2021 COLORADO SCHOOL DISTRICT COST OF LIVING ANALYSIS

Colorado Legislative Council

CONTENTS

2021 COLORADO SCHOOL DISTRICT COST OF LIVING ANALYSIS

CONDUCTED FOR THE COLORADO LEGISLATIVE COUNCIL

SECTION 1: OVERVIEW OF THE STUDY

Corona Insights is pleased to present the 2021 Colorado School District Cost of Living Analysis to the Colorado Legislative Council. The purpose of this study is to create a cost of living index for each of the 178 school districts in Colorado to be utilized in the per pupil funding formula for K-12 education, as mandated by the Public School Finance Act of 1994.

A cost of living index is a tool for comparing how expensive it is to live in one school district rather than another. We start by assuming that the same family buys the same items while living in different districts, and then determine how much it would cost to buy those things in each district.

For the 2021 Colorado School District Cost of Living Study, our family (i.e., "benchmark household") is a family of three people with a total household income of $59,834, which is the average salary of a Colorado teacher with a bachelor's degree and 10 or more years of experience.

The research process involves the following steps, which are described in greater detail in Section 3:

1. We assume that the benchmark household purchases the same goods and services as a typical family of that size and income, according to the national Consumer Expenditure Survey (CES) conducted by the Bureau of Labor Statistics (BLS).
2. We select a variety of specific items to represent categories of spending. For example, we select a banana to represent purchases of fruits and vegetables. These items comprise our market basket.
3. Then we collect prices for the items in the market basket from businesses or service providers (such as a utility) in each district.
4. We then account for geographic patterns in where people shop for retail items in the market basket, which may be in their own district or in different districts.
5. Based on where people typically shop, and how much items cost in each place, we figure out how much residents of each district typically pay for the total market basket. This allows us to compare how expensive it would be for the benchmark family to live in each district.

Section 2 of this report provides the results of this study, with maps and tables showing the relative cost of living in each school district in Colorado. Section 3 of this report provides in-depth information on the methodology for the study. Appendices A-E provide additional results, raw data, research instruments and products, additional documentation on changes from the previous study, and statistical procedures used.

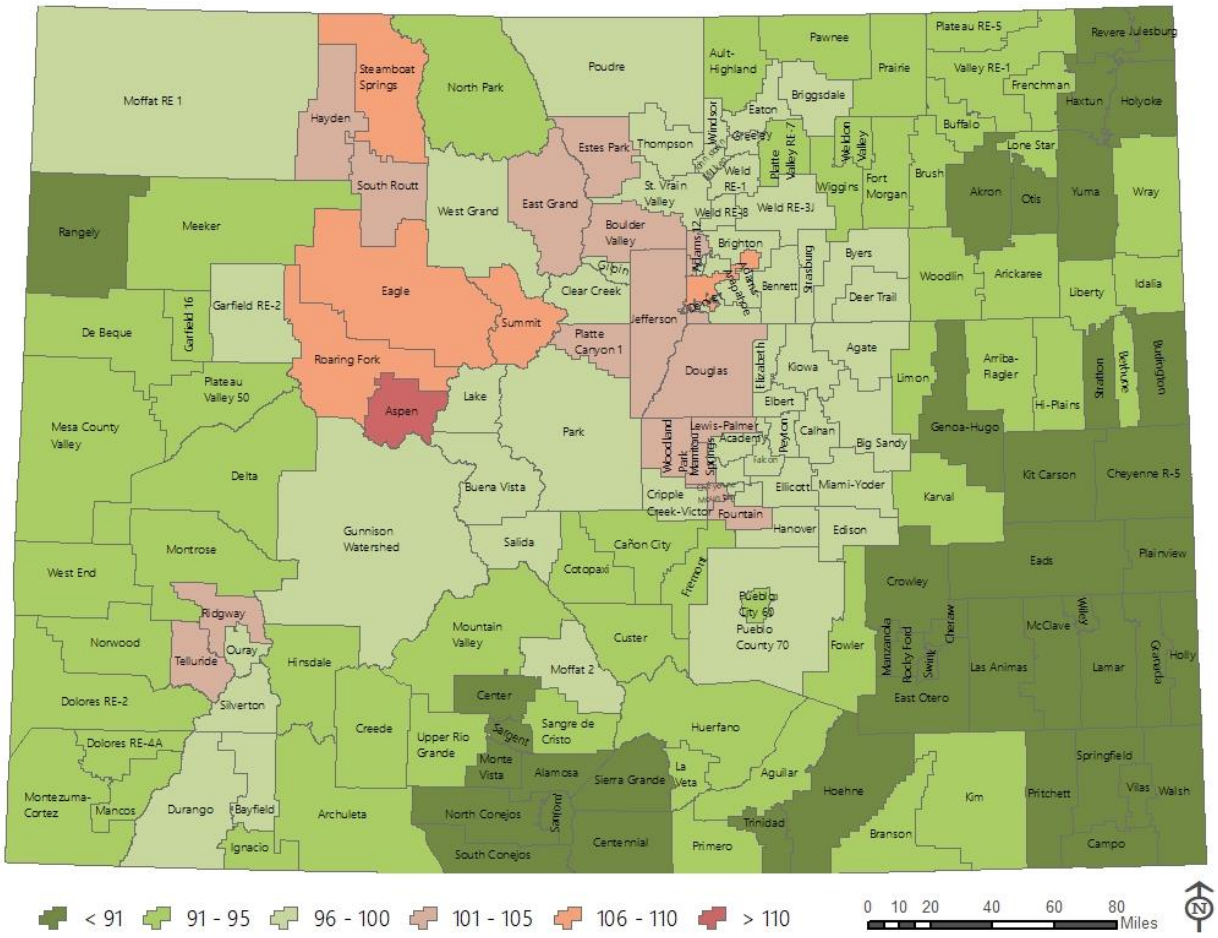
SECTION 2: 2021 COLORADO SCHOOL DISTRICT COST OF LIVING RESULTS

The table that extends across the following several pages provides the overall cost of living in each of Colorado's 178 school districts, as calculated in 2021. Figures are reported in order by District number (and alphabetically by County name), along with associated rankings, ratings, and comparisons.

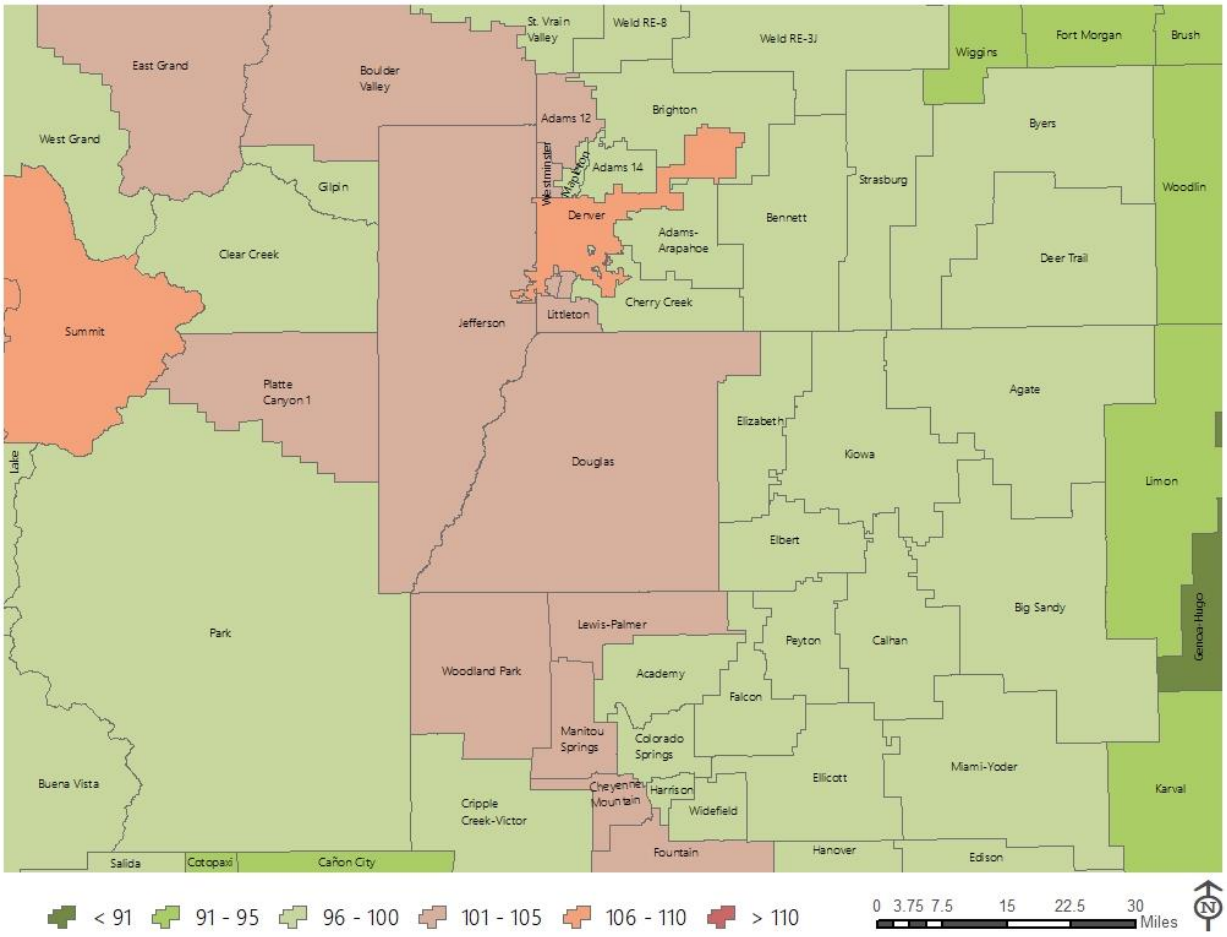
Cost of living figures relate to the cost of buying a market basket of goods and services that represents the spending patterns in the United States of the average 3-person household earning $59,834. (See Section 3.1 for more discussion of the archetypal household.) More detailed results by expense category may be seen in Appendix A. Raw data for selected goods may be seen in Appendix D.

The findings are largely consistent with previous years. Aspen continues to have the highest cost of living, however its disparity is less extreme in 2021 than it was in 2019, primarily due to the addition of travel distance to gas spending calculations, which is discussed in Section 3.4 and Appendix B. Other mountain resort districts make up the top of the list, including Summit County, Roaring Fork, Steamboat Springs, and Eagle County districts. Denver and Boulder remain near the top at #6 and #7, respectively. The districts with the lowest costs of living are primarily located in the Eastern Plains and the San Luis Valley.

Below, two maps provide a visual summary of the cost of living index for the 178 school districts. The first map is a statewide view and the second is a detailed view of the Denver and Colorado Springs metro areas. Statewide maps for each major expenditure category are provided in Appendix A.



Note. The index value is the ratio of the cost of the market basket in each district to the statewide average cost of the market basket. An index value that is greater than 100 means that district is more expensive than average, while a value less than 100 means that district is less expensive than average. In this map, shades of green depict less expensive districts, while shades of orange depict more expensive districts.


St. Vrain Valley
Weld RE-8
Weld RE-3J
Wiggins
Fort Morgan
Brush
East Grand
Boulder Valley
Brighton
Adams 12
Byers
West Grand
Westminster
Adams 14
Strasburg
Woodlin
Gilpin
Denver
Bennett
Clear Creek
Adams-Arapahoe
Deer Trail
Summit
Jefferson
Littleton
Cherry Creek
Platte Canyon 1
Agate
Elizabeth
Kiowa
Lake
Douglas
Limon
Elbert
Big Sandy
Lewis-Palmer
Peyton
Calhan
Genoa-Hugo
Park
Woodland Park
Academy
Falcon
Manitou Springs
Colorado Springs
Miami-Yoder
Buena Vista
Ellicott
Karval
Cheyenne Mountain
Harrison
Cripple Creek-Victor
Widefield
Salida
Cotopaxi
Cañon City
Fountain
Hanover
Edison
< 91
91 - 95
96 - 100
101 - 105
106 - 110
> 110
0 3.75 7.5 15 22.5 30
Miles
N

2021 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2021
		State Average	$59,834	100	
10	Adams	Mapleton 1	$59,708	99.8	38
20	Adams	Adams 12 Five Star Schools	$60,703	101.5	19
30	Adams	Adams County 14	$59,355	99.2	42
40	Adams	School District 27J	$60,025	100.3	31
50	Adams	Bennett 29J	$59,865	100.1	33
60	Adams	Strasburg 31J	$59,748	99.9	37
70	Adams	Westminster Public Schools	$61,071	102.1	18
100	Alamosa	Alamosa RE-11J	$52,993	88.6	146
110	Alamosa	Sangre De Cristo Re-22J	$54,891	91.7	109
120	Arapahoe	Englewood 1	$62,465	104.4	8
123	Arapahoe	Sheridan 2	$60,566	101.2	23
130	Arapahoe	Cherry Creek 5	$60,124	100.5	27
140	Arapahoe	Littleton 6	$61,676	103.1	13
170	Arapahoe	Deer Trail 26J	$58,320	97.5	60
180	Arapahoe	Adams-Arapahoe 28J	$59,569	99.6	39
190	Arapahoe	Byers 32J	$58,446	97.7	56
220	Archuleta	Archuleta County 50 Jt	$56,998	95.3	81
230	Baca	Walsh RE-1	$50,980	85.2	170
240	Baca	Pritchett RE-3	$50,791	84.9	173
250	Baca	Springfield RE-4	$50,242	84.0	176
260	Baca	Vilas RE-5	$50,849	85.0	172
270	Baca	Campo RE-6	$51,237	85.6	169
290	Bent	Las Animas RE-1	$50,338	84.1	175
310	Bent	McClave Re-2	$52,097	87.1	156
470	Boulder	St Vrain Valley RE1J	$59,567	99.6	40
480	Boulder	Boulder Valley Re 2	$63,100	105.5	7
490	Chaffee	Buena Vista R-31	$58,899	98.4	47
500	Chaffee	Salida R-32	$57,981	96.9	69
510	Cheyenne	Kit Carson R-1	$51,761	86.5	160
520	Cheyenne	Cheyenne County Re-5	$50,950	85.2	171
540	Clear Creek	Clear Creek RE-1	$59,125	98.8	45
550	Conejos	North Conejos RE-1J	$52,686	88.1	150
560	Conejos	Sanford 6J	$51,734	86.5	162
580	Conejos	South Conejos RE-10	$51,615	86.3	165
640	Costilla	Centennial R-1	$53,509	89.4	138
740	Costilla	Sierra Grande R-30	$53,482	89.4	139
770	Crowley	Crowley County RE-1-J	$53,465	89.4	140
860	Custer	Custer County School District C-1	$56,677	94.7	86
870	Delta	Delta County 50(J)	$55,928	93.5	95
880	Denver	Denver County 1	$63,180	105.6	6
890	Dolores	Dolores County RE No.2	$54,518	91.1	114
900	Douglas	Douglas County Re 1	$61,073	102.1	17
910	Eagle	Eagle County RE 50	$63,234	105.7	5
920	Elbert	Elizabeth School District	$58,506	97.8	55
930	Elbert	Kiowa C-2	$57,986	96.9	67
940	Elbert	Big Sandy 100J	$57,366	95.9	78
950	Elbert	Elbert 200	$58,567	97.9	51
960	Elbert	Agate 300	$59,226	99.0	43

