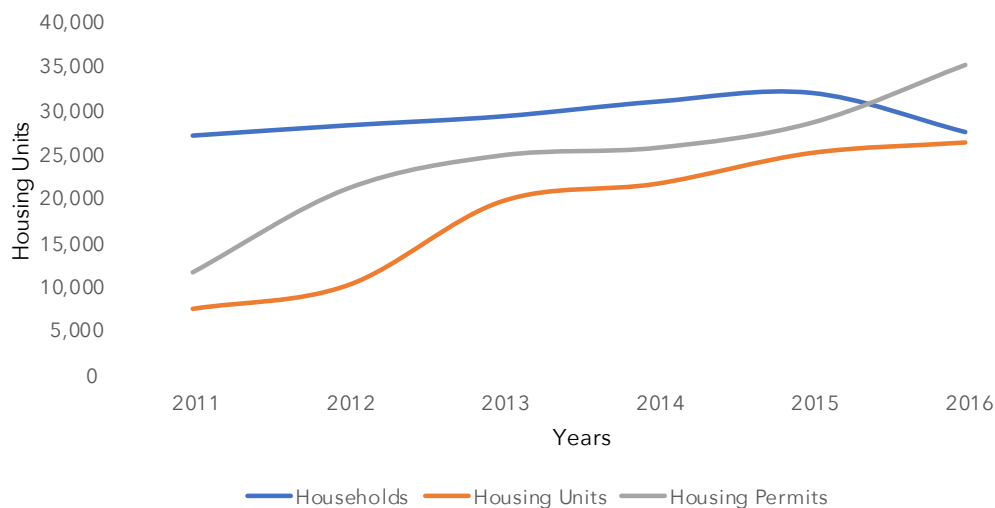
Figure 1: Annual historic growth of housing units, housing permits and households. As vacancy rates have dropped, the region now adds more new housing units on average for every new household than it did coming out of the last recession.

How elected officials and the citizens of Colorado choose to address the state's issues related to growth, will dictate the prosperity of Coloradans for years to come. The concerns that come with strong growth, including demands on infrastructure, schools, open spaces, and water are real and need to be met with smart policy efforts to mitigate any negative impacts. However, a growing effort to restrict residential housing growth to no more than 1% per year that may appear on the ballot this fall, will have immense economic ramifications as it eliminates the construction of around 31,000 or 49,000 new units over just the first 2 years alone.

Initiative 66, titled "Limit on Local Housing Growth," would impose a 1% cap on the number of new housing permits, relative to the total number of existing homes, that could be issued in any given calendar year across 10 front range counties. This rule would impose that cap at the county level and would require the counties to develop a process to issue housing permits, that would ultimately overrule any current permitting process at a city of local level.

Ten counties would be immediately impacted. If passed in the fall of 2018, voters would not be allowed to vote to remove or amend the 1% cap until after 2020.

## THE 10 COUNTIES DIRECTLY IMPACTED:

- Adams County
- Arapahoe County
- Boulder County
- Broomfield County
- Denver County
- Douglas County
- El Paso County
- Jefferson County
- Larimer County
- Weld County

Within this area, both the City of Golden and the City of Boulder already have similar 1% housing growth caps in place. In 2017, the median sales price of a home in Golden was $520,200, and $825,000 in Boulder (Zillow, 2019). The average median sales price of the Denver Metro covering, Jefferson, Denver, Adams, Arapahoe and Douglas counties was $313,952. This puts the median sales price in Golden and Boulder, 166% and 263% higher than the region's average. The issue of housing affordability in these areas is likely even softened by the fact that as Golden and Boulder have chosen to cap their growth, surrounding communities in the rest of Boulder County, Jefferson County, Weld County, Larimer County, Broomfield County and even Denver County, have allowed workers needing to commute into those cities to find more affordable housing options.

Under Initiative 66 the options for the areas that could accommodate displaced growth and still provide access to employment centers are incredibly limited. The ability for the closest mountain communities in Gilpin County or Clear Creek County or the border towns in Elbert County to accommodate displaced growth would be very challenging. Central City, the largest city in Gilpin County, has a total population of roughly 730 people and sits roughly 35 miles from downtown Denver. The town of Elizabeth in Elbert County has a total population of 1,400 people and is roughly 52 miles from Colorado Springs and 43 miles from downtown Denver. The map in Figure 2 shows all 10 impacted counties along with some of the surrounding counties.

To the extent any growth is displaced to surrounding communities that can still access employment centers, the sprawl would only cause further transportation, energy and water infrastructure problems. Similar to the limited likelihood that individuals unable to find a home will relocate within Colorado outside of the growth restricted areas, large companies and small businesses will face similar challenges. Businesses choose to locate near areas they can find workers, customers and suppliers. The likelihood that an employer in the front-range looking to expand, or a new business looking to relocate within the 10-county region, would choose another part of the state not subject to the cap will likely be minimal if any.

Figure 2: Map of impacted counties
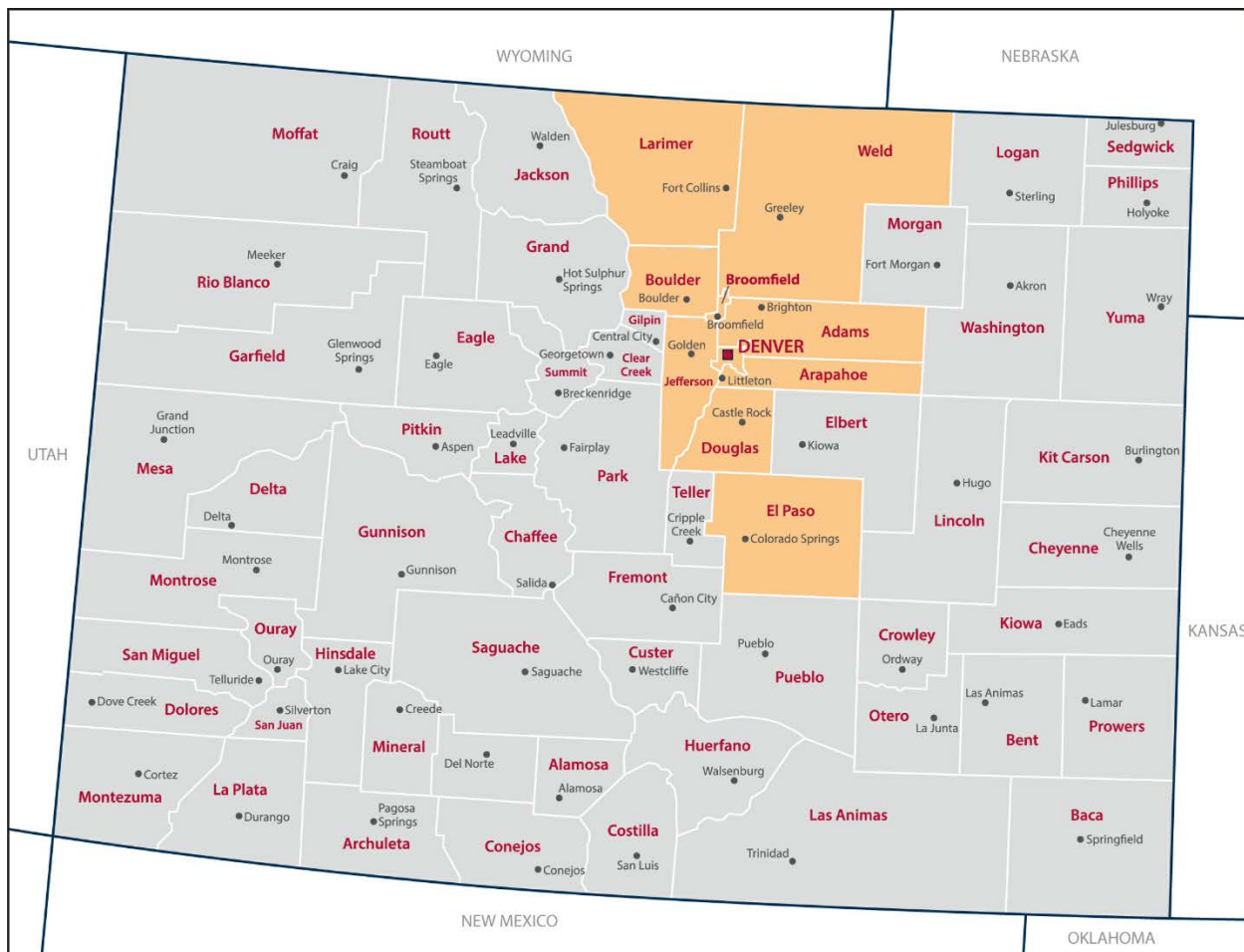
This report analyzes two alternative projections for what the current level of new housing growth is estimated to look like as a baseline. The two alternatives were developed using different approaches to estimate how housing growth would occur in each county relative to the projected level of household growth from the State Demography Office. One approach estimated a three-year average of housing unit growth relative to household growth, and then applied that percentage to the household projections for 2019 through 2028. The second approach estimated a three-year average of housing permits relative to household growth and then applied that percentage to the household projections for 2019 through 2028.

Figure 3 provides a look at the historical number of housing units and residential housing permits along with a 2018 through 2028 projection. Also included in the figure are the estimates for what the number of housing units would be if under each projection the number was only able to grow at 1% from 2019 to 2028.

With an estimated 1.8 million housing units throughout the 10 counties directly impacted by this initiative, the 1% cap would allow only 37,000 new units to be constructed between 2019 and 2020 or roughly 18,500 per year. Using two alternative methodologies to estimate the current forecast for housing units based upon the household projections from the state demographer's office, this cap would eliminate the construction of an average of 23,900 or 15,700 new homes per year over the next decade. Of the lost number of units, an estimated 58.02% would be single family detached homes, 6.23% would be single family attached, mostly townhomes, and 35.75% would be apartments.

Here is a look at the historical numbers of housing units compared to the projections for the next two years.

Figure 3: Historical housing units and 2019-2028 projections
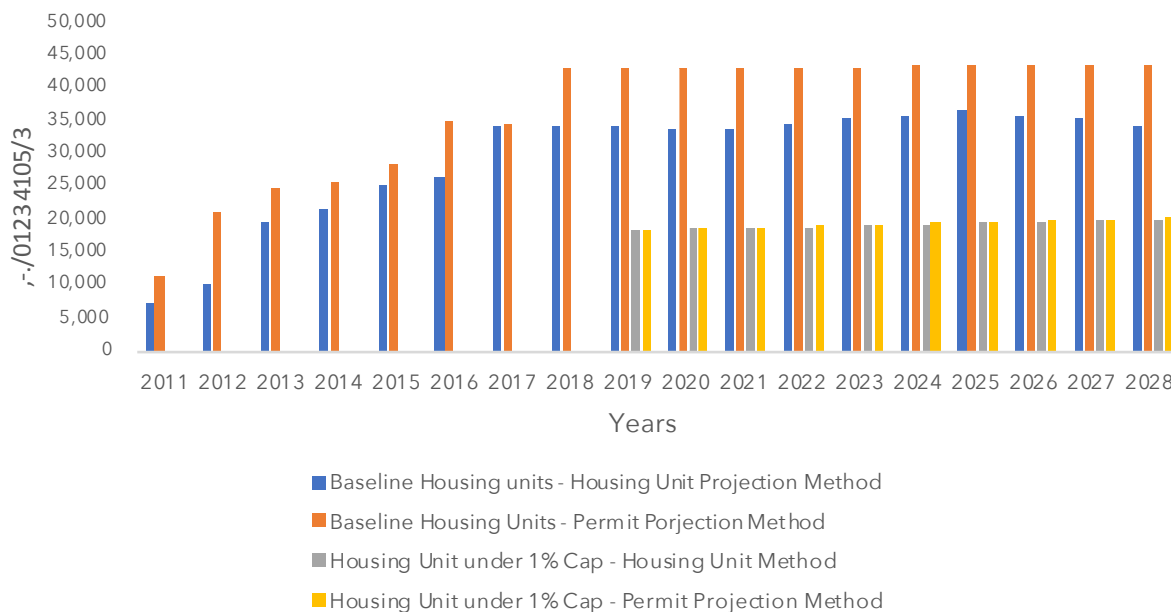
For the period of 2019-2028 the estimated impact of Initiative 66 would;

- Eliminate between 45% to 55% of new residential housing units
- Remove $54B to $80B in new residential investment spending
- Reduce the number of jobs by between 36,000 and 55,000 annually
- Overrule local jurisdiction's control of issuing housing permits

Given the stakes, it is critical for voters to understand the economic, fiscal and broader impacts that such a policy would create. While there are real issues which will restrict growth, imposing a one-size fits all cap will only cause harm to the state's economic future.

