



# COLORADO SCHOOL DISTRICT COST OF LIVING STUDY

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2007

**Prepared for:**

Colorado Legislative Council

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## SECTION 1. INTRODUCTION

Corona Research is pleased to present this report to the Colorado Legislative Council. The following pages provide the cost of living index for 2007 for each of Colorado's 178 school districts, along with a description of the project design and research methodology.

### BACKGROUND

Corona Research was retained to conduct the 2007 Colorado School District Cost of Living Study for the Colorado Legislative Council. This study measures the differences in the cost to purchase a typical "market basket" of goods among the 178 public school districts in the State of Colorado. The cost of living indices developed herein is used as one component of each district's per pupil funding formula.

This report is the latest in a series of biennial reports that were first conducted as a result of the Public School Finance Act of 1994.

## SECTION 2. GENERAL OVERVIEW OF RESEARCH DESIGN

The goal of the project is to develop comparative cost of living figures for each of the 178 school districts in the state. To do that requires answering five major questions:

1. What is a “typical” (archetypal) Colorado household in terms of size and income?
2. What types of goods and services does that archetypal household buy?
3. Where do they buy those goods and services?
4. How much do those goods and services cost in differing geographic locations?
5. If an archetypal household lives in each of the 178 school districts, what is the difference between their costs to buy those goods, based on the prices where they shop?

The research process therefore sought to answer each of these questions.

As a structure for this approach, the cost of living estimates are based on the following global assumptions:

### Research Structure

We begin with an archetypal household of three people with a total household income of \$44,500

*and*

We place that household in each school district in Colorado,

*and*

That household spends their income on the same suite of goods and services that are purchased by the average household of that size and income level throughout the United States,

*and*

That household shops inside and outside their district in a pattern that emulates the geographic shopping patterns of all households in that district,

*and*

The price for goods and services in each district where they shop may differ, even if the good or service is identical, based on market factors.

As residents of each district, what is the difference in their cost to purchase that suite of goods and services?

An overview of the methodology is provided in Section 4 of this report, with additional detail provided in Appendix B. Appendix C denotes notable methodological changes between the 2005 study and the 2007 study.

**SECTION 3. THE RESULTS – THE COST OF LIVING IN COLORADO SCHOOL DISTRICTS**

The table that extends across the following several pages provides the overall cost of living in each of Colorado’s school districts, as calculated in 2007. Figures are reported in order by District number, along with appropriate rankings, ratings, and comparisons. A map is also provided for the reader’s convenience.

Cost of living figures relate to the cost of buying a market basket of goods and services that represents the spending patterns of the average archetypal household in the United States. (See Section 4 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.

**Exhibit 3-1a. Map of Colorado School Districts, 2007**

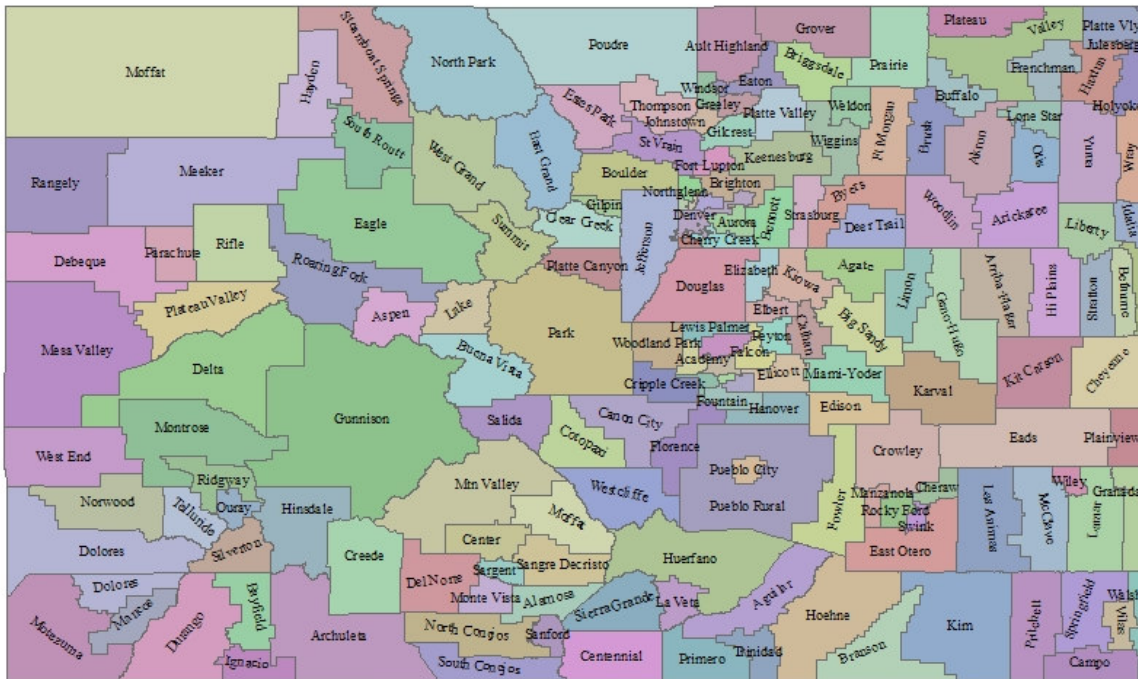
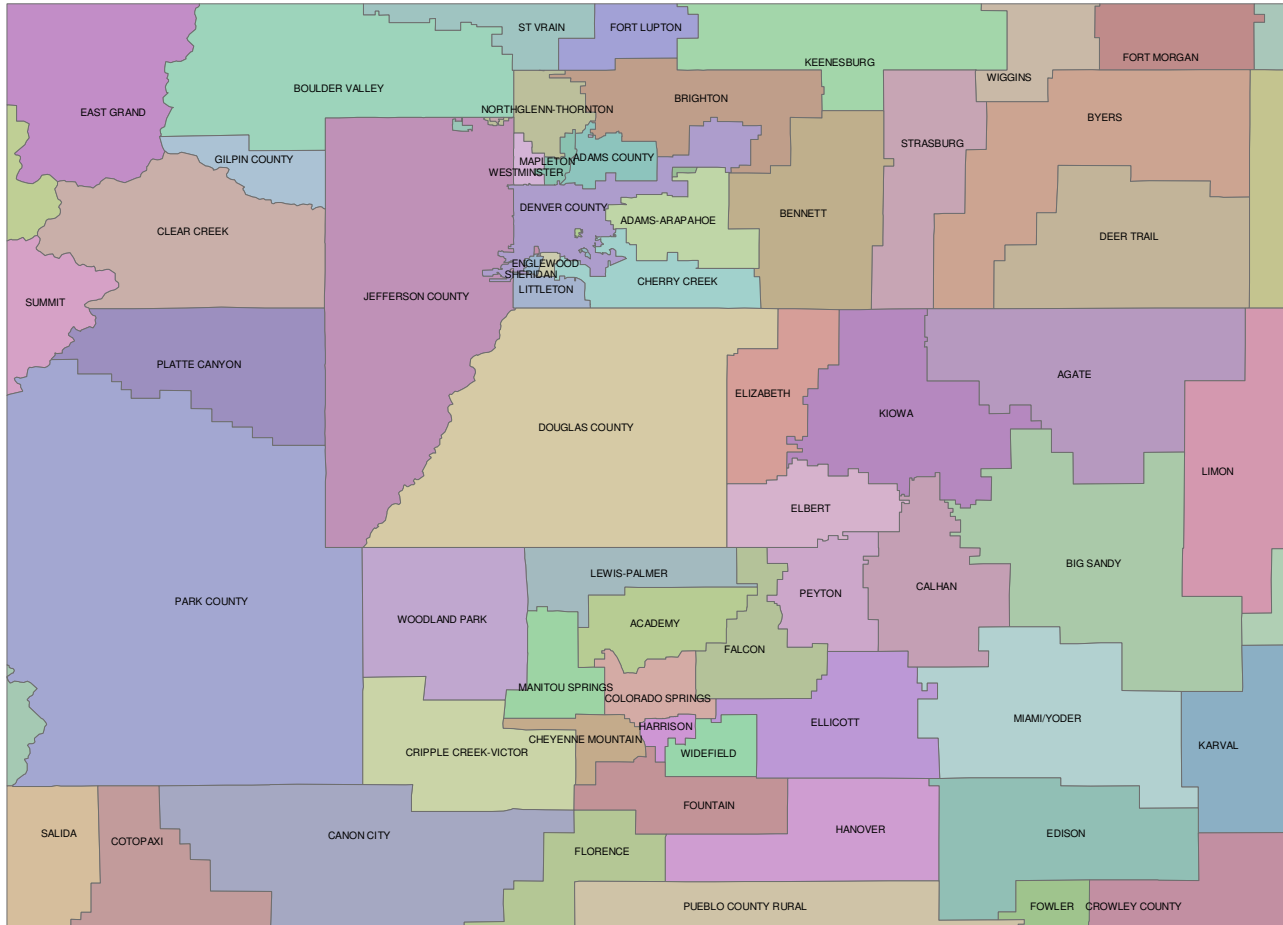


Exhibit 3-1b. Detailed Map of School Districts in the Denver and Colorado Springs Metro Areas, 2007



**Exhibit 3-2. Cost of Living by School District, 2007**

<b>County</b>	<b>District</b>	<b>Total</b>	<b>Rank</b>
	State	\$44,500	
Adams	Mapleton 1	\$42,711	78
Adams	Northglenn-Thornton 12	\$44,396	45
Adams	Adams County 14	\$42,402	87
Adams	Brighton 27J	\$43,524	60
Adams	Bennett 29J	\$44,294	48
Adams	Strasburg 31J	\$43,905	54
Adams	Westminster 50	\$44,138	51
Alamosa	Alamosa RE-11J	\$39,758	127
Alamosa	Sangre de Cristo RE-22J	\$39,841	126
Arapahoe	Englewood 1	\$44,588	43
Arapahoe	Sheridan 2	\$44,651	39
Arapahoe	Cherry Creek 5	\$44,352	46
Arapahoe	Littleton 6	\$45,116	34
Arapahoe	Deer Trail 26J	\$43,416	64
Arapahoe	Adams-Arapahoe 28J	\$43,481	62
Arapahoe	Byers 32J	\$43,339	65
Archuleta	Archuleta County 50 JT	\$44,641	40
Baca	Walsh RE-1	\$37,202	173
Baca	Pritchett Re-3	\$36,886	174
Baca	Springfield RE-4	\$37,778	166
Baca	Vilas School District RE-5	\$36,444	178
Baca	Campo RE-6	\$36,622	177
Bent	Las Animas RE-1	\$37,657	168
Bent	McClave RE-2	\$37,752	167
Boulder	St Vrain Valley RE 1J	\$44,243	49
Boulder	Boulder Valley RE 2	\$48,200	12
Chaffee	Buena Vista R-31	\$43,927	53
Chaffee	Salida R-32	\$43,793	55
Cheyenne	Kit Carson R-1	\$38,767	148
Cheyenne	Cheyenne County RE-5	\$39,135	144
Clear Creek	Clear Creek RE-1	\$46,976	16
Conejos	North Conejos RE-1J	\$37,836	165

<b>County</b>	<b>District</b>	<b>Total</b>	<b>Rank</b>
Conejos	Sanford 6J	\$37,568	169
Conejos	South Conejos RE-10	\$38,265	157
Costilla	Centennial R-1	\$37,447	170
Costilla	Sierra Grande R-30	\$38,564	151
Crowley	Crowley County RE-1-J	\$38,186	158
Custer	Consolidated C-1	\$44,908	36
Delta	Delta County 50(J)	\$42,020	98
Denver	Denver County 1	\$45,892	26
Dolores	Dolores County RE NO2	\$40,064	121
Douglas	Douglas County RE 1	\$45,419	29
Eagle	Eagle County RE 50	\$51,899	5
Elbert	Elizabeth C-1	\$47,832	13
Elbert	Kiowa C-2	\$46,245	24
Elbert	Big Sandy 100J	\$42,490	83
Elbert	Elbert 200	\$46,479	19
Elbert	Agate 300	\$44,634	42
El Paso	Calhan RJ-1	\$42,594	80
El Paso	Harrison 2	\$42,205	92
El Paso	Widefield 3	\$43,189	68
El Paso	Fountain 8	\$43,581	58
El Paso	Colorado Springs 11	\$42,265	91
El Paso	Cheyenne Mountain 12	\$46,285	22
El Paso	Manitou Springs 14	\$45,144	33
El Paso	Academy 20	\$44,480	44
El Paso	Ellicott 22	\$41,753	101
El Paso	Peyton 23 JT	\$44,830	38
El Paso	Hanover 28	\$43,135	70
El Paso	Lewis-Palmer 38	\$46,448	21
El Paso	Falcon 49	\$44,310	47
El Paso	Edison 54 JT	\$41,571	105
El Paso	Miami-Yoder 60	\$41,325	106
Fremont	Canon City RE-1	\$40,924	111
Fremont	Florence RE-2	\$42,398	88
Fremont	Cotopaxi RE-3	\$41,599	104
Garfield	Roaring Fork RE-1	\$51,609	6
Garfield	Garfield (Rifle) RE-2	\$44,879	37
Garfield	Garfield (Parachute) 16	\$42,972	74