2021 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2021
		State Average	$59,834	100	
970	El Paso	Calhan RJ-1	$58,510	97.8	54
980	El Paso	Harrison 2	$58,289	97.4	61
990	El Paso	Widefield 3	$60,038	100.3	30
1000	El Paso	Fountain 8	$60,601	101.3	21
1010	El Paso	Colorado Springs 11	$58,411	97.6	59
1020	El Paso	Cheyenne Mountain 12	$60,143	100.5	26
1030	El Paso	Manitou Springs 14	$62,068	103.7	10
1040	El Paso	Academy 20	$59,766	99.9	36
1050	El Paso	Ellicott 22	$58,729	98.2	48
1060	El Paso	Peyton 23 Jt	$58,557	97.9	53
1070	El Paso	Hanover 28	$58,941	98.5	46
1080	El Paso	Lewis-Palmer 38	$61,353	102.5	14
1110	El Paso	District 49	$60,086	100.4	28
1120	El Paso	Edison 54 JT	$58,040	97.0	66
1130	El Paso	Miami/Yoder 60 JT	$58,264	97.4	62
1140	Fremont	Canon City RE-1	$55,989	93.6	94
1150	Fremont	Fremont RE-2	$56,567	94.5	87
1160	Fremont	Cotopaxi RE-3	$56,331	94.1	90
1180	Garfield	Roaring Fork RE-1	$65,186	108.9	2
1195	Garfield	Garfield Re-2	$59,962	100.2	32
1220	Garfield	Garfield 16	$56,793	94.9	84
1330	Gilpin	Gilpin County RE-1	$57,749	96.5	72
1340	Grand	West Grand 1-JT	$59,377	99.2	41
1350	Grand	East Grand 2	$61,163	102.2	16
1360	Gunnison	Gunnison Watershed RE1J	$60,079	100.4	29
1380	Hinsdale	Hinsdale County RE 1	$56,965	95.2	82
1390	Huerfano	Huerfano Re-1	$54,385	90.9	117
1400	Huerfano	La Veta Re-2	$55,085	92.1	107
1410	Jackson	North Park R-1	$55,189	92.2	104
1420	Jefferson	Jefferson County R-1	$60,481	101.1	25
1430	Kiowa	Eads RE-1	$51,689	86.4	164
1440	Kiowa	Plainview RE-2	$52,256	87.3	154
1450	Kit Carson	Arriba-Flagler C-20	$53,795	89.9	131
1460	Kit Carson	Hi-Plains R-23	$53,589	89.6	135
1480	Kit Carson	Stratton R-4	$53,054	88.7	145
1490	Kit Carson	Bethune R-5	$53,807	89.9	130
1500	Kit Carson	Burlington RE-6J	$53,079	88.7	143
1510	Lake	Lake County R-1	$57,726	96.5	73
1520	La Plata	Durango 9-R	$59,769	99.9	35
1530	La Plata	Bayfield 10 Jt-R	$58,251	97.4	63
1540	La Plata	Ignacio 11 JT	$57,062	95.4	80
1550	Larimer	Poudre R-1	$58,075	97.1	65
1560	Larimer	Thompson R2-J	$57,983	96.9	68
1570	Larimer	Estes Park R-3	$62,043	103.7	11
1580	Las Animas	Trinidad 1	$52,203	87.2	155
1590	Las Animas	Primero Reorganized 2	$53,759	89.8	132
1600	Las Animas	Hoehne Reorganized 3	$53,531	89.5	137
1620	Las Animas	Aguilar Reorganized 6	$53,689	89.7	133

2021 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2021
		State Average	$59,834	100	
1750	Las Animas	Branson Reorganized 82	$54,081	90.4	124
1760	Las Animas	Kim Reorganized 88	$54,247	90.7	121
1780	Lincoln	Genoa-Hugo C113	$52,857	88.3	148
1790	Lincoln	Limon RE-4J	$54,322	90.8	119
1810	Lincoln	Karval RE-23	$55,369	92.5	102
1828	Logan	Valley RE-1	$53,880	90.0	127
1850	Logan	Frenchman RE-3	$54,726	91.5	112
1860	Logan	Buffalo RE-4J	$54,363	90.9	118
1870	Logan	Plateau RE-5	$54,280	90.7	120
1980	Mesa	De Beque 49JT	$55,402	92.6	101
1990	Mesa	Plateau Valley 50	$55,638	93.0	99
2000	Mesa	Mesa County Valley 51	$54,492	91.1	115
2010	Mineral	Creede School District	$53,816	89.9	129
2020	Moffat	Moffat County RE: No 1	$58,623	98.0	49
2035	Montezuma	Montezuma-Cortez RE-1	$54,859	91.7	110
2055	Montezuma	Dolores RE-4A	$56,310	94.1	91
2070	Montezuma	Mancos Re-6	$56,548	94.5	89
2180	Montrose	Montrose County RE-1J	$56,549	94.5	88
2190	Montrose	West End RE-2	$55,464	92.7	100
2395	Morgan	Brush RE-2(J)	$56,147	93.8	92
2405	Morgan	Fort Morgan Re-3	$55,161	92.2	105
2505	Morgan	Weldon Valley RE-20(J)	$55,712	93.1	98
2515	Morgan	Wiggins RE-50(J)	$56,893	95.1	83
2520	Otero	East Otero R-1	$49,544	82.8	178
2530	Otero	Rocky Ford R-2	$50,450	84.3	174
2535	Otero	Manzanola 3J	$51,479	86.0	167
2540	Otero	Fowler R-4J	$54,838	91.6	111
2560	Otero	Cheraw 31	$51,819	86.6	159
2570	Otero	Swink 33	$49,678	83.0	177
2580	Ouray	Ouray R-1	$58,557	97.9	52
2590	Ouray	Ridgway R-2	$61,213	102.3	15
2600	Park	Platte Canyon 1	$61,742	103.2	12
2610	Park	Park County RE-2	$59,820	100.0	34
2620	Phillips	Holyoke Re-1J	$52,066	87.0	157
2630	Phillips	Haxtun RE-2J	$53,171	88.9	142
2640	Pitkin	Aspen 1	$73,196	122.3	1
2650	Prowers	Granada RE-1	$51,481	86.0	166
2660	Prowers	Lamar Re-2	$51,467	86.0	168
2670	Prowers	Holly RE-3	$52,284	87.4	153
2680	Prowers	Wiley RE-13 Jt	$51,742	86.5	161
2690	Pueblo	Pueblo City 60	$56,026	93.6	93
2700	Pueblo	Pueblo County 70	$57,251	95.7	79
2710	Rio Blanco	Meeker RE-1	$54,042	90.3	125
2720	Rio Blanco	Rangely RE-4	$52,960	88.5	147
2730	Rio Grande	Upper Rio Grande School District C-7	$54,102	90.4	123
2740	Rio Grande	Monte Vista C-8	$52,788	88.2	149
2750	Rio Grande	Sargent RE-33J	$53,075	88.7	144
2760	Routt	Hayden RE-1	$60,586	101.3	22

2021 Cost of Living Index for Colorado School Districts

School District ID	County	School District	Total	Index	Rank 2021
		State Average	$59,834	100	
2770	Routt	Steamboat Springs RE-2	$63,654	106.4	4
2780	Routt	South Routt RE 3	$60,605	101.3	20
2790	Saguache	Mountain Valley RE 1	$53,940	90.1	126
2800	Saguache	Moffat 2	$57,586	96.2	77
2810	Saguache	Center 26 JT	$51,703	86.4	163
2820	San Juan	Silverton 1	$57,955	96.9	70
2830	San Miguel	Telluride R-1	$62,194	103.9	9
2840	San Miguel	Norwood R-2J	$55,861	93.4	96
2862	Sedgwick	Julesburg Re-1	$52,039	87.0	158
2865	Sedgwick	Revere School District	$52,311	87.4	152
3000	Summit	Summit RE-1	$65,006	108.6	3
3010	Teller	Cripple Creek-Victor RE-1	$58,428	97.7	58
3020	Teller	Woodland Park Re-2	$60,507	101.1	24
3030	Washington	Akron R-1	$53,240	89.0	141
3040	Washington	Arickaree R-2	$54,946	91.8	108
3050	Washington	Otis R-3	$53,550	89.5	136
3060	Washington	Lone Star 101	$54,108	90.4	122
3070	Washington	Woodlin R-104	$54,423	91.0	116
3080	Weld	Weld County RE-1	$57,693	96.4	74
3085	Weld	Eaton RE-2	$57,597	96.3	76
3090	Weld	Weld County School District RE-3J	$57,606	96.3	75
3100	Weld	Windsor RE-4	$59,141	98.8	44
3110	Weld	Johnstown-Milliken RE-5J	$58,569	97.9	50
3120	Weld	Greeley 6	$58,445	97.7	57
3130	Weld	Platte Valley RE-7	$55,754	93.2	97
3140	Weld	Weld Re-8 Schools	$58,150	97.2	64
3145	Weld	Ault-Highland RE-9	$56,690	94.7	85
3146	Weld	Briggsdale RE-10	$57,907	96.8	71
3147	Weld	Prairie RE-11	$54,722	91.5	113
3148	Weld	Pawnee RE-12	$55,197	92.2	103
3200	Yuma	Yuma 1	$52,462	87.7	151
3210	Yuma	Wray RD-2	$53,610	89.6	134
3220	Yuma	Idalia RJ-3	$53,827	90.0	128
3230	Yuma	Liberty J-4	$55,134	92.1	106

SECTION 3: METHODOLOGY

3.1 IDENTIFYING THE BENCHMARK HOUSEHOLD

The first step in a cost of living study is to determine whose cost of living the index will reflect. This entity is referred to as the "benchmark household". The 2021 benchmark household was defined by the Colorado Legislative Council to be a three-person household with a total annual household income of $59,834, which is the average salary in 2020 of a Colorado teacher with a bachelor's degree and 10 or more years of experience. A three-person household is the average household size in Colorado (US Census Bureau, 2015-2019). This benchmark household was defined in the same way as in prior studies since 2015. (Prior to 2015, the benchmark household was defined using the average teacher salary, overall, without specifying a level of education and experience.)

Over the past studies, the household size has remained constant, and the household income has increased at a moderate rate. The table below summarizes the history of benchmark household income values used for the study.

Household Income Definition for 3-Person Benchmark Household

Year	Household Income	Percent Change
2021	59,834	5.8%
2019	56,547	6.5%
2017	53,115	2.3%
2015[a]	51,930	5.3%
2013[b]	49,300	0.2%
2011	49,200	3.6%
2009	47,500	6.7%
2007	44,500	3.5%
2005	43,000	7.5%
2003	40,000	5.3%
2001	38,000	

[a] Since 2015, the household income definition has specified the average salary of a Colorado teacher with a bachelor's degree and 10 or more years of experience. [b] The 2013 salary was revised to be consistent with the 2015 household income definition. The 2013 study originally used a salary of $49,100.

3.2 IDENTIFYING THE MARKET BASKET OF GOODS AND SERVICES

The next step in a cost of living study is to determine what the benchmark household will buy. The goal of this step is to develop a list of goods and services that, in combination, can represent the full range of typical annual purchases for the benchmark household. To begin, we obtain a list of spending categories from the Consumer Expenditure Survey (CES), which is conducted by the Bureau of Labor Statistics (BLS). The CES gathers information on the buying habits of American consumer households and then provides summary data about what households spend their money on and how much of their spending goes to each category. In particular, they provide data on the spending

habits of 3-person households at different income levels that we use to calculate typical expenditures for our benchmark family earning $59,834. The table below shows the major expenditure categories and the amount of income spent on each category, sorted from largest to smallest expenditures.

Consumer Expenditures for a 3-Person Household Earning $59,834

Expenditure Category	% of Income 2019	% of Income 2021
Housing	32.3%	30.4%
Transportation	16.9%	20.5%
Food	13.5%	13.4%
Healthcare	8.9%	8.1%
Personal taxes	5.2%	4.9%
Entertainment	4.1%	4.1%
Apparel and services	2.7%	2.7%
Personal care products and services	1.2%	1.1%
Tobacco	0.9%	0.7%
Alcoholic beverages	0.5%	0.4%
Other	13.8%	13.7%
Total	*100%*	*100%*

Spending patterns for the benchmark household in 2021 were largely similar to spending patterns in 2019. (Note that the most recent data available in 2021 reflected the period of 2018-2019. See Appendix B for additional discussion about the impact of the COVID-19 pandemic on spending patterns.) Transportation saw the greatest increase, growing by 3.6%, while housing declined by 1.9%. The increase in transportation spending is primarily attributable to increases in the percentage of spending on vehicle purchases and vehicle insurance.

Starting from the detailed expenditure categories (provided in the table below), Corona Insights and the Colorado Legislative Council developed a list of specific goods and services to represent the expenditures of our benchmark household. This list of goods and services comprise the "market basket" for the cost of living study. An effort was made to retain market basket items from the previous study, while selecting items that: a) are representative of the expenditure category, b) are widely available statewide in a substantially similar form, and c) represent a minimum proportion of spending (e.g., at least 0.5%). More information on the selection criteria for 2021 can be found in Appendix B.

Consumer Expenditure Survey Categories and Specific Weights Utilized in Cost of Living Index (Weight as a percentage of income)

Expenditure Category	% of Income	Representative Market Basket Items 2021
Food	**13.35%**	
Food at home	7.47%	
Cereals and bakery products	1.03%	Cheerios
Meats, poultry, fish, and eggs	1.65%	Ground Beef
Dairy products	0.72%	Milk
Fruits and vegetables	1.40%	Bananas
Other food at home	2.67%	Coke
Food away from home	5.88%	Pizza
Housing	**30.37%**	
Owned Dwellings	7.71%	
Mortgage interest and charges	4.18%	Mortgage Payment
Property taxes	2.27%	Property Taxes
Maintenance, repairs, insurance, other expenses	1.26%	Homeowner's Insurance
Rented Dwellings	9.38%	Rent & Renter's Insurance Payment
Utilities, fuels, and public services	7.52%	
Natural gas	0.71%	Natural Gas
Electricity	2.92%	Electric
Telephone services	2.82%	Telephone
Water and other public services	1.07%	Water & Sewer
Household operations	2.24%	Day Care Services
Household furnishings and equipment & Housekeeping supplies	3.52%	Smoke Detector
Transportation	**20.52%**	
Vehicle purchases (net outlay) & vehicle finance charges	10.28%	Car Payment (Interest rate, bank financing fees, taxes, title, registration)
Gasoline and motor oil	4.15%	Gasoline: 85 Unleaded
Other vehicle expenses	6.08%	
Maintenance and repairs	1.89%	Oil and Filter Change, Front-End Alignment
Vehicle insurance	4.19%	Insurance Premiums
Healthcare	**8.15%**	Health Insurance Premium
Entertainment	**4.07%**	AA Batteries
Personal care products and services	**1.08%**	Woman's Haircut, Man's Haircut
Personal taxes (not including stimulus)	**4.90%**	Income Tax with Itemized Deductions for Mortgage Interest
Other *[assumed not to vary between districts]*	**17.56%**	
Alcoholic beverages	0.43%	
Apparel and services	2.73%	
Reading	0.09%	
Education	1.14%	
Tobacco products and smoking supplies	0.72%	
Miscellaneous	1.03%	
Cash contributions	1.66%	
Personal insurance and pensions	9.76%	
Total	*100.00%*	

3.3 DETERMINING WHERE, WHEN, AND HOW TO COLLECT COSTS OF MARKET BASKET ITEMS

Market basket items can be divided into two main categories for data collection. In the first category are retail goods and services that can be purchased from many shopping locations throughout the state. These items include groceries, restaurant meals, household items, auto services, and haircuts. In the second category are items most people think of as bills: mortgage and rent payments, car payment, insurance, utilities, and taxes. In 2021, prices for most of the retail goods and services were obtained by making telephone calls to individual businesses as well as visits to select websites of retailers. In contrast, prices for most of the bills were calculated from information provided in government publications, other publicly available data, and through municipal authorities (either via telephone calls or online, where published).