QUICK PRIMER ON GROWTH, POPULATION, HOUSEHOLDS AND HOUSING

There are many ways to measure growth for a regional economy. Population growth covers the growth in all people, young, old, native or migrants. With a current population of 5,722,618, over the past 10 years the average annual population growth in Colorado has been 1.67% and is projected to grow another 1.6% per year over the next 2 years, or roughly by 71,000 people on average per-year. The US average population growth from 2010 to 2017 was .74%.

Household growth captures the growth in the number of occupied housing structures, or the number of houses that have people living in them. This reflects an average of all households from families with 3 children living in a 5-bedroom home, to empty nesters, retirees, and single individuals renting one-bedroom apartments. The average household size currently stands as 2.56 people per household. The current total number of households in all 10 counties is 1,809,473, and the average annual household growth over the past 8 years, has been 1.91% and is projected by the Colorado state demographer's office to be 2.2%, or 39,426 per-year on average for the next 2 years.

Housing reflects the total number of residential housing units regardless of whether someone lives in it or not. In 2018 there are an estimated 1.83 million housing units throughout the 10-county region. This covers single-family detached homes, attached townhouses as well as apartments, condominiums and mobile homes. It does not cover hotel rooms. The estimates for the annual growth rate from 2010 to 2016 was just 1.08% per year. Using the housing unit methodology, there will be an estimated average annual growth rate of 1.83%, or 33,945 units per year, for the years 2019-2020 under current baseline. Using the housing permit methodology that figure jumps to 2.3% growth, or 43,072 units per-year, on average for 2019 and 2020. This is the metric that will be restricted under Initiative 66.

REDUCTION IN NEW HOUSING UNITS FROM 1% CAP

To estimate the annual reduction in new housing units under a 1% growth cap, this report compared the annual growth in new housing units with each projection method both with and without a 1% imposed cap for each year from 2019 to 2028. With each method, housing units for each county are expected to grow at a rate above 1% for at least the next two years. All counties, except Jefferson County, are also projected to have a growth rate above 1% for the 2021-2028 period. We assumed that in the years that Jefferson County is not projected to grow above 1%, we assumed that displaced growth from surrounding counties would move to Jefferson County and cause it to hit the 1% cap. Therefore, that displacement was able to lower the net loss in new residential investment. More information on the development of each method for projecting housing growth can be found in the methodology appendix.

The figure 4 and table 1 show the reduction across all 10 counties over the 10-year window. Given there is not a single source for a projection of housing units by county in the state, using two methods to estimate the loss provides the ability to demonstrate a range of impacts, but should not be interpreted as necessarily a lower and upper bound.

The historical permits projection method offers a higher estimate for the lost number of housing units. With the 1% cap, a total of 239,000 new units would be lost over 10 years, or a 55.3% reduction in new housing units compared to the no cap scenario. The historical housing unit projection method produces a lower estimate of lost residential units suggesting a total of 158,000 fewer housing units with the 1% cap, or a 45% reduction in the number of new units compared to the no cap scenario.

Figure 4: 10-county total reduction in new housing units
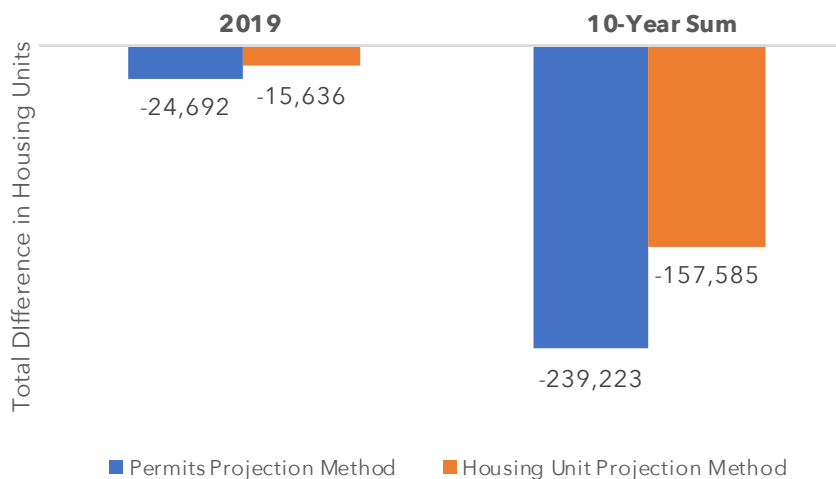
DIFFERENCE IN HOUSING UNITS BY COUNTY

COUNTY	PERMITS PROJECTION METHOD			HOUSING UNIT PROJECTION METHOD		
	2019	10-Year Sum	10-Year % Difference in New Residential Units	2019	10-Year Sum	10-Year % Difference in New Residential Units
Adams County	-5,832	-60,245	-75.91%	-2,902	-29,885	-61.37%
Arapahoe County	-3,015	-27,989	-50.92%	-1,306	-10,733	-28.60%
Boulder County	-597	-5,655	-28.20%	-615	-5,691	-28.33%
Broomfield County	-281	-2,725	-48.19%	-856	-8,608	-74.21%
Denver County	-5,235	-49,358	-58.85%	-3,270	-40,540	-54.17%
Douglas County	-2,778	-27,475	-67.69%	-2,069	-20,354	-60.96%
El Paso County	-2,280	-21,837	-42.99%	-1,378	-12,810	-30.74%
Jefferson County	-393	-2,387	-8.53%	-420	2,524	10.93%
Larimer County	-1,599	-15,171	-49.05%	-1,011	-10,176	-39.34%
Weld County	-2,683	-26,382	-69.21%	-1,808	-21,312	-64.66%
10-County Sum	-24,692	-239,223	-55.33%	-15,636	-157,585	-45.06%

Table 1: Difference in housing units by county

Above figures present the numbers of housing units lost by county by year for both projection methods. It also gives the percentage loss that those numbers represent against the baseline number of new units. Based on the permits projection method, the top three counties who will lose the most housing units on a percentage basis from 2019 to 2028 would be Adams, Denver and Arapahoe. Based on the housing unit projection method, the counties that lose the most on a percentage basis would be Douglas, Weld and Adams. In contrast, Jefferson County would see the smallest relative impact on new housing units for both methods.

DIFFERENCE IN DIRECT RESIDENTIAL SALES LOSS (FIXED 2018 $)

COUNTY	PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
	2019	2019-2028	2019	2019-2028
Adams County	-$1,761,902,025	-$18,200,741,859	-$876,628,364	-$9,028,727,891
Arapahoe County	-$1,020,255,741	-$9,472,559,071	-$441,961,114	-$3,632,504,261
Boulder County	-$265,856,168	-$2,516,670,354	-$273,639,228	-$2,532,428,111
Broomfield County	-$107,406,472	-$1,042,141,310	-$327,439,175	-$3,291,597,022
Denver County	-$1,946,370,236	-$18,350,232,173	-$1,215,642,076	-$15,071,865,986
Douglas County	-$1,196,224,174	-$11,830,824,339	-$891,117,356	-$8,764,493,284
El Paso County	-$600,665,245	-$5,753,627,836	-$363,110,338	-$3,375,178,216
Jefferson County	-$143,421,386	-$871,530,126	-$153,443,879	$921,597,997
Larimer County	-$493,404,758	-$4,681,316,399	-$312,106,064	-$3,140,225,204
Weld County	-$727,571,685	-$7,154,846,922	-$490,288,856	-$5,779,882,642
All 10 Counties	-$8,263,077,888	-$79,874,490,388	-$5,345,376,450	-$53,695,304,619

Table 2: Direct loss in residential investment by county

Above figures provide the total direct residential sales loss by county by year. Both projection methods conclude Denver county, Adams county, and Douglas county would be the top 3 counties bearing the most significant residential sales loss in dollars if the 1% housing unit cap is applied. Broomfield or Jefferson county are the least impacted counties.

While the 10 impacted counties will see direct losses to residential investment, it may be the case that some households choose to locate outside of the 10-county region but stay within Colorado. For reasons mentioned in the introduction, the number of options of surrounding communities that would still allow for workers to commute to major employment centers is incredibly limited. However, a small portion of people, possibly retirees or those that can telecommute, may desire to stay in Colorado and are willing to move into a surrounding county. Of those that do chose to relocate, only a portion will result in the construction of a new residential unit as many will buy an existing property rather than build a new one. For the simulation, and to account for some displacement, 10% of lost residential investment along the 10 front-range counties goes to other Colorado counties.

BROADER ECONOMIC IMPACTS

Understanding the direct loss in residential investment spending is not enough. The impacts to businesses that build, sell, finance or manage homes will be immediate. As they lose business and the industries around residential construction shrink so will their employment base, causing incomes to fall and consumer demand to shrink. All these shocks to the economy are often called the multiplier effect. It is a term that captures these secondary impacts to intermediate demand, or the supply chain along with the tertiary impacts to consumer spending from loss of income. A later section discusses the additional impacts that will result from a restriction in housing units that could slightly alter the impacts in either a positive or negative manner.

The estimates of the regional economic impacts on employment, income, and gross regional product (GRP), were simulated using a 3-region PI+ model developed by REMI. PI+ is a structural, economic forecasting and simulation model, used throughout state and local governments across the country, and recognized as a national leader. More information about the PI+ model is available at the end of this report.

The PI+ model contains three distinct economic regions. Each region interacts with the others, along with the rest of the country and the rest of the world, through trade, population flows and consumer spending patterns.

Here is each region in the model and the underlying counties;

REGION 1 - METRO DENVER

     a.   Adams County

     b.   Denver County

     c.   Boulder County

     d.   Jefferson County

REGION 2 - DENVER SOUTH

     e.   Arapahoe County

     f.   Douglas County

REGION 3 - REST OF COLORADO

     g.   This region includes all other counties in Colorado not included in Region 1 and 2

The total values from Figure 5, which represent a weighted total based upon average new construction of units by type, were used to reduce the policy variable in PI+ called fixed residential investment spending. There were several other adjustments made to the simulations that are described in more detail in the Methodology Appendix. They include:

- Using a Colorado specific housing discount rate to convert 2016 dollars to 2009 dollars for purpose of more accurate calculation within the model
- Adjustment to labor productivity of multi-family unit construction
- 10% displacement of housing to the rest of Colorado
- Restricting the models default induced investment response while accounting for some dynamic loss in non-residential investment

The resulting impacts reflect only the downstream impacts on supply industries and their loss in demand, value added, and income. The other impacts that may slightly alter the magnitude of the impacts presented here are discussed in a later section.