<b>County</b>	<b>District</b>	<b>Total</b>	<b>Rank</b>
Gilpin	Gilpin County Re-1	\$45,552	27
Grand	West Grand 1-JT	\$46,268	23
Grand	East Grand 2	\$52,181	4
Gunnison	Gunnison Watershed RE1J	\$45,425	28
Hinsdale	Hinsdale County RE-1	\$45,351	30
Huerfano	Huerfano RE-1	\$39,628	132
Huerfano	La Veta RE-2	\$42,091	97
Jackson	North Park R-1	\$41,786	99
Jefferson	Jefferson County R-1	\$45,085	35
Kiowa	Eads RE-1	\$36,741	175
Kiowa	Plainview RE-2	\$36,642	176
Kit Carson	Arriba-Flagler C-20	\$40,257	119
Kit Carson	Hi-Plains R-23	\$39,877	125
Kit Carson	Stratton R-4	\$39,956	123
Kit Carson	Bethune R-5	\$39,536	134
Kit Carson	Burlington RE-6J	\$41,031	109
Lake	Lake County R-1	\$45,345	31
La Plata	Durango 9-R	\$48,923	9
La Plata	Bayfield 10 JT-R	\$46,854	17
La Plata	Ignacio 11 JT	\$45,301	32
Larimer	Poudre R-1	\$44,162	50
Larimer	Thompson R-2J	\$43,541	59
Larimer	Park (Estes Park) R-3	\$47,456	15
Las Animas	Trinidad 1	\$41,254	107
Las Animas	Primero Reorganized RE-2	\$39,583	133
Las Animas	Hoehne Reorganized 3	\$40,282	118
Las Animas	Aguilar Reorganized 6	\$39,096	146
Las Animas	Branson Reorganized 82	\$38,470	155
Las Animas	Kim Reorganized 88	\$37,986	163
Lincoln	Genoa-Hugo C113	\$40,286	117
Lincoln	Limon RE-4J	\$42,112	96
Lincoln	Karval RE-23	\$38,673	150
Logan	Valley RE-1	\$40,751	114
Logan	Frenchman RE-3	\$39,668	130
Logan	Buffalo RE-4	\$39,912	124
Logan	Plateau RE-5	\$38,529	152
Mesa	De Beque 49JT	\$42,158	93

<b>County</b>	<b>District</b>	<b>Total</b>	<b>Rank</b>
Mesa	Plateau Valley 50	\$43,753	56
Mesa	Mesa County Valley 51	\$42,841	76
Mineral	Creede Consolidated 1	\$43,048	72
Moffat	Moffat County RE:NO 1	\$43,501	61
Montezuma	Montezuma-Cortez RE-1	\$41,758	100
Montezuma	Dolores RE-4A	\$42,949	75
Montezuma	Mancos RE-6	\$43,418	63
Montrose	Montrose County RE-1J	\$42,591	81
Montrose	West End RE-2	\$42,487	84
Morgan	Brush RE-2 (J)	\$42,429	86
Morgan	Fort Morgan RE-3	\$41,663	102
Morgan	Weldon Valley School RE 20J	\$41,028	110
Morgan	Wiggins RE-50(J)	\$43,287	66
Otero	East Otero R-1	\$38,740	149
Otero	Rocky Ford R-2	\$38,064	162
Otero	Manzanola 3J	\$37,883	164
Otero	Fowler R-4J	\$38,490	154
Otero	Cheraw 31	\$38,111	160
Otero	Swink 33	\$39,707	128
Ouray	Ouray R-1	\$49,244	8
Ouray	Ridgway R-2	\$46,452	20
Park	Platte Canyon 1	\$47,631	14
Park	Park County RE-2	\$46,034	25
Phillips	Holyoke RE-1J	\$39,467	137
Phillips	Haxtun RE-2J	\$39,476	136
Pitkin	Aspen 1	\$90,637	1
Prowers	Granada RE-1	\$37,373	171
Prowers	Lamar RE-2	\$39,235	143
Prowers	Holly RE-3	\$37,344	172
Prowers	Wiley RE-13 JT	\$38,504	153
Pueblo	Pueblo 60	\$41,618	103
Pueblo	Pueblo County Rural 70	\$42,157	94
Rio Blanco	Meeker RE-1	\$42,989	73
Rio Blanco	Rangely RE-4	\$40,810	113
Rio Grande	Del Norte C-7	\$42,315	89
Rio Grande	Monte Vista C-8	\$40,502	116

County	District	Total	Rank
Rio Grande	Sargent RE-33J	\$39,643	131
Routt	Hayden RE-1	\$46,587	18
Routt	Steamboat Springs RE-2	\$51,263	7
Routt	South Routt RE 3	\$48,320	11
Saguache	Mountain Valley RE 1	\$38,273	156
Saguache	Moffat 2	\$41,189	108
Saguache	Center 26 JT	\$38,103	161
San Juan	Silverton 1	\$48,838	10
San Miguel	Telluride R-1	\$59,508	2
San Miguel	Norwood R-2J	\$43,937	52
Sedgwick	Julesburg RE-1	\$40,546	115
Sedgwick	Platte Valley RE-3	\$39,376	140
Summit	Summit RE-1	\$53,493	3
Teller	Cripple Creek-Victor RE-1	\$42,560	82
Teller	Woodland Park RE-2	\$44,636	41
Washington	Akron R-1	\$39,452	138
Washington	Arickaree R-2	\$39,344	141
Washington	Otis R-3	\$38,959	147
Washington	Lone Star 101	\$39,268	142
Washington	Woodlin R-104	\$40,194	120
Weld	Weld County RE-1	\$42,151	95
Weld	Eaton RE-2	\$43,221	67
Weld	Keenesburg RE-3(J)	\$42,281	90
Weld	Windsor RE-4	\$43,630	57
Weld	Johnstown-Milliken RE-5J	\$43,136	69
Weld	Greeley R-6	\$42,601	79
Weld	Platte Valley RE-7	\$43,133	71
Weld	Fort Lupton RE-8	\$42,809	77
Weld	Ault-Highland RE-9	\$42,455	85
Weld	Briggsdale RE-10	\$40,899	112
Weld	Prairie RE-11	\$39,415	139
Weld	Pawnee (Grover) RE-12	\$39,508	135
Yuma	Yuma 1	\$39,703	129
Yuma	Wray RD-2	\$40,037	122
Yuma	Idalia RJ-3	\$39,110	145
Yuma	Liberty J-4	\$38,166	159

## SECTION 4. PROJECT METHODOLOGY

As discussed in Section 2, the project was structured upon addressing and linking five research questions, as follows.

1. What is a “typical” (archetypal, or “benchmark”) Colorado household?  
*(See “Identifying the Benchmark Household” in this section.)*
2. What types of goods and services does that archetypal household buy?  
*(See “Identifying the Market Basket of Goods and Services” in this section.)*
3. Where do they buy those goods and services?  
*(See “Identifying and Measuring Geographic Shopping Patterns” in this section.)*
4. How much do those goods and services cost in differing geographic locations?  
*(See “Data Collection” in this section.)*
5. If an archetypal household lives in each of the 178 school districts, what is the difference between their costs to buy those goods, based on the prices where they shop?  
*(See “Developing Final Cost of Living Measures” in this section.)*

The approach to answering each of those questions is presented in this section. Appendix B provides additional detail for interested readers.

## IDENTIFYING THE “BENCHMARK” HOUSEHOLD

The benchmark household in past studies has typically been a household of average size for the state, with an income related to typical teaching incomes. This figure was defined by the Colorado Legislative Council in 2007 to be a three-person household with a total household income of \$44,500.

Over the past three studies, the household size has not changed, and the household income has increased at a moderate rate.

**Exhibit 4-1. Definition of the Archetypal Household**

<b>Year</b>	<b>Size of Benchmark Household</b>	<b>Household Income of Benchmark Household</b>
<b>2007 (Current Study)</b>	<b>3 people</b>	<b>\$44,500</b>
2005 Study	3 people	\$43,000
2003 Study	3 people	\$40,000

## IDENTIFYING THE “MARKET BASKET” OF GOODS AND SERVICES

### *Methodology at a Glance*

**Goal: Develop a list of specific goods and services that collectively serve as a proxy for all spending by the archetype household.**

1. *The Bureau of Labor Statistics compiles annual data on consumer spending habits through Consumer Expenditures Surveys.*
2. *Corona Research examined the most recent Consumer Expenditure Survey Data to identify major categories of spending (housing, food at home, etc.) A total of 18 categories were defined.*
3. *Corona Research and the Colorado Legislative Council jointly identified a “market basket” of individual items that represent each major category of spending. For example, a variety of goods such as milk, bread, and other foods were identified to represent grocery expenditures.*
4. *Selected items were identified with as much specificity as possible in terms of size and quality, so that directly comparable data could be gathered in every school district where that item was sold.*
5. *Some items, such as energy costs, are monopolistic goods or services. They were merely measured on a per-unit cost in each district.*
6. *The market basket was designed to be consistent with the 2005 study where possible and appropriate. In fact, only three items were changed from 2005: the average house size increased, film was replaced by batteries as a household good, and a DVD player replaced a cathode-ray television set as an electronics item.*
7. *The average expenditures per major category were calculated and set aside for the final calculations, as the collected data was weighted in proportion to those average expenditures.*

The goal of this step of the process was to develop a list of goods and services that, in combination, can represent the full range of purchases for the archetypal household. The primary data source for this type of analysis is Consumer Expenditure Surveys that are compiled by the Bureau of Labor Statistics. Corona Research utilized the latest available data at the time of the study, which was the 2005/2006 data set.

Data in the Consumer Expenditure Surveys are available by household size and year. Corona used the data for three-person households, and interpolated between the results for household incomes of \$40,000 and \$45,000 to estimate expenditures for a household with an income of \$44,500.

Two key types of data were produced from this analysis: a set of categories that reflect major types of expenditures, and average spending levels for the archetypal household within each of those categories. That data is shown in the following exhibit.

Also shown in the exhibit are individual items that were selected jointly by the Corona Research team and the Colorado Legislative Council as being representative of each major expenditure category. Prices gathered for these items (with statistical weightings to ensure that their pricing matches total spending) formed the basis of 2007 Cost of Living estimates.

**Exhibit 4-2. Spending Patterns of the Archetypal Household**

<b>Expenditure Category</b>	<b>Average Spending of the Archetypal Household in the U.S., 2005/2006 Consumer Expenditure Surveys</b>	<b>Representative “Market Basket” Items</b>
<b>Food at Home</b>	<b>\$3,642</b>	
Cereal	\$478	White bread, spaghetti
Meat	\$833	Ground beef, fryer chicken
Dairy	\$412	Milk
Fruits & vegetables	\$629	Potatoes, bananas, canned green beans, canned peaches
Other	\$1,291	Coffee, soup, frozen waffles
<b>Food Away From Home</b>	<b>\$2,662</b>	<b>Lunch: Cheeseburger meal Dinner: Pepperoni pizza Dinner: NY strip steak meal</b>
<b>Alcoholic Beverages</b>	<b>\$435</b>	<b>Beer</b>
<b>Housing</b>	<b>\$13,975</b>	
Shelter	\$7,684	
Mortgage interest and charges	\$5,937	Mortgage payment
Property taxes	\$1,075	Property taxes
Maintenance, repairs, insurance and other	\$672	Homeowners’ insurance, home maintenance/repairs
Utilities	\$3,625	
Natural gas	\$466	Natural gas
Electricity	\$1,458	Electric

Telephone Service	\$1,294	Telephone
Water	\$407	Water and sewer
Household operations	\$737	Daycare services
Household supplies	\$600	Laundry soap
Household furniture	\$1,329	Mattress
<b>Apparel and Services</b>	<b>\$1,873</b>	
Men	\$569	Men's dress shirt, men's t-shirts
Women	\$874	Women's turtleneck, women's jeans
Footwear	\$430	Women's dress shoes
<b>Transportation</b>	<b>\$9,105</b>	
Vehicle	\$3,802	Car payment/auto financing
Gas	\$2,465	Gas: 85 unleaded
Vehicle finance charges	\$587	Interest rate for full purchase price/bank charges
Maintenance and repairs	\$864	Oil change, front-end alignment
Vehicle insurance	\$1,388	Insurance premiums
<b>Healthcare</b>	<b>\$2,798</b>	<b>Health insurance premium</b>
<b>Entertainment</b>	<b>\$2,035</b>	
Fees	\$302	Movie (first run, full length)
Equipment	\$949	DVD player
Pets	\$414	Pet food
Other	\$370	Batteries (AA)
<b>Personal Care</b>	<b>\$618</b>	<b>Women's/men's haircuts, tampons, shaving cream, toothpaste</b>
<b>Reading</b>	<b>\$83</b>	



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<b>Education</b>	<b>\$454</b>	
<b>Tobacco</b>	<b>\$455</b>	<b>Cigarettes (carton)</b>
<b>Misc.</b>	<b>\$648</b>	
<b>Cash Contributions</b>	<b>\$1,020</b>	
<b>Insurance</b>	<b>\$3,938</b>	
<b>Personal Taxes</b>	<b>\$760</b>	

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Disaggregated results for the cost of living by major category are provided in Section 5 and detailed raw data are provided in Appendix D.

## IDENTIFYING AND MEASURING GEOGRAPHIC SHOPPING PATTERNS

### *Methodology at a Glance*

#### *Goal: Develop a series of matrices that shows where residents of each school district shop for various goods and services.*

- 1. In order to study a diverse sample of shopping patterns in a variety of communities, Corona divided the 178 school districts into ten types of regions based on the size of the local business community. The actual measure used in setting the cutoffs was the average number of employees per business, counting only business that were listed by Dun & Bradstreet as selling one or more of the products defined in the market basket.. Regions ranged from very small rural districts where businesses were, on average, very small, to large urban areas. The tenth area was an exception to the rule, as it was designed to include only resort communities, for which it was theorized that geographic shopping patterns might differ from those of similarly sized non-resort communities.*
- 2. Corona Research conducted 2,710 surveys of randomly selected households throughout the state, stratifying the sample so that 271 surveys were conducted in each region type. This produced a 5 percent margin of error at a 90 percent confidence interval.*
- 3. Each survey respondent was asked to state the town in which his or her household made their most recent purchase of a sample of household goods. (They could also state that their last purchase was online, or that they never purchase that particular good.) Respondents in urban areas were also asked to provide the distance that they traveled, since some large communities contain more than one school district.*
- 4. The survey instrument is provided in Appendix E.*
- 5. Upon completion of the survey, Corona Research developed a suite of mathematical models to increase the precision of the survey data as a predictor of geographic shopping patterns within each region. The model utilized a combination of raw survey results, predictive modeling, cross-product geographic patterns, and radius modeling.*
- 6. The output of the model was a large matrix for each product category, where each row described the residents of an individual school district (a “home” district), and each column represented a district where goods or services could be purchased (a “buying” district). The intersection of a given row and column represented the proportion of purchases among residents of the “home” district who could be expected to purchase that product in that particular “buying” district. The sum of each row represented each home district’s shopping pattern, totaling to 100 percent of purchases of that particular product. This matrix could then be multiplied by a matrix of prices for each product in each district to produce an overall price in the home district.*
- 7. In some cases, purchase patterns may be reported for a district that does not sell a particular product. For example, the model may predict that residents of District X buy 20 percent of their cars in District Y, but District Y does not have a sales outlet that sells cars. There are many reasons for this, including a survey reporting a private transaction with an individual, a purchase from an outlet that closed down, a modeling prediction that doesn’t recognize a lack of sales outlets, or many other reasons. For this reason, the model was designed with flexibility, so that these instances could be overridden with pricing from a nearby district that does have such a sales outlet. As with any model this complex, some manual adjustments were necessary in individual situations. Overall, though, the match of “buying districts” and “selling” districts was roughly 99 percent.*

If every resident in a school district made all of their purchases within a school district, calculating the cost of living in that district would be straightforward. However, this is not the case. Often, residents leave their district to make purchases, either because they can obtain a better price, better selection, more convenience, or some other benefit. Because prices will vary across district boundaries, it is necessary to understand these geographic shopping patterns in order to develop the actual cost of living in each school district.