RETAIL ITEMS

The table below provides the data source and data collection method for each of the retail items.

	CES Category	Market Basket Item	Data Source	Collection Method
Food	Cereals and bakery products	Cheerios	Sample from commercial list provider for Grocery, General Stores, and Convenience Stores	Phone calls to businesses
Food	Fruits and vegetables	Bananas		
Food	Meats, poultry, fish and eggs	Ground beef		
Food	Dairy	Milk		
Food	Other food at home	Coke		
Food	Food away from home	Pizza	Sample from commercial list provider for Pizza Restaurants	
Housing	Housekeeping supplies, furnishings, & equipment	Smoke detector	Sample from commercial list provider for Hardware, Department Stores, Grocery, General Stores, Drugstores	
Entertainment		Batteries		
Personal care		Man's haircut	Sample from commercial list provider for Beauty & Barber Shops	
Personal care		Woman's haircut		
Transportation	Maintenance and repairs	Oil and filter change	Sample from commercial list provider for Auto Repair Shops	
Transportation	Maintenance and repairs	Front-end alignment		

For each of the retail items, we identified a set of Standard Industrial Classification (SIC) codes that correspond to businesses that are likely to sell the item. We then purchased a list of all businesses associated with those SIC codes from D&B Hoovers. To select a sample of businesses to collect prices from, we first used ArcGIS software to map the latitude and longitude coordinates for each business to the school district for each business using school district shape files available from the Census Bureau. As in the previous study, we determined that a sample of 10 businesses per item per school district was the minimum target. Because not all businesses would answer their phones or provide pricing information, we determined to start with a sample of 15 businesses per item per district in order to obtain 10 prices. In many districts, there were fewer than 15 businesses available for some items. In those cases, all known businesses in those districts were included in the sample. In districts with more than 15 businesses available, a weighted random sample of businesses was selected where weights were used to ensure that the sample of businesses reflects the market share of businesses in the community.

From a statistical perspective, if all stores selling a given product had an equal market share, meaning people were just as likely to buy the product at any store as any other store, then taking a simple random sample of stores would be appropriate, and calculating simple averages of the prices available at those stores would give a reasonably accurate measure of what people pay and how confident we are in that estimate as a function of the sample size within the universe of stores. However, because people tend to shop more at some stores than others (or more people shop at some stores than others), the average amount paid isn't a simple average of the prices available across stores but is a weighted average of prices available by how many people buy at each location (i.e., the market share of the location). Rather than weighting the prices obtained on the back end, we instead sampled businesses according to market share in order to account for this complexity. However, this methodology was most flawed in small districts where we were likely to gather prices from all businesses selling a product and weight them equally in calculating a district price, even though there may be one particular business in that district that is responsible for a disproportionate percentage of sales of that item in that district.

To gather data from the sample of businesses selected, we primarily made phone calls to the individual businesses. We also gathered some pricing online, where pricing for individual business locations was available. In addition, we used online sources to verify business addresses, search for missing or alternate phone numbers, verify business closures, and search for additional businesses in districts where no businesses existed in the sample. We also used online sources if businesses in the district did not provide pricing.

To execute the phone survey, we recruited temporary contractors to perform the data collection. A Corona Insights Principal who has been involved in past data collection for this project served as the phone research manager in charge of training and overseeing the staff. All hires were screened, interviewed, and background checked by our staffing agency prior to employment. Data collectors were paid hourly. Phone calls and online searches were made from Corona's office.

We developed an overview and training guide for data collectors. We then conducted training with all data collectors. Training focused on the importance of collecting data in the exact same manner from all businesses contacted and included how to record prices and how to enter data. Data collectors focused on one product at a time, and prior to starting data collection for a specific item, a thorough review of that market basket item, including relevant details, common questions and allowed substitutions, was provided. The research manager and other Corona staff were available for questions during the entire data collection period. The research manager also made periodic check-ins with the data collectors to answer questions and monitor progress. Data was entered directly into an Excel spreadsheet.

Most of the phone data collection was completed in a two-week period to minimize variability in pricing due to timing. The research manager conducted random data checks to ensure the correct prices were collected.

NON-RETAIL ITEMS ("BILLS")

The table below provides the data source and data collection method for each of the non-retail items.

	CES Category	Market Basket Item	Data Source	Collection Method
Housing	Shelter	Mortgage Interest Payment	Housing values from outside consultant; interest rate from Zillow	Secondary Data & Online Source
		Property Taxes	Colorado Dept of Local Affairs - 2020 Annual Report & Final Residential Rate Study for 2019-2020	Online sources
		Homeowners' Insurance	Colorado Dept of Regulatory Agencies, Division of Insurance (HO-3 policy)	Online source
		Rent Payment & Renter's Insurance	American Community Survey (ACS) Colorado Dept of Regulatory Agencies, Division of Insurance (HO-4 policy)	Online sources
	Utilities	Electric	Colorado Association of Municipal Utilities, U.S. Dept of Homeland Security, National Oceanic and Atmospheric Administration, Colorado Public Utilities Commission	Online sources Phone calls to providers
		Natural gas	Colorado Public Utilities Commission National Oceanic and Atmospheric Administration U.S. Energy Information Administration	Online sources Phone calls to providers
		Telephone	Colorado Public Utilities Commission The Tax Foundation	Online sources
		Water and Wastewater	Water and wastewater utilities across the state. Homeguide.com and Homeadvisor.com.	Online sources Phone calls to providers
	Household Operations	Daycare Services	The Self-Sufficiency Standard for Colorado US Office of Child Care	Online sources
Transportation	Vehicle purchases & vehicle finance charges	Vehicle Payment	Sample from commercial list provider for banks and credit unions; Kelley Blue Book; Colorado Dept of Revenue; Colorado Legislative Council	Online sources Phone calls to providers
	Gasoline and motor oil	Gasoline: 85 unleaded	Oil Price Information Service American Community Survey (ACS)	Purchase database & online source
	Vehicle insurance	Auto Insurance Premium	Colorado Dept of Regulatory Agencies, Division of Insurance (Plan 2, Driver C)	Online source
Healthcare		Health Insurance Premium	Colorado Dept of Regulatory Agencies, Division of Insurance (Individual Min/Max Premiums for Silver and Bronze Tiers)	Online source

Data collection for non-retail items was tailored to each item, but in most cases involved locating some publicly available information and supplementing with phone calls to specific providers or municipal authorities to fill in missing information. Corona staff executed the data collection for these items, with the exception of bank rates and fees for the vehicle payment calculation, which were collected by phone calls to banks and credit unions by the temporary staff, as described in the previous section on phone calls for retail items. More information about the data collection for each of these items is provided in the next section of the report.

3.4 DATA COLLECTION DETAILS

PROCESS OVERVIEW

For the retail items identified above, the data collection process followed the same steps, so we describe those as a group, below. For each of the non-retail items, we describe their data collection process individually.

RETAIL ITEMS

Retail item prices were collected by telephone for every district. The sample for telephone calls was prepared following the protocol described in the previous section of the report. Detailed item descriptions for each of these items, as well as the number of prices obtained for each item is provided in the table below.

	CES Category	Market Basket Item	Description	N Obs 2021
Food	Cereals and bakery products	Cheerios	Price of General Mills Cheerios Toasted Whole Grain Oat Cereal plain, 8.9 oz. If size not available, note difference in size and record price.	391
	Fruits and vegetables	Bananas	Price per pound. If bananas are priced by the bag or by the banana, note that in the file. Do not price organic.	401
	Meats, poultry, fish and eggs	Ground beef	Price per pound of prepackaged, regular ground beef, 80% lean or most comparable, from a 1- to 2-pound package of loose ground beef. Note if different percent lean. Do not price family pack, pre-formed patties, or tube packaging.	328
	Dairy	Milk	Price for one gallon (128 Fl. oz.) 2% milk, collect cheapest price. If no 2%, then price (in order of preference) 1%, skim, whole. Note if not 2%. Do not price organic, soy, or flavored milks (e.g., chocolate, etc.). Do not price half gallon.	554
	Other food at home	Coke	Price for a 2L bottle of regular Coca-Cola. Do not price diet, caffeine free, cherry, or other varieties.	423
	Food away from home	Pizza	Price for a cheese pizza, regular or thin crust, 14" diameter (note size if other).	412
Housing	Housekeeping supplies, furnishings, & equipment	Smoke detector	Price of most basic smoke detector offered. Preferably no dual carbon monoxide, dual sensor, 10 year, or similar. Note any premium features on model priced.	353
Entertainment		Batteries	Price for a 4-pack of the cheapest AA alkaline batteries. Do not price lithium or rechargeable.	625

Personal care		Man's haircut	Price of man's wash, cut, and dry.	394
		Woman's haircut	Price of woman's wash, cut, and dry without styling.	359
Transportation	Maintenance and repairs	Oil and filter change	Price of an oil and filter change for a 2017 Ford F-150 pickup with a 3.5-liter engine. Price includes new filter, 6 quarts of 5w-30 full synthetic oil, and disposal of old oil. Do not price with tax.	314
	Maintenance and repairs	Front-end alignment	Price of front-end alignment for a 2017 Ford F150 pickup with 2-wheel drive.	171

After all data was collected, we validated and cleaned the data. Data collectors included notes next to any price where the item diverged from the market basket description. We reviewed those notes and adjusted any prices accordingly (typically scaling prices for differently sized items or multi-packs) and scanned for any obvious data entry errors. Next, outliers were identified and removed, using the same rule as the previous study. Specifically, we used box and whisker plots and truncated extreme values to the boxplot whisker (i.e., the 25th or 75th percentile plus 1.5 times the inter-quartile range).

Finally, appropriate taxes for each item in each location were added to each price, and an average price was calculated for each district. For food at home items, appropriate grocery taxes were applied; for food away from home items, appropriate dining out taxes were applied; and normal sales taxes were applied to the smoke detector and batteries as well as 40% of the oil change price (which reflects the portion of the cost covering materials as opposed to labor). No tax was applied to haircut prices or front-end alignment prices as they are not considered taxable goods.

NON-RETAIL ITEMS SUMMARY

Detailed item descriptions for each of the non-retail items, as well as the number of prices obtained for each item is provided in the table below.

CES Category		Market Basket Item	Description	N Obs 2021
Housing	Shelter	Mortgage Interest Payment	Mortgage interest payment, based on housing values provided by outside consultant. Mortgage payment interest rate for 30-year fixed, 20% down, credit score over 720 (as of day housing values scheduled to be delivered: 11/15/2021)	1 per district
		Property Taxes	Property taxes based on district home value, residential assessment rate, and mill levies	1 per district, 1 per county
		Homeowners' Insurance	Insurance premium for HO-3 policy with limits of $200,000 dwelling replacement, $160,000 contents replacement (frame structure type), $100,000 personal liability, $1,000 medical expense, $500 deductible	24 cities from 17 providers
		Rent Payment & Renter's Insurance	Median gross rent paid for a three-bedroom home Insurance premium for HO-4 policy for frame structure type with limits of $40,000 contents replacement, $100,000 personal liability, $1,000 medical expense, $500 deductible	Rent estimates for 170 districts insurance for 24 cities from 16 providers

	Utilities	Electric	Price for 700 kWh per month, adjusted for use by climate, plus utility sales tax	55 electric utilities
		Natural gas	Price for 62.5 therm per month, adjusted for use by climate, plus utility sales tax	81 service areas
		Telephone	Taxes, surcharges, and fees associated with monthly mobile phone service	Not applicable
		Water and Wastewater	Annual average bill for water service using 11,000 gallons per month and wastewater service using 5,000 gallons per month. Well and septic systems were priced based on item cost and installation, operation, and maintenance divided by the life expectancy of a system.	249 utilities
	Household Operations	Daycare Services	Weekly cost of child daycare	3 per county
Transportation	Vehicle purchases & vehicle finance charges	Vehicle Payment	Payment calculated using Blue Book purchase value and interest rate on loan for full purchase price and bank charges, taxes and registration fees for 2019 Honda Civic for four years. (2019 Honda Civic LX Sedan, 4-door. Engine: 4-cyl. 2.0L. Trans: Automatic/CVT. Mileage: 24,000. Amenities: air conditioning, pwr. steering, cruise control, air bags - front & side, stability control/traction control).	512 banks/ credit unions
	Gasoline and motor oil	Gasoline: 85 unleaded	Price per gallon of self-serve, 85 Octane, unleaded gasoline.	1790
	Vehicle insurance	Auto Insurance Premium	Insurance premiums for 2017 Ford Fusion SE 2.5L Automatic with liability policy limits of $50,000/$100,000 for bodily injury, $25,000 property damage, $50,000/$100,000 for uninsured motorist coverage, $5,000 for medical payments, and a $500 deductible. For a 35-yr old male driver, married, principal operator, drives less than 15 miles to work each way, no accidents or traffic convictions in three years.	24 cities from 16 providers
Healthcare		Health Insurance Premium	Prices of health care insurance premiums for a 40-year-old. Average price of "Bronze" and "Silver" health insurance premiums.	9 regions from 3 to 8 providers

HOUSING – SHELTER – MORTGAGE PAYMENT / PROPERTY TAXES

Home values were provided to Corona Insights by the Colorado Legislative Council via a study by an outside consultant, and they were based on a specified home size. This is the same approach used in previous years. We calculated an annual mortgage interest payment based on a 30-year fixed rate mortgage for 80 percent of the home value with the current mortgage interest rate for Colorado on November 15, 2021.

Owners of residential homes are subject to property tax on their dwelling. The entire value of the home is not taxed; only the assessed value of the home can be taxed. The assessed value of a home is the actual home value multiplied by an assessment percentage. This assessment percentage is the same for the entire state of Colorado and is 7.15% for 2021. In 2020, Colorado Amendment B, Gallagher Amendment Repeal and Property Tax Assessment Rates Measure passed allowing the CO State Legislature to freeze property tax assessment rates at the current rate of 7.15% for residential property. The assessed value of the home is then multiplied by the decimal equivalent of the total mill

levy. The total mill levy is the sum of the mill levies from the county, city, school district, and any other special levies an area may have. To get the decimal equivalent of a mill levy, the levy is multiplied by .001.

Mill levies were obtained from the 2020 annual report for the Department of Local Affairs. This report was the most recent report available from the Division of Property Taxation. The report included mill levies for every county, city, school district, and any other applicable levy in the state of Colorado. The mill levies were summed by school district. The stated home price for each school district was multiplied by the assessment percentage to get the assessed value. The assessed value was multiplied by the total of all applicable mill levies for the district (county, school district, average municipal value in the county, and any special levy) to calculate the property tax. This process was repeated for all school districts.

HOUSING – SHELTER – HOMEOWNER'S INSURANCE

Homeowner insurance rates were collected from the most recent Homeowner's Insurance Premiums Report provided by the Colorado Department of Regulatory Agencies, Division of Insurance. Rates in this report were drawn from a survey of insurance providers that the Division of Insurance conducts annually; data in the report was current as of July 2021. Premiums were for a coverage period of one year and were based on full replacement cost coverage. Premiums were calculated based on a HO-3 policy, which is the most commonly written policy for a homeowner. The HO-3 policy assumed the home was frame structure, 10 years old, equipped with dead-bolt locks and smoke detectors, was within 5 miles of a fire station, and was within 1,000 feet of a fire hydrant. The policy limits were based on a dwelling replacement cost of $200,000, a contents replacement of $160,000, personal liability of $100,000, medical expense of $1,000 and a $500 deductible. These specifications were also used in prior studies.