EMPLOYMENT

The companies now faced with lower demand will likely need to make accompanying cuts to labor or will be unable to hire new workers at the rate of current projections. The PI+ model uses the BEA (Bureau of Economic Analysis) definition of employment which captures full-time, part-time and self-employed workers all as 1 job. This definition fully reflects the total number of jobs, rather than number of people employed as one person may have multiple jobs. Therefore, as a rule of thumb, the BEA jobs figures are 30% higher than the BLS (Bureau of Labor Statistics) jobs figures, which are used by the state for official projections of employment and can vary significantly by sector. The current projection for total employment growth in the state of Colorado over the next two years is roughly 2.03% or 58,800 jobs per year. (Employment, 2018) The following tables show the loss in employment across all sectors by regions in relation to the baseline forecast for each year. The two scenarios show that the impacts could be around 35,500 fewer jobs per year up to 55,100 fewer jobs per year.

TOTAL IMPACT ON EMPLOYMENT

	PERMITS PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-33,231	-33,003	-33,243	-32,543	-31,824	-31,047	-30,365	-29,402	-28,548	-27,913
Denver South	-17,538	-17,151	-17,087	-16,623	-16,153	-15,667	-15,244	-14,819	-14,440	-14,109
Rest of CO	-7,921	-8,363	-8,617	-8,599	-8,466	-8,261	-8,032	-7,836	-7,634	-7,463
All Regions	-58,690	-58,517	-58,947	-57,765	-56,443	-54,975	-53,641	-52,057	-50,622	-49,485
10-year annual average					-55,114					

	HOUSING UNIT PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-20,301	-20,243	-19,560	-20,649	-21,962	-21,600	-22,725	-21,083	-19,896	-17,081
Denver South	-10,506	-10,307	-10,256	-10,529	-10,423	-9,969	-10,023	-9,268	-8,511	-7,544
Rest of CO	-4,229	-4,575	-5,044	-5,580	-5,647	-5,821	-5,871	-5,690	-5,363	-5,104
All Regions	-35,036	-35,125	-34,860	-36,758	-38,032	-37,390	-38,619	-36,041	-33,770	-29,729
10-year annual average					-35,536					

TOTAL IMPACT ON EMPLOYMENT (PERCENT)

	PERMITS PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-2.04%	-2.02%	-2.03%	-1.99%	-1.94%	-1.89%	-1.85%	-1.78%	-1.72%	-1.67%
Denver South	-2.65%	-2.59%	-2.57%	-2.51%	-2.43%	-2.34%	-2.27%	-2.20%	-2.13%	-2.07%
Rest of CO	-0.53%	-0.56%	-0.58%	-0.58%	-0.57%	-0.55%	-0.54%	-0.52%	-0.51%	-0.50%
All Regions	-1.55%	-1.55%	-1.55%	-1.53%	-1.49%	-1.45%	-1.41%	-1.36%	-1.32%	-1.28%
10-year annual average					-1.45%					

	HOUSING UNIT PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-1.24%	-1.24%	-1.20%	-1.26%	-1.34%	-1.32%	-1.38%	-1.28%	-1.20%	-1.02%
Denver South	-1.59%	-1.56%	-1.54%	-1.59%	-1.57%	-1.49%	-1.49%	-1.37%	-1.26%	-1.11%
Rest of CO	-0.28%	-0.31%	-0.34%	-0.37%	-0.38%	-0.39%	-0.39%	-0.38%	-0.36%	-0.34%
All Regions	-0.92%	-0.93%	-0.92%	-0.97%	-1.00%	-0.98%	-1.01%	-0.94%	-0.88%	-0.77%
10-year annual average					-0.93%					

GRP

Gross Regional Product captures the total net value of goods and services produced throughout the region. The way to calculate GRP is similar to the way Gross Domestic Product is calculated at the national level. The income approach is the sum of consumption, plus investment, plus government spending, plus net exports, captures the value of all final goods in the economy. Different from just total sales, which includes double counting of intermediate purchases, GRP is a common aggregate measure of the size of an economy.

The two projection methods show between a $36 Billion and $56 Billion loss to GRP over 1 years. These numbers correspond to an average annual reduction from the baseline of 0.9% and 1.4% statewide.

Table 4: GRP impacts by PI+ region

TOTAL IMPACT ON GRP
(BILLIONS FIXED 2018 $)

COUNTY	PERMITS PROJECTION METHOD									
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-$3.28	-$3.28	-$3.35	-$3.33	-$3.30	-$3.25	-$3.22	-$3.15	-$3.09	-$3.05
Denver South	-$1.71	-$1.68	-$1.70	-$1.69	-$1.67	-$1.65	-$1.63	-$1.61	-$1.59	-$1.57
Rest of CO	-$0.64	-$0.69	-$0.72	-$0.73	-$0.73	-$0.72	-$0.71	-$0.70	-$0.69	-$0.68
All Regions	-$5.63	-$5.65	-$5.77	-$5.75	-$5.69	-$5.63	-$5.56	-$5.45	-$5.36	-$5.31
10-year annual average					-$55.79					

COUNTY	HOUSING UNIT PROJECTION METHOD									
	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-$2.00	-$2.02	-$1.97	-$2.12	-$2.27	-$2.26	-$2.40	-$2.25	-$2.14	-$1.86
Denver South	-$1.02	-$1.01	-$1.02	-$1.07	-$1.08	-$1.06	-$1.08	-$1.01	-$0.94	-$0.85
Rest of CO	-$0.35	-$0.38	-$0.42	-$0.47	-$0.49	-$0.51	-$0.52	-$0.51	-$0.49	-$0.47
All Regions	-$3.37	-$3.41	-$3.42	-$3.66	-$3.84	-$3.83	-$4.00	-$3.77	-$3.57	-$3.17
10-year annual average					-1.401%					

TOTAL IMPACT ON GRP (PERCENT)

	PERMITS PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-1.89%	-1.86%	-1.86%	-1.82%	-1.76%	-1.71%	-1.66%	-1.59%	-1.53%	-1.48%
Denver South	-2.45%	-2.38%	-2.36%	-2.30%	-2.23%	-2.16%	-2.09%	-2.02%	-1.95%	-1.89%
Rest of CO	-0.52%	-0.55%	-0.56%	-0.56%	-0.55%	-0.54%	-0.52%	-0.51%	-0.49%	-0.48%
All Regions	-1.53%	-1.52%	-1.52%	-1.49%	-1.45%	-1.40%	-1.36%	-1.31%	-1.27%	-1.23%
10-year annual average					-$36.03					

	HOUSING UNIT PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-1.15%	-1.14%	-1.10%	-1.15%	-1.22%	-1.19%	-1.24%	-1.14%	-1.06%	-0.90%
Denver South	-1.47%	-1.43%	-1.42%	-1.46%	-1.44%	-1.38%	-1.38%	-1.27%	-1.16%	-1.02%
Rest of CO	-0.28%	-0.30%	-0.33%	-0.36%	-0.37%	-0.38%	-0.38%	-0.37%	-0.34%	-0.32%
All Regions	-0.92%	-0.91%	-0.90%	-0.95%	-0.98%	-0.95%	-0.98%	-0.91%	-0.84%	-0.73%
10-year annual average					**-0.905%**					

PERSONAL INCOME

Personal income is the broadest measure of income capturing, wage and salary income, dividend, interest and rental income along with supplemental income, along with a few other categories. The largest component for the resulting decline in total personal income is from the loss in wage and salary resulting from fewer jobs throughout the state. Total income is a key economic driver as it indicates the demand for local businesses, and consumer facing companies in retail such as restaurants, clothing stores, auto dealers among numerous others.

The total amount of personal income lost throughout the state is estimated to be around $24.5B to $38B over 10 years.

Table 5: Personal income impacts by PI+ region

TOTAL IMPACT ON PERSONAL INCOME (BILLIONS FIXED 2018 $)

BASE										
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	143.7	146.0	148.8	151.8	154.3	156.8	159.5	162.3	165.2	168.3
Denver South	65.9	67.1	68.6	70.1	71.4	72.8	74.2	75.7	77.3	78.9
Rest of CO	117.2	119.1	121.3	123.8	125.6	127.4	129.9	132.1	134.4	136.8
All Regions	326.8	332.2	338.6	345.7	351.4	357.0	363.6	370.1	376.9	383.9
10-year annual average					**3546.2**					

PERMITS PROJECTION METHOD										
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-2.007	-1.927	-2.044	-2.092	-2.111	-2.112	-2.11	-2.081	-2.058	-2.042
Denver South	-1.135	-1.084	-1.156	-1.194	-1.215	-1.229	-1.242	-1.245	-1.249	-1.253
Rest of CO	-0.482	-0.499	-0.535	-0.557	-0.564	-0.567	-0.565	-0.558	-0.55	-0.543
All Regions	-3.624	-3.51	-3.735	-3.843	-3.89	-3.908	-3.917	-3.884	-3.857	-3.838
10-year annual average					**-38.006**					

HOUSING UNIT PROJECTION METHOD										
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-1.221	-1.181	-1.208	-1.332	-1.438	-1.441	-1.538	-1.455	-1.408	-1.252
Denver South	-0.684	-0.656	-0.692	-0.756	-0.795	-0.799	-0.843	-0.809	-0.781	-0.718
Rest of CO	-0.263	-0.277	-0.313	-0.357	-0.374	-0.394	-0.409	-0.401	-0.386	-0.368
All Regions	-2.168	-2.114	-2.213	-2.445	-2.607	-2.634	-2.790	-2.665	-2.575	-2.338
10-year annual average					**-24.549**					

TOTAL IMPACT ON PERSONAL INCOME (PERCENT)

	PERMITS PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	1.40%	-1.32%	-1.37%	-1.38%	-1.37%	-1.35%	-1.32%	-1.28%	-1.25%	-1.21%
Denver South	-1.72%	-1.61%	-1.69%	-1.70%	-1.70%	-1.69%	-1.67%	-1.64%	-1.62%	-1.59%
Rest of CO	-0.41%	-0.42%	-0.44%	-0.45%	-0.45%	-0.45%	-0.43%	-0.42%	-0.41%	-0.40%
All Regions	-1.14%	-1.23%	-1.30%	-1.31%	-1.31%	-1.30%	-1.27%	-1.24%	-1.20%	-1.17%
10-year annual average					**-1.07%**					

	HOUSING UNIT PROJECTION METHOD									
COUNTY	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Metro Denver	-0.85%	-0.81%	-0.81%	-0.88%	-0.93%	-0.92%	-0.96%	-0.90%	-0.85%	-0.74%
Denver South	-1.04%	-0.98%	-1.01%	-1.08%	-1.11%	-1.10%	-1.14%	-1.07%	-1.01%	-0.91%
Rest of CO	-0.22%	-0.23%	-0.26%	-0.29%	-0.30%	-0.31%	-0.32%	-0.30%	-0.29%	-0.27%
All Regions	-0.66%	-0.64%	-0.65%	-0.71%	-0.74%	-0.74%	-0.77%	-0.72%	-0.68%	-0.61%
10-year annual average					**-0.69%**					

ADDITIONAL IMPACTS

Beyond the direct impact to residential investment, there are other competing economic forces that could offset some of the negative impacts, along with only make the impacts shown in this report even worse. Below is a discussion of some of those competing forces. However, based upon some alternatives tested within the model, the net effect would likely only cause the impacts described in previous chapter to be even more negative.