For all previous cost of living studies conducted from 1997 through 2005, geographic shopping patterns were estimated based on a large statewide survey that was conducted in 1997. For the 2007 study, Corona Research was asked to update the analysis of geographic shopping patterns.

Ideally, updating the analysis of geographic shopping patterns would involve conducting statistically robust surveys in each and every school districts, which would determine geographic shopping patterns for each product in the market basket. However, the large number of school districts in the state mean that this approach is not feasible, as the cost to do so would have been quite high (approximately one million dollars to complete the described ideal analysis).

Corona Research therefore took an alternate approach. The research team designed a survey that asked about geographic purchasing patterns for 18 types of products. For 15 small product categories, respondents were asked where they or a member of their household most recently purchased each item. Residents outside metro areas were asked about the town where they purchased the item, while residents within metro areas were asked about both the town and the distance that they traveled. (Residents were also allowed to state that they bought the product online, or that they never buy the product.)

The fifteen small product categories were:

- Non-perishable groceries such as canned goods
- Fruits, vegetables, or other produce
- Perishable groceries such as milk or ice cream
- Household products such as laundry soap, batteries, or toothpaste
- A meal at a restaurant that was not fast food
- Alcoholic beverages that were purchased to drink at home (not at a bar or restaurant)
- Casual clothing
- Dress clothing
- Dress shoes
- Gasoline
- Car maintenance and repair services
- Movie tickets at a theater
- Haircut
- Pet food
- Day care services

For the three larger products, residents were asked if they had purchased in the past 3 years; and if so, whether they were living in their current community when they bought each one. They were then asked what city they purchased any such items in (which could include “online” if they bought the item on a computer). They were then asked what town or city they thought they would go to if they were going to buy these items tomorrow. The three large products were:

- Car
- Mattress
- DVD player

The larger products were asked in a different manner because for some of these products, the person could have made the purchase several years earlier when living in a different place, or they could simply not remember if their last purchase was several years ago.

A total of 2,710 surveys were completed, using a stratified random sampling technique that oversampled in smaller communities. This oversampling was intentional, in that it provided the research team with statistically sound data for ten different types of communities, ranging from very small rural communities with few or no businesses, up to major metro areas.

Using the data gathered in this survey, the research team then developed a family of predictive models to estimate geographic shopping patterns in each district for each product category. For example, the team developed data that show what proportion of purchases of haircuts by residents of District A was made in Districts B, C, D, etc. The goal of this was to take into account the prices of goods not only in a district’s own business community, but also in other nearby communities.

Because different types of communities have fundamentally different shopping patterns, and because different types of data were available for different types of communities, several models were used to develop estimates. Depending on the particular geography and survey data, shopping patterns for any district might include only one district where shopping occurs, or might include many districts. Details of the modeling philosophy are presented at the end of Appendix B.

The final shopping patterns matrices are presented in Appendix F, and more detailed information about the methodology of the survey and model is presented at the end of Appendix A.

## DATA COLLECTION PROCEDURES

### *Methodology at a Glance*

**Goal: Gather pricing data for a large variety of goods and services in all school districts where those goods and services are sold.**

*Various types of data were gathered in different ways. A very short summary of approaches is provided below. Additional overview information is provided in this section of the report, and detailed information is provided in Appendix A.*

- 1. Retail Purchases - Pricing for a number of basic retail items were gathered on-site at retail stores across the state. These included all “food at home” items (perishables, non-perishables, and produce), alcoholic beverages, household goods, pet food, personal care products, tobacco, clothing, shoes, furniture, entertainment (movie tickets), electronics, and restaurant meals.*
- 2. Housing – Average home values for a home with specified characteristics were provided by the Colorado Legislative Council as a product of a separate research contract with another consulting firm.*
- 3. Homeowner’s insurance – Pricing data for a home with specified characteristics was provided by two large insurance companies that provide coverage throughout the state.*
- 4. Home maintenance - Costs were estimated by examining comparative wage levels of workers in home maintenance industries such as plumbing, electrical, and other services, and weighting those services based on typical home expenditures, as reported in U.S. census data.*
- 5. Utilities - Data on utility prices was gathered from the Public Utilities Commission via 2006 annual reports and/or sales reports filed by electric, telephone, and gas utility providers. (Some adjustment and estimation was required above and beyond the report data.)*
- 6. Water/Sewer – Data were gathered via phone calls from Corona Research to over 250 cities and towns throughout the state, as well as visits to municipal web sites. Rates were then applied to specified “typical” usage rates.*
- 7. Day Care – Information by county was obtained from the 2007 Market Rate Survey of Child Care Providers, conducted by Qualistar Early Learning as part of a contract with the Colorado Department of Human Services, Division of Child Care. These rates were then applied to specific school districts.*
- 8. Transportation – Vehicle financing rates were gathered for a specified vehicle (a 2005 Honda Civic) from local lending institutions throughout the state. Using the standard blue book value for purchase price, payment costs (principal and interest) were estimated by county and then mapped to school districts.*
- 9. Vehicle insurance – Pricing data for two vehicles with specified characteristics was provided by three large vehicle insurance companies that provide coverage throughout the state.*
- 10. Vehicle Maintenance – Prices for an oil and filter change and for a front end alignment were gathered via phone calls to a stratified random sample of vehicle maintenance shops in Colorado school districts.*

11. *Gasoline – Gasoline prices were gathered during a single-day round of visits and phone calls to a stratified random sample of gas stations in Colorado school districts.*
12. *Health Insurance – Prices from four of the largest health insurance providers in the state – three PPO’s and 1 HMO – were used to develop pricing for a three-person family of a specified age and gender profile.*
13. *Personal Services – Prices for men’s and women’s haircuts were used as the proxy for this category. Prices were gathered via telephone inquiries to a stratified random sample of hair cutting and styling establishments throughout the state.*
14. *Other types of expenses – Some types of expenses that were deemed to be more or less constant across geographic areas were not analyzed. These include reading, education, “miscellaneous expenses”, contributions, personal insurance, pension payments, and personal taxes. However, taxes were added to all of the previous categories where applicable.*

For each category of market basket items listed below, we describe how the cost of those items was collected, and also summarize the amount of data that was collected in the 2007 study. Additional data collection details for each category are presented in Appendix B.

#### Methodology Note

Corona developed a sophisticated sampling plan for data collection efforts where onsite collection was required at retail establishments. Using a list of firms compiled by Dun & Bradstreet, Corona examined revenue data by store and then developed an algorithm to sample firms within each district in a manner that ensured that a representative variety of stores were being sampled, based on their market share. The algorithm first identified the preferred number of stores to be sampled, and then identified specific stores based on their revenue size compared to their competitors. This approach ensured that high-sales outlets were sampled in proportion to their sales, as opposed to a random sampling approach that would oversample smaller stores.

#### FOOD AT HOME

Food at home items consisted of potatoes, bananas, canned green beans, canned peaches, ground beef, whole fryer chicken, milk, white bread, spaghetti, coffee, soup, and frozen waffles. Prices for these items were gathered by in-person visits to grocery stores throughout the state. The number of grocery stores visited (and in metro areas, the selection of stores to visit) were determined with a sampling algorithm developed by Corona Research, applied to a database of business listings provided by Dun & Bradstreet, that was supplemented with lists of Wal-Mart Supercenters and Super Targets. All sampling for items making up the food at home category was done at the school district level after coding the business listings with school district locations. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey to produce final prices for each district.

Detailed descriptions of the food at home items in the market basket and the number of prices collected are provided in the table below.

<b>Food At Home</b>				
<b>CES Category</b>	<b>Specific Item</b>	<b>Description</b>	<b>Collection Method</b>	<b>N of Observations</b>
Fruits and vegetables	Potatoes	Price for a 10 lb. bag of lowest price Russet potatoes. If 10 lb. bag is not available, substitute nearest sack size. DO NOT USE PRICE OF POTATOES BY THE POUND.	On-Site	299
Fruits and vegetables	Bananas	Price per pound. If bananas are priced by the bag or by the banana, report the price and weigh a bunch.	On-Site	310
Fruits and vegetables	Canned Green Beans	Price of store brand cut green beans, 14.5 oz.	On-Site	405
Fruits and vegetables	Canned Peaches	Price of store brand sliced peaches in heavy syrup, 15.25 oz.	On-Site	395
Meats, poultry fish and eggs	Ground Beef	Price per pound of regular ground beef, 80% lean or most comparable. Note if different percent lean. Average size package, loose prepackaged, i.e., 1 to 2 pound package. DO NOT PRICE FAMILY PACK.	On-Site	293
Meats, poultry fish and eggs	Chicken, whole fryer	Price per pound of one whole fryer chicken. If whole fryer not available, price whole fryer chicken, cut up. Least expensive brand.	On-Site	285
Dairy	Milk	Price for one gallon (128 Fl. oz.) 2% milk, store brand or lowest price.	On-Site	432
Cereals and bakery products	White Bread	Price for store brand 24 oz. (1.5 lb.) loaf of sliced white bread. If store brand not available, record price of lowest priced brand.	On-Site	395
Cereals and bakery products	Spaghetti	Price of store brand spaghetti noodles, 16 oz. package. If store brand is not available, record price of lowest priced brand.	On-Site	382
Other food at home	Coffee	Price for a 39 oz. can of Folgers Classic Roast Coffee, ground, red can. DO NOT PRICE DECAFFINATED.	On-Site	380
Other food at home	Soup	Price for a 10 <sup>3</sup> / <sub>4</sub> oz. can of original Campbell's Chicken Noodle Soup. Not "HomeStyle" or "Classic" packaging or other variations.	On-Site	424
Other food at home	Frozen Waffles	Price of 10 waffles, buttermilk or plain flavored, store brand, prebaked, 12.3 oz.	On-Site	315

## FOOD AWAY FROM HOME

Food away from home items consisted of a cheeseburger meal, a pizza, and a steak meal. Prices for these items were gathered by in-person visits to restaurants throughout the state. The number of restaurants to be visited was determined with a sampling algorithm developed by Corona Research, applied to a database of business listings provided by Dun & Bradstreet that was supplemented with DexOnline directory listings. All sampling for food away from home items was done at the school district level after coding the business listings to the appropriate school district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.

Detailed descriptions of the food away from home items in the market basket and the number of prices collected are provided in the table below.

<b>Food Away From Home</b>				
<b>CES Category</b>	<b>Specific Item</b>	<b>Description</b>	<b>Collection Method</b>	<b>N of Observations</b>
Restaurants	Lunch	Price for cheeseburger, French fries and regular Coke.	On-Site	460
Restaurants	Dinner	Price for pepperoni pizza, regular or thin crust, 14" diameter (note size if other).	On-Site	298
Restaurants	Dinner	Price for 12 oz. New York Strip steak, potato, soup or salad, and coffee. If New York strip not available, price Sirloin or Ribeye. Note size of steak if not 12 oz. DO NOT PRICE CHOPPED SIRLOIN.	On-Site	308

## ALCOHOLIC BEVERAGES

Alcoholic beverage prices were collected for a 6-pack of beer. Prices were gathered by in-person visits to grocery and liquor stores throughout the state. Beer was treated as a grocery item and so the initial sample of stores were the grocery stores selected by the food at home sampling. However, because not all grocery stores sell beer, the sample of stores was supplemented with a list of Liquor Stores from Dun and Bradstreet. All sampling for alcoholic beverages was done at the school district level after coding the business listings to the appropriate school district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.

A detailed description of the alcoholic beverage item in the market basket and the number of prices collected are provided in the table below.



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## Alcoholic Beverages

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CES Category	Specific Item	Description	Collection Method	N of Observations
Alcoholic beverages	Beer	Price for a 6-pack of 12 oz. cans Coors Light or Original beer, 3.2% alcohol by volume. If Coors not available, price Budweiser.	On-Site	577

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### HOUSING

#### *Shelter – Mortgage payment/ Property taxes*

Mortgage payments were provided by an outside consultant as in previous years. Corona Research added property tax estimates based Division of Property Taxation website. ([http://www.dola.state.co.us/dpt/publications/docs/2005\\_annual\\_report/SECXI.pdf](http://www.dola.state.co.us/dpt/publications/docs/2005_annual_report/SECXI.pdf)). This report was the most recent available data from the Division of Property Taxation.

#### *Shelter – Homeowner’s Insurance*

In obtaining homeowner’s insurance rates, hazard insurance was sought for a \$100,000 frame dwelling built in 1970 with \$80,000 contents coverage, \$100,000 liability/medical payments, and a \$250 deductible. These are the same specifications use in previous studies. Two homeowner’s insurance companies were willing to provide homeowner insurance rates by zip code to Corona Research to be used in the study. The rates were averaged to the county level, and then district averages were created from the final county homeowner’s insurance rates. The final rates for each district were weighted from the two companies based on their respective market share and then the weighted rate from each insurance company was summed to get a total (final) weighted rate for each district.