The Homeowner's Insurance Premiums Report included premiums from 64 insurance companies for 24 cities across Colorado. To better represent "typical" homeowner insurance rates, insurance companies that made up less than one percent of the Direct Written Premium market share in Colorado were excluded. Thus, our analysis included premiums from the 17 largest homeowner insurance providers, which in aggregate, made up 65 percent of the Colorado homeowner insurance market. We calculated the median premium from these 17 insurance providers for each of the 24 Colorado cities in the report. The median was used, rather than a mean, to reduce the influence of price outliers in some markets. Lastly, to derive homeowner insurance premiums for each school district, premium rates at each district's weighted population center were predicted, based on spatial insurance cost patterns for the 24 cities from which we did have insurance data. This equal interval interpolation method was also employed to predict homeowner insurance rates in prior studies.

HOUSING – SHELTER – RENT

Home rental costs were primarily based on median gross rent estimates, for the universe of renter-occupied housing units paying cash rent, which were collected from the U.S. Census Bureau's 2015-2019 American Community Survey (ACS) 5-year estimates (e.g., table B25031). This dataset was chosen because it provided rent cost estimates by number of bedrooms in each housing unit (e.g., studio, 1 bedroom, 2 bedrooms, etc.), which allows for more consistent comparison of the 3-bedroom model household across school districts. However, rent estimates were not available for all housing unit types across all districts, and further, the margin of error of the estimate was very high in some cases. Estimates associated with high margins of error may not be reliable.

We therefore used a multi-step process to refine and increase the reliability of rental estimates. First, we classified school districts into one of five regions: Eastern Plains, Front Range, Mountain Resort, Non-resort Mountains, or the

San Luis Valley. We collected median rent estimates for 3-bedroom housing units within each school district, then we calculated the interquartile range (i.e., the 75th percentile minus the 25th percentile) of these estimates within each region. Separately, we calculated the average percentage increase from 2-bedroom to 3-bedroom estimates within each region. For example, on average, a typical 3-bedroom home rents for 17% more than a typical 2-bedroom home in Eastern Plains school districts, whereas it rents for 25% more in Front Range districts. We calculated a second estimate to rent a 3-bedroom home by inflating the 2-bedroom estimate by the average percentage increase within its region. For example, rental estimates for 2-bedroom homes in Eastern Plains districts were inflated by 17% while 2-bedroom homes in Front Range districts were inflated by 25%. Thus, we obtained two estimates for a 3-bedroom home in each district—one direct and one derived. When the direct 3-bedroom estimate fell within 1.5 times the interquartile range for all 3-bedroom estimates within its region, and, when the 2-bedroom inflated estimate fell within 1.5 times the interquartile range for all 2-bedroom inflated estimates within its region, the final estimate was the average of the two estimates. When estimates fell below or above 1.5 times the interquartile range for its region, a region-specific low cap or high cap, based on the 25th and 75th quartiles, was used as a proxy estimate.

The above approach worked well for all districts in the Front Range and Mountain Resort regions, and almost all districts in the Non-resort Mountains and San Luis Valley. However, the median rental estimates in the Eastern Plains varied notably by district, and this variation may have been the result of lower reliability in the ACS estimates for very small and rural school districts. Therefore, for 75 school districts primarily located in 15 Eastern Plains counties, the countywide 3-bedroom estimate was used as a proxy for the school district estimate. Most Eastern Plains districts are completely contained in their county; for the few that span county boundaries, their rent estimate was calculated as the proportion of the households within the district and each county (akin to how daycare costs were calculated). This approach increased the reliability of small district rental estimates and decreased district to district variability in the Eastern Plains region.

After this, three districts still did not have any rental estimate, and five additional districts had outlier estimates. To calculate rental estimates for these remaining eight districts, we used an interpolation technique that predicted rental costs at the mean population center of the district based on spatial cost of rent patterns within the districts for which we had rent estimates. This was the same technique used to estimate insurance and gas costs.

Finally, monthly rental insurance costs were added to rent estimates to produce a final rent estimate for each district. Renter insurance rates were collected from the 2021 Homeowners Insurance Premiums Report provided by the Colorado Department of Regulatory Agencies, Division of Insurance. Premiums were calculated based on a HO-4 policy, which is commonly referred to as "renter's insurance" or "renter's coverage." The HO-4 policy covers the insured's personal property but does not cover the property belonging to the owner of the rental unit (i.e., the house or apartment). Premiums were for a coverage period of one year and were based on full replacement cost coverage.

The Homeowner's Insurance Premiums Report included premiums from 64 insurance companies for 24 cities across Colorado. To better represent "typical" renter insurance rates, insurance companies with less than one percent of the Direct Written Premium market share in Colorado were excluded. Thus, our analysis included premiums from the 16 largest insurance providers, which in aggregate, made up 62 percent of the Colorado homeowner insurance market. We calculated the median premium from these 16 insurance providers for each of the 24 Colorado cities in the report. The median was calculated, rather than a mean, to reduce the influence of price outliers in some markets. Note that the Division of Insurance confirmed that HO-4 rates from Farmers Insurance Exchange were incorrect in the 2021 dataset; therefore, we used rates from 2018 for the Farmers Insurance Exchange value as a substitute. Lastly, to derive homeowner insurance premiums for each school district, we predicted (i.e., interpolated) premium rates at each

district's weighted population center based on spatial insurance cost patterns of the 24 cities from which we did have insurance data.

HOUSING – UTILITIES – ELECTRIC

To estimate an average monthly electric bill within each school district, we calculated standardized electric rates by provider, allocated those rates to census blocks in each provider's service area, adjusted electric use based on local climate, applied location specific utility taxes, and then calculated an average electric bill within each school district.

Electric utility rates were collected from the 2021 survey of electric utility providers, which was conducted by the Colorado Association of Municipal Utilities (CAMU). CAMU collected billing rates, based on 700-megawatt usage, from Colorado electric utilities in January and July 2021. These rates included tax equivalents, either the exact PILOT (payment in lieu of taxes) or transfer to the municipal general fund but did not include county or municipal sales tax. We averaged the winter and summer rate for each utility. The CAMU dataset did not include rates from the towns of Center, Fleming, Haxtun, Holly, Holyoke, Julesburg, Yuma, or Mountain Parks Rural Electric Association, so we called these utilities to collect rates.

Next, we retrieved the Electric Retail Service Territories global information system (GIS) shapefile from the United States Department of Homeland Security, Homeland Infrastructure Foundation – Level Data (HIFLD). The data in this shapefile was last updated on July 8, 2020. We appended the CAMU electric rates to each electric provider.

Electricity usage in Colorado varies across geographies based on climate. For example, households in Southeast Colorado, where average summer temperatures are higher than elsewhere in the state, use more electricity for home cooling. We accounted for this disproportionate use by applying an upward adjustment factor for households in counties where the average June to September temperature was higher than the average statewide June to September temperature, as reported by the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. For example, we applied a 1.09 use adjustment factor for households in Pueblo County, where the average summer temperature was warmer than the statewide average.

Leveraging GIS, we then overlaid the electric utility provider and rate map with the climate map and a map including every census block (with number of household counts), town/city, county, and school district in Colorado. We then calculated aggregate electric bills within each block based on utility rates, use adjustments for four summer months, and local utility sales taxes. Lastly, we calculated average electric bills for each school district based on the aggregate electric bills and number of households within each district.

HOUSING – UTILITIES – GAS

To calculate the average monthly natural gas bill within each district, we used a methodology foundationally similar to that described above for electric providers. We calculated standardized natural gas cost rates by utility provider, calculated propane equivalent rate, allocated the appropriate gas or propane rate to every census block in Colorado, adjusted natural gas use based on local climate, applied location specific utility taxes, and then calculated an average natural gas bill within each school district. Specific details are described below.

Natural gas costs were collected from the most recent annual reports that utilities had filed with the Colorado Public Utility Commission. These reports contain annual residential revenues collected in 2020, the number of residential customers for each of the providers' service areas, and the amount of natural gas delivered to residential customers in

2020. We used the revenue data and the amount of gas delivered data to calculate the amount of dollars paid per therm of natural gas delivered. Then we calculated the cost to receive 62.5 therms per month, which is a typical amount of natural gas for a single-family home. By standardizing the rate to dollars per therm, rather than dollars per customer, we can accurately calculate and compare the cost for equivalent service.

After calculating natural gas rates by provider service area, we acquired and used the natural gas utility provider territory log from the Colorado Department of Regulatory Agencies, Public Utilities Commission to assign natural gas utility service areas and rates to 295 census designated places (e.g., cities, towns, and other housing developments) throughout Colorado. In a few cases, two natural gas providers were assigned to one census designated place, in which case we averaged the rates of the two providers.

Many households in Colorado, especially in rural areas, do not have access to natural gas services, and these households typically rely on propane (a type of liquid petroleum) for home heating. In this study, we assumed that households within a census designated place received natural gas service and households outside a census designated place used propane. We used data from the Energy Information Administration to calculate the cost for propane relative to the cost of natural gas, based on the average residential prices for natural gas and propane in Colorado, the total amount of natural gas and propane consumed in Colorado, and the actual energy output for each fuel type in British Thermal Units. The relative conversion factor was 2.92 (a slight drop from 3.06 in 2019), meaning for each dollar spent for natural gas would require $2.92 for an equivalent amount of propane. The final cost of propane service was calculated by county as the average natural gas rate within each county multiplied by the statewide conversion factor. Each census block outside a census designated place was assigned a local propane rate.

Natural gas usage varies across geographies based on climate. For example, households in mountains or mountain valleys, where winter temperatures are typically much lower than elsewhere in the state, likely use more natural gas for home heating. In this study, we accounted for this disproportionate use by applying an upward adjustment factor for households based on their county's average November to February temperature relative to the average statewide November to February temperature, as reported by the National Oceanic and Atmospheric Administration, National Centers for Environmental Information. For example, we applied a 1.19 use adjustment factor for households in Alamosa County, where the average winter temperature was cooler than the statewide average.

Leveraging GIS, we then overlaid the natural gas utility provider and rate map with the climate map and a map including every census block (with number of household counts), town/city, county, and school district in Colorado. We then calculated aggregate natural gas bills within each block based on the dollar per therm rates, use adjustments for climate, and local utility sales taxes. Lastly, we calculated average natural gas/propane bills for each school district based on the aggregate electric natural gas/propane bills and number of households within each district.

HOUSING – UTILITIES – TELEPHONE

Consistent with the three previous cost of living studies, telephone service pricing was assumed to be essentially constant across the state and the variance between districts comes from the taxes and fees. As such, we began with a constant cost of $140 per month, which was the typical spending amount from the CES data. As with other taxable services, applicable taxes were applied for each census block in Colorado. First, we applied state and county normal sales taxes, and city sales taxes where applicable. Next, we applied county/local 911 surcharges (obtained from the Public Utilities Commission). Then we applied flat state and federal Universal Service Fund taxes, a flat state 911 charge, and a flat TDD tax (obtained from the Tax Foundation, Fiscal Fact 780).

Leveraging GIS, we applied the appropriate total phone tax to the flat bill of $140 for every census block (with number of household counts) in Colorado. We then calculated aggregate phone bills within each block, and from that calculated an average household phone bill within each district.

HOUSING – UTILITIES – WATER/WASTEWATER

To estimate an average monthly water and wastewater bill within each school district, we calculated standardized water and wastewater cost rates by utility provider, calculated well and septic equivalent rates, allocated those rates to every census block throughout Colorado, applied location specific utility taxes, and then calculated an average water and wastewater bill within each school district. Specific details follow.

Water and wastewater rates were gathered by calling water and wastewater utilities or by searching for their rates online. Where applicable, rates were for three-quarter inch pipe size, and we used one single family equivalent (SFE) when rates were determined by house size. We collected rate information from 248 utilities throughout the state, providing water or wastewater to 249 of Colorado's census designated places (e.g., cities, towns, and other housing developments). Most water utilities are municipal, but some are water and sanitation districts. We attempted to collect rates from an additional 32 utilities at small municipalities but received no response. In very limited cases, proxy values, based on the rates from 2019 were used when we received no response from a utility, but more commonly we used well and septic estimates (described below).

After rates were collected, a monthly water and wastewater bill was calculated for each utility based on a home that uses 11,000 gallons of water per month and produces 5,000 gallons of wastewater for processing per month. The usage level for water was based on data for Colorado domestic per capita water use, reported by the USGS (Estimated Use of Water in the United States, 2015). The usage level for wastewater was based on data reported by Denver Water. We then assigned utilities and their average bill to census designated places. In a few cases, more than one water or wastewater providers were assigned to one census designated place, in which case we averaged the rates of the providers.

Many households in Colorado, especially in rural areas, do not have access to utility water or wastewater services, and these households typically rely on private well water and septic systems. In this study, we assumed that households within a census designated place received utility water and wastewater service and households outside a census designated place relied on wells and septic systems. Additionally, when no contact information could be found or we received no response from a utility, or when municipal officials told us households in their area used only wells and septic systems, we applied a well and septic rate. Well water costs were calculated based on well installation, operation, and maintenance costs described online (https://homeguide.com/costs/well-pump-cost#repair). We assumed a pump and installation (not including drilling) would cost $2,000 and last 15 years, resulting in an annual cost of $133. Additionally, we calculated operation, maintenance, and testing costs of $166 per year, for an annual total of $300 and a $25 monthly cost. Septic system costs were calculated based on installation, operation, and maintenance costs described online (https://www.homeadvisor.com/cost/plumbing/install-a-septic-tank/). We assumed a tank would last 20 years and would cost $4,000 to install and $2,000 to maintain during that time span, resulting in a $300 annual cost, or $25 monthly cost.

Leveraging GIS, we overlaid a map of census designated places, and each place's appropriate water and wastewater bill, with a map including every census block (with number of household counts), county, and school district in Colorado. We then calculated aggregate water and wastewater bills within each block based on the average utility

rate for blocks within census designated places or by the well and septic estimates for the remaining blocks. We applied local utility sales taxes as applicable. Lastly, we calculated average water and wastewater bills for each school district based on the aggregate district bill and number of households within each district.

HOUSING – HOUSEHOLD OPERATIONS – DAYCARE

As in the 2019 study, daycare costs incorporated in this study were based on information provided in The Self-Sufficiency Standard for Colorado 2018. This was still the most recent data available as of 2021. This study was prepared for the Colorado Center on Law and Policy by the Center for Women's Welfare at the University of Washington School of Social Work. Specific childcare costs for an infant (ages 0 to <3), a preschooler (ages 3 to <6), and a school-aged child (ages 6 to <13) were collected for each county in Colorado and then weighted by the proportion of children in care for each grouping, as reported by the Department of Health and Human Services data on children participating in Child Care and Development Fund (CCDF)-funded programs (Table 9 in their Fiscal Year 2019 publication).

Final average daycare costs were reapportioned from the county level to the school district level by calculating the proportion of households within each district and county combination, then weighting the average daycare costs by those proportions. For example, in the St. Vrain District, 71% of households are located in Boulder County while 29% of households are located in Weld County. The daycare estimate for St. Vrain District is the sum of 71% of the Boulder County daycare average and 29% of the Weld County average.