Additional issues that would restrict growth

Given the reduction in housing supply here are several additional consequences that would have further negative impacts on businesses and households throughout the state.

- Direct loss in new households and population as people choose to leave the state or not to come to the state.
- Further increase in housing costs due to restricted supply leading to additional issues with sprawl and affordability.
- Loss in home related purchasing of services and goods ie. utilities, furnishing, etc.

There is a strong likelihood that with such a significant reduction in the availability of new homes, along with the large reduction in the creation of new jobs, that the region will lose people and households that otherwise would have stayed simply because of the availability of homes. This means that rather than simply seeing the unemployment rate rise as a result of fewer jobs, you will see slower population growth overall. In recent updated projections for households and the metro area's population, there have already been slight revisions downward as forecasters have had to adjust for more significant reductions in affordability resulting from rising prices. This would mean that there would be other direct impacts that would occur such as direct employment loss, as jobs leave the state and companies choose not to come to Colorado in the first place.

The larger issue that is not directly accounted for in the simulation is the further pressure that a 1% cap in new housing will place on prices given the reduction in supply. As supply falls even further relative to demand, one would expect prices to rise even faster. The impact that lower supply can have on prices can be shown through the availability of existing vacant units. There is a strong correlation between the rise in housing prices beyond the growth in incomes as the number of vacant units falls. In 2010, the vacancy rate across the 10 counties was 6.17%. By 2016 that rate had fallen to 2.17% (Colorado Office of Demography, 2018). The result, is that in recent years for certain counties, housing construction of new units has grown faster than new households.
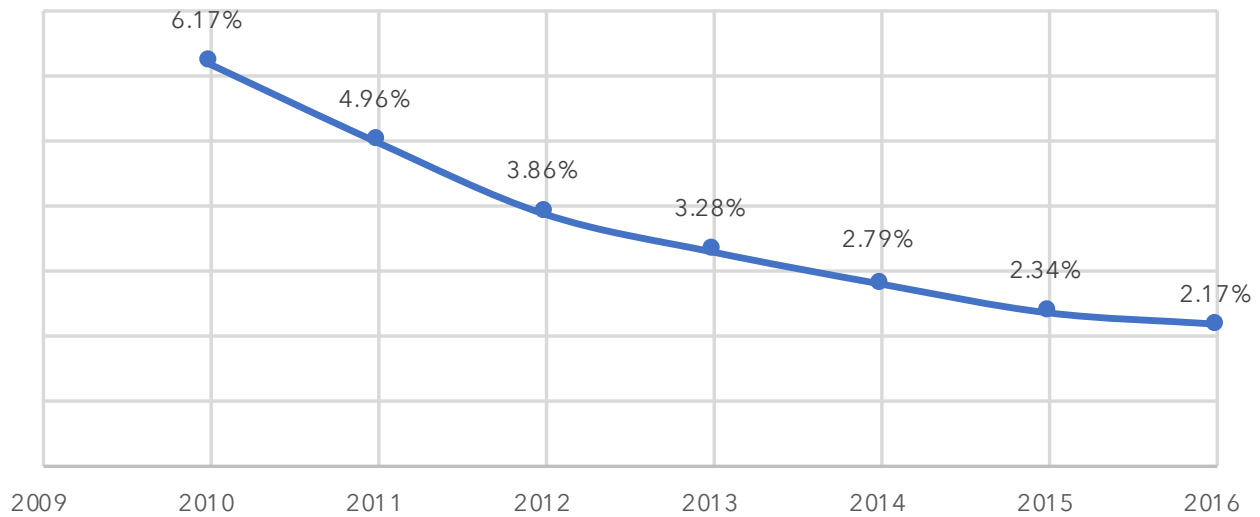
Figure 5: Vacancy rate by year

2016 VACANCY RATE/UNITS BY COUNTY

COUNTY	VACANCY RATE	VACANT UNITS
Adams County	0.34%	579
Arapahoe County	0.19%	481
Boulder County	2.91%	3888
Broomfield County	3.49%	919
Denver County	3.11%	9774
Douglas County	0.39%	460
El Paso County	2.23%	5977
Jefferson County	2.33%	5559
Larimer County	6.36%	9214
Weld County	1.42%	1502

Source: Colorado State Demography Office

The combination of continued strong employment growth with low housing inventory, has contributed to prices rising much faster than incomes. This puts significant economic strain on individual's budgets as other spending gets crowded out to accommodate higher rents, higher mortgages and lower savings. The further restriction in supply will only add pressure to affordability in the near-term. From 2010 to 2016, the single-family housing price growth rate was 4.9 times greater than median household income in all 10 counties. While Douglas, Jefferson, Adams and Larimer counties saw greater disparities in the growth between income and prices, the average of 4.9 has meant that for every additional dollar income earned, housing costs have grown by 5 dollars. From 2011 to 2016, the apartment rent growth rate is 3.89 times greater than median household income for all 10 counties. That ratio is more severe in Jefferson and Douglas where rent is 6.38 and 5.85 times more than income.

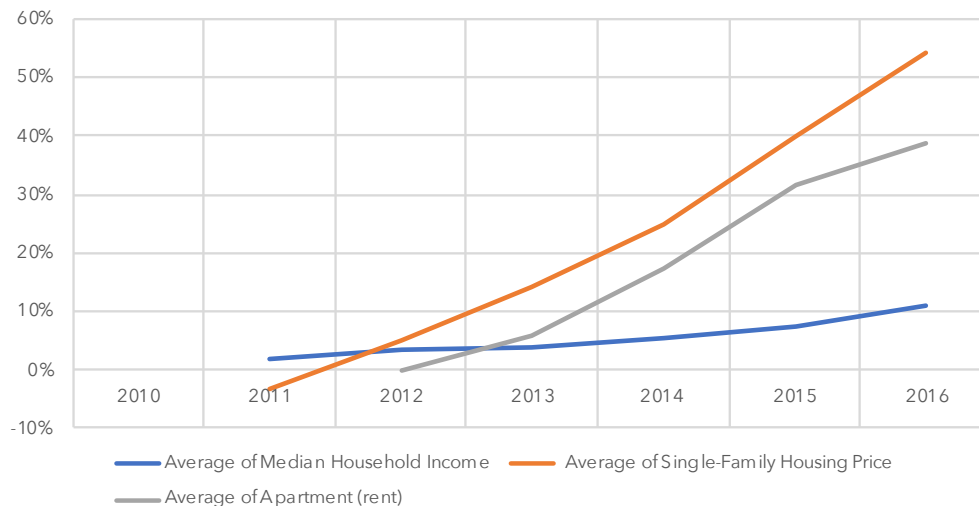*Figure 6: 10-county average housing costs growth against income growth*

PERCENTAGE GROWTH IN HOUSING COSTS AND INCOME FROM 2010 - 2016			
COUNTY	MEDIAN HOUSEHOLD INCOME	SINGLE FAMILY HOUSING PRICE	APARTMENTS RENTS
Adams County	12.4%	82.2%	41.9%
Arapahoe County	12.9%	65.8%	49.1%
Boulder County	11.5%	38.5%	45.6%
Broomfield County	10.2%	36.2%	45.6%
Denver County	23.6%	79.8%	59.6%
Douglas County	6.6%	45.8%	38.7%
El Paso County	7.0%	29.3%	31.6%
Jefferson County	9.0%	61.3%	57.4%
Larimer County	9.7%	62.8%	28.9%
Weld County	13.0%	67.1%	52.7%
All 10 Counties	11.6%	56.9%	45.1%

As there are fewer and fewer homes relative to demand, not only will prices climb relative to income growth, but as prices closer to employment centers grow faster, more affordable housing options will only get farther away. Therefore, for those that can find a housing option, or build a new housing unit, it will become much more expensive the closer one gets to desirable urban or suburban centers. This will force growth even farther away from employment centers and use more vacant land, require longer commute time by using more of the transportation network and have an overall higher intensity of energy and water usage (Kevin Nelson, 2009).

After the construction of a new home, the spending related to new furnishings, utility hookups and other home related purchases are a significant part of retail and other sectors. By lowering the number of new homes, you also restrict the home related purchases that occur in every year that follows. We chose to not include these impacts, as we didn't want to directly assume that there would be a reduction in the state's population. The PI+ model does capture population impacts and therefore does show some population and income loss due to the lower employment levels. Therefore, the model already does account for less spending on home related purchases and we did not want to layer another policy variable to capture any further household spending loss.

Additional Issues That May Offset Some of Negative Impacts

The impacts shown in this report are large and given the resiliency of an entire state economy worth questioning how these negative impacts might be partially offset. Several of those ways might include;

- An increase in home prices will add equity to home owners and raise the price at which they can sell
- Owners of rental units and apartments will similarly benefit as their property value increases along with the rents they can charge

- For those that remain in the region that are unable to buy a new home, some of what they would have spent on a mortgage or new furnishings and utilities will continue to be spent on other items in the economy
- To the extent prices go up, the total value of residential investment of new homes that do get built, will be higher than baseline and offset some of currently estimated direct losses

While affordability issues mean that more money from disposable income is going to housing, this also means that owners of housing whether single-family or multi-family, will likely see their wealth grow. For those that own homes and still are paying off a mortgage, the increase in the value of their home will add equity possibly allowing them to refinance or sell for a larger profit. However, upon selling one's home, should they choose to rebuy in the region, they will simply be using those higher profits to pay for the price increase in another property limiting the wealth effects.

Those that currently own rental units will benefit as they can charge higher rent prices. The additional income generated each month will provide additional disposable income that depending on where the owner lives, could be spent locally and offset some of the negative impacts to retail and other consumer sectors.

There will be similar offsetting impacts as those that remain in the region who are unable to or choose not to buy a new home, continue to spend some of the money that otherwise would have gone to the purchase of a new home within the regional economy. While they would still likely need to pay for rent elsewhere, there could be a marginal amount of additional spending that would have otherwise gone into the purchasing of a new home. This is part of the reason we chose to leave out the impacts related to less purchases on home related services such as utilities and furnishings. Much of that money would be spent elsewhere rather than on home related purchases.

The above issues (higher homer values, rental income and substitution of spending) all relate to additional wealth, or income that could partially offset the negative impacts of reducing residential investment. Just for the purpose of understanding how significant this offset could be in mitigating the negative impacts, we can evaluate a scenario where disposable income throughout the impacted regions increases by $1B per-year between 2019 and 2020. This could be from a combination of reasons. If each household that could not buy a new home instead continued to spend an additional $10,000 per year, that would be just over $250M. If the increase in home values and rents generates an additional $750M in income and the full $1B is spent within the state, that offset in consumer demand would only support 10,000 jobs.

The final potential offsetting effect is that to the extent this policy will raise prices, it will raise the value of homes that do get built. That increase will offset some of the negative impacts shown earlier related to losses in residential investment. As another hypothetical to test just how large of an effect this would have we assumed a 10% increase in the value of new construction. So if the 37,000 homes that do get built, cost roughly an additional $40,000 per unit that would equal $1.48B over two years. If you model the increase in the value of new residential investment, along with a 10% increase in the consumer price of housing, you would see a net negative impact of an additional 14,000 jobs on top of what is presented earlier. So, while some of the residential investment loss will be mitigated, the resulting higher overall housing costs more than outstrip the potential benefits.

Conclusion

With strong population and economic growth, some of Colorado's largest metro areas are already facing housing affordability problems. Publicly developed city and region-wide plans must address the growing issues with resource constraints such as water and infrastructure, and while residents should have a say in the growth of their communities, a 1% cap in new housing units proposed through Initiative 66, would inflict substantial additional harm to the state's economy. Through eliminating local control over housing growth and reducing new residential construction for 45% or 55% in 10 years from 2019 to 2020, the resulting job loss and income loss would be felt by hundreds of thousands of Coloradans. The citizens of Colorado deserve smart solutions to mitigate the consequences of growth, but the question to ask is, "Is a 1% growth cap really the answer?"

