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An Evaluation of the Proposal to Implement a Chained Weighted CPI

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An Evaluation of the Proposal to Implement a Chained Weighted CPI

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Introduction

The causes and effects of price changes have been monitored for hundreds of years. Such economic indicators as value, consumption, and inflation of goods and services have become important statistics to track in every recent historical period; the ancient Greeks and Romans, Medieval times, the Industrial Revolution and the current and continual rise of capitalism. These measures are vital for businesses and economies to monitor because an increase in the cost of resources of a devaluation of currency can have catastrophic consequences if overlooked. There have been many hypotheses and thoughts on how to gauge price changes, but it wasn't until the late 19th and early 20th century that two German economists gave the world its first formulas on how to measure and evaluate these changes.

The Bureau of Labor Statistics (BLS) recently developed a way to view price changes in the economy called the chained consumer price index (C-CPI-U). There is much debate over this calculation because, if implemented, it would greatly affect government spending on programs such as Social Security and Veteran benefits. A quick overview of how the C-CPI-U is calculated does not appear to be anything to disagree with. A conclusion which can be drawn, and will be discussed in this thesis, is that the major controversy lies in what will happen to those who benefit from possible reduction of benefits in some government programs that use the CPI as a gauge on how much to give each person who receives the benefit.

This thesis will begin with a general discussion on the methodology of price indexes. The Consumer Price Index will become the main focus, but it is important to

understand the foundations and basic reasoning for the computations. Following this will

be a dialogue on how the current CPI is calculated along with providing a sample data set

of some basic current figures. The third section will focus on comparing the chained CPI

versus the current method. To conclude, there will be a discussion of what a change in the

primary configuration of the CPI means; how it will impact economic data collection,

calculations, above mentioned government programs, political ramifications, and any

other distortions which may occur from the implementation of the C-CPI-U. In turn, the

pros and cons of remaining with the current method will be brought about as well.

Chapter 1: **Understanding Basics of Price Indices; Lasperyes, Paasche, and Geometric Mean**

Historical Overview

A brief history of business will show that the study of price changes and inflation patterns have been of realized importance for hundreds of years, as documented in Aristotle's *Politics.* Within his book, Aristotle maintains the idea that citizens within the city-state, a political/geographic community, will achieve prosperity and happiness only if everyone plays fair. Transactions occur on a moral basis and no one intentionally tries to commit usury. The idea that resources and money are scarce was realized within the city-state and those within it should perform commerce in the highest moral standards. In other words, the economy would only function if everyone knew how much prices of goods were and no one overcharged anyone (Samuels 14). This is an economic psyche similar to Peter Kropotkin's homo reciprocans*,* in his 1902 book *Mutual Aid: A Factor in Evolution.* In the novel, Kropotkin describes this state of mind to where people desire and naturally work together to provide "mutual aid" for one another. The idea of price equilibrium was not demonstrated in early writings, but a fair price on all business practices appeared to be ideal business for the scholars of those times.

In the 17th and 18th centuries, writers looked at the current economic system of mercantilism. A common conclusion that money and wealth being separate entities was being realized more and more. An English economist, Charles Davenant, was one of these writers, and based on 20th century interpretations of his work, money was more of a

'barometer' of the trade deficit/surplus of a country. The best way to understand this concept is with this quote from *The History of Economic Thought:*

> *Money helps speed up interaction within the marketplace, and stimulates growth and development. Thus, a net flow of money could be a means of procuring wealth; but wealth itself was always the result of production and consumption (ibid 53).*

As you can see, the conversation of pricing and fair value in the world has evolved. Before more discussion into the theory and discussion of price applications commences, let us review the basic principles and understandings of a price index.

Price Index Basics

As defined in *Introductory Statistics for Business and Economics,* a price index is 'a single figure that shows how a whole set of prices has changed' (Wonnacott 664). This broad explanation is ideal because it demonstrates that a price index could refer to a data set of prices as big as the US economy or something as small as a household's expenditures and it states that the index is intended to simplify the data set. For example, it is easier to say that the price of goods and services in Buffalo, NY have increased 5% overall than to say that gas prices increased 12%, food went down 3%, entertainment prices remained level, and so on. The basic equation for the price change of a good is:

$$\pi = \frac{P_t - P_0}{P_0}$$

Whereas $\square$ is the change in price, the numerator represents the difference between the current price of a good and a base year price of that same good, and the denominator represents the base year of the good we wish to compare. For example, we want to know how much the price of milk changed from 2011 to 2012 in the USA. In

2011, average price of milk was $3.39 a gallon and in 2010 it was $2.79 a gallon. This makes the equation calculate to:

$$.2151 = \frac{3.39 - 2.79}{2.79}$$

The price of milk inflated close to 22% in the USA from 2010 to 2011. A price relative demonstrates the same information but presents it in a different way. Keeping with the above data, a price index equation looks like this:

$$Price\ Relative = \frac{P_t}{P_0}\ x\ 100$$

Each value within a price index is referred to as a relative value. A relative value will show the change of the price of a commodity corresponding from the previous period or a base period (encyclopediabritannica.com). When utilizing 2011's milk price for time t and the base year, our equation would equal 100.

$$\frac{3.39}{3.39}\ x\ 100 = 1\ x\ 100 = 100$$

In all price indices, the selected base year will have a price relative equal to 100. Now using 2012's milk price for P_t, our calculation is (rounded to nearest integer):

$$\frac{3.39}{2.79}\ x\ 100 = 122$$

When put into a chart, the similarity between how the first equation shows price inflation against how a price index will demonstrate inflation becomes more apparent.