TRANSPORTATION – VEHICLE PAYMENTS

Vehicle pricing was gathered for a 2019 Honda Civic LX Sedan. The purchase price of the 2019 Honda Civic was $26,131 (per Kelley Blue Book information on the fair purchase price from a dealer in November 2021, assuming the vehicle had 24,000 miles at the time of purchase). This was the base price used to determine annual car payments for a four-year loan. This price was assumed to be constant throughout the state, which ensures that the identical vehicle is being purchased in each district. With a used car purchase, not only is availability of a specific model limited across districts, but the specific condition and features on each available vehicle can vary widely making it impossible to compare available pricing for a specific vehicle. Instead, the vehicle value is held constant at the KBB value, and the variance between districts comes from the sales and registration taxes and fees, as well as the financing rates and fees available. Ownership taxes, registration & licensing fees, other fees (title) are provided in the "Colorado Motor Vehicle Law Resource Book" from the Colorado Legislative Council. The vehicle weight is also required for calculating taxes; this was obtained from the vehicle manufacturer's website. Sales taxes were calculated for each taxing jurisdiction and averaged for each district, weighted to the proportion of households within each taxing jurisdiction.

Financing rates for vehicle loans were obtained from telephone surveys of 512 banking institutions and credit unions throughout the state. The list of banking institutions to survey was obtained from a commercial list vendor and a sample was drawn as described in the previous section of the report. Banking institutions were mapped to the bank's physical location, and each bank's finance rate and total fees (e.g., filing fees) were appended to that location. Then, we used a spatial interpolation technique to predict financing rates and fees for every school district based on spatial patterns across the 512 institutions. Average monthly car payments were then calculated for each district, given the total amount financed (including the purchase price, all bank loan charges, and any applicable sales tax, specific ownership tax, title, and registration fees) and the interest rate charged by the bank or credit union.

TRANSPORTATION – GASOLINE

Gasoline costs were calculated as a factor of the price of gasoline in each district and an estimated amount of driving for commuting and shopping in each district. Gasoline prices from 1,790 gas stations across Colorado were purchased from the Oil Price Information Service, which gathers and compiles daily data on gas prices from individual locations. Prices were collected on September 15, 2021. The minimum price was $2.799 and the maximum price was $4.999. However, annual total spending on gasoline depends on both the price of gas and the amount of gas used; the latter we estimated from secondary sources. First, we accessed commute time data from the U.S Census Bureau, American Community Survey (table B08012) 2019 5-year dataset, and we calculated an average commute time for each school district, which ranged from 8-minues to 54-minutes. We then converted commute minutes into commute miles per year by assuming an average driving speed of 40 miles per hour by someone who works five days per week in a 2019 Honda Civic that gets 33 miles per gallon. Additionally, we calculated average distance for grocery shopping by calculating the miles from each block in every district to the nearest grocery or department store with at least three employees, assuming one shopping trip was made each week. We added average commute miles to shopping miles and multiplied that sum by the average price per gallon of gasoline for that district, after applying gasoline shopping patterns.

TRANSPORTATION – VEHICLE INSURANCE

Vehicle insurance rates were collected from the most recent Auto Insurance Premiums Report from the Colorado Department of Regulatory Agencies, Division of Insurance. Rates in this report were drawn from a survey of insurance providers that the Division of Insurance conducts annually; data in the report was current as of July 2021. Premiums were for a coverage period of six months (which we adjusted to represent monthly costs) and were based on a basic model vehicle 2017 Ford Fusion SE 2.5L Automatic. Premiums were based on a hypothetical driver who was a 35-year-old male, married, principal operator, driving less than 15 miles to work each way, who had no accidents or traffic convictions in the past three years. The policy included coverage for property damage of $25,000, bodily injury of $50,000 per person or $100,000 per occurrence, uninsured or underinsured motorist coverage of $50,000 per person or $100,000 per occurrence, $5,000 for medical payments, and a $500 deductible. All policy specifications, including car make and model, were pre-determined by the Division of Insurance. These specifications were also used in the 2019 cost of living study.

The Auto Insurance Premiums Report included premiums in 24 cities spread throughout Colorado from 69 insurance companies. To better represent "typical" vehicle insurance rates, insurance companies that made up less than one percent of the market share in Colorado were excluded. Thus, our analysis included premiums from the 16 largest vehicle insurance providers, which in aggregate, made up 66 percent of the Colorado vehicle insurance market. We averaged the premiums from these 16 insurance providers for each of the 24 Colorado cities in the report. Lastly, to derive vehicle insurance premiums for each school district, we used a spatial interpolation technique to predict premium rates at the districts' mean population centers, based on spatial vehicle insurance rate patterns of premium rates among the 24 cities in the report. This interpolation method was similarly employed to predict vehicle insurance rates in prior cost of living studies.

HEALTHCARE

Healthcare insurance premiums for 2021 were collected from the Colorado Department of Regulatory Agencies, Division of Insurance. All premiums were based on a 40-year-old person. Low and high premiums were provided by

three to eight insurance companies for each of nine geographic "rating" areas they served. We first calculated the midpoint between the low and high costs for each company in each rating area. Then we averaged these mid-points for all "Silver" and "Bronze" plans, both on-exchange and off-exchange. Averages by rating area were then assigned to appropriate counties, without overlap. This approach was consistent with the 2019 study.

Final average health insurance premiums were reapportioned from the county level to the school district level by calculating the proportion of households within each district and county combination, then weighting the average premium by those proportions. For example, in the St. Vrain District, 71% of households are located in Boulder County while 29% of households are located in Weld County. The health insurance premium estimate for St. Vrain District was the sum of 71% of the Boulder County premium average and 29% of the Weld County average.

PERSONAL (INCOME) TAXES

Personal income taxes were calculated for the benchmark family in each district using the IRS Form 1040 for 2020 for federal income tax and adding state income tax and occupational/head taxes for relevant local jurisdictions. For federal income taxes, the standard deduction was compared to the itemized deduction calculated using mortgage interest (recognizing allowable limits), as well as specific ownership taxes from the vehicles, state income taxes, and cash contributions based on the CES, and the higher of the two deductions was used for each district. IRS Publication 936 was used to calculate the allowable limits on home mortgage interest deductions for high home value districts (e.g., Aspen). Specific ownership taxes were calculated from the original Manufacturer's Suggested Retail Price (MSRP) value for each vehicle, and the tax formula from the Colorado Motor Vehicle Law Resource Book. Colorado state income taxes were calculated from the formulas in publication, DR 1098 "Colorado Income Tax Withholding Tables for Employers".

Major federal tax reform was enacted for 2018, which included lowering tax rates, increasing the standard deduction, suspending personal exemptions, increasing the child tax credit, and limiting or discontinuing certain deductions. As a result, for all districts except Aspen 1 (which has the highest deduction for mortgage interest, even recognizing allowable limits), our calculation found the standard deduction to be greater than itemized deductions. The new tax rules have greatly reduced variability in the index due to income taxes. Of note this year (though it does not impact variability between districts), the Colorado state income tax withholding rate was reduced to 4.55% for tax year 2020 and later per the passage of Proposition 116.

ALCOHOL, TOBACCO, APPAREL, READING, EDUCATION, MISCELLANEOUS EXPENSES, CASH CONTRIBUTIONS, AND PERSONAL INSURANCE AND PENSIONS

Mirroring previous cost of living studies, the major expenditure categories for Reading, Education, Miscellaneous Expenses, Cash Contributions, and Personal Insurance and Pensions were not sampled in this 2021 Cost of Living study. Similar to the previous studies, these expenditure categories were expected to be constant for the relevant benchmark family and were thus held constant for all districts. No significant geographic variation or trends were expected to be seen for these goods, and the final costs for each district came directly from the benchmark family's spending level calculated for each category from the Consumer Expenditure Survey.

As in 2019, expenses for Alcohol, Tobacco, and Apparel categories were also held constant for all districts, as previous years of data collection had found very low variability in prices between districts. Apparel items were increasingly being reported to be purchased online, further reducing variability between districts.

3.5 DEVELOPING FINAL COST OF LIVING MEASURES

After the collection of all price data, two major steps were taken to develop the final cost of living measures. First, the price data for the market basket items was weighted by the shopping patterns model in order to develop prices for each district that reflect where people in the district purchase their items. Second, annual expenditures are calculated by determining the ratio of the district average price to the statewide average price for each good and then multiplying that average by the typical expenditure on that item according to the Consumer Expenditure Survey. This second step scales up costs so that the limited numbers of (for example) grocery items for which data were collected represent the full annual expenditures for food for the benchmark household. Each of these steps is described in further detail below.

INTEGRATE PRICE DATA WITH SHOPPING PATTERNS SURVEY DATA

People do not make all their purchases in the school district in which they live. A shopping patterns survey, conducted in 2019, gathered data on where people shop for 15 categories of items and services: produce, perishable groceries, non-perishable groceries, alcoholic beverages, household products, clothing and shoes, gas, car maintenance and repair, small appliances, tobacco, TVs, and where they go for movie theaters, haircuts, pizza restaurants and other restaurant meals. For each of these items, the shopping patterns matrix specifies where people living in each district shop for each item, based on the proportional location of surveyed shoppers' most recent purchases. For example, people who live in the Denver County school district may buy gasoline in not only Denver but also neighboring school districts such as Adams-Arapahoe, Boulder Valley, Brighton, Cherry Creek, Jefferson County, and others. By multiplying the shopping patterns matrices that link "home district" with "shopping districts", regional variations in costs and shopping preferences are reflected.

In any instances where people reported shopping in a district where a price was not able to be gathered, the proportion of shopping attributed to that district is redistributed proportionally among the other districts where people reported shopping and where prices were gathered.

CALCULATE ANNUAL EXPENDITURES

Calculating the annual expenditures for each district involved determining the district average price for each item, weighting that price by the proportion of teachers in the district to calculate a state average price, calculating the ratio of the district average price to the state average price, and then multiplying that ratio by the typical expenditures in a category according to the Consumer Expenditure Survey. These steps are elaborated below.

Mirroring the methodology used since the 2007 cost of living study, most market basket items were sampled by school district in 2021. This helped to ensure that all final cost of living data was specific to an exact school district. In a few cases, the data were only available at a county or region level and needed to be applied to districts based on location. Utilities prices, daycare prices, and insurance prices are a few of the cases where data was available at the county or region level and had to be applied to districts. In these cases, the county (or other) price was assigned to each district located in that county in order to arrive at a price for each district.

Statewide average prices were then calculated by weighting the average price in each district by the proportion of the state's teachers in that district and then adding together the weighted prices for all districts. District average prices were then compared to state average prices by calculating the ratio of the district average price to the state average

price. These ratios were then multiplied by the typical expenditure for the category according to the Consumer Expenditure Survey in order to determine a final annual expenditure on that item for each district.

This process was repeated for each market basket item, and then all expenditures on items in a common category were summed to determine annual expenditures for that category (i.e., categories include food at home, food away from home, housing, transportation, etc.). Finally, annual expenditures in each category were combined to provide total annual expenditures for each district.

CALCULATE CONFIDENCE INTERVALS

Confidence intervals were also calculated for most expenditure categories to estimate the uncertainty in the prices available to consumers in each district. For each district sampled, the variance of the mean (i.e., standard error), was calculated for the prices obtained from that district. These variances were weighted by the shopping patterns for each district and the teacher populations to calculate a state average variance. Then ratio variances were calculated by comparing the variance for a district to the state average variance. Ratio variances were aggregated over items in a category and a confidence interval was calculated for the category as a whole.

Essentially, large confidence intervals reflect a large variance of the mean, which means there is a large variability in the prices collected and relatively few prices collected. In some cases, variability in the error may be reduced by additional sampling in those districts; however, this is only likely to be true in large districts where the universe of stores available to sample from is large. In, for example, a small, rural district with only one substantial grocery store, where a convenience store has also been sampled, the variance of the mean will be large, but sampling additional convenience stores (if any are available) is likely to only artificially inflate the mean price for the district, because convenience stores tend to charge higher prices than grocery stores. In cases like this there is a tradeoff between reducing error variability and accurately estimating the cost of living in a district. Whether additional sampling is needed should be evaluated on a case by case basis. It should be noted that other factors in addition to the variability of the mean district price will affect uncertainty in the cost of living indices, but currently no additional factors are incorporated in the confidence interval estimates. See Appendix C for a more detailed discussion of statistical measures used in this study.

APPENDIX A: DETAILED RESULTS

Appendix A provides an additional level of detail about the results of the study, breaking out costs of living in each district by major expenditure category.

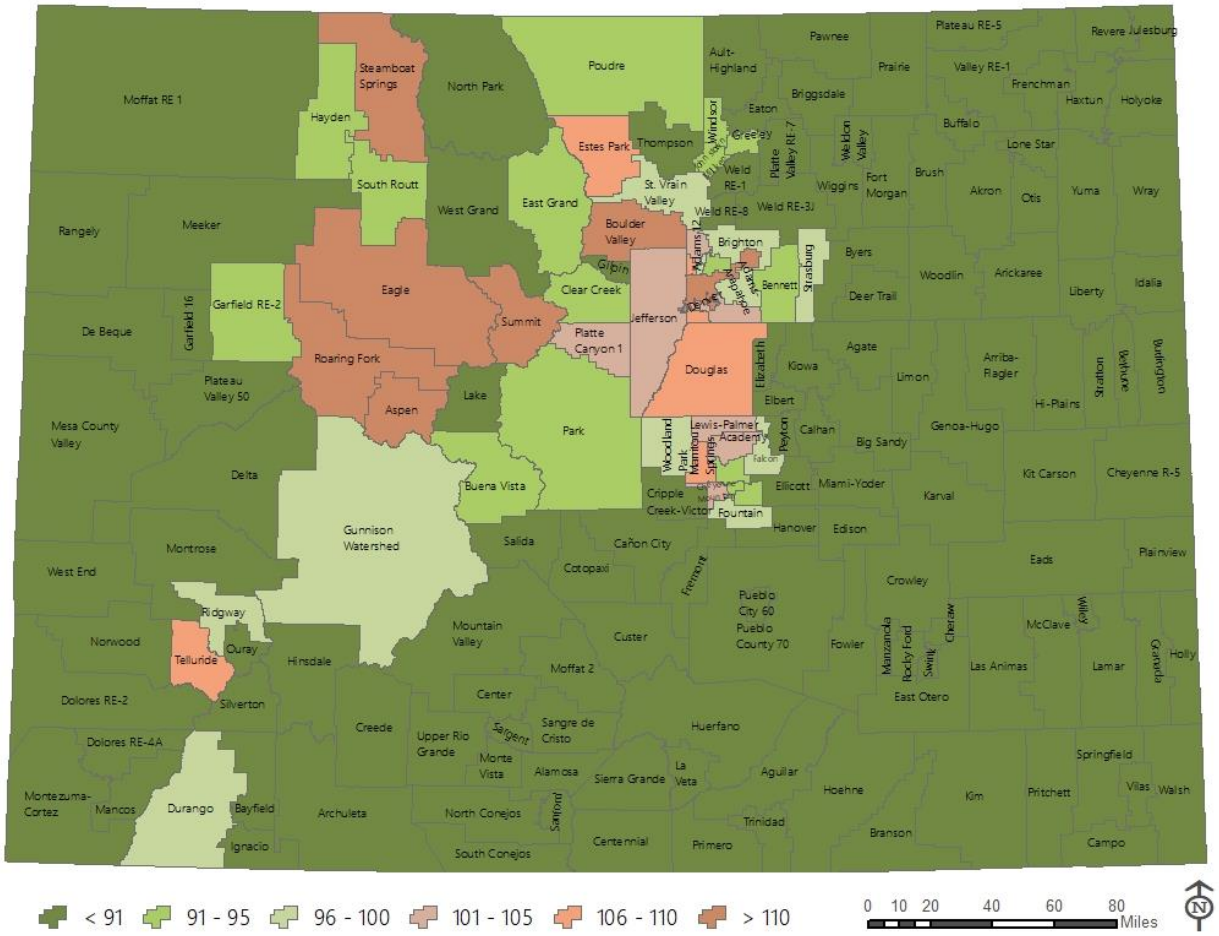
Results are provided both in visual form, through maps provided in this section, and in tabular form in an accompanying spreadsheet. Readers receiving this report electronically will need to review an accompanying spreadsheet file, due to the volume of data.