Appendix A – Methodology

DEVELOPMENT OF HOUSING UNIT PROJECTION

The first step in understanding what the economic impact of Initiative 66 might be, was to create a baseline projection for the number of housing units each of the 10-counties impacted might expect to add under current conditions. While there are historic estimates of housing units by county, there is no public source for the projected number of housing units for each county. The Colorado Office of Demography does provide an annual projection for the estimated number of households by county. We developed two estimates of housing units based upon the relationship between housing units and households. The first method estimated the three-year average ratio between annual household growth and housing unit growth for the years, 2014, 2015 and 2016. Annual household estimates and housing unit estimates were also provided by the Demography Office as of March 2018. The second method estimated the three-year average ratio between annual household growth and residential permits for the years 2014, 2015 and 2016. The annual number of residential permits are provided by the State of Cities Data Systems (SOCDS, 2010-2016) developed by the U.S. Department of Housing and Urban Development Office of Policy Development and Research. They provide an estimate for the number of permits issued by county, by unit type including single family and multi-family. The 3-year ratio of housing units or permits to households, was then multiplied by the projected number of households for each county in 2019 through 2028. In some counties that ratio was above 100% and in others it was below 100%.

Table 8: 3-year ratio relative to household growth

3-YEAR RATIO RELATIVE TO HOUSEHOLD GROWTH		
COUNTY	HOUSING UNITS	RESIDENTIAL PERMITS
Adams County	96%	156%
Arapahoe County	78%	113%
Boulder County	88%	88%
Broomfield County	115%	56%
Denver County	102%	133%
Douglas County	100%	121%
El Paso County	72%	88%
Jefferson County	75%	75%
Larimer County	87%	108%
Weld County	69%	90%
10 County Total	82%	101%

To develop the baseline under a 1% growth cap scenario, we grew the 2018 estimate of housing for each methodology and allowed it to grow by only 1% annually from 2019 to 2028.

RESIDENTIAL INVESTMENT

Lost residential investment is an estimate of the direct loss in residential sales revenue. Direct residential sales loss is calculated by multiplying the lost number of housing units in each county by the average housing price from each specific county. The housing quantities used for calculating residential sales loss are developed by two methods mentioned earlier. To estimate the lost number of housing units by type, the same data source for total permits was used. Initially, the 2016 number of new single-family and multi-family units were calculated. Then using Census data we broke out the number of single-family homes by attached and detached using the share of the existing base from Census data. The estimated ratios for the percent of new units by type and by county are shown in the Table 11.

Table 9: Historic housing permits percentages

HISTORIC HOUSING GROWTH BY TYPE OF HOUSING			
COUNTY	SINGLE-FAM DETACHED	SINGLE-FAM ATTACHED	APARTMENTS %
Adams County	74.04%	8.88%	17.08%
Arapahoe County	49.44%	8.11%	42.45%
Boulder County	40.16%	4.81%	55.03%
Broomfield County	62.73%	6.58%	30.69%
Denver County	23.77%	4.00%	72.22%
Douglas County	69.95%	4.93%	25.12%
El Paso County	70.30%	8.41%	21.29%
Jefferson County	55.96%	7.14%	36.90%
Larimer County	52.46%	5.48%	42.06%
Weld County	81.38%	3.93%	14.69%

Housing types are categorized as single-family attached housing units, single-family detached housing units and multifamily units. Mobile homes and time shares are excluded from this study given they are such a small share of new units annually.

ESTIMATED DIFFERENCE IN HOUSING QUANTITY BY TYPE BY COUNTY

	PERMITS PROJECTION METHOD							
	2019				2019-2028			
COUNTY	TOTAL	Q SFD	Q SFA	Q APT	TOTAL	Q SFD	Q SFA	Q APT
Adams	-5,832	-4,318	-518	-996	-60,245	-44,604	-5,348	-10,292
Arapahoe	-3,015	-1,490	-244	-1,280	-27,989	-13,837	-2,270	-11,882
Boulder	-597	-240	-29	-329	-5,655	-2,271	-272	-3,112
Broomfield	-281	-176	-18	-86	-2,725	-1,709	-179	-836
Denver	-5,235	-1,245	-209	-3,781	-49,358	-11,734	-1,975	-35,648
Douglas	-2,778	-1,943	-137	-698	-27,475	-19,218	-1,356	-6,902
El Paso	-2,280	-1,603	-192	-485	-21,837	-15,351	-1,837	-4,650
Jefferson	-393	-220	-28	-145	-2,387	-1,336	-170	-881
Larimer	-1,599	-839	-88	-672	-15,171	-7,959	-831	-6,380
Weld	-2,683	-2,183	-105	-394	-26,382	-21,470	-1,036	-3,876

	HOUSING UNIT PROJECTION METHOD							
	2019				2019-2028			
COUNTY	Total	Q SFD	Q SFA	Q APT	Total	Q SFD	Q SFA	Q APT
Adams	-2,902	-2,148	-258	-496	-29,885	-22,127	-2,653	-5,106
Arapahoe	-1,306	-646	-106	-554	-10,733	-5,306	-870	-4,557
Boulder	-615	-247	-30	-338	-5,691	-2,286	-274	-3,131
Broomfield	-856	-537	-56	-263	-8,608	-5,399	-567	-2,642
Denver	-3,270	-777	-131	-2,362	-40,540	-9,638	-1,622	-29,280
Douglas	-2,069	-1,447	-102	-520	-20,354	-14,237	-1,004	-5,113
El Paso	-1,378	-969	-116	-293	-12,810	-9,005	-1,077	-2,728
Jefferson	-420	-235	-30	-155	2,524	1,413	180	931
Larimer	-1,011	-531	-55	-425	-10,176	-5,339	-558	-4,280
Weld	-1,808	-1,471	-71	-266	-21,312	-17,344	-837	-3,131

*Note: Q SFD: Quantity of single-family detached. Q SFA: Quantity of single-family attached. Q APT: Quantity of Apartment

The median and average housing price used to calculate residential investment loss is collected from multiple sources. Single family housing price data in Boulder county, Weld county, Larimer county and Broomfield county are from IRES (IRES-MLS, 2010-2016). REColorado (REColorado, 2010-2016)contributed single family housing price data for Jefferson county, Adams county, Arapahoe county, Denver county, Boulder county and Douglas county. Single-family housing price data for El Paso county was provided by Pikes Peak Association of REALTORS (PPAR, 2010-2016). Apartment Association of Metro Denver (AAMD, 2010-2016) provide the apartment rent data for Adams county, Arapahoe county, Boulder county, Broomfield county, Denver county, Douglas county and Jefferson county. Apartment rent data for El Paso county, Larimer county and Weld county is from Colorado Department of Local Affairs (Colorado Department Of Local Affairs, 2010-2016). The compiled county average housing price data used for lost investment calculation is present in the table below:

Table 11: 2016 housing prices

2016 HOUSING PRICES (FIXED 2016 $)			
COUNTY	S-ATTACHED	S-DETACHED	MULTI-FAMILY
Adams County	$ 332,877	$ 221,161	$ 210,854
Arapahoe County	$ 423,354	$ 226,865	$ 260,866
Boulder County	$ 552,387	$ 361,394	$ 373,952
Broomfield County	$ 460,122	$ 313,064	$ 238,411
Denver County	$ 482,411	$ 368,548	$ 335,543
Douglas County	$ 504,072	$ 300,327	$ 251,634
El Paso County	$ 287,302	$ 180,974	$ 217,403
Jefferson County	$ 447,694	$ 254,566	$ 261,304
Larimer County	$ 353,000	$ 253,900	$ 260,291
Weld County	$ 290,000	$ 207,143	$ 184,222

The data for median household income by county is from American Fact Finder. The growth rate of median household income is calculated and compared with the growth rate of single family and apartments housing prices shown in Figure 7.

INPUTS TO REMI PI+ MODEL

The annual estimate of lost residential investment in dollars is then entered in the PI+ model using the Residential Investment Spending policy variable. This variable reflects the exogenous demand effects of new spending on residential housing. The model first estimates how the lost spending in dollars will flow through to intermediate sectors such as construction, real estate and professional services. Even though we are directly telling the model that there is less new investment, it does not automatically adjust prices upward. As discussed in earlier sections of the report, we chose not to add additional direct assumptions on price changes, beyond the default price inflation in the model.

We directly adjusted the residential investment loss to 2009 dollars rather than allowing the model to convert internally. The model was underrepresenting the price inflation in housing since 2009 and therefore overrepresenting the actual value that was lost.

We also adjusted the labor productivity assumption for the construction of multi-family housing units. Given the labor productivity in multi-family housing is roughly 17% higher than in single-family residential construction and the overall construction industry in general, we again assumed the model was overestimating the employment effects. By taking the portion of the residential investment that was going to multi-family construction, we could estimate the default direct difference in construction jobs estimated by the model, and what it should be with a higher labor productivity. Then we entered the difference back into the model and nullified the intermediate demand so as to only replace the income loss and the jobs, but not the intermediate purchases.

As discussed in an earlier section, 10% of all lost residential investment within the 10-county region, was assumed to be displaced to other parts of the state. The amount of displacement would be expected to be very low, as those that chose to move their residence somewhere else within the state, would very likely not be able to retain their employment unless they work remotely.

An adjustment was also made to allow the vacancy rates within each county to drop annually proportionally to the last several years of decline. Given the already very low inventory, most existing vacant units would need to be substantially renovated to meet the standards of new buyers. For the vacant units that become occupied each year, half of the total investment expenditure per new unit, was input into the model to account for some offsetting investment effects. This has the effect of dampening the overall negative impacts, as the vacancy rate declines even further as demand outpaces supply.