Price of Milk Index (per gallon-USA) 2010-2011	
Year	Price Relative
2010	100
2011	122

When adding a third and fourth year to the table, the separation of price index and inflation becomes apparent. Though a price index will generally have a positive correlation to inflation calculations, they are not one in the same.

Price of Milk Index (per gallon-USA) 2009-2012			
Year	Price($)	Price Relative	Inflation (%)
2009	2.69	96	n/a
2010	2.79	100	3.7
2011	3.39	121.5*	21.5
2012	3.49	125*	2.9

* These numbers calculate to exactly 121.505376 and 125.0896, respectively

Economists and financial gurus can draw important implications from price index data and from inflation rates. In turn, a number of questions can arise from both data sets, such as;

Ok, the price of milk has increased but what caused the large price increase from 2010 to 2011? Was there a shortage? Did production costs increase? Was there disruption in the market place? What caused the market to stabilize to a more moderate price increase?

Though these are questions which will take more research, the price index is still more comprehensive than an inflation index, especially when looking at a large data set.

In the example of the price index for milk from 2009-2012, the price of milk does increase over time but can be seen in two different lights. Per the price relatives, the cost

of milk has increased 25 index points since our base year of 2010, and 3 index points since 2011. In review of the inflation data, the absence of a base year is cause for closer analysis. Though 2012 reports an inflation rate of 2.9%, the conclusion that the price of milk has changed 2.9% since 2010 is false. Inflation is calculated based on the previous year's data. When reviewing 2011's data, then 2012's, the set is more comprehensive. Based on this example of a single commodity, utilization of a price index of relatives is more efficient than an inflation index, though inflation should not be disregarded because it can give vital information that can complement a price index.

In a price index, there may be more than one good. For example, along with milk, bread and pepper prices will be analyzed. To incorporate consumer spending habits along with the actual price of goods, price indexes weigh said goods in a given 'basket of goods'. With every selection of a good or service to purchase, and eventually consume, there are several considerations that a consumer asks themselves. Some of these considerations are the necessity of the good, how many units of that good they will need, their budget constraints, the brand of the good to purchase, the quality of the good that suits their needs best, and the importance of this particular good or service in comparison to others to purchase. While there are several price index equations such as the Carli, Dutot, and Jevons equations, this paper will discuss the three predominant methods: the Paasche Index method, Laspeyres approach, and the geometric mean methodology.

Paasche Index and Laspeyres Index

The major difference between the Paasche index method and Laspeyres approach is how prices are weighted. German economist Herman Paasche's equation uses weights

of the current period's consumer habits whereas Laspeyres focuses on weights on the

previous periods. Each equation does have its notable pros and cons, but examination of

both is essential to the understanding to why the USA Bureau of Labor Statistics prefers

one over the other.

There are several variations to denote the Paasche Index. The formula utilized in
this study will be derived from policonomics.com equation reads as such[1]:

$$P_p = \frac{\Sigma(p_{c,t_n} * q_{c,t_n})}{\Sigma(p_{c,t_0} * q_{c,t_n})} * 100$$

$P_p = Paasche\ Index\ Price$

$p_{c,t} = Price\ of\ good\ c\ in\ time\ t$

$q_{c,t} = quantity\ of\ good\ c\ in\ time\ t$ ("Price Index" 4)

The t_0 notes the base year and n refers to the current year being used in the

calculation. Paasche's equation finds a price index that shows the relative change in the

price of a good, or a market basket of goods, for the current period from the base period,

using the quantity demanded today. Using the milk data from earlier, say that in 2010

four gallons of milk were demanded and in 2011 five gallons were demanded. Using the

prices, the formula calculates to:

$$P_{P2010} = \frac{(2.79)(4)}{(2.79)(4)} * 100 = \frac{11.16}{11.16} * 100 = 100$$

$$P_{P2011} = \frac{(3.39)(5)}{(2.79)(5)} = \frac{16.95}{13.95} = 1.21505376 * 100 \cong 1.215 * 100 = 121.5$$

In this insistance, P_{P2011} is the same as found in previous data, prior to multiplying by

100. If the Paasche Index were to be at 1 in 2011, it is assumed that one could have

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[1] http://www.policonomics.com/laspeyres-paasche/

consumed the same amount of milk in 2010 as one is consuming in 2011, given that income has not changed. A real world application of the Paasche formula would be the GDP Deflator. The US derives its equation for finding the amount by which the nominal GDP must be divided/deflated to obtain real GDP. (*Macroeconomics 12*)

In other words, the Paasche index states how much today's basket of goods would have cost at the base year prices. The major criticism of this calculation is that price inflation is understated. The equation does not account for practicality of consumer spending habits. If the price of a good changes, the quantity demanded and consumed of that good, in the basket of goods, will likely change. Looking retrospectively of how much the consumer could have bought on the needs of today's goods causes an understatement of price change. This is a key concept to remember when the C-CPI-U and geometric mean formulas are discussed later.

The Laspeyres formula calculates a price index based on how much the base year's basket of goods would cost in today's prices. It was developed by German economists Etienne Laspeyres around the same time Herman Paasche was developing his formula. Laspeyres' formula reads as follow:

$$P_{L} = \frac{\Sigma(p_{c,t_{n}}) * (q_{c,t_{0}})}{\Sigma(p_{c,t_{0}}) * (q_{c,t_{0}})} * 100$$

Using the milk data from earlier, say that in 2010 four gallons of milk were demanded and in 2011, 5 gallons were demanded. Using the prices from the table on page 9, the formula