#### *Utilities - Electric*

In order to calculate the average monthly electric bill for residents around the state, Corona examined the 2006 Annual Reports filed by electric companies from around the state with the Colorado Public Utilities Commission (PUC). The detailed reports filed by electric companies provide enough information to calculate an average bill (for a company’s service area). After all of the 2006 annual reports were gathered and analyzed, electric bill monthly rates were assigned to school districts based on the service areas for all electric companies operating in the state of Colorado.

#### *Utilities - Gas*

The methodology used to calculate the average monthly natural gas bill for Colorado school districts was similar to that described for electric providers (see above). Every natural gas provider operating in the state of Colorado is required to file natural gas sales figures by community with the Public Utilities Commission (PUC). These detailed reports were used to calculate an average bill for

each service area. After all of the 2006 annual reports were gathered and analyzed, natural gas monthly rates were assigned to school districts based on the service areas for all natural gas providers. It should also be noted that some service areas do not utilize natural gas, but instead depend on propane for their heating needs. In specific cases where services areas (and the school districts residing within those areas) used propane, Corona used data from the Energy Information Administration to calculate the relative cost of using propane for energy instead of natural gas, based on the actual energy output for each fuel in BTU's and the 2006 average cost for each fuel in Colorado. After determining this "conversion factor," the cost of propane service for each school district without natural gas service was computed by averaging the natural gas bills of the surrounding districts and inflating that average based on the analysis described above.

### *Utilities - Telephone*

In order to calculate the average monthly telephone bill for residents around the state, Corona obtained telephone rates from the Public Utilities Commission's "2006 ILEC Annual Report." This report detailed the monthly base rates being charged by each "incumbent local exchange carrier" around the state. Once again, the methodology used to calculate the average monthly telephone bill within each school district mirrored the methodology described for electricity providers. The monthly base rates detailed in the "2006 ILEC Annual Report" were assigned to each of the school districts based on the providers' coverage areas. Additional to the base rates found in each school district, a variety of other fees (different depending on the area and provider) were incorporated into the final total monthly telephone bill for an area (and ultimately school district). Final monthly telephone rates were calculated for each district depending on the service providers in a districts area and the different fees attached to those providers operating within a specific school district.

### *Utilities – Water/Sewer*

In order to determine the average monthly payments for water and sewer bills in each school district, Corona Research conducted a telephone survey of over 250 cities throughout the state of Colorado in order to collect water/sewer rate information for municipalities located within Colorado's school districts. An attempt was made to collect data from each of the 256 agencies contacted in previous studies, but in certain municipalities or areas where no contact information could be found, no data could be found or in towns that used only wells or septic tanks, proxy values were used based on the rates charged in the nearest town. Once all water/sewer rate information was collected, final district averages were calculated and weighted based on the total populations of cities and municipalities located within a school district.

### *Household Operations – Day Care*

The average cost of day care for the 2007 Cost of Living study was based on day care costs in each county in Colorado. Average day care cost information was obtained from the 2007 Market Rate Survey of Child Care Providers, conducted by Qualistar Early Learning. The Market Rate Survey of Child Care Providers provides full-time weekly rates of caring for children between 0 and 2 years, and 2 to 6 years in all 64 Colorado counties.

In determining the average weekly costs for childcare services, the average of child care centers (CCC's) and family care centers (FCC's) for both age groups provided, 0 to 2 years and 2 to 6 years,

was calculated. The averages were then weighted appropriately since rates were reported in 2 year (0 to 2 years) and 4 year (2 to 6 years) increments. Weekly rates were then converted to a monthly cost by multiplying the weekly cost of care by 52 weeks per year and then dividing it by 12. Final district average prices were assigned from the appropriate county in which the district resides.

### *Housekeeping Supplies – Laundry Soap*

Expenditures for housekeeping supplies were gathered by collecting prices for laundry soap. Prices were gathered by in-person visits to grocery stores throughout the state. Laundry soap was treated as a grocery item and so the stores sampled were the grocery stores selected by the food at home sampling. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey to produce final prices for each district.

A detailed description of the housekeeping supplies item in the market basket and the number of prices collected are provided in the table at the end of this section (below).

### *Household Furnishings and Equipment - Mattress*

Expenditures for household furnishings were gathered by collecting prices for mattresses. Prices were gathered by in-person visits to furniture and mattress stores throughout the state. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey to produce final prices for each district.

A detailed description of the household furnishings item in the market basket and the number of prices collected are provided in the table at the end of this section (below).

## Housing

CES Category	Specific Item	Description	Collection Method	N of Observations
Shelter	Mortgage Payment	Mortgage payment, including principle, interest, and property taxes, based on housing values provided buy outside consultant	Online	
Shelter	Homeowners' Insurance	\$100,000 frame dwelling built in 1970. \$80,000 contents coverage, \$100,000 liability/medical payments. \$250 deductible	Call	
Shelter	Home Maintenance	Average hourly cost of labor for household maintenance and repair tasks per the State of Colorado Occupational Employment Statistics.	Database (Census & Occupational Employment Statistics)	
Utilities	Utilities	Annual average bill for electric, natural gas, telephone, and water and sewer services collected from utility providers throughout the state.	PUC Database/Call	
Household Operations	Day Care Services	Weekly cost of daycare.	Database	1 per county
Housekeeping Supplies	Laundry Soap	Price for 100 Fl. oz. of Tide liquid household laundry detergent. If Tide is not available, price of Cheer.	On-Site	379
Household furnishings and equipment	Mattress	Price of Queen size mattress. Sealy Posturepedic with 736 coils where possible. If not available, price Simmons Beautyrest with 759 coils, then SpringAir with 700 coils, then Serta with 800 coils. Price full set (mattress / box spring.) Find out if price includes bed frame and delivery in local area. If not, get prices for frame and delivery.	On-Site	99

## APPAREL

Apparel items consisted of men's dress shirts, men's T-shirts, women's turtlenecks, women's jeans, and women's dress shoes. Prices for these items were gathered by in-person visits to clothing stores throughout the state. The number of clothing stores visited was determined with a sampling algorithm developed by Corona Research and applied to a database of business listings provided by Dun & Bradstreet. The Dun & Bradstreet list was also supplemented with lists of Wal-Mart Supercenters and Super Targets so that apparel prices would also be obtained at these supercenters. All sampling for clothing items was done at the school district level after coding the business listings to the appropriate school district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then

average prices were weighted using the shopping patterns survey results to produce final prices for each district.

Detailed descriptions of the apparel items in the market basket and the number of prices collected are provided in the table below.

<b>Apparel</b>				
<b>CES Category</b>	<b>Specific Item</b>	<b>Description</b>	<b>Collection Method</b>	<b>N of Observations</b>
Men and Boys	Men's Dress Shirt	Price for white or solid color Oxford (button-down collar), long sleeve, button cuff shirt. Arrow brand where possible, poly/cotton blend. If store does not have Arrow, price comparable label (inexpensive).	On-Site	207
Men and Boys	Men's T Shirt	Price for one 3-pack of men's white t-shirts, v-neck. Hanes brand where possible, Fruit of the Loom or Jockey, otherwise 100% cotton. Must be in a 3 pack.	On-Site	147
Women and Girls	Women's Turtleneck	Price of long sleeve turtleneck shirt, black, store label, with minimum trim. Poly/cotton blend if available. If there is no store label, price least expensive brand.	On-Site	218
Women and Girls	Women's Jeans	Price of Lee Jeans, relaxed fit, not shone washed, 5-pocket. The "Circle-X" label where possible, "Riders" otherwise. If Lee not available record brand and price of least expensive store brand.	On-Site	199
Footwear	Women's Shoes	Price of black leather women's pump, 1" heel, no trim, store brand, size 7.5, with leather uppers and sole. If store has no brand label, price least expensive brand.	On-Site	161

## TRANSPORTATION

### *Vehicle Financing*

Vehicle financing estimate were derived by contacting lending institutions in all possible districts and gathering data on finance rates for a four-year loan for a 2005 Honda Civic. The Corona Research team then calculated a monthly payment that included the purchase price, loan charges, and any applicable taxes, title fees, or registration fees.

### *Vehicle insurance*

Insurance companies with a large market share for vehicle insurance in Colorado were determined by analyzing the 2006 "Annual Report of the Commissioner of Insurance" These

companies were contacted to determine vehicle insurance rates by zip code. Insurance rates were gathered and averaged for two vehicles types.

### *Vehicle expenses – Oil Change & Front-End Alignment*

Vehicle maintenance expense items consisted of oil changes and front-end alignments. Prices for these items were gathered by phone calls to auto repair shops throughout the state. The number of shops to sample was determined with a sampling algorithm developed by Corona Research which was applied to a database of business listings provided by Dun & Bradstreet. In areas where the original Dun & Bradstreet list of business was insufficient, Dex Online yellow pages were utilized to create a more robust list of vehicle maintenance businesses. All sampling for vehicle maintenance items was done at the school district level after coding the business listings to the appropriate district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added where applicable, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.

Detailed descriptions of the vehicle maintenance items in the market basket and the number of prices collected are provided at the end of this section.

### *Gasoline*

Gasoline prices were gathered on a single day by phone calls and visits to gas stations throughout the state. The number of shops to sample was determined with a sampling algorithm developed by Corona Research which was applied to a database of business listings provided by Dun & Bradstreet. In areas where the original Dun & Bradstreet list of business of gas stations was insufficient, Dex Online yellow pages were utilized to create a more robust list of gas stations. All sampling for gasoline prices was done at the school district level after coding the business listings to the appropriate district. After prices were collected, the dataset of prices for each item was screened for outliers, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.

Detailed descriptions of the vehicle maintenance items in the market basket and the number of prices collected are provided in the table below.

## Transportation

CES Category	Specific Item	Description	Collection Method	N of Observations
Transportation	Vehicle Payment	Payment calculated using Blue Book purchase value and interest rate on loan for full purchase price and bank charges for 2005 Honda Civic for four years. (2003 Honda Civic LX Sedan, 4-door. Engine: 4-cyl. 1.7 liters. Trans: 5-speed manual. Mileage: 24,000. Amenities: air conditioning, pwr. steering, cruise control, air bags.)	Online (Bluebook Values)  Call	
Transportation	Vehicle Insurance	Insurance premiums for 2005 Ford Ranger and 2003 Honda Civic (2001 Ford Ranger XL Long Bed Pickup. Engine: V6 4.0 liter, Trans: 5-speed manual, Drive: 2-wheel drive. Mileage: 60,000. Amenities: A/C, pwr. steering, cruise control, air bags standard) (2003 Civic described above)	Call	
Transportation	Oil and Filter Change	Price of an oil and filter change for a 2003 Ford Ranger pickup. Oil must not be synthetic; filter should be the least expensive available.	Call	221
Transportation	Front-End Alignment	Price of front-end alignment for a 2003 Ford Ranger pickup; 2 wheel drive.	Call	170
Transportation	Gasoline	Price of self-serve, 85 Octane, unleaded gasoline.	Call (one-day)	424

### HEALTH CARE - HEALTH INSURANCE MONTHLY PREMIUM

In order to determine the average monthly health insurance premium rate in each school district, Corona Research collected rate information from four of the largest health insurance providers in the state. Data was collected for PPO's from three of the companies, and an HMO from the remaining provider. Rates for three different plans were collected from each company: a high-end, mid-range, and low-end plan. Costs were collected by zip code and/or county, and then final health care costs were assigned to school districts (based on the zip code or county final health care costs).

## Health Care

CES Category	Specific Item	Description	Collection Method	N of Observations
Health Care	Health Insurance Premium	Monthly cost of family health insurance coverage for a family of three, all non-smokers, all in good health.	Database	9 - 12 per county

### ENTERTAINMENT

Entertainment items consisted of movie tickets, a DVD player, batteries, and pet food. Prices for movie tickets were gathered by phone calls to movie theaters throughout the state. Prices for

DVD players, batteries, and pet food were gathered by in-person visits to grocery and electronics stores throughout the state. The number of stores visited was determined with a sampling algorithm developed by Corona Research that was applied to a database of business listings provided by Dun & Bradstreet. The Dun & Bradstreet list was also supplemented with lists of Wal-Mart Supercenters and Super Targets so that entertainment item prices would also be obtained at these supercenters. All sampling for entertainment items was done at the school district level after coding the business listings to the appropriate school district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added where applicable, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.

Detailed descriptions of the entertainment items in the market basket and the number of prices collected are provided in the table below.

<b>Entertainment</b>				
<b>CES Category</b>	<b>Specific Item</b>	<b>Description</b>	<b>Collection Method</b>	<b>N of Observations</b>
Fees and Admissions	Movie	Price of adult admission to a first-run, full-length movie.	Call	80
Television, Radios, Sound Equipment	DVD Player	Single-disc player, NO DVR (i.e., TIVO), Blu-Ray/HD format, recorder, or combo units (i.e., vcr included); Sony, if not available then Panasonic, otherwise cheapest brand offered.	On-Site	167
Other supplies, equipment, and services	Batteries	4 Pack AA Batteries. Energizer brand; if not available then cheapest 4 pack of AA. DO NOT PRICE LITHIUM BATTERIES.	On-Site	440
Pets, Toys, and Playground Equipment	Pet Food	Price for a 5.5 oz. can of Friskies cat food. If Friskies not available, price of 9 Lives or Whiskas.	On-Site	407

#### PERSONAL CARE PRODUCTS AND SERVICES

Personal care items consisted of haircuts, shaving cream, toothpaste, and tampons. Prices for haircuts were gathered by phone calls to beauty and barber shops throughout the state. Prices for shaving cream, toothpaste, and tampons were gathered by in-person visits to grocery stores throughout the state. The number of stores visited was determined with a sampling algorithm developed by Corona Research that was applied to a database of business listings provided by Dun & Bradstreet. The Dun & Bradstreet list was also supplemented with lists of Wal-Mart Supercenters and Super Targets so that personal care product prices would also be obtained at these supercenters. All sampling for personal care items was done at the school district level after coding the business listings to the appropriate school district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added where applicable, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.



Detailed descriptions of the personal care items in the market basket and the number of prices collected are provided in the table below.