Appendix B – 2019 – 2020 Results Comparison

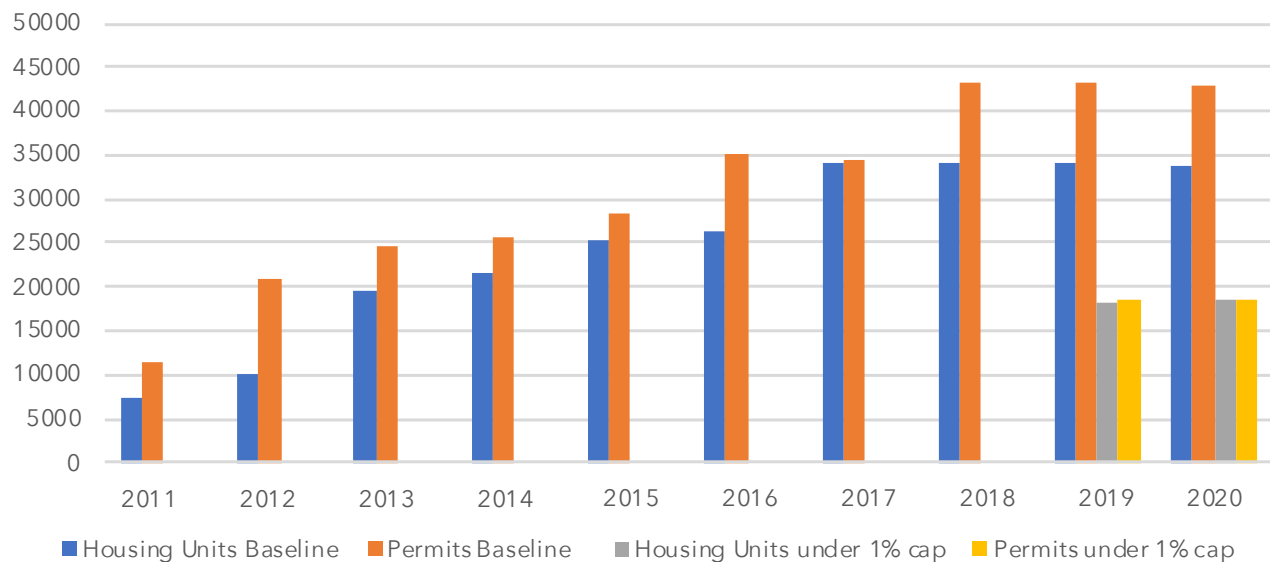*Figure 8: Historical housing units and 2019-2020 projections*

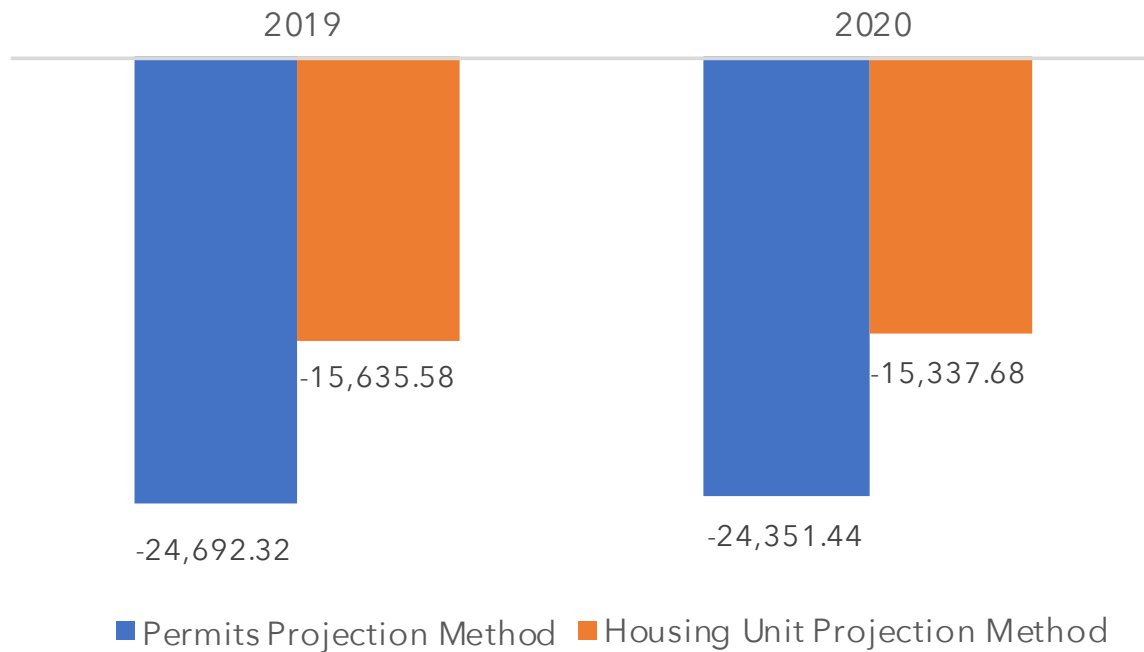*Figure 9: 10-county total reduction in new housing units*

Table 12: Fewer housing units by county

	FEWER HOUSING UNITS BY COUNTY					
	PERMITS PROJECTION METHOD			HOUSING UNIT PROJECTION METHOD		
COUNTY	2019	2020	2019-2020	2019	2020	2019-2020
Adams County	(5832)	(5873)	-76.1%	(2902)	(2920)	-61.7%
Arapahoe County	(3015)	(2882)	-53.2%	(1306)	(1206)	-32.8%
Boulder County	(597)	(619)	-30.5%	(615)	(637)	-31.1%
Broomfield County	(281)	(283)	-50.0%	(856)	(864)	-75.0%
Denver County	(5235)	(5039)	-60.8%	(3270)	(3112)	-49.2%
Douglas County	(2778)	(2796)	-68.9%	(2069)	(2082)	-62.4%
El Paso County	(2280)	(2288)	-45.1%	(1378)	(1380)	-33.2%
Jefferson County	(393)	(323)	-12.7%	(420)	(350)	-13.5%
Larimer County	(1599)	(1570)	-51.1%	(1011)	(985)	-39.8%
Weld County	(2683)	(2680)	-70.4%	(1808)	(1803)	-61.7%
10 County Total	(24692)	(24351)	-56.9%	(15636)	(15338)	-45.6%

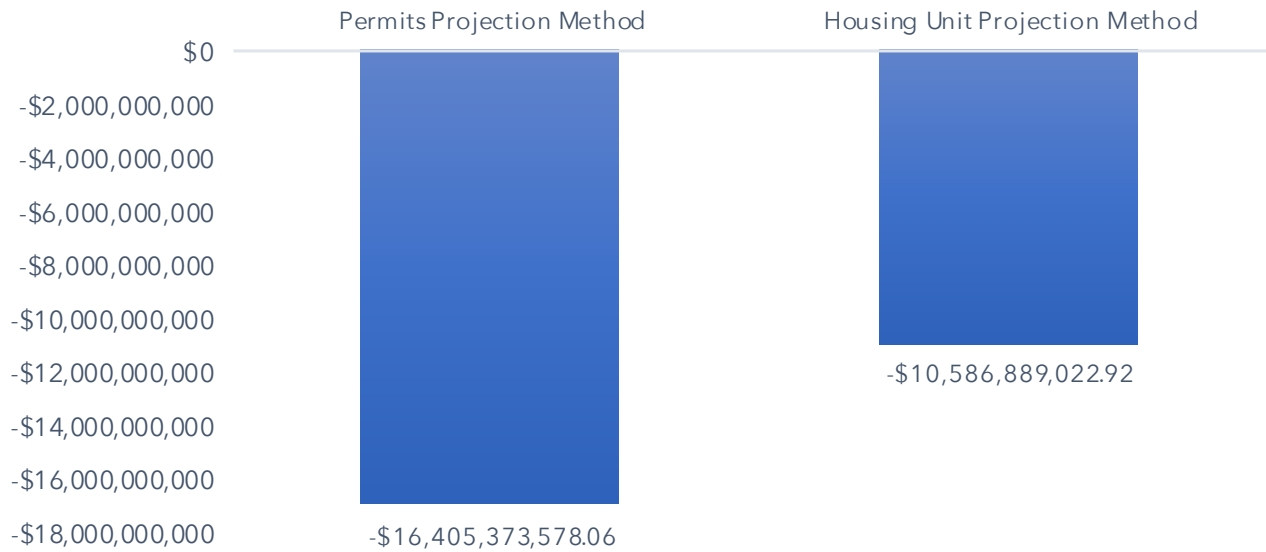*Figure 10: 10-county reduction in residential investment over 2 years*

	Permits Projection Method	Housing Unit Projection Method
	-$16,405,373,578.06	-$10,586,889,022.92

Table 13: Direct loss in residential investment by county

	FEWER HOUSING UNITS BY COUNTY					
	PERMITS PROJECTION METHOD			HOUSING UNIT PROJECTION METHOD		
COUNTY	2019	2020	2019	2020	2020	2019-2020
Adams County	$ 1,761,902,025	$ 1,774,433,634	$ 876,628,364	$ 882,273,245	(2920)	-61.7%
Arapahoe County	$ 1,020,255,741	$ 975,221,416	$ 441,961,114	$ 408,185,567	(1206)	-32.8%
Boulder County	$ 265,856,168	$ 275,361,686	$ 273,639,228	$ 283,283,867	(637)	-31.1%
Broomfield County	$ 107,406,472	$ 108,252,670	$ 327,439,175	$ 330,249,588	(864)	-75.0%
Denver County	$ 1,946,370,236	$ 1,873,335,701	$ 1,215,642,076	$ 1,156,820,296	(3112)	-49.2%
Douglas County	$ 1,196,224,174	$ 1,203,916,508	$ 891,117,356	$ 896,517,008	(2082)	-62.4%
El Paso County	$ 600,665,245	$ 602,705,342	$ 363,110,338	$ 363,490,567	(1380)	-33.2%
Jefferson County	$ 143,421,386	$ 117,843,693	$ 153,443,879	$ 127,702,699	(350)	-13.5%
Larimer County	$ 493,404,758	$ 484,513,812	$ 312,106,064	$ 304,044,447	(985)	-39.8%
Weld County	$ 727,571,685	$ 726,711,228	$ 490,288,856	$ 488,945,290	(1803)	-61.7%
All 10 Counties	$ 8,263,077,888	$ 8,142,295,690	$ 5,345,376,450	$ 5,241,512,573	(15338)	-45.6%

Table 14: Residential investment that will be displaced to the rest of the state

	PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
	2019	2020	2019	2020
Displaced residential investment that remains in Colorado ($2016)	$826,307,789	$814,229,569	$534,537,645	$524,151,257

Table 15: Employment impacts by region

TOTAL IMPACT OF EMPLOYMENT (THOUSANDS)						
	BASE		PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020	2019	2020
Metro Denver	1650.808	1650.272	-29.018	-26.400	-17.441	-15.921
Denver South	672.307	672.174	-17.049	-15.316	-10.337	-9.334
Rest of CO	1506.578	1501.624	-7.985	-7.762	-4.262	-4.259
ALL	3829.69	3824.07	-54.051	-49.477	-32.041	-29.513
Average Annual Impact			-51.764		-30.777	

TOTAL IMPACT ON EMPLOYMENT (PERCENT)				
	PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020
Metro Denver	1.76%	-1.60%	-1.06%	-0.96%
Denver South	2.54%	-2.28%	-1.54%	-1.39%
Rest of CO	0.53%	-0.52%	-0.28%	-0.28%
ALL	1.41%	-1.29%	-0.84%	-0.77%
2 Years Average Annual Impact	-1.35%		-0.81%	

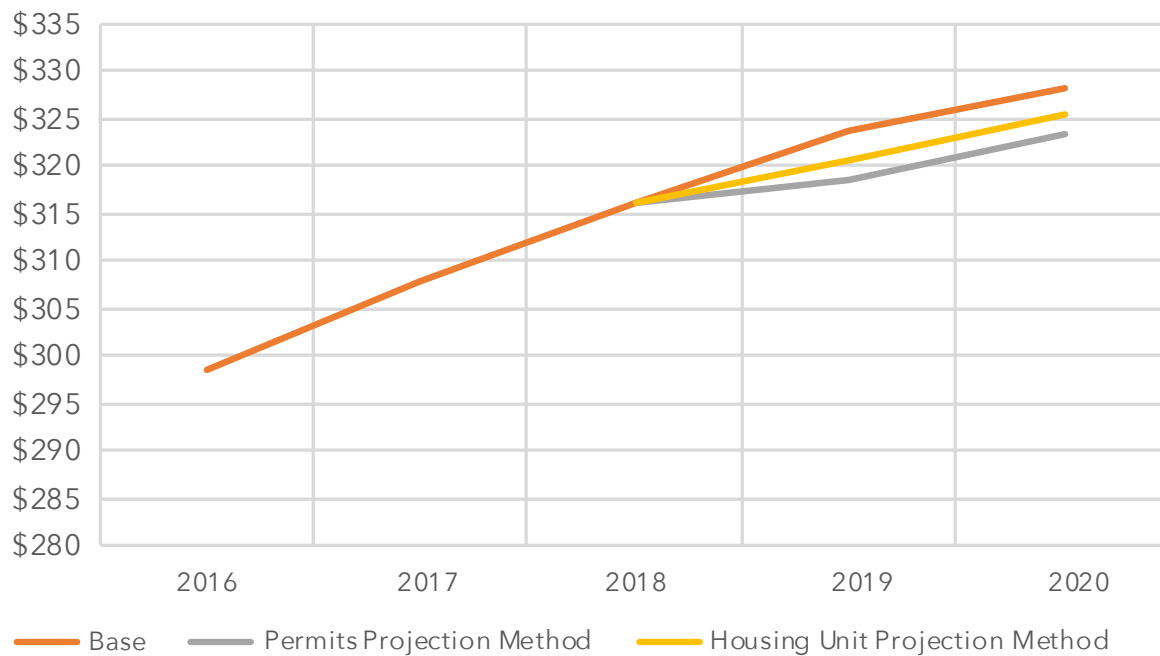*Figure 12: GRP impacts across the state (Billions Fixed 2018 $)*