Maps are provided for the four largest expenditure categories: A) housing, B) transportation, C) food at home, and D) healthcare.

Note. The index value is the ratio of the cost of the housing market basket in each district to the statewide average cost of the housing market basket. In the following maps, shades of green depict less expensive districts while shades of orange depict more expensive districts.

EXHIBIT A: MAPS OF THE **HOUSING** INDEX, 2021

STATEWIDE



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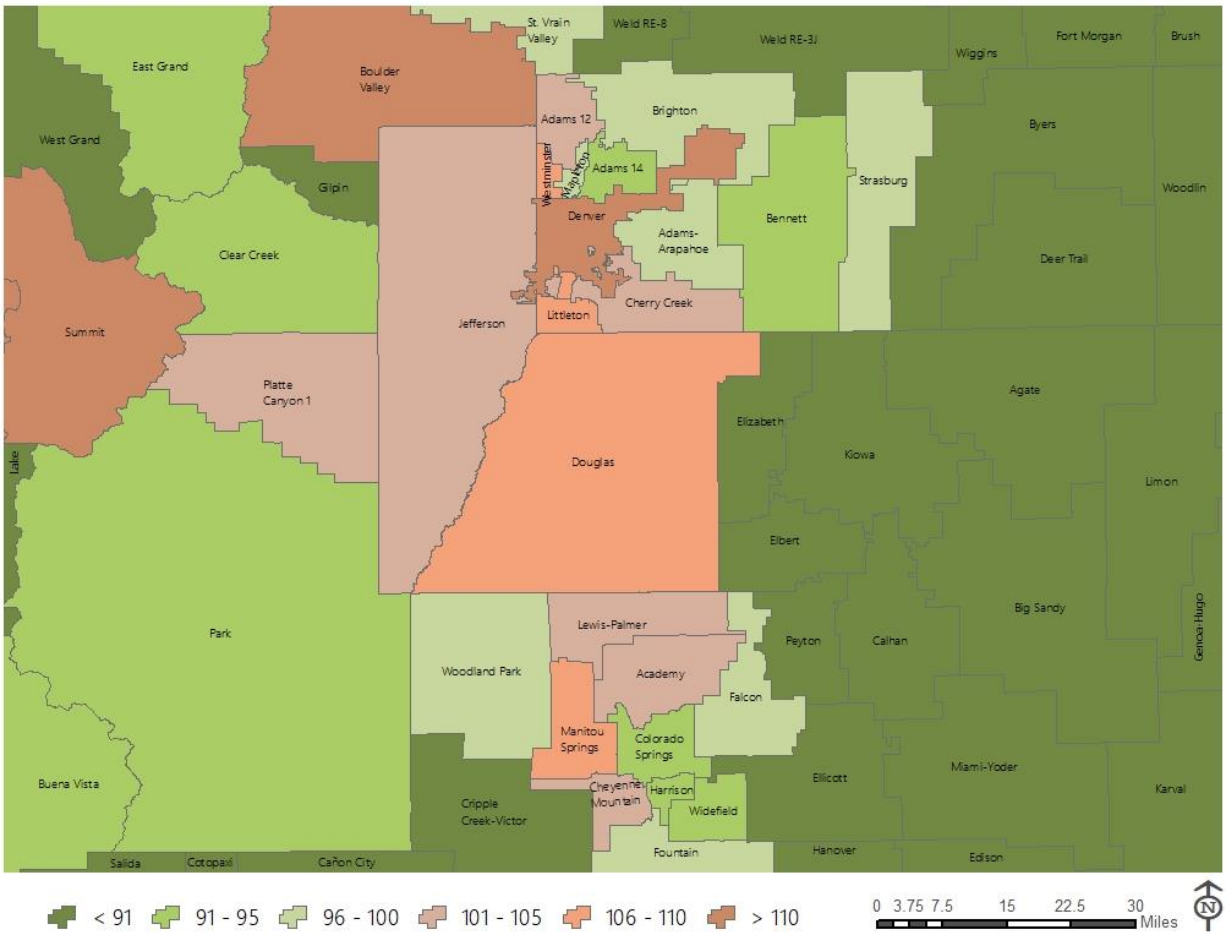
St. Vrain Valley
Weld RE-8
Weld RE-3J
Fort Morgan
Brush
Wiggins
East Grand
Boulder Valley
Brighton
Byers
West Grand
Adams 12
Westminster
Adams 14
Strasburg
Woodlin
Gilpin
Denver
Bennett
Clear Creek
Adams-Arapahoe
Deer Trail
Cherry Creek
Littleton
Summit
Jefferson
Platte Canyon 1
Agate
Elizabeth
Douglas
Kiowa
Lake
Limon
Elbert
Big Sandy
Lewis-Palmer
Peyton
Calhan
Genoa-Hugo
Park
Woodland Park
Academy
Falcon
Manitou Springs
Colorado Springs
Miami-Yoder
Buena Vista
Cheyenne Mountain
Harrison
Ellicott
Karval
Cripple Creek-Victor
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Cañon City
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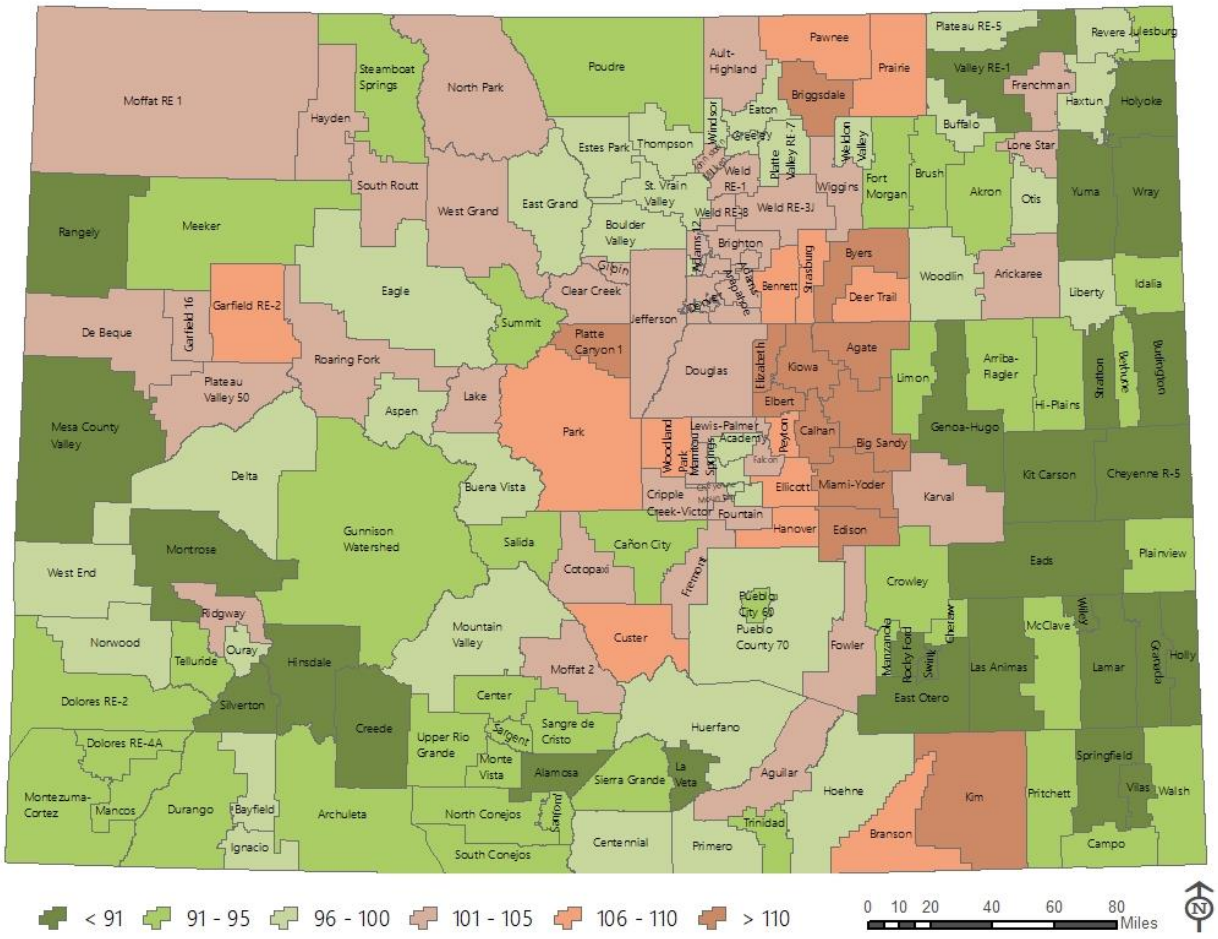
EXHIBIT B: MAPS OF THE **TRANSPORTATION** INDEX, 2021

STATEWIDE



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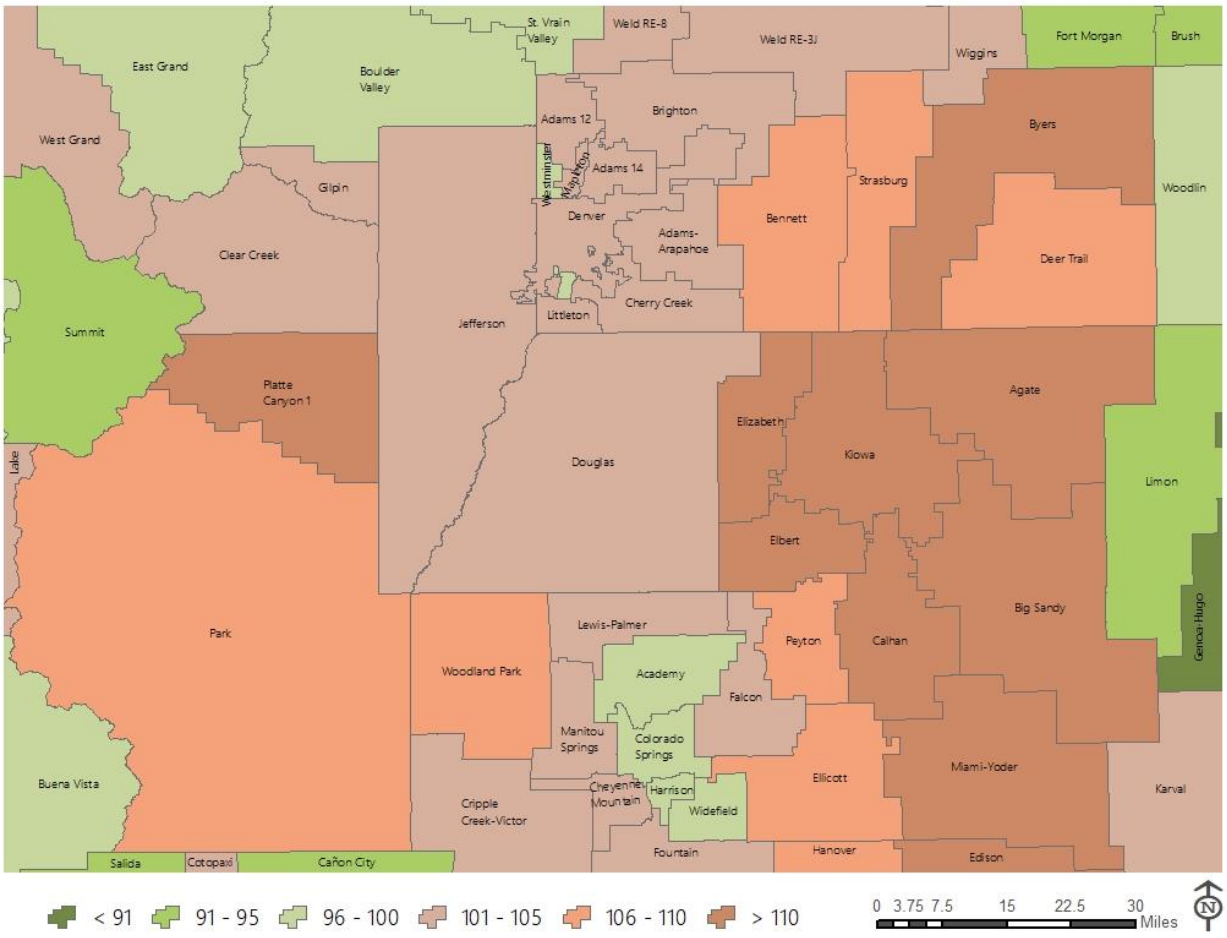
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Deer Trail
Cherry Creek
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Woodland Park
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Falcon
Manitou Springs
Colorado Springs
Miami-Yoder
Buena Vista
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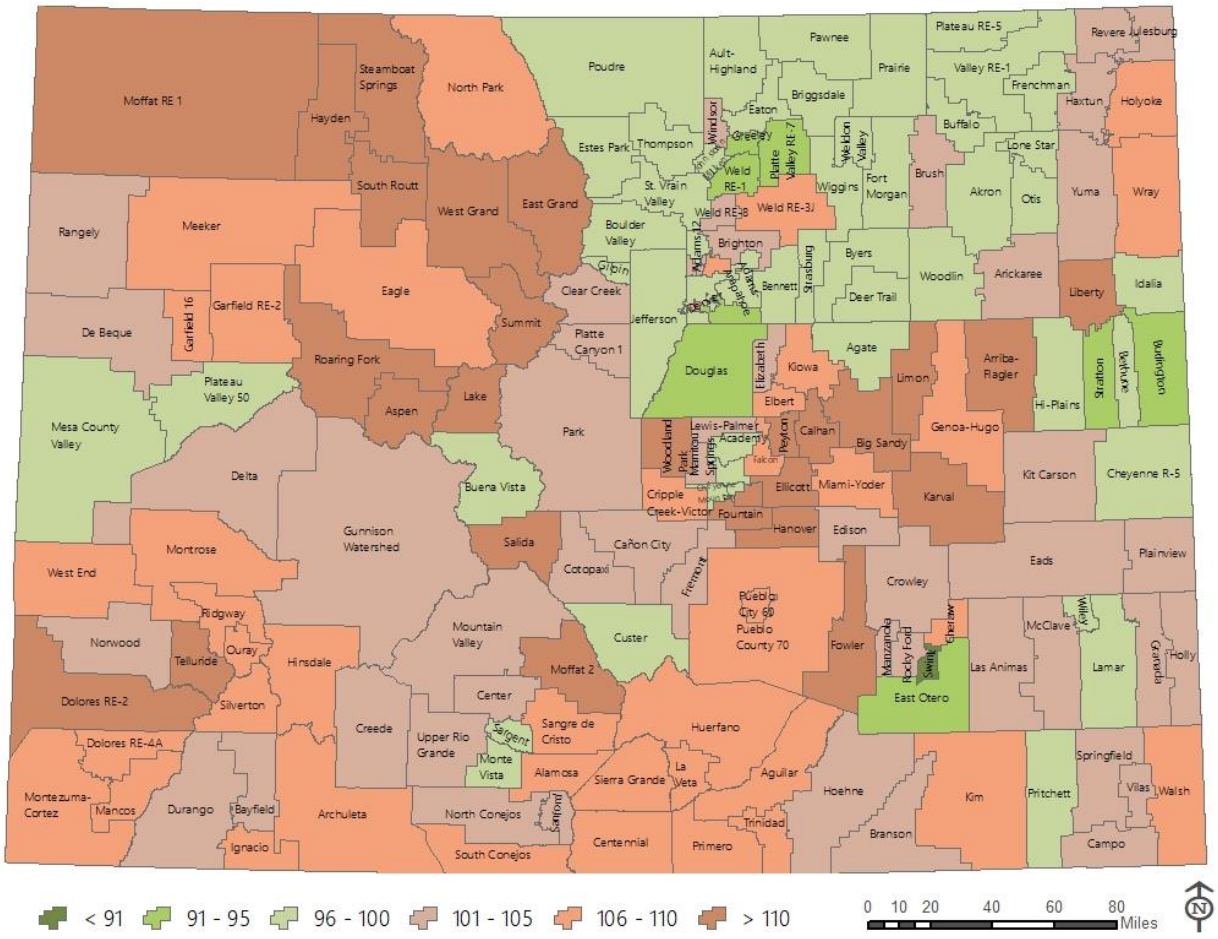
EXHIBIT C: MAPS OF THE **FOOD AT HOME** INDEX, 2021