<b>Personal Care Products and Services</b>				
<b>CES Category</b>	<b>Specific Item</b>	<b>Description</b>	<b>Collection Method</b>	<b>N of Observations</b>
Personal Care Services	Man's Haircut	Price of man's wash, cut and dry	Call	510
Personal Care Services	Woman's Haircut	Price of woman's wash, cut and dry	Call	498
Personal Care Products	Shaving Cream	Price of Colgate regular shaving cream 11.0 oz.	On-Site	378
Personal Care Products	Toothpaste	Price of Crest regular Paste Tartar Protection 6.4 oz.	On-Site	393
Personal Care Products	Tampons	Price for one box of 20 Tampax Regular Absorbency (not the slender style.) Note if different size box.	On-Site	371

#### TOBACCO

Tobacco and smoking expenditures were represented by a carton of cigarettes. Prices for cigarettes were gathered by in-person visits to grocery stores throughout the state. The number of stores visited was determined with a sampling algorithm developed by Corona Research that was applied to a database of business listings provided by Dun & Bradstreet. The Dun & Bradstreet list was also supplemented with lists of Wal-Mart Supercenters and Super Targets so that tobacco prices would also be obtained at these supercenters. All sampling for tobacco items was done at the school district level after coding the business listings to the appropriate school district. After prices were collected, the dataset of prices for each item was screened for outliers, taxes were added, average prices were computed for each district, and then average prices were weighted using the shopping patterns survey results to produce final prices for each district.

A detailed description of the tobacco item in the market basket and the number of prices collected are provided in the table below.

<b>Tobacco Products/Smoking Supplies</b>				
<b>CES Category</b>	<b>Specific Item</b>	<b>Description</b>	<b>Collection Method</b>	<b>N of Observations</b>
Tobacco	Cigarettes	Price for one carton (200 cigarettes) of Winston Filter, king size, soft pack cigarettes.	On-Site	412

#### READING, EDUCATION, AND MISCELLANEOUS EXPENSES

The major expenditure categories for Reading, Education, Miscellaneous Expenses, Cash Contributions, Personal Insurance and Pensions and Personal Taxes were considered to be constant for the relevant benchmark household and were not sampled in this 2007 Cost of Living study. These categories have been held constant throughout all previous Cost of Living studies. No

geographical variations are expected for these across the state of Colorado, so all districts receive the same average costs for each of these categories.

## DEVELOPING FINAL COST OF LIVING MEASURES

After the collection of all pricing data and shopping patterns data, two major steps were taken to develop the final cost of living measures. First, the price data for the market basket items was integrated with 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 by the typical expenditure on that item according to the Consumer Expenditure Survey. This second step scales up costs so that the limited number of (for example) grocery items for which data are collected represent the full expenditures for food for the archetypal household. Each of these steps is described in further detail below.

### INTEGRATE PRICE DATA WITH SHOPPING PATTERNS SURVEY

People do not make all of their purchases in the school district in which they live. The shopping patterns survey gathered data about where people shop for 17 categories of items and services: produce, perishable groceries, non-perishable groceries, alcoholic beverages, pet food, household products, casual clothes, dress clothes, shoes, cars, gas, car maintenance and repair, mattresses, DVD players, movie tickets, and where they go for haircuts and restaurant meals. For each of these items, Corona Research developed matrices that specify where people living in each district shop for each item. 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 Northglenn-Thornton. By multiplying the shopping patterns matrices that link “home district” with “shopping districts”, regional variations in costs and shopping preferences are reflected.

### 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.

The majority of the market basket items were sampled by school district in 2007, as opposed to community in the 2005 study. In a few cases the data was only available at a county or region level, and needed to be applied to districts based on location. Utilities prices, day care 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 conducted for each market basket item, and then all of the expenditures on items in a common category were added 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 available from that district. These variances were weighted by the shopping patterns for each district and the teacher populations to calculate a state average variance, and 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. Details of the statistical methods involved are provided in an appendix to the 2005 Cost of Living Report, and are also discussed in Appendix G of this 2007 report.

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 even 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 G 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 direct by major expenditure category.

Readers receiving this report electronically will need to review an accompanying spreadsheet file, due to the volume of data.

## APPENDIX B: DETAILED METHODOLOGICAL NOTES – DATA COLLECTION

In Section 4 of the report, a methodological overview is provided regarding the data collection methods for each major expenditure category, and for the development of geographic shopping patterns matrices. This appendix provides additional detail on those topics for the interested reader.

In the bulk of this appendix, data collection techniques are expanded upon. Notable sampling techniques, data collection procedures and weighting techniques are expanded upon for each major expenditure category. When sampling, data collection, and weighting techniques were identical between expenditure categories, these techniques will not be repeated in each write-up in order to reduce redundancy.

### FOOD AT HOME

All Food At Home item prices were collected in-person throughout the school districts. Business listings for grocery stores in Colorado were collected from the Dun & Bradstreet database. This list was supplemented with a complete list of Wal-Mart Supercenters and Super Target locations. Corona labeled each of the businesses with the school district it is located in using arc-GIS software. Then we developed a sampling plan based on the number of businesses in each school district, which resulted in a goal of sampling the larger of five (businesses) or five percent of businesses in each district. Corona attempted to sample all businesses from districts with fewer than five stores in a given category. In metro area districts with large numbers of businesses in each category, the businesses to be sampled were chosen based on store revenues provided by Dun & Bradstreet. The total revenue for a district was divided by the number of stores to be sampled from that district ( $n$ ), then stores were rank-ordered by their revenue values and one store was chosen from each  $n$ -tile of the distribution.

Field research was then conducted by a team of data collectors who visited each district and attempted to collect prices from the number of stores identified by the sampling plan. Prices were not to be gathered from gas stations; and convenience stores were to be avoided unless no other businesses could be identified in the district. Data collection sheets were then entered into a database, which was randomly checked for human error in data entry. The database was checked for outliers by identifying prices that were outside three standard deviations from the mean for their region (using regions from the shopping patterns survey to group similar districts together). Grocery tax for each location was then added to each price, and an average price was calculated for each district.

### FOOD AWAY FROM HOME

All Food Away From Home item prices were collected in-person throughout the school districts. Business listings for eating places in Colorado were collected from the Dun & Bradstreet database, and then Corona labeled each by school district using arc-GIS software. The sampling plan for items in the Food Away From Home Category was developed similarly to the Food At Home Category (see above). The main difference between the sampling for the Food Away From Home Category was data collectors were asked to obtain three different prices for each of the three different Food Away From Home items (that would be three different prices in each district for cheeseburgers meals, pizza meals and steak meals). In Colorado metro areas with a plethora of eating places, data collectors were instructed to obtain an increased number of prices for each Food Away From Home

item so that the overall sample for those districts would be more representative of the overall eating places district population. Corona attempted to sample all businesses from districts with fewer than three stores in a given category (cheeseburger, pizza or steak eating places).

Field research was collected and entered with the same method as described in the Food At Home section (see above). It should be noted that prices were not to be gathered from fast food restaurants, even if no other eating places were available within a specific school district. All outliers for Food Away From Home were analyzed and checked with the same method described in the Food At Home Section (see above). Dining tax for each location was then added to each price, and an average price was calculated for each district.

### ALCOHOLIC BEVERAGES

All Alcoholic Beverage item prices (a six pack of beer) were collected in-person throughout the school districts. Alcoholic Beverage prices and Food At Home items were collected at the same time and utilized the same methodology (see **Food At Home detailed methodology**, above). Beer prices were collected at all grocery stores where beer was sold. In districts where beer prices were not obtainable at grocery stores (or if there were too few grocery stores available in a district), data collectors were instructed to obtain beer prices at local convenience or liquor stores. It should be noted that business listings for liquor stores in Colorado were collected from the Dun & Bradstreet database and added to the final data collector list of stores to be sampled (data was collected primarily at liquor stores in districts that had fewer than five total grocery stores to be sampled). Liquor stores were also geo-coded and labeled to the appropriate district using arc-GIS.

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district.

### HOUSING

#### SHELTER – MORTGAGE PAYMENT/PROPERTY TAXES

Mortgage payments were provided to Corona Research by the Colorado Legislative Council via a study by an outside consultant, based on a specified home size. This is the same approach used in previous years.

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 7.96%. 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.

In order to get mill levies, the 2005 annual report for the Department of Local Affairs Division of Property Taxation was obtained from Division of Property Taxation website. ([http://www.dola.state.co.us/dpt/publications/docs/2005\\_annual\\_report/SECXI.pdf](http://www.dola.state.co.us/dpt/publications/docs/2005_annual_report/SECXI.pdf)). This report was the most recent available from the Division of Property Taxation. The report includes 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 (7.96%) 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). This value is the property tax. This process was repeated for all school districts.

#### SHELTER – HOMEOWNER’S INSURANCE

Insurance companies with a large market share for homeowner’s insurance in Colorado were determined by analyzing the 2006 “Annual Report of the Commissioner of Insurance”. These companies were contacted to determine homeowner’s insurance rates by zip code. In obtaining homeowner’s insurance rates, hazard insurance was sought for a \$100,000 frame dwelling built in 1970 with \$80,000 contents coverage, \$100,000 liability/medical payments, and a \$250 deductible. These are the same specifications use in previous studies.

The rates were provided by zip code. Once the zip codes for each county were determined, the rates for each zip code were averaged for each county so that rates by school district could be determined. Two companies gave rate information for homeowner’s insurance, and those companies make up approximately 37% of the total market share. The rates for each company were weighted using their respective market share (i.e. Company A market share/(Company A market share + Company B market share), producing a weighted rate for homeowner’s insurance. The weighted rate from each insurance company was summed for homeowner’s insurance to get a total weighted rate for each school district.

#### SHELTER – HOME MAINTENANCE/REPAIRS

The Shelter subcomponent also included costs for household maintenance and repairs. Data from the U.S. Bureau of Census data provided information regarding the typical costs residents spent on maintenance and repairs such as painting, plumbing, heating/air conditioning, electrical, and other miscellaneous services. The research team developed weights for each of these areas as a function of maintenance expenditures, as a percentage of the total spending on maintenance and repairs

Once relative weights for the services were determined, Corona Research obtained regional Occupational Employment Statistics (OES) wage data by occupation for the state of Colorado for six different regions within the state. These wage levels were used as a proxy for measuring the relative costs of household maintenance and repairs. Overall costs for the maintenance and repairs component were measured by region and then mapped into the appropriate school districts.

#### UTILITIES – ELECTRIC

In order to calculate the average monthly electric bill for residents around the state, Corona examined the 2006 Annual Reports filed by electric companies from around the state with the Colorado Public Utilities Commission. Specifically, these reports contain data about each company’s annual residential revenues and average number of residential customers. Using this information, it is possible to calculate an average bill, which includes both base and usage fees charged by each electric company.

In a select few cases, data for a company or municipality electric provider was not available from the Public Utilities Commission. In such cases, telephone calls were made to the offices of the



appropriate organization to obtain their annual revenues and number of customers so that an average billing rate could be calculated as described above.

After an average bill had been calculated for each of the state's electric providers, these rates were assigned to each of the school districts. In cases where a single organization provides electric service for the entire school district, this process was very straightforward. In some cases, however, a single school district may have as many as three major electric providers. In this situation, the school district's average billing weight was calculated by averaging the district's billing rates, weighted by the number of people in the district covered by each electric provider.

One possible limitation of this methodology is that each electric provider's annual report only contains data on their service area as a whole. For some providers which have a fairly small service area, this likely results in an accurate value being assigned to each school districts. For providers which serve a highly-varied area, however, this average may tend to underestimate the high-usage areas and overestimate the low-usage areas.

#### UTILITIES – GAS

In order to calculate the average monthly natural gas bill for residents around the state, Corona used a methodology very similar to that described for electric providers. Each of the state's natural gas providers is required to file their sales of natural gas by community with the PUC each year. As with the annual reports for electric providers, these filings contain annual residential revenues and residential customers for each of the providers' service areas. This data can then be used to calculate an average bill for each service area.

Unlike electric providers, which report their revenues and customer counts across the entire state, natural gas providers are required to provide their data for each of their individual service areas. For this reason, the average bill for each service area should be very accurate, since the geographic coverage of each service area is relatively small.

After compiling the average monthly bill for each service area, these values were allocated to the school districts covered by each area as was done for both electric and telephone providers. Again, in areas where multiple providers serve a single school district, a weighted average based on population size covered was used to calculate the rate to be assigned to each district.

One unique aspect of determining an average bill for natural gas across the state is that some school districts depend on propane for their heating needs rather than natural gas. While it is possible to gather information on propane *prices* around the state, propane providers do not have an accurate measurement of the actual propane *usage* in their area. Trying to estimate the true cost of propane service based on some estimated usage value, therefore, would likely be very inaccurate. Instead, Corona used data from the Energy Information Administration to calculate the relative cost of using propane for energy instead of natural gas, based on the actual energy output for each fuel in BTU's and the 2006 average cost for each fuel in Colorado.

After determining this "conversion factor," the cost of propane service for each school district without natural gas service was computed by averaging the natural gas bills of the surrounding districts and inflating that average based on the analysis discussed above. This analysis should yield a far more robust analysis than simply estimating the usage in each area arbitrarily.

## UTILITIES – PHONE

In order to calculate the average monthly telephone bill for residents around the state, Corona obtained telephone rates from the Public Utilities Commission’s “2006 ILEC Annual Report.” This report detailed the monthly base rates being charged by each “incumbent local exchange carrier” around the state. Each provider charges the same rate throughout their service area, with the exception of CenturyTel. In this case, each of CenturyTel’s rate areas was considered to be a separate provider for the purposes of computing an average bill.

Similar to the process used for electric providers, these rates were assigned to each of the school districts based on the providers’ coverage areas. In areas where multiple providers serve a single school district, a weighted average based on population size covered was used to calculate the rate to be assigned to each district.

In addition to the base rates being charged by each company, a variety of other fees contribute to the total monthly bill in an area. First, a number of fees are assessed on telephone bills across the entire state. Specifically, the high cost surcharge, hearing impaired relay fund, low income surcharge, and subscriber line charges are the same across the entire state. Similarly, state taxes were applied for all districts. Other charges, such as the 911 surcharge, vary from one area of the state to another. These charges were, therefore, applied on a district-by-district basis to calculate the overall average bill.