Base   Permits Projection Method   Housing Unit Projection Method

TOTAL IMPACT ON GRP (BILLIONS FIXED 2018 $)						
	BASE		PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020	2019	2020
Metro Denver	$153.06	$155.49	$2.95	$2.72	$1.78	$1.65
Denver South	$61.55	$62.49	$1.67	$1.51	$1.01	$0.92
Rest of CO	$108.97	$110.26	$0.65	$0.64	$0.35	$0.35
ALL	$323.59	$328.24	$5.26	$4.87	$3.14	$2.92
2 Year Total	$651.82		-$10.13		-$6.06	

TOTAL IMPACT ON GRP (PERCENT)				
	PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020
Metro Denver	-1.76%	-1.60%	1.01%	0.92%
Denver South	-2.54%	-2.28%	1.43%	1.28%
Rest of CO	-0.53%	-0.52%	0.28%	0.28%
ALL	-1.42%	-1.29%	0.84%	0.77%
2 Year Total	-1.36%		-0.81%	

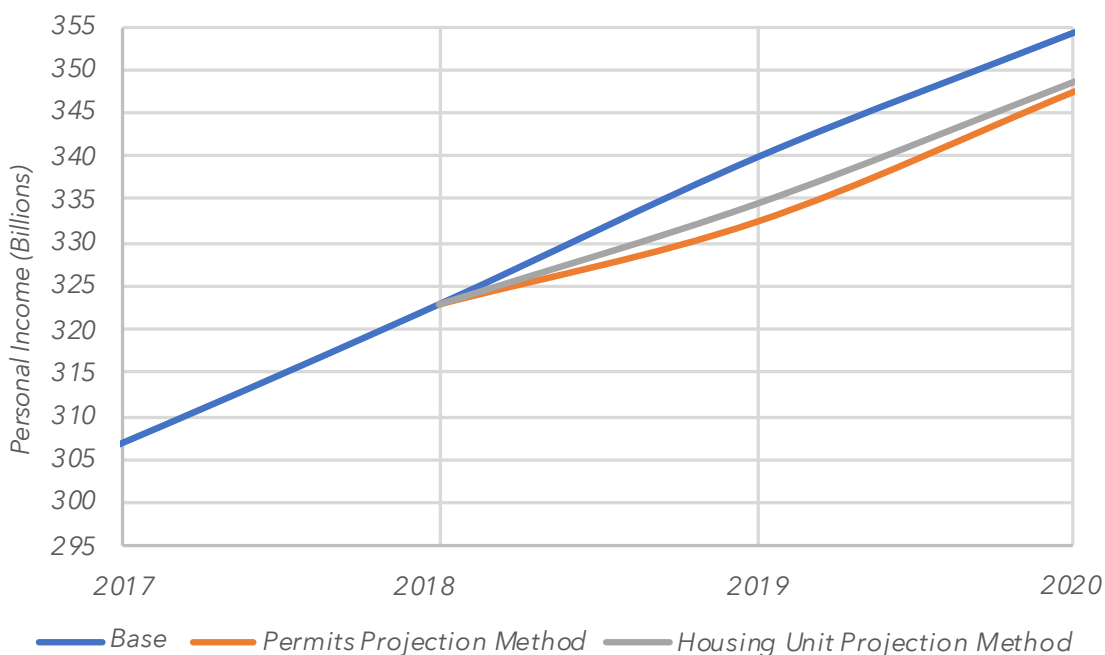*Figure 13: Personal impacts across the state*
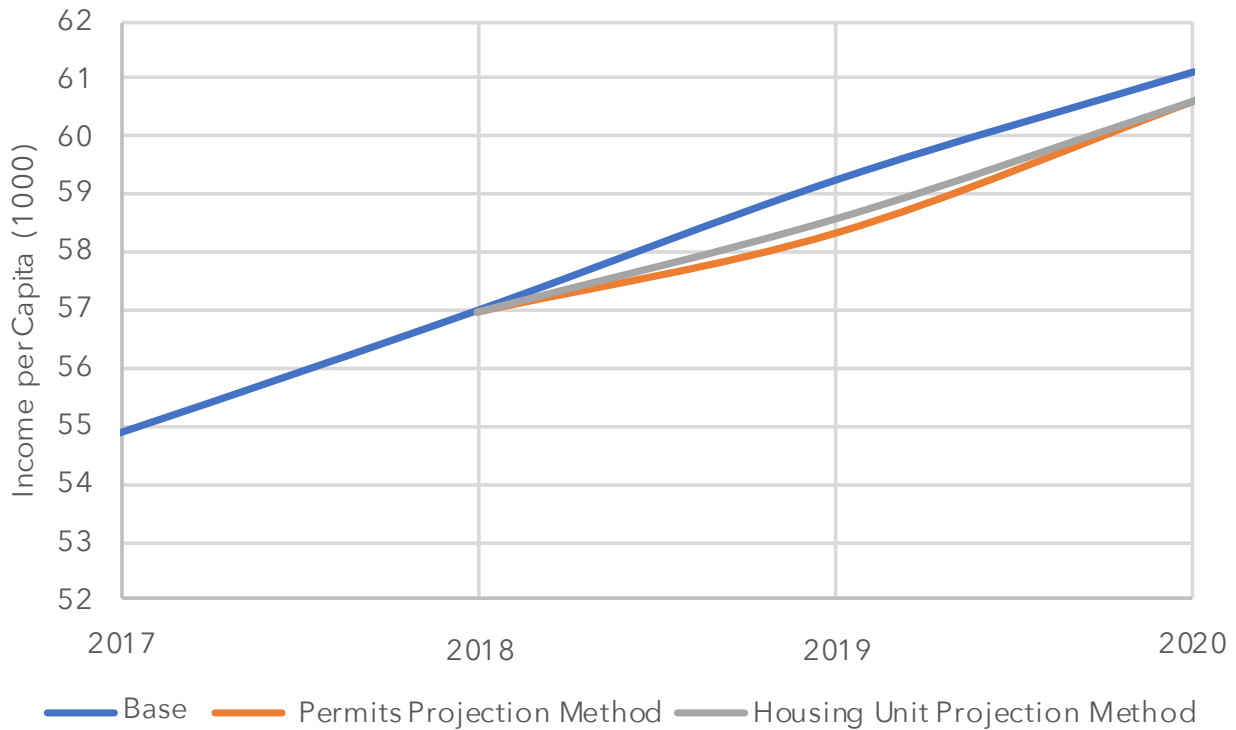
Figure 14: Income-per-capita impacts across the state

Table 17: Personal income impacts by PI+ region

TOTAL IMPACT ON INCOME (BILLIONS FIXED 2018 $)						
	BASE		PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020	2019	2020
Metro Denver	$146.741	$152.956	-$1.778	-$1.561	-$1.071	-$0.944
Denver South	$68.297	$71.346	-$1.078	-$0.939	-$0.653	-$0.572
Rest of CO	$124.765	$129.840	-$0.476	-$0.452	-$0.258	-$0.251
ALL	$339.803	$354.142	-$3.332	-$2.952	-$1.982	-$1.767
2 Year Total	$693.945		-$6.284		-$3.749	

TOTAL IMPACT ON INCOME (PERCENT)				
	PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020
Metro Denver	-1.28%	-1.27%	-0.74%	-0.64%
Denver South	-1.68%	-1.62%	-0.98%	-0.84%
Rest of CO	-0.42%	-0.45%	-0.22%	-0.21%
ALL	-1.04%	-1.04%	-0.60%	-0.53%
2 Year Total	-1.04%		-0.57%	

Table 18: Per capita income impacts by PI+ region

TOTAL IMPACT ON PERSONAL INCOME PER-CAPITA (THOUSANDS FIXED 2018 $)						
	BASE		PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020	2019	2020
Metro Denver	$65.115	$67.027	-$0.541	-$0.275	-$0.323	-$0.164
Denver South	$67.383	$69.539	-$0.725	-$0.364	-$0.437	-$0.219
Rest of CO	$50.567	$52.250	-$0.140	-$0.093	-$0.076	-$0.052
ALL	$59.256	$61.133	-$0.414	-$0.234	-$0.246	-$0.139
2 Years Annual Average	$60.195		-$0.324		-$0.193	

TOTAL IMPACT ON PERSONAL INCOME PER-CAPITA (PERCENT)				
	PERMITS PROJECTION METHOD		HOUSING UNIT PROJECTION METHOD	
Region	2019	2020	2019	2020
Metro Denver	-0.84%	-0.43%	-0.50%	-0.25%
Denver South	-1.10%	-0.55%	-0.67%	-0.33%
Rest of CO	-0.29%	-0.19%	-0.16%	-0.11%
ALL	-0.72%	-0.41%	-0.43%	-0.24%
2 Years Annual Average	-0.54%		-0.32%	

Appendix C – REMI Model Overview

MODEL FRAMEWORK

PI+, Tax-PI and TranSight are structural economic forecasting and policy analysis model. The following core framework applies to all REMI model builds. The model integrates input-output, computable general equilibrium, econometric and economic geography methodologies. The model is dynamic, with forecasts and simulations generated on an annual basis and behavioral responses to compensation, price, and other economic factors.

The model consists of thousands of simultaneous equations with a structure that is relatively straightforward. The exact number of equations used varies depending on the extent of industry, demographic, demand, and other detail in the specific model being used. The overall structure of the model can be summarized in five major blocks: (1) Output and Demand, (2) Labor and Capital Demand, (3) Population and Labor Supply, (4) Compensation, Prices, and Costs, and (5) Market Shares. The blocks and their key interactions are shown in Figures 1 and 2.