STATEWIDE



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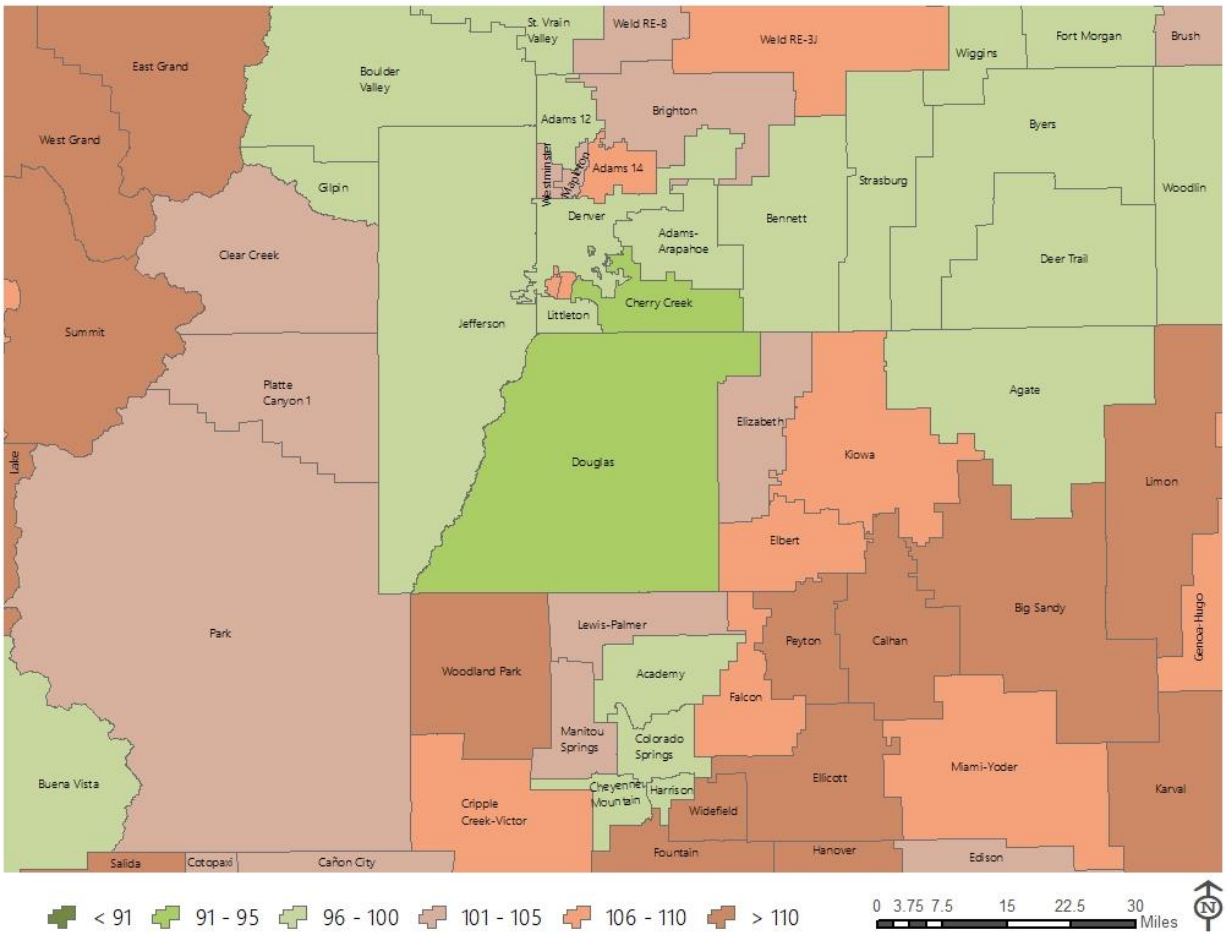
East Grand
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Fremont
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Gilpin
Boulder Valley
St. Vrain Valley
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Weld RE-3J
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Lincoln
Kiowa
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Kit Carson
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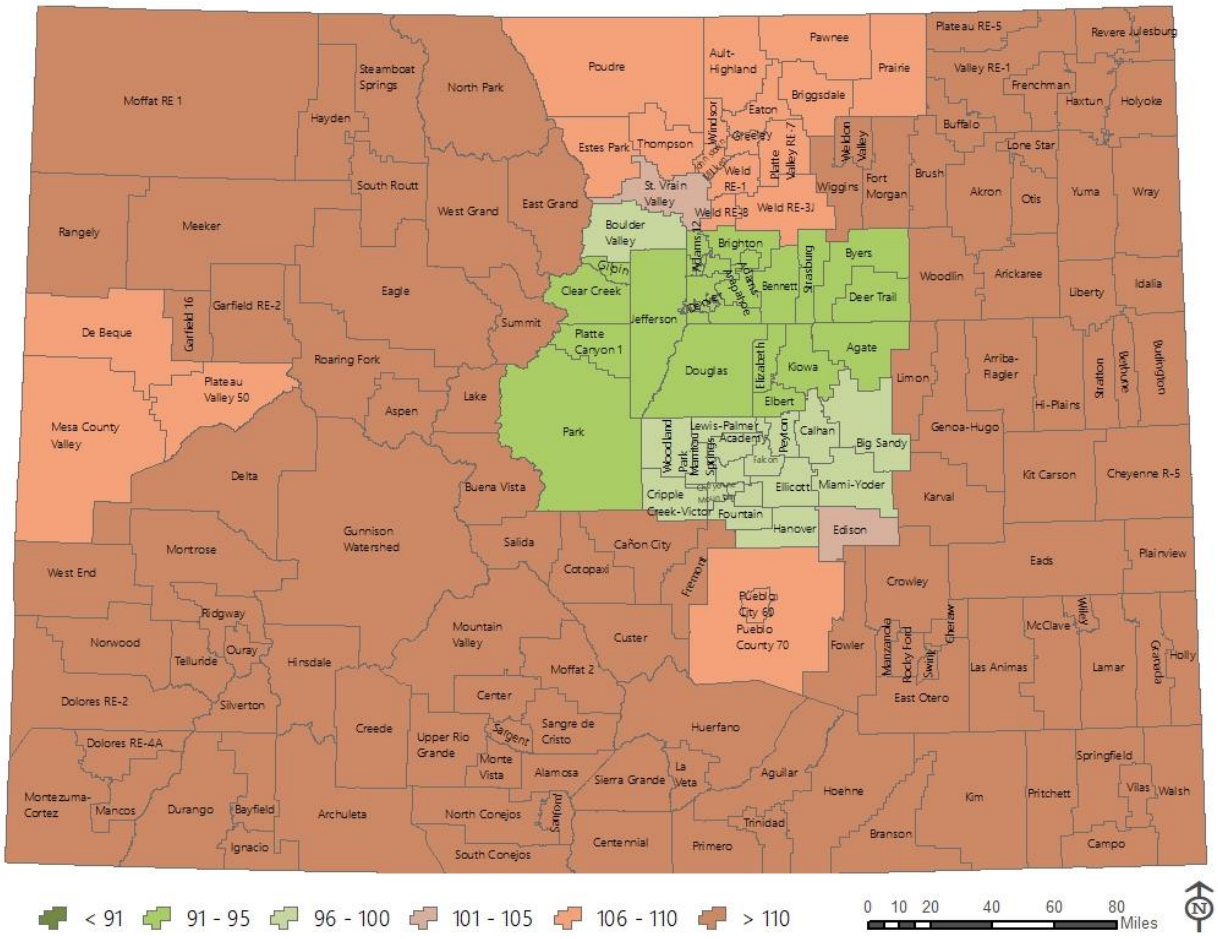
EXHIBIT D: MAPS OF THE **HEALTHCARE** INDEX, 2021

STATEWIDE



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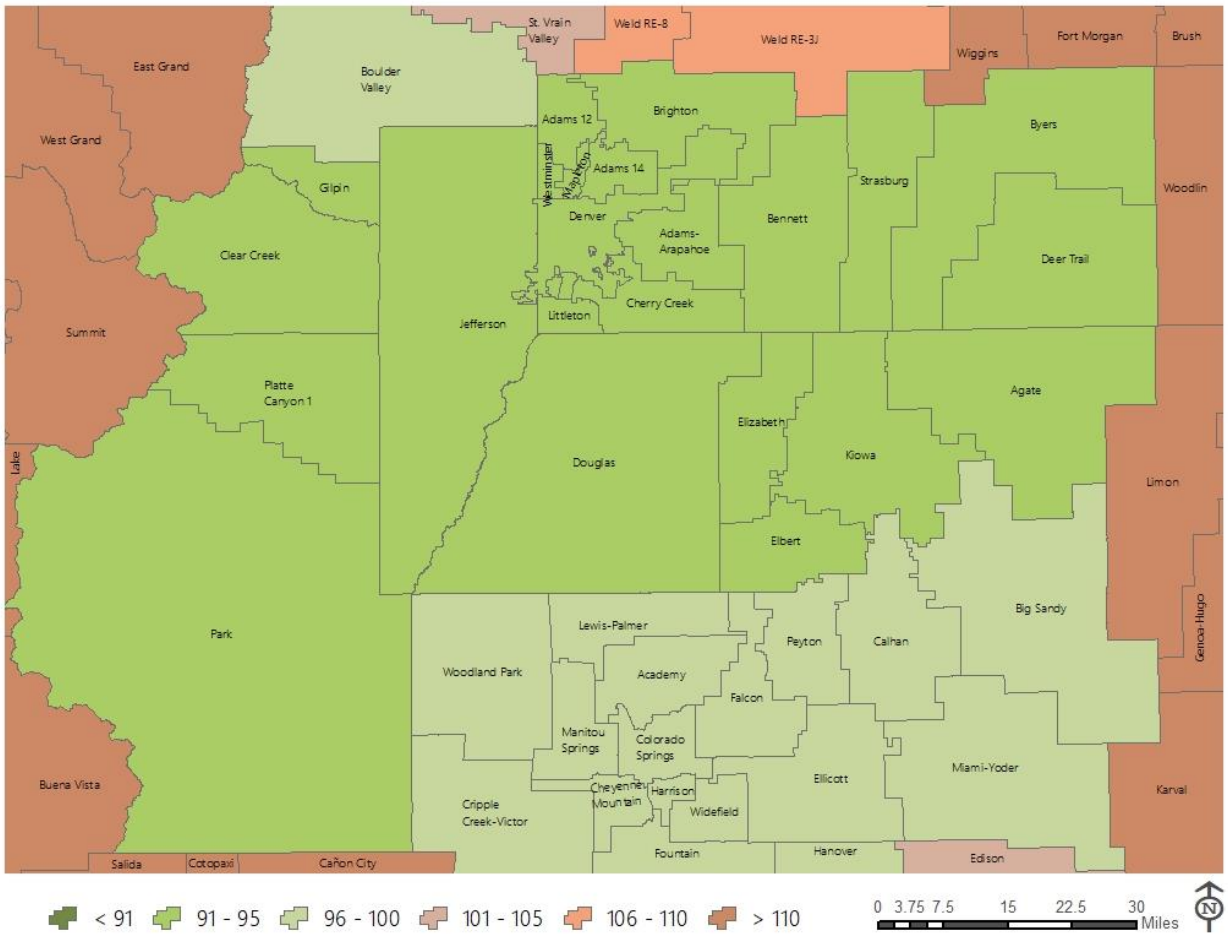
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Manitou Springs
Colorado Springs
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APPENDIX B: CHANGES FROM THE 2019 STUDY AND IMPLICATIONS

IMPACT OF THE COVID-19 PANDEMIC ON DATA SOURCES AND ACCURACY

For this year's cost of living study, we began by thinking through the impact that the COVID-19 pandemic may have on the cost-of-living index, as well as the impact of utilizing some real-time data sources along with some time-lag data sources, given the unusual situation of the pandemic occurring in the interim.

In particular, the Consumer Expenditure Survey from the Bureau of Labor Statistics (BLS) that determines the spending patterns for the index is released on a significant time-lag, with the most recently released data at the time of this study being 2018-2019. During the pandemic, BLS has reported significant changes in household spending, including decreased spending on alcohol, food, apparel, personal care, transportation, and education. Food and alcohol spending reductions were due to reduced spending away from home that was not fully compensated for by spending for food at home. The actual distribution of household spending in 2021 across spending categories is likely to have been different than the distribution utilized for this study. However, because spending decreased in most categories, the relative distribution may be similar. It will be several years before data is available to measure this impact. Potential impacts on the overall index can be assessed when data on 2021 spending patterns are released.

In addition, we searched for and explored any newly available data sources that may improve on data utilized in the previous study. Other impacts and changes are discussed below.

MARKET BASKET CHANGES

The 2019 Cost of Living Study utilized an optimized market basket that focused data collection of a smaller number of reliable indicators that were more proportionally representative of expenditure categories. In 2021, we continued with the optimized market basket, with minimal updates. Specifically, the following were updated:

- Batteries were used in place of movie tickets for the entertainment category. This was done largely as a result of the pandemic's impacts on movie theaters, from closures to a change in movie distribution likely impacting preferences.
- As in previous iterations of the study, the vehicles used in collecting oil change prices and vehicle financing information were updated. For the oil change, the F-150 XL truck was updated from a 2015 to a 2017 model year, and for financing, the Honda Civic LX 4-door sedan was updated from a 2017 to a 2019 model year.

While we generally recommend reevaluating the market basket for each study, we recommend that additional consideration be given to the entertainment category going forward given the likely continued changes seen in the marketplace for various media.

RETAIL DATA COLLECTION IMPACTS

Due to our data collection occurring via telephone and online, our data collection process was not directly hindered by COVID-19 beyond the additional safety measures in-office. Anecdotally, however, we did feel there were some data collection challenges related to retail staffing challenges encountered by businesses in 2021. For instance, it was sometimes harder to get through to a person and hold times were often longer. Cooperation by some retailers may have been lower due to a lack of capacity to run and check a price as well. We believe this to be the case for Coke observations, where many convenience stores refused to provide a price.

Moving more data collection online, as feasible, and hopefully a return to more "normal" staffing levels at retailers, will likely mitigate these challenges in future years.