## UTILITIES – WATER/SEWER

In order to determine the average monthly payments for water and sewer bills in each school district, Corona Research collected rate information for 256 cities and towns throughout the state. The data collection was initiated by using a spreadsheet that held contact data and information from similar research performed in 2005. Corona employees attempted to collect data from each of the 256 agencies; most of the information was collected via phone calls, although rates for some towns were found online. Phone calls proved to be the fastest source of information in most cases. In the event that no contact information could be found, or if a town used only wells or septic tanks, proxy values were used based on rates charged in the nearest town.

After data collection was complete, equations for determining monthly totals were written into the spreadsheet for each of the 256 towns. The equations figured rate totals based on a home that uses 6,000 gallons of water per month, and produces 6,000 gallons of wastewater for processing per month. These totals were then applied to the appropriate school districts. In some cases, rates had only been researched for one town within a district; in these cases, that rate was simply applied to the entire district. Other school districts were host to multiple towns, and data had been collected from several towns within the district. In those cases, each rate was weighted according to population so that a more accurate value for each district could be determined.

## HOUSEHOLD OPERATIONS – DAY CARE

In order to determine the average cost of day care in each Colorado county, information was first based on content from the 2007 Market Rate Survey of Child Care Providers, conducted by Qualistar Early Learning. Qualistar Early Learning is the result of a merger that occurred in 2004 between two early education non-profit organizations based in Colorado – Educare Colorado and the Colorado Office of Resource and Referral Agencies (CORRA). Qualistar Early Learning is under

contract to the Colorado Department of Human Services, Division of Child Care as the State Resource and Referral Agency. As part of this contract they conduct this bi-yearly market research study of state-wide day care costs.

Included in the Market Rate Survey of Child Care Providers are costs for licensed child care centers (CCC), family child care providers (FCC), and school-age child care (SACC) facilities in all 64 counties. Full-time weekly rates of caring for children between 0 and 2 years, and 2 to 6 years are provided in Qualistar's report.

In determining the average weekly costs for childcare services, the average of child care centers (CCC's) and family care centers (FCC's) for both age groups provided, 0 to 2 years and 2 to 6 years, was calculated. The averages were then weighted appropriately since rates were reported in 2 year (0 to 2 years) and 4 year (2 to 6 years) increments. Weekly rates were then converted to a monthly cost by multiplying the weekly cost of care by 52 weeks per year and then dividing it by 12.

The majority of Colorado school districts were contained within one county, making this mathematical process fairly straight-forward. Broomfield County was an exception, however, as it is the newest county in Colorado. Broomfield County overlapped into several other school districts (primarily the Boulder Valley and Northglenn school districts), so additional weights were applied to those districts to incorporate the values from each of the counties represented in each district. In total, it was approximated that 9.73 percent of the Boulder Valley school district was actually in Broomfield County, and therefore this percentage from Broomfield County was applied to the final Boulder Valley school district day care average.

#### HOUSEKEEPING SUPPLIES – LAUNDRY SOAP

All Housekeeping Supplies item prices were collected in-person throughout the school districts. Laundry soap was used as the item to be collected for the Housekeeping Supplies Category. Laundry Soap prices were collected at the same time and using the same sampling methodology described for Food At Home items (see **Food At Home Methodology Section**, above).

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district.

#### HOUSEHOLD FURNISHINGS AND EQUIPMENT – MATTRESS

Mattress prices were used to represent the Household Furnishings and Equipment category. Mattress prices were collected in-person throughout the school districts. Business listings for mattresses in Colorado were collected from the Dun & Bradstreet database, and then Corona labeled each by school district using arc-GIS software. The sampling plan for mattresses was developed similarly to the Food At Home Category (see **Food At Home Methodology section**, above) in that the goal was to sample the larger of five (mattress businesses) or five percent of mattress businesses in each district.

Data collectors were instructed to get prices for one of four specific brands of mattresses (Sealy Posturepedic – 736 coil count, Simmons Beautyrest – 759 coil count, Spring air – 700 coil count, or

800 coil count) which were agreed to be relatively comparable items by the Corona Research and Colorado Legislative Council. Due to the multitude of different mattress options available at different stores throughout the state, those four brands specified in the market basket were sometimes not readily available for pricing at each store visited. When this was the case, data collectors were instructed to obtain help from mattress sales representatives to find the mattress in that store which was most comparable to the target mattress brands in the market basket.

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district.

## **APPAREL**

Apparel prices were collected in-person throughout the school districts. The apparel items to be collected for the Apparel Category included Men's Dress Shirt, Men's T-shirt, Women's Jeans, Women's Turtle Neck, and Women's Shoes. Business listings for apparel business in Colorado were collected from the Dun & Bradstreet database. The Dun & Bradstreet list was also supplemented with lists of Wal-Mart Supercenters and Super Targets so that apparel prices would also be obtained at these supercenters. Corona then geo-coded and labeled each apparel store into the appropriate school district using arc-GIS software.

Similar to the sampling plan detailed in Food At Home (see above), the sampling plan for apparel was based on the number of businesses in each school district, which resulted in a goal of sampling the larger of five (apparel stores) or five percent of apparel stores in each district for each apparel item. Corona attempted to sample all apparel stores from districts with fewer than five stores in a given category. Overall, in each district it was the minimum goal to obtain five different prices for each item, but this was not possible in many districts which did not have five total apparel stores.

It should be noted that specific brands and types of clothing items were targeted for pricing for each item, but often those specific brands would not be available within a given store. When this was the case, data collectors were instructed to find brands and item types which most closely replicated the initial target brands.

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price for each apparel item was calculated for each district.

## **TRANSPORTATION**

### **VEHICLE FINANCING**

Vehicle pricing was gathered for a 2005 Honda Civic. The purchase price of the 2005 Honda Civic, \$16,670 per blue book information, 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, as had been assumed in previous cost of living studies. Financing rates for vehicle loans were obtained from telephone surveys of banking institutions and credit unions throughout the state. The list of banking institutions to survey came from information provided by the Federal Deposit Insurance Corporation (FDIC) and National Credit Union Administration (NCUA) which provided market share information for the institutions. This data was gathered on a county basis and then mapped to the district level to obtain the rate for each district. Average monthly car payments were then calculated, given the total amount financed (including the purchase price, all bank loan charges, and

any applicable tax, title, and registration fees) and the interest rate charged by the bank or credit union.

#### VEHICLE INSURANCE

Insurance companies with a large market share for vehicle insurance in Colorado were determined by analyzing the 2006 “Annual Report of the Commissioner of Insurance” These companies were contacted to determine vehicle insurance rates by zip code.

For vehicle insurance, two vehicles were used to calculate rates. The first vehicle was a 2005 Honda Civic LX sedan with a four cylinder 1.7 liter engine, five speed manual transmission, 24,000 miles, air conditioning, power steering, power windows, power locks, tilt, cruise control, AM/FM CD, and dual airbags. The coverage was comprehensive with liability policy limits of \$25,000/\$50,000/\$15,000 with a \$250 deductible and 15,000 miles per year. The second vehicle was a 2005 Ford Ranger XL long bed pickup with a 4.0 liter V6 engine, 5 speed manual transmission with two wheel drive, 60,000 miles, air conditioning, power steering, cruise control, AM/FM CD, and airbags. The coverage was liability only with liability policy limits of \$25,000/\$50,000/\$15,000 with 15,000 miles per year. These two cars are similar to the ones used in previous studies and represent highly popular makes and models. The model year was updated from 2003 to 2005 from the previous study and some features had to be adjusted accordingly for this study. For each car and across each zip code, the driver’s characteristics were held constant. The driver was assumed to be a thirty year old married man with good credit and a good driving record. The particular characteristics of the driver were not vitally important because the comparison of the rates were done using ratios, and as long as the driver’s information was held constant by each insurance company, the utilization of the ratio method can be assumed to be a valid method of comparison. Data was given for six months, so the total of the two vehicle’s insurance was summed and multiplied by two to get the yearly rate for both cars.

The rates were provided by zip code. Once the zip codes for each county were determined, the rates for each zip code were averaged for each county so that rates by school district could be determined. Three insurance companies gave rate information for vehicle insurance, and they account for approximately 33% of the total market share for vehicle insurance. The rates for each company were weighted using their respective market share (i.e.  $\text{Company A market share} / (\text{Company A market share} + \text{Company B market share})$ ), producing a weighted rate for vehicle insurance. The weighted rate from each insurance company was summed for vehicle insurance to get a total weighted rate for each school district.

#### OIL AND FILTER CHANGE

Oil Change prices were collected by telephone for every district. Business listings for automobile maintenance and repair shops in Colorado were collected from the Dun & Bradstreet database, and Dex Online yellow pages information was used to supplement those lists when additional automobile maintenance shops were needed to sample in a specific district. Each gas station was then geo-coded and labeled into the appropriate school district using arc-GIS software. The Oil Change Prices obtained were for a 2003 Ford Ranger (see the Transportation table in Section 4)

Similar to the sampling plan detailed in Food At Home (see above), Corona attempted to sample the larger of five (gas stations) or five percent of all gas stations in each district. Ultimately in many of

the smaller (mostly rural) districts where fewer automotive maintenance and repair shops existed, an attempt to obtain oil change prices was made at any (and all) maintenance shops available in the district.

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district. It should be noted that sales tax was only applied to the parts of an oil change, and this was standardized across all oil change prices to reflect approximately 40 percent of the total oil change price. Therefore, 40 percent of all final oil change prices were taxed with the local sales tax, and the remaining 60 percent was left untaxed.

#### FRONT-END ALIGNMENT

Front-End Alignment prices were collected at the same time and with the exact same methodology as Oil Changes (see Oil Change Methodology, above). After all data was collected, entered and outliers were analyzed and removed, an average price was calculated for each district. It should be noted that no tax was applied to Front-End Alignment prices, because it is considered a service that is not taxed.

#### GASOLINE

Gasoline prices were gathered on a single day by phone calls and visits to gas stations throughout the state. All gas prices had to be obtained on the same day due to the relative instability of gas prices on a national and regional level. Unleaded grade 85 octane gasoline was priced for the category. Business listings for gas stations in Colorado were collected from the Dun & Bradstreet database. Each gas station was then geo-coded and labeled into the appropriate school district using arc-GIS software.

Similar to the sampling plan detailed in Food At Home (see above), the sampling plan for gas stations was based on the number of businesses in each school district, which resulted in a goal of sampling the larger of five (gas stations) or five percent of all gas stations in each district. Corona attempted to sample all gas stations from districts with fewer than five stores in a given category, and an attempt was made to obtain gas prices for each district (though some districts had no gas stations located in their boundaries or the few gas stations that were in their boundaries would not divulge that information over the phone).

After all data was collected, entered and outliers were analyzed and removed, an average price was calculated for each district.

#### HEALTH CARE

In order to determine the average monthly health insurance premium rate in each school district, Corona Research collected rate information from four of the largest health insurance providers in the state. Data were collected for PPO's from three of the companies, and an HMO from the remaining provider. Using each insurance provider's website, Corona employees gathered rates as they would apply to a family of three, all non-smokers, and in good health. The family of three was described as: 1 Male, 37, DOB 3/17/1970; 1 Female, 36, DOB 5/15/1971; and 1 Female, 6, DOB 6/7/2001. Most of the websites determined rates based on location within the state as indicated by county or zip code. In the cases when a zip code was required, the code from the applicable county seat was used.

Rates for three different plans were collected from each company: a high-end, mid-range, and low-end plan were priced from each. The plans are not necessarily comparable between all companies because benefits varied widely among the providers. In addition to recording plan rates, Corona employees also noted the benefits provided by each plan. The costs collected for each zip code were then applied to school districts within each county.

## ENTERTAINMENT

### MOVIE TICKET

Movie Ticket prices were collected by telephone for every district. Business listings for movie theaters in Colorado were collected from the Dun & Bradstreet database, and Dex Online yellow pages information was used to supplement those lists when additional movie theaters were needed to sample in a specific district. Each movie theater was then geo-coded and labeled into the appropriate school district using arc-GIS software.

Data collectors were instructed to obtain the price of an adult admission ticket for each movie theater sampled, and only movie theaters showing current release movies were sampled (no Dollar Movie Theater prices were used in the final district averages).

After all data was collected, entered and outliers were analyzed and removed, an average price for movie tickets was calculated for each district. It should be noted that no tax was applied to movie theater prices, because it is not considered a taxable good.

### DVD PLAYER

In previous Cost of Living Studies, the market basket good for Television, Radios and Sound Equipment was a 20 inch RCA television. Due to the increasing technological changes in the television landscape at the current time, Corona and the Colorado Legislative Council agreed to change this market basket good to a DVD player. DVD Player prices were collected in-person throughout all of the districts.

Business listings for electronics and home appliance stores in Colorado were collected from the Dun & Bradstreet database, and Dex Online yellow pages information was used to supplement those lists when additional electronics stores were needed to sample in a specific district. Each electronic store was then geo-coded and labeled into the appropriate school district using arc-GIS software.

Similar to the sampling plan detailed in Food At Home (see above), Corona attempted to sample the larger of five (electronics stores) or five percent of all electronics stores in each district. Ultimately, many of the smaller (mostly rural) districts often did not have electronics stores, and in those districts data collectors would do their best to obtain at least one price per district. In several districts, there were no DVD prices to be obtained (due to a general dearth of available stores selling DVD players in that district).

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district.

## BATTERIES

All battery prices were obtained in-person at the same time grocery prices were collected. Therefore, the sampling, data collection and analysis plan for batteries is exactly the same as described in the **Food At Home Methodology section** (see above).

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district. It should be noted that film was gathered in previous Cost of Living studies, and Corona Research and the Colorado Legislative Council agreed to substitute battery prices for film prices for the 2007 study.

## PET FOOD

All pet food prices were sampled in-person at the same time grocery prices were collected. Therefore, the sampling, data collection and analysis plan for pet food is exactly the same as described in the **Food at Home Methodology** described earlier in this section (see above). Cat food was the specific item priced for pet food.

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district.