Figure 1: REMI Model Linkages

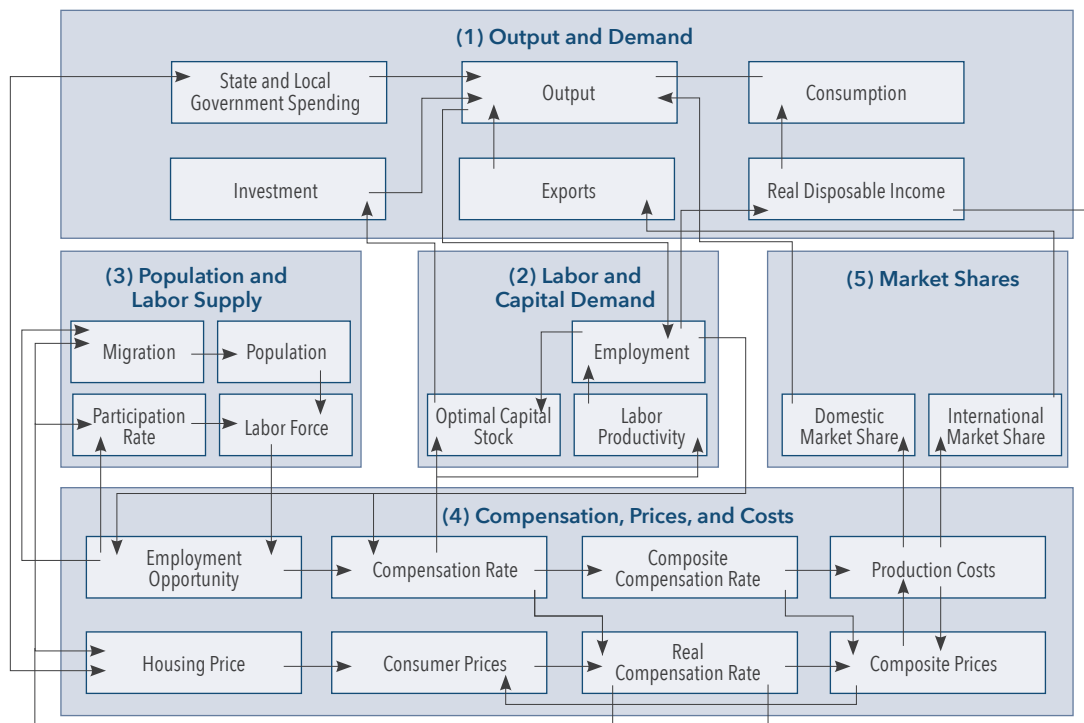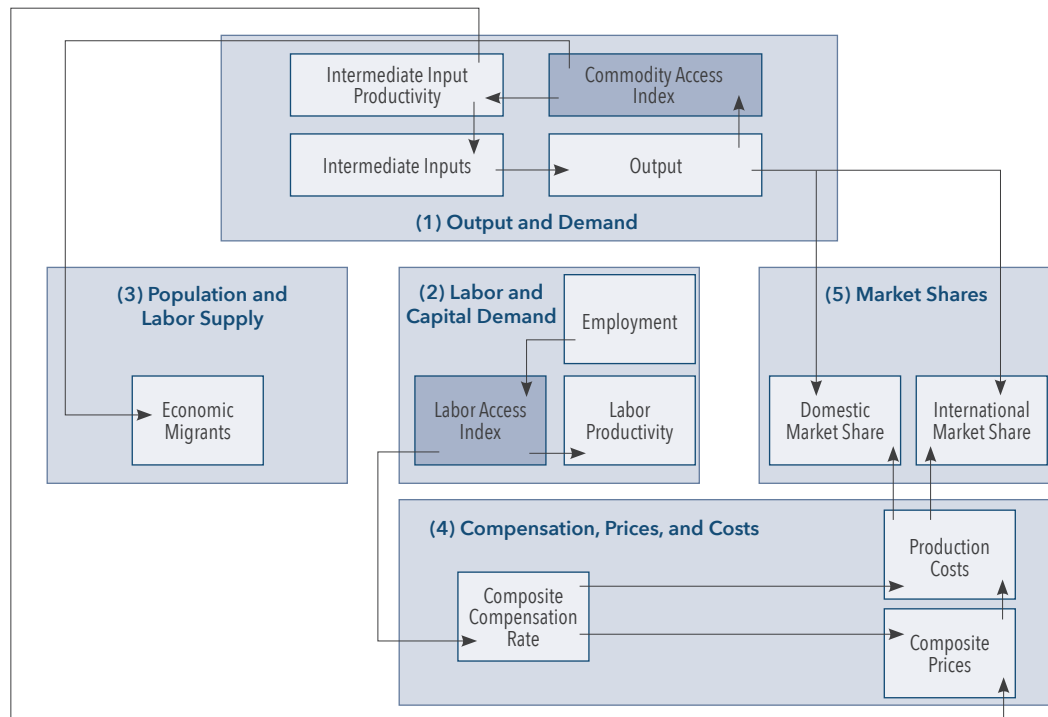## REMI MODEL LINKAGES (EXCLUDING ECONOMIC GEOGRAPHY LINKAGES)

ECONOMIC IMPACT OF RESTRICTING HOUSING GROWTH

ECONOMIC GEOGRAPHY LINKAGES

The Output and Demand block consists of output, demand, consumption, investment, government spending, exports, and imports, as well as feedback from output change due to the change in the productivity of intermediate inputs. The Labor and Capital Demand block includes labor intensity and productivity as well as demand for labor and capital. Labor force participation rate and migration equations are in the Population and Labor Supply block. The Compensation, Prices, and Costs block includes composite prices, determinants of production costs, the consumption price deflator, housing prices, and the compensation equations. The proportion of local, inter-regional, and export markets captured by each region is included in the Market Shares block.

Models can be built as single region, multi-region, or multi-region national models. A region is defined broadly as a sub-national area, and could consist of a state, province, county, or city, or any combination of sub-national areas.

Single-region models consist of an individual region, called the home region. The rest of the nation is also represented in the model. However, since the home region is only a small part of the total nation, the changes in the region do not have an endogenous effect on the variables in the rest of the nation.

Multi-regional models have interactions among regions, such as trade and commuting flows. These interactions include trade flows from each region to each of the other regions. These flows are illustrated for a three-region model in Figure 3.

Figure 3: Trade and Commuter Flow Linkages

TRADE AND COMMUTER FLOW LINKAGES
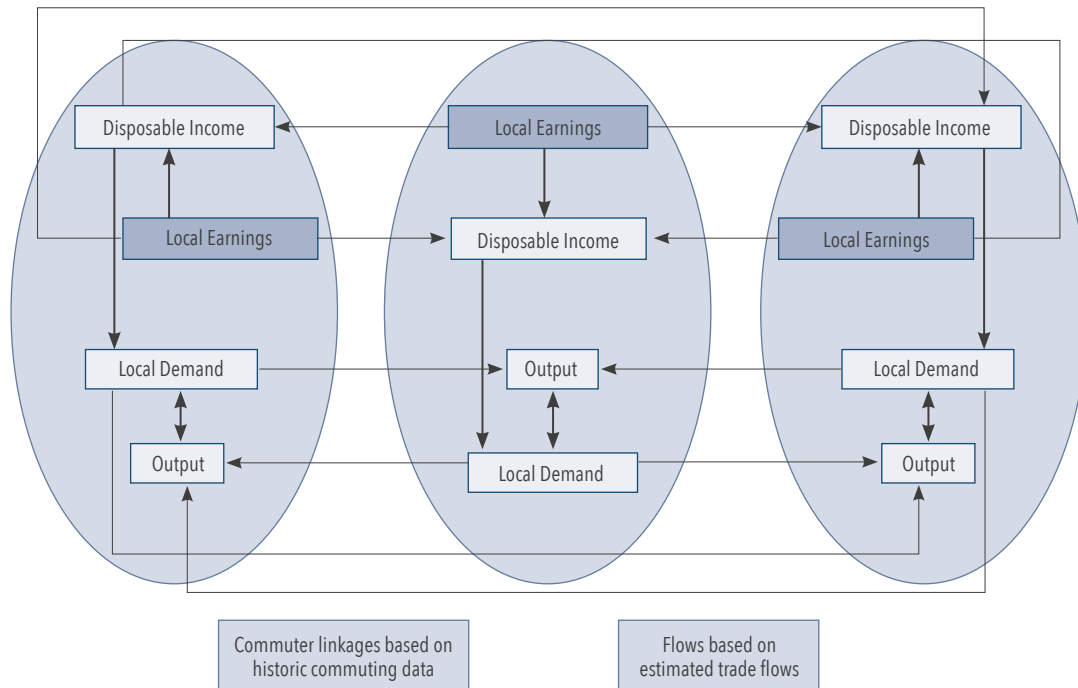
Multiregional national models also include a central bank monetary response that constrains labor markets. Models that only encompass a relatively small portion of a nation are not endogenously constrained by changes in exchange rates or monetary responses.

BLOCK 1. OUTPUT AND DEMAND

This block includes output, demand, consumption, investment, government spending, import, commodity access, and export concepts. Output for each industry in the home region is determined by industry demand in all regions in the nation, the home region's share of each market, and international exports from the region.

For each industry, demand is determined by the amount of output, consumption, investment, and capital demand on that industry. Consumption depends on real disposable income per capita, relative prices, differential income elasticities, and population. Input productivity depends on access to inputs because a larger choice set of inputs means it is more likely that the input with the specific characteristics required for the job will be found. In the capital stock adjustment process, investment occurs to fill the difference between optimal and actual capital stock for residential, non-residential, and equipment investment. Government spending changes are determined by changes in the population.

BLOCK 2. LABOR AND CAPITAL DEMAND

The Labor and Capital Demand block includes the determination of labor productivity, labor intensity, and the optimal capital stocks. Industry-specific labor productivity depends on the availability of workers with differentiated skills for the occupations used in each industry. The occupational labor supply and commuting costs determine firms' access to a specialized labor force.

Labor intensity is determined by the cost of labor relative to the other factor inputs, capital and fuel. Demand for capital is driven by the optimal capital stock equation for both non-residential capital and equipment. Optimal capital stock for each industry depends on the relative cost of labor and capital, and the employment weighted by capital use for each industry. Employment in private industries is determined by the value added and employment per unit of value added in each industry.

BLOCK 3. POPULATION AND LABOR SUPPLY

The Population and Labor Supply block includes detailed demographic information about the region. Population data is given for age, gender, and race, with birth and survival rates for each group. The size and labor force participation rate of each group determines the labor supply. These participation rates respond to changes in employment relative to the potential labor force and to changes in the real after-tax compensation rate. Migration includes retirement, military, international, and economic migration. Economic migration is determined by the relative real after-tax compensation rate, relative employment opportunity, and consumer access to variety.

BLOCK 4. COMPENSATION, PRICES AND COSTS

This block includes delivered prices, production costs, equipment cost, the consumption deflator, consumer prices, the price of housing, and the compensation equation. Economic geography concepts account for the productivity and price effects of access to specialized labor, goods, and services.

These prices measure the price of the industry output, taking into account the access to production locations. This access is important due to the specialization of production that takes place within each industry, and because transportation and transaction costs of distance are significant.   Composite prices for each industry are then calculated based on the production costs of supplying regions, the effective distance to these regions, and the index of access to the variety of outputs in the industry relative to the access by other uses of the product.

The cost of production for each industry is determined by the cost of labor, capital, fuel, and intermediate inputs. Labor costs reflect a productivity adjustment to account for access to specialized labor, as well as underlying compensation rates. Capital costs include costs of non-residential structures and equipment, while fuel costs incorporate electricity, natural gas, and residual fuels.

The consumption deflator converts industry prices to prices for consumption commodities. For potential migrants, the consumer price is additionally calculated to include housing prices. Housing prices change from their initial level depending on changes in income and population density.

Compensation changes are due to changes in labor demand and supply conditions and changes in the national compensation rate. Changes in employment opportunities relative to the labor force and occupational demand change determine compensation rates by industry.

BLOCK 5. MARKET SHARES

The market shares equations measure the proportion of local and export markets that are captured by each industry. These depend on relative production costs, the estimated price elasticity of demand, and the effective distance between the home region and each of the other regions. The change in share of a specific area in any region depends on changes in its delivered price and the quantity it produces compared with the same factors for competitors in that market. The share of local and external markets then drives the exports from and imports to the home economy.

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