In other cases, a reduced number of observations may be due to business closures, either permanent or temporary. This was likely a contributing factor in our collection of fewer haircut prices (for men and women) as many phones just rang and rang when calling businesses. Salons have been one of the hardest hit industries and one struggling to recover.[1]

[1] https://coloradosun.com/2021/08/23/paycheck-protection-loans-salon-covid-recovery-small-business/

VEHICHLE PURCHASES AND FINANCE CHARGES

For one market basket item, vehicle payment, we did collect many more observations in 2021 than in previous years. This was due to several of the larger banks confirming that their rates would be consistent throughout the state for our given profile. Loans are written at their central offices and when we contacted these offices, we confirmed this with their staff. This allowed us to record the interest rate and fees for all branches rather than only those branches reached via telephone, resulting in a higher number of observations.

HOUSING COST ESTIMATES AND MARKET DYNAMICS

Housing shelter costs include estimates of mortgage payments, property taxes, homeowners insurance, rent, and rental insurance. The only notable methodological change this year to housing shelter was how we estimated rent. As in 2019, which was the first year rent was included in the cost of living study, we utilized American Community Survey (ACS) data on contract rent. The criterion we applied in 2019 for using a district's rent estimate as provided in the ACS data, was based on the estimated margin of error for the district estimate (also provided by ACS). In 2021, we instead used regional interquartile ranges to determine acceptability of individual rent estimates. Further, we calculated a secondary estimate based on a regional inflation factor from a 2-bedroom to 3-bedroom unit, and when both the original 3-bedroom estimate and our inflated 2-bedroom estimate fell within the regional interquartile range, we averaged the two estimates together instead of relying on only one estimate. This updated approach produced fewer outlier estimates and less variability by region than relying on one estimate only. Lastly, recognizing that there is less district to district rental cost variability in the far Eastern Plains, we used the more reliable countywide rent estimates that we assigned to school districts in this region. This new approach reduced the number of districts that were interpolated from 54 in 2019 to just eight in 2021.

Although these updates improved the study, there are still notable limitations. Primarily, the housing market in Colorado is dynamic, and in some regions, rental costs have risen dramatically over the past two years. However, the rental cost estimates for the current study are derived from data spanning 2015 to 2019. That is, the results represent the typical rental costs within those five years, inflation-adjusted to 2019 dollars. The actual median rental cost in 2021 is likely higher than our estimates for some, but not necessarily all, districts.

DAYCARE IMPACTS

In 2020, the COVID pandemic had a drastic effect on the childcare industry; many childcare centers had to close temporarily and some even permanently. According to a March 2021 report from Early Milestones Colorado, the average enrollment decline for all childcare center program ages (birth to 12 years old) was 37 percent. On the other hand, family childcare homes experienced a significant increase in enrollment of about 59 percent. With many families

facing pay cuts or job losses, childcare affordability became an even greater concern during the pandemic, and some parents may have remained out of the workforce due to a combination of childcare costs, childcare availability, and pandemic concerns, resulting in lower spending on childcare. The data sources we rely upon for daycare spending estimates are both released at a significant lag, as are the spending category estimates from the Bureau of Labor Statistics. Actual spending on daycare in 2021 may have been quite different than previous years, which would add some error to this year's estimates, and may also impact future years of the study once released data catches up with the pandemic.

GASOLINE USE

Prior cost of living studies assumed that households in all districts purchased the same amount of gasoline. However, it is likely that households in rural areas need more gasoline because they have longer commutes or travel further for goods and services. Indeed, according to the American Community Survey, the average work commute time in each Colorado school district ranged from 8 minutes to 54 minutes. Likewise, the average distance to a grocery or department store varied by district, ranging from less than 3 miles to 41 miles.

Therefore, we incorporated travel distance into the cost for gasoline this year by multiplying the cost for gas by an estimated amount of gas used for commuting and shopping in each district. This change resulted in an increase in the spending on gasoline, primarily in rural districts that are far from services, and therefore it better represents the true cost of living in each district.

APPENDIX C: STATISTICAL MEASURES & TECHNIQUES USED IN THIS REPORT

This appendix is reproduced from previous cost of living reports to ensure that this information on the development of confidence intervals is available to readers each year. Confidence intervals reflect the uncertainty arising from the fact that every store in the state is not visited. The general concept employed in this methodology is the propagation of uncertainty. Uncertainty propagation examines how the uncertainty in a calculated result depends on the uncertainty in the measured values that are entered into the formula. The generalized equation for error propagation for a function *f(x, y, z …)* where variables x, y and z are uncorrelated is:

$$\sigma_f^2 = \left(\frac{\partial f}{\partial x}\right)^2 \sigma_x^2 + \left(\frac{\partial f}{\partial y}\right)^2 \sigma_y^2 + \left(\frac{\partial f}{\partial z}\right)^2 \sigma_z^2 + \ldots \quad [1]$$

where σ_i^2 is the variance of variable *i*. For this project, we are interested in determining the variances (the 95% confidence interval of f is approximately $1.96\sigma_f$) of the cost of living index $COL = f(\mu_D, S, p, w)$ where μ_D are the mean prices of consumer products in the district, S are the shopping patterns, *p* are the decimal population fractions in each district, and w are weights that determine the contributions of individual consumer products to the overall cost of living. All four of these variable types are estimated from surveys of one type or another, and hence have error associated with them. However, only the errors in the district consumer prices μ_D are considered in the Bengtsson treatment.

The Bengtsson derivations for the propagation of μ_D errors are approximate in that equation [1] is not applied directly to the *COL* function. Rather, for simplicity, equation [1] is applied successively to components of the *COL* function in order to build up the final expression for σ_f^2 . This simplification is probably necessary given the complexity of the *COL* function. An amplification of the derivation of the variances of interest is provided later. The conceptual part of this appendix will address some key questions.

Does a large variance in the item cost data automatically translate to a large confidence interval? Consider that you wanted to get a haircut in Aspen. It is likely that you could find haircuts ranging from around $20 to well over $100, leading to a large variance in the price of haircuts in Aspen. Does this necessarily mean that the cost of living index will have a large confidence error? No, because the confidence interval depends on the *variance of the estimate of the mean price* as opposed to the variance of the sample. But districts with large price variances do require more intensive sampling. Consider a simplified example where there are 20 places to get a haircut in Aspen, and at half of them you can get a $20 haircut and at the other half haircuts cost $100. Let's also assume that by chance whenever we sample haircut prices that we sample equally between the two haircut prices. Table 1 illustrates what happens to the variance and 95% confidence interval of the estimate of the mean price as a function of number of prices sampled.

Variance and Confidence Interval of Mean Price Estimate as a Function of Sample Size

N	Estimate of Mean Price	Variance of Sample	Variance of Estimate of Mean Price	95% Confidence Interval of Estimate of Mean Price
2	$60	3200	1516	$76
4	$60	2133	449	$42
8	$60	1829	144	$24
16	$60	1797	24	$10

While this example is somewhat extreme, it does illustrate that large variances in the district prices can be overcome by more intensive sampling. However, a question arises; are the higher priced haircuts even pertinent to the middle-income population targeted by the study, given the availability of lower priced haircuts? Seemingly, much of this problem would go away with a combination of strict item criteria and careful outlier detection process. If additional sampling of certain districts is indicated by large CI, more detailed outlier removal for that shopping district may be indicated.

Does a large CI always signal a need for additional price sampling? The primary motivation of determining confidence intervals of COL indices is to determine if additional sampling is needed. The question arises, is additional sampling always in indicated when the CI is large? Probably not. Consider a rural area where there may be one grocery store in which the majority of people shop, but also several small convenience stores with somewhat higher prices. Provided the initial price sampling included the grocery store, additional sampling of convenience stores will likely artificially inflate the mean price. The uncertainty in the size of the shopping universe also complicates this situation (see first paragraph of the appendix). As the number of stores sampled (n) approaches the number of stores in the universe of stores (U), the uncertainty in the mean price estimate approaches zero. So, in a small district with large price variances, the strategy for reducing the CI would be to sample every store. However, in some cases the number of stores sampled to date exceeded the supposed value of U. This uncertainty of U makes it difficult to be certain that every store has been sampled. The need to increase sampling of high CI districts needs to be evaluated on a case by case basis. Most of the challenges described so far could be eliminated with store-specific shopping patterns for the target income group. However, reliable collection of such data is probably impossible.

What are the limitations of the method used to calculate the confidence intervals of the COL indices? One of the major limitations of the method of calculating CI is that only uncertainty in mean district prices is taken into account. There is also likely to be uncertainty in the shopping patterns, which also propagates through the calculation and would affect the uncertainty in the COL indices. There may also be smaller errors associated with the weighting and population factors, depending on what these measures are designed to represent. Mathematically, the derivation of an analytical expression to propagate uncertainty in the district prices, shopping patterns, and other sources of uncertainty may be difficult. A Monte Carlo method may be more practical. However, given the expected size of the uncertainty in the shopping patterns, the overall uncertainty in the COL indices, if additional factors are included, may appear to be unacceptably large without prior education.

Alternatively, a separate CI interval could be calculated using uncertainty of the shopping pattern alone, without consideration of the uncertainty in shopping patterns. The purpose of this CI would be to determine if additional surveying of shopping patterns is needed.

What does the confidence interval actually tell us? The confidence interval as calculated by the Bengtsson method indicates the level of uncertainty in the COL indices as affected by uncertainty in the prices available to consumers. It does not reflect the overall uncertainty in the mean COL estimates. It can be used as a screening tool to identify districts that may potentially benefit from additional price sampling. However, once identified, some additional consideration needs to be given to whether additional price sampling would actually be beneficial or whether tools such as outlier detection may be more appropriate. In general, shopping areas that have a large number of consumer choices and large price variances may benefit from additional sampling. If the shopping district has relatively few choices, additional sampling could help provided 1) the new stores sampled actually capture a significant market share and 2) the total universe of stores in the district is known with certainty.

Statistical Appendix

To illustrate the application of equation 1 to the *COL* function and to aid in decoding the vector notation in the Bengtsson methodology, we will consider a simple case in which there are two school districts and three shopping districts in the state. For each consumer item that contributes to the COL index, we estimate the mean price within the district μ_D by a shopping survey of a subset *n* of the stores. We also calculate the variance of the sample σ_D from the sample data. The *variance of the estimate of* μ_D is given by $\sigma_\mu^2 = \sigma_D^2/n$, which is also the square of the standard error of the sample. As *n* approaches the total number of stores that have that item (*U*), the accuracy of our estimate of μ_D increases. We account for this effect on σ_μ^2 by multiplying by the factor $(U-n)/(U-1)$. So, for our example we have: $\mathbf{\mu_D} = (\mu_{D1}, \mu_{D2}, \mu_{D3})'$ and $\mathbf{\sigma_\mu} = (\sigma_{\mu1}^2, \sigma_{\mu2}^2, \sigma_{\mu3}^2)'$. We also have the shopping pattern matrix (note that the shopping matrix assembled by Corona Insights is actually **S'** as shown below):

$$\mathbf{S}' = \begin{pmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{22} & S_{23} \end{pmatrix} \qquad [2]$$

The actual prices paid by consumer in the district is the shopping-pattern-weighted costs $\mathbf{\mu_{SD}} = \mathbf{S}'\mathbf{\mu_D}$. If we expand this for school district 1 we get:

$$\mu_{SD1} = S_{11}\mu_{D1} + S_{12}\mu_{D2} + S_{13}\mu_{D3} \qquad [3]$$

If we now apply equation [1] to find $\sigma_{S\mu1}^2$ (the variance of μ_{SD1}):

$$\sigma_{S\mu1}^2 = \left(\frac{\partial\mu_{SD1}}{\partial\mu_{D1}}\right)^2\sigma_{\mu1}^2 + \left(\frac{\partial\mu_{SD1}}{\partial\mu_{D2}}\right)^2\sigma_{\mu2}^2 + \left(\frac{\partial\mu_{SD1}}{\partial\mu_{D3}}\right)^2\sigma_{\mu3}^2 = S_{11}^2\sigma_{\mu1}^2 + S_{12}^2\sigma_{\mu2}^2 + S_{13}^2\sigma_{\mu3}^2$$

This corresponds to the vector notation:

$$\sigma_{S\mu}^2 = S'\sigma_\mu^2 S$$

where σ_μ^2 and $\sigma_{S\mu}^2$ are square matrices with the elements of interest on the diagonals.

The state-average price is given by:

$$\mu_{SS} = p_1(S_{11}\mu_{D1} + S_{12}\mu_{D2} + S_{13}\mu_{D3}) + p_2(S_{21}\mu_{D1} + S_{22}\mu_{D2} + S_{23}\mu_{D3})$$
$$= (p_1S_{11} + p_2S_{21})\mu_{D1} + (p_1S_{12} + p_2S_{22})\mu_{D2} + (p_1S_{13} + p_2S_{23})\mu_{D3}$$

To find the variance of the state-average price we again apply equation [1]:

$$\sigma_{SS}^2 = \left(\frac{\partial\mu_{SS}}{\partial\mu_{D1}}\right)^2\sigma_{\mu1}^2 + \left(\frac{\partial\mu_{SS}}{\partial\mu_{D2}}\right)^2\sigma_{\mu2}^2 + \left(\frac{\partial\mu_{SS}}{\partial\mu_{D3}}\right)^2\sigma_{\mu3}^2$$
$$= (p_1S_{11} + p_2S_{21})^2\sigma_{\mu1}^2 + (p_1S_{12} + p_2S_{22})^2\sigma_{\mu2}^2 + (p_1S_{13} + p_2S_{23})^2\sigma_{\mu3}^2$$

This corresponds to the vector notation:

$\sigma_{SS}^2 = p'S'\sigma_\mu^2 Sp$ ← imagine this in bold

The *COL* is a weighted function of the ratios $r_D = \mu_{SD}/\mu_{SS}$. Now for district 1 we calculate the variance σ_{r1}^2 of the ratio $r_{D1} = \mu_{SD1}/\mu_{SS}$ by application of equation [1] again, remembering that the variances of μ_{SD1} and μ_{SS} are $\sigma_{S\mu1}^2$ and σ_{SS}^2, respectively:

$$\sigma_{r1}^2 = \left(\frac{\partial r_D}{\partial\mu_{SD1}}\right)^2\sigma_{S\mu1}^2 + \left(\frac{\partial r_D}{\partial\mu_{SS}}\right)^2\sigma_{SS}^2$$
$$= \frac{1}{\mu_{SS}^2}\sigma_{S\mu1}^2 + \frac{\mu_{SD1}^2}{\mu_{SS}^4}\sigma_{SS}^2 = \frac{1}{\mu_{SS}^2}\left(\sigma_{S\mu1}^2 + r_{D1}^2\sigma_{SS}^2\right)$$

where we assume r_{D1} can be approximated by 1. Finally, the cost of living index over i items is given by:

$$COL = \sum w_i r_{Di}$$

and its variance is given by:

$$\sigma_{COL}^2 = \sum w_i^2\sigma_{ri}^2$$

APPENDIX D: RAW PRICING DATA FOR SELECTED PURCHASE CATEGORIES

This appendix provides the raw pricing data that underpins the analysis. Readers receiving this report electronically will need to review an accompanying spreadsheet file, due to the volume of data.

APPENDIX E: SHOPPING PATTERNS MATRICES

This appendix provides the geographic shopping patterns matrix used in this analysis. The matrix is based on a survey of Colorado residents conducted in the fall of 2019. Data from this survey, in conjunction with mathematical modeling methods, were used to construct a geographic shopping matrix describing where the residents of each school district typically purchase products (i.e., what proportion of purchases are made in the home district, in each neighboring district, online, etc.). Readers of this report will need to review an accompanying spreadsheet file due to the volume of data.