## PERSONAL CARE PRODUCTS AND SERVICES

### PERSONAL CARE PRODUCTS - SHAVING CREAM, TOOTHPASTE, TAMPONS

All personal care product prices such as shaving cream, toothpaste and tampons were sampled in-person at the same time grocery prices were collected. Therefore, the sampling, data collection and analysis plan for shaving cream, toothpaste, and tampons is exactly the same as described in the **Food at Home Methodology** described earlier in this section (see above).

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price for each personal care product, and an average price was calculated for each district for each of the three products in this category.

## HAIRCUT

Both men's and women's haircut prices were collected by telephone for every district. Business listings for beauty salons and barber shops in Colorado were collected from the Dun & Bradstreet database, and Dex Online yellow pages information was used to supplement those lists when additional beauty salons/barber shops were needed to sample in a specific district. Each beauty shop/barber shop was then geo-coded and labeled into the appropriate school district using arc-GIS software.

Data collectors were instructed to ask for the price of full cut, wash and dry haircut. Each beauty salon/barber shop were asked for the price of both women's and men's haircuts, but some stores only offered either women's or men's cuts.



Corona attempted to sample the larger of five (beauty shops) or five percent of all beauty shops in each district for both men's and women's haircuts. As seen in other market basket categories, many of the smaller (mostly rural) districts often did not have as many beauty shops, and in those districts data collectors would do their best to obtain at least one price per district.

After all data was collected, entered and outliers were analyzed and removed, an average price was calculated for each district. No sales tax was applied to the final haircut prices, because haircuts are considered a service not a taxable good.

## TOBACCO

Cigarette prices were sampled in-person at the same time grocery prices were collected. Therefore, the sampling, data collection and analysis plan for cigarette prices is exactly the same as described in the **Food at Home Methodology** described earlier in this section (see above). An attempt was made to obtain cigarette prices at all grocery stores that were visited by data collectors. Similar to the sampling approach used for beer prices, data collectors were instructed to obtain cigarette prices at local convenience or liquor stores in districts where cigarette prices were not obtainable at grocery stores (or if there were too few grocery stores available in a district).

It should be noted that business listings for liquor stores in Colorado were collected from the Dun & Bradstreet database and added to the final data collector list of stores to be sampled for cigarettes (cigarette data was collected primarily at liquor stores in districts that had fewer than five total grocery stores to be sampled). Liquor stores were also geo-coded and labeled to the appropriate district using arc-GIS. The Dun & Bradstreet list was also supplemented with lists of Wal-Mart Supercenters and Super Targets so that cigarette prices would also be obtained at these supercenters.

After all data was collected, entered and outliers were analyzed and removed, sales tax was added to each price, and an average price was calculated for each district.

## READING, EDUCATION, MISCELLANEOUS EXPENSES, CASH CONTRIBUTIONS, PERSONAL INSURANCE AND PENSIONS, AND PERSONAL TAXES

Mirroring previous Cost of Living studies, the major expenditure categories for Reading, Education, Miscellaneous Expenses, Cash Contributions, Personal Insurance and Pensions and Personal Taxes were not sampled in this 2007 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 divvied across the districts came directly from the benchmark families spending level calculated for each category from the *Consumer Expenditure Survey*.

## APPENDIX C. NOTABLE METHODOLOGICAL CHANGES FROM THE 2005 COST OF LIVING REPORT

A few notable methodological changes were implemented between the 2005 and 2007 Cost of Living Reports. In the opinion of the research team, each of these changes had a positive impact on the quality of the data.

### Minor changes to the market basket

Minor changes were made to a few of the goods included in the market basket. These changes are detailed below:

- **Camera Film changed to Batteries:** When analyzing the previous market basket goods, Corona Research Staff and Colorado Legislative Council Staff agreed that due to the proliferation of digital cameras in the marketplace, the pricing of camera film for the average benchmark family was less practical in the 2007 marketplace. Batteries were selected as the replacement good for camera film due to the fact that batteries purchases would likely be unaffected by the current switch towards digital cameras. In general, it was felt that the benchmark family would be more likely to be buying batteries than camera film, and this necessitated the change to batteries.
- **Home size for mortgage purposes increased.** The 2005 study used a 1,300 square foot house, and the Colorado Legislative Council elected to increase that size to 1,500 square feet in the 2007 study.
- **Television changed to DVD Player:** Corona Research Staff and Colorado Legislative Council Staff also agreed that the previous market basket good of a 20 inch RCA color television was becoming somewhat antiquated in its representation of an electronics entertainment market basket good. This belief was held mainly due to the technological advances occurring within the current 2007 television markets. It was felt by both staffs that television sets were in a transition phase, and the previously sampled RCA television would be both hard to find in stores but it also would not be the best representation of this entertainment category. The DVD player was selected due to its rapid acceptance of the product (and rapid rejection of the VHS player) throughout the nation. DVD players were also easier to find at most of the stores and in most of the towns, and it was felt that this would be a comparable good that could be easily found throughout the state of Colorado.

### Sampling by district

One of the biggest changes incorporated into the methodology for this year's Cost of Living study was the general sampling plan for all of the market basket goods. In previous years, market basket goods were all sampled at the city level, and then the market basket data was then extrapolated down to the district level. In the 2007 study, all in-person and telephone gathered market basket data was sampled to the district level. This meant that data collectors attempted to visit and gather data in each school district in Colorado.

In the research team's opinion, this led to a more clean calculation of cost of living in urban areas with multiple school districts.

### **Sampling algorithm**

Corona employed a two-tier stratified random sampling method for the on-site data collection, as opposed to the pure random sampling used in previous versions of the report.

At the first tier, when a number of cities were included in one district, sampling was appropriated by each of those cities based on the total population of each city. This eliminated the need for post data collection weighting of the data by population, because the cities had already been sampled by city population. It also ensured that pricing reflected the variety of communities in each district. In the 2007 Cost of Living report, an effort was made to visit all pertinently populated cities within any district.

Additionally, inside each town, a second-tier stratification took place. Corona sorted the available firms by estimated revenue levels (as obtained by Dun & Bradstreet), and developed a sample that represented the distribution of revenues among the stores. This ensured that high-sales outlets would be represented in the sample if they dominated the market, while also ensuring that smaller outlets would be sampled if there were enough of them to counterbalance the high-sales stores.

### **Shopping patterns survey**

The completion of the shopping patterns survey and associated development of new shopping patterns was a major milestone for the report series, as the previous shopping patterns matrix was over ten years old. The new matrix better represents current market dynamics.

### **Online purchases included in the analysis**

In the shopping patterns survey, respondents were asked for each of the items/categories in the survey if they bought those items online. In previous Cost of Living studies, no attempt to quantify and interpret the effects of online purchases had been undertaken. In the 2007 Cost of Living study, Corona was able to ask shopping pattern survey respondents how frequently they bought goods online. As it turned out, online purchases were only a significant proportion of total purchases for the apparel category. Approximately 10 percent of all respondents indicated they bought apparel goods online. Therefore, Corona collected online apparel data and incorporated these final costs into the final apparel shopping patterns matrix (which was ultimately combined with the final district data to form the final cost of living numbers).

**APPENDIX D: RAW 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 SURVEY INSTRUMENT

Good evening. My name is \_\_\_\_\_ and I am calling to conduct a 7-minute survey about where people shop. May I begin? [If asked, the sponsor of the study is Corona Research, a market research firm in Denver.]

### FILTER QUESTIONS

1. First, may I ask your age? \_\_\_\_\_ (IF AGE IS >18 SKIP TO q\_2)  
 Refused [IF RESPONDENT REFUSES TO ANSWER, ASK q\_1a]
  - 1a. Are you 18 years old or older?  
 YES (1) [SKIP TO Q\_2]  
 NO (2) [ASK Q\_1b.]
  - 1b. Is there an adult over 18 years of age or older in the household that I could speak with?  
 YES (1) [RETURN TO INTRO AND q\_1]  
 NO (2) ("I'm sorry. We can't include your household in the survey, but thank you for your time." ABORT THE SURVEY AND HANG UP.)
2. Are you a Colorado resident?  
 YES (1) [CONTINUE]  
 NO (2) [THANK & TERMINATE]
  - 2a. Can you please tell me the name of the town in Colorado where you currently live?  
 Lives in a town [SELECT TOWN FROM DROP DOWN BOX AND SKIP TO q\_4]  
 Other town, record name in 2aOther \_\_\_\_\_  
 Does not live in a town [THEY DO NOT LIVE IN A TOWN ASK q\_2b AND q\_3]
  - 2b. What is the name of the closest town in Colorado to where you live? \_\_\_\_\_ [SELECT TOWN FROM DROP DOWN BOX]
3. What county do you live in? [DO NOT READ RESPONSES. CHECK ONE IN LIST. IF METRO COUNTY OR IN SAMPLE 7,8 or 9 ASK Q\_5 MILEAGE FOR ALL ITEMS]

### SHOPPING LOCATIONS

I'm going to read you a list of 15 items, and please tell me the name of the city or town where you or a member of your household last purchased each item [IF IN METRO LABELED COMMUNITY, ADD "and how far from home you bought that item?"]. Please be as specific as possible about the city or town where you last purchased each item, for example, if you purchased the item in Centennial, say Centennial rather than Denver. If the last time you purchased the item was when you

were traveling away from home, please tell us where you last purchased the item when not traveling. Also, if your last purchase of that item was online using a computer, you can answer “online”.

<b><u>Purchased Item</u></b>	<b><u>City name</u></b>	<b><u>Mileage</u></b>
	<p>4. The city or town where you or a member of your household last purchased each item?</p>	<p>5. About how many miles from your home did you buy this item? Please make your best guess if you're not sure. [INTERVIEWER, PLEASE RECORD ONLY THE NUMBER GIVEN. IF THEY'RE NOT SURE, PROMPT FOR BEST GUESS.]</p> <p>[ASK IF IN REGIONS 7,8 &amp; 9, BASED ON SAMPLE]</p>
<p>a. Non-perishable groceries such as canned goods</p>	<ul style="list-style-type: none"> <li>➤ Select city from drop down list</li> <li>➤ Purchased Online [SKIP to Q4B]</li> <li>➤ Never buys Item [SKIP to Q4B]</li> </ul> <p>[IF FIRST RESPONSE IS: The city of Denver ASK q4a_1</p>	
<p>q4a_1 “Do you mean the City of Denver or another city in the Denver metro area?”</p> <p><input type="checkbox"/> The city of Denver [CONTINUE]</p> <p><input type="checkbox"/> Another city in metro area [SELECT CITY FROM DROP DOWN BOX]</p>		
<p>b. Fruits, vegetables, or other produce</p>	<ul style="list-style-type: none"> <li>➤ Select city from drop down list</li> <li>➤ Purchased Online</li> <li>➤ Never buys Item</li> <li>➤ Home grown</li> </ul>	
<p>c. Perishable groceries such as milk or ice cream</p>	<ul style="list-style-type: none"> <li>➤ Select city from drop down list</li> <li>➤ Purchased Online</li> <li>➤ Never buys Item</li> </ul>	
<p>d. Household products such as laundry soap, batteries, or toothpaste</p>	<ul style="list-style-type: none"> <li>➤ Select city from drop down list</li> <li>➤ Purchased Online</li> <li>➤ Never buys Item</li> <li>➤</li> </ul>	
<p>e. Meal at a restaurant that was not fast food</p>	<ul style="list-style-type: none"> <li>➤ Select city from drop down list</li> <li>➤ Purchased Online</li> <li>➤ Never buys Item</li> </ul>	
<p>f. Alcoholic beverages purchased to drink at home (not at a bar or</p>	<ul style="list-style-type: none"> <li>➤ Select city from drop down list</li> <li>➤ Purchased Online</li> </ul>	

restaurant)	➤ Never buys Item	
g. Casual clothes	➤ Select city from drop down list ➤ Purchased Online ➤ Never buys Item	
h. Dress clothes	➤ Select city from drop down list ➤ Purchased Online ➤ Never buys Item	
i. Dress shoes	➤ Select city from drop down list ➤ Purchased Online ➤ Never buys Item	
j. Gasoline	➤ Select city from drop down list ➤ Never buys Item	
k. Car maintenance and repair services	➤ Select city from drop down list ➤ Purchased Online ➤ Never buys Item	
l. Movie tickets at a theater	➤ Select city from drop down list ➤ Purchased Online ➤ Never buys Item	
m. Haircut	➤ Select city from drop down list ➤ Never buys Item	
n. Pet food	➤ Select city from drop down list ➤ Purchased Online ➤ Never buys Item	
o. Day care services	➤ Select city from drop down list ➤ Never buys Item	

We're almost done. My last questions are about three less frequent purchases.

	<p>a. Have you purchased a [XXX] in the past 3 yrs?</p> <p>Yes=1 [ASK b.]</p> <p>No=2 [ASK d.]</p> <p>Don't Know=3 [ASK d.]</p>	<p>b. Were you living in your current community when you bought it?</p> <p>Yes=1 [ASK c.]</p> <p>No=2 [ASK d.]</p> <p>Don't Know=3 [ASK d.]</p>	<p>c. In what city did you purchase the item? You can also answer "online" if you bought the item on a computer.</p> <p>➤ Select city from drop down list</p> <p>➤ Purchased Online</p> <p>[SKIP to 7a]</p>	<p>d. What town or city do you think you would go to if you were going to buy a [XXX] tomorrow?</p> <p>➤ Select city from drop down list</p> <p>➤ Would Purchase Online</p>
6. Car				

7. Mattress				
8. DVD player				

**ABOUT YOU**

9. What is your gender? \_\_\_Male \_\_\_Female [RECORD BY OBSERVATION IF POSSIBLE.]

Thank you. We appreciate your time.



## APPENDIX F: GEOGRAPHIC SHOPPING MATRICES

Appendix F provides two volumes of information. First, this appendix provides additional detail about the methodology used to define geographic shopping patterns. Second, the actual matrices are presented.

### ANALYSIS OF GEOGRAPHIC SHOPPING PATTERNS

Because residents often leave their school district to make purchases, and because prices often vary across district boundaries, it is necessary to understand the geographic shopping patterns of each school district in order to develop the actual cost of living in each district.

For all previous cost of living studies conducted from 1997 through 2005, geographic shopping patterns were estimated based on a large statewide survey that was conducted in 1997. For the 2007 study, Corona Research was asked to update the analysis of geographic shopping patterns.

Ideally, updating the analysis of geographic shopping patterns would involve conducting statistically robust surveys in each and every school districts, which would determine geographic shopping patterns for each product in the market basket. However, the large number of school districts in the state mean that this approach is not feasible, as the cost to do so would have been quite high.

### THE SHOPPING PATTERNS SURVEY

Corona Research therefore took an alternate approach. The research team designed a survey that asked about geographic purchasing patterns for 18 types of products. For 15 small product categories, respondents were asked where they or a member of their household most recently purchased each item. Residents outside metro areas were asked about the town where they purchased the item, while residents within metro areas were asked about both the town and the distance that they traveled. (Residents were also allowed to state that they bought the product online, or that they never buy the product.)

The fifteen small product categories were:

- Non-perishable groceries such as canned goods
- Fruits, vegetables, or other produce
- Perishable groceries such as milk or ice cream
- Household products such as laundry soap, batteries, or toothpaste
- A meal at a restaurant that was not fast food
- Alcoholic beverages that were purchased to drink at home (not at a bar or restaurant)
- Casual clothing
- Dress clothing

- Dress shoes
- Gasoline
- Car maintenance and repair services
- Movie tickets at a theater
- Haircut
- Pet food
- Day care services (This was eventually discarded in favor of another method, due to small sample sizes in the survey data.)

For the three larger products, residents were asked if they had purchased in the past 3 years; and if so, whether they were living in their current community when they bought each one. They were then asked what city they purchased any such items in (which could include “online” if they bought the item on a computer). They were then asked what town or city they thought they would go to if they were going to buy these items tomorrow. The three large products were:

- Car
- Mattress
- DVD player

The larger products were asked in a different manner because for some of these products, the person could have made the purchase several years earlier when living in a different place, or they could simply not remember if their last purchase was several years ago.

## REGION SELECTION

A total of 2,710 surveys were completed, using a stratified random sampling technique that oversampled in smaller communities. This oversampling was intentional, in that it provided the research team with statistically sound data for ten different types of communities, ranging from very small rural communities with few or no businesses, up to major metro areas.

The regions were selected on the basis of population of major towns within districts and employees per business in these towns. This data was acquired from Dun & Bradstreet reports, which list city demographic and business data by zip code. The research team identified a moderate correlation between employees per business and the log of the population ( $R^2 = 0.483$ ), meaning that smaller communities tend to be home to smaller businesses.

Based on a presumption that companies with a higher number of employees per business may offer different levels of price and selection, the team postulated that these differences might produce differences in shopping patterns. Therefore, it was worthwhile to examine various size categories of these communities to capture those differences.

Of the ten regions, six represented non-metro, non-resort communities. These six regions were defined by merely segmenting those towns into six groups based on the average number of employees their businesses have. (This figure counted only businesses that provided services or goods that were gathered as part of the project.)

Three other regions represented metropolitan areas, on the premise that geographic shopping patterns in these areas would differ significantly from those of rural areas, due to the proximity of businesses in neighboring districts. Of these regions, one was comprised of the districts that make up the Consolidated Statistical Metropolitan Area of Denver (less Weld County), and another represented the districts in the Colorado Springs metropolitan area. The third region was comprised of all other metropolitan areas in the state: Grand Junction, Fort Collins, Greeley, and Pueblo.

The tenth region was an anomaly, and included school districts surrounding cities in mountain resort areas, such as Aspen or Telluride. These cities in general were posited to potentially have differing geographic shopping patterns due to the high prices that are common among many goods and services in those communities.

## ANALYSIS AND MODELING

Upon completion of the survey, the research team had a large amount of survey data on geographic shopping patterns, and that data covered different types of communities from small rural towns to major metropolitan areas. However, even with conducting 2,710 surveys, a large number by most measures, that still equates to only about 15 completed surveys per district on average, which is not sufficient to directly develop patterns of shopping in each district.

Therefore, the team sought to maximize the value of the data using mathematical modeling. In essence, the survey data could be used several ways to assess geographic shopping patterns in a district. These ways include:

1. Directly examining survey responses within a district. Typically, there were fewer than 30 responses in any district, but even small numbers can provide some guidance about shopping patterns.
2. Examining the shopping patterns of all product categories within a district. Even if the team had only (for example) ten survey responses in a district, more data was available. Recall that the survey asked about 18 product categories, so the team actually had 180 data points available that provided some insight about where people traveled to shop, even though those patterns might differ somewhat for different products.
3. Examining the shopping patterns of similar types of communities for a particular product category. By defining the regions that were discussed earlier, the survey team was able to identify shopping patterns for communities that had one major attribute in common: the size of their business community. While other factors may vary, such as the size and distance of nearby towns where shopping might occur, statistical inferences may be drawn.
4. Examining differences in shopping patterns by type of product. Within a region, the research team could examine whether patterns differed substantially for various types of products.

In addition to these data from the survey, other data were developed as part of the research, including data on the populations and distances of myriad pairs of towns, and the geographic situations of various districts. The latter will be discussed in more detail in the “Radius Model” below.

Using the data gathered in this survey, the research team then developed a family of predictive models to estimate geographic shopping patterns in each district for each product category. For example, the team developed data that show what proportion of purchases of gasoline by residents of District A was made in Districts B, C, D, etc. The goal of this was to take into account the prices of goods not only in a district's own business community, but also in other nearby communities.

Because different types of communities may have fundamentally different logic behind their shopping patterns, different approaches were needed for each type of community. Each general approach is discussed below.

### *Rural Model*

For rural areas, shopping patterns depend to a great degree on the size of the home community and the distance and sizes of nearby communities. Therefore, the model in this case had to take into account distances between "points" (towns) as well as their sizes.

The rural model was created to estimate the percent of purchases that were made in a "buy town" by buyers from each "live town." The model was based upon three sources, forming what is commonly called a *triangulation* methodology. The first two came directly from the shopping patterns survey, namely, 1) data from each combination of live town/buy town/category and 2) data for an aggregation of all categories for a particular live town/buy town pair. The third source was a regression equation that was based upon the market survey data, the populations of the live town and the buy town, and the distance from the live town to the buy town.

The aggregate data for a particular live town/buy town pair included all of the products that were purchased in any category. The supposition for this method was that if buyers chose to buy one product in another district, it was likely that they would buy other products there as well.

The third source regression equation was in the form of  $y = B_0 + B_1X_1 + B_2X_2 \dots B_nX_n$

In this equation,  $y$  represents the percent of a particular category of product bought by a resident of a live town in a buy town.  $B_0$  is a constant;  $X_i$  represents the population and distance factors and the number of buy cities that are prevalent in the buying pattern for a given live town; and  $B_i$  values represent the coefficients of these  $X_i$  factors which give an indication of the strength of the effect of each factor. For details on the exact use and computation of these  $X$  factors, please see appendix \_\_\_\_\_. These equations were generated for every combination of *product category* and the *city rank* (based on the most desirable nearby buy cities), totaling  $3 \times 18 = 54$  equations. The variance explained by each equation generally ranged from 30% to 60%, with no equation being used that explained less than 25% of the variance in shopping district choices. Out of the 54 equations, only 40 met this criterion and were therefore available for the triangulation of data to estimate the percents. In the other 14 cases, we relied solely on the two market survey sources when they were available.

If Corona had used just one of any of these sources for estimating percents, the strength of the statistical significance would likely have been relatively weak. However, by triangulating the percentages using a weighted combination of these sources, the research team made the best use of the shopping patterns survey data and the demographic secondary data (population and distances to cities) that was available for each pair of cities. For example, districts where larger numbers of survey responses were available had that portion of the triangulation weighted more heavily. In this way, the researchers maximized the accuracy of the rural percent predictor model.

Some districts in Colorado were not a part of the shopping patterns survey. Therefore their shopping patterns had to be estimated using the regression equations as the sole predictor. And where these equations were not available for the second and/or third most desirable shopping district, estimates had to be made based upon a fixed ratio from the first district equation, which was available for every category of product.

The shopping patterns survey specifically asked respondents to include purchases that they made while on vacation or other travel. However, purchases were not infrequently reported as taking place in a distant town where there was no apparent shopping pattern. These purchases were probably a random statistical anomaly, though they occurred often enough for the team to note that they represent a small but measurable part of a community's purchasing patterns. Because of these outlier purchases, the research team created a procedure to handle them so that they would not unduly affect the final shopping patterns. When rural purchases were greater than 155 miles away, the researchers created a pseudo-district, called *Colorado Distant* to represent the buy district for this purchase. Corona Research then applied a statewide average price for these purchases in order to give a more reasonable estimate for such purchases, which could have occurred in any Colorado district. The team chose 155 miles as a demarcation because 5% of purchases in rural regions were made 155 or miles from the purchaser's home town according to the shopping patterns data. If the distances were from a normal distribution (the distribution is actually skewed to the right), this would represent two standard deviations from the mean, which is a good rule of thumb for data that is in an "outlier" status, i.e. at a considerable distance from the mean.

In addition to geographic shopping patterns, the model estimated online shopping patterns, using basic results derived directly from the shopping patterns survey. Clothing purchases (casual clothes, dress clothes, and dress shoes) were the only product categories accounting for more than two percent of purchases, and so are the only categories in which online purchases were included.

Upon completion of the modeling, each school district in the non-metro areas had shopping patterns defined for each of the 17 final product categories. (Day care was eventually discarded since most survey respondents did not purchase that service.) Each district was then hand-checked, and in certain instances manual corrections were made where obvious outliers occurred. The team took a conservative approach to eliminating outliers, so some instances still exist where shopping patterns go beyond the typical radius.

#### *Urban Models*

Urban shopping patterns are fundamentally different from rural shopping patterns. Where rural models represent distances between "points" (towns) of varying sizes, urban models are more of a soup, with no clear distinctions between school districts other than political boundaries. This means that a respondent in School District A can conceivably walk across the street to shop in School District B. Therefore, the population/distance model used in the rural model is not applicable.

Two basic methods were used to estimate shopping patterns for the metro areas. The method that was used depended upon the amount of data that was available from the shopping pattern survey for a particular school district. When there was sufficient direct data from the shopping pattern survey (greater than 25 data points for most categories), the team made predictions of percent purchases for a category based directly on the shopping pattern data. Generally, these cities were those that had a great deal of shopping pattern data points, such as Denver with 67, or cities where almost all of the shopping was done in that city due to its relative high population, such as Grand Junction, or a city with both conditions.

The second method that was used in the metro areas was applied to towns where the number of survey data points was fewer than 25 data points, too low to make an estimate from the shopping patterns data. For these districts, the research team developed a radius model to estimate shopping patterns.

In urban areas, the surveys asked not only about the town in which shopping was done, but also the distance traveled from home. Based on this data, the team could draw radii from the centroid of a district and estimate the geographic area of every school district that fell within that radius. By assigning shopping proportions to “doughnuts”, rings of increasing radii, and assuming that shoppers were indifferent about whether they crossed a school district boundary, the researcher could estimate the proportions of shopping that fell within each neighboring district and the home district, assuming homogeneous distribution of businesses within each district. The researchers used graphs with 2.5 mile, 5 mile, and ten mile radius concentric circles and ellipses to aid in this analysis. The percents were further weighted by the relative abundance of shopping in these buy districts. This weighting was calculated based upon the relative number of businesses in these metro districts. This analysis was based on the supposition that purchases from other districts would be more or less uniformly distributed across these retail businesses.

Just as the team handled “outlier” data in the rural model, a provision was also made to handle random outlier events in the urban model. The team used as a criterion that at least three purchases had to be made in the shopping patterns data before a live town/buy town pair would be considered a shopping pattern. Pairs that did not meet this criterion were discarded.

#### **GEOGRAPHIC SHOPPING MATRICES**

The following tables show the relationships between geographic areas and the shopping patterns of residents. In the tables, each row represents a district and a product category, and each column represents the proportion of shopping that occurs in a particular region. Therefore, each row adds up to 100 percent of the shopping for a particular product category in a particular district.

As described in Appendix A, these tables are based on a variety of modeling methods, survey data, and geographic data. As such, the rows represent predominant areas of shopping and are not intended to model every potential shopping trip. The goal was to develop major patterns sufficient to develop cost estimates for products.

Readers receiving this report electronically will need to review an accompanying spreadsheet file, due to the volume of data.

## APPENDIX G: STATISTICAL MEASURES USED IN THIS REPORT

The research team evaluated the method of calculating confidence intervals of cost of living indices as outlined in the document “Statistical Methodology 2005 Colorado School District Cost of Living Study,” by Thomas Bengtsson. 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  $f(x, y, z \dots)$  where variables  $x$ ,  $y$  and  $z$  are uncorrelated is:

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

where  $\sigma_i^2$  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  $\mu_D$  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  $\mu_D$  are considered in the Bengtsson treatment.

The Bengtsson derivations for the propagation of  $\mu_D$  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  $\sigma_f^2$ . 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.

Table G-1. 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 careful outlier detection process, as was implemented in the 2007 study. 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 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  $n$  approaches  $U$ , 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 size 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 groups. However, reliable collection of such data is probably impossible.

*What are the limitations of the methodology used to calculate the confidence intervals of the COL indices?* One of the major limitations of the methodology 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 may appear to be unacceptably large to the client 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.

#### *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  $\mu_D$  by a shopping survey of a subset  $n$  of the stores. We also calculate the variance of the sample  $\sigma_D$  from the sample data. The *variance of the estimate of  $\mu_D$*  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  $\mu_D$  increases. We account for this effect on  $\sigma_\mu^2$  by multiplying by the factor  $(U - n)/(U - 1)$ . So for our example we have:  $\mu_D = (\mu_{D1}, \mu_{D2}, \mu_{D3})'$  and  $\sigma_\mu = (\sigma_{\mu1}^2, \sigma_{\mu2}^2, \sigma_{\mu3}^2)'$ . We also have the shopping pattern matrix (note that the shopping matrix assembled by Corona Research is actually  $S'$  as shown below):

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

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

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

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

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

This corresponds to the vector notation:

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

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

The state-average price is given by:

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

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

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

This corresponds to the vector notation:

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

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

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

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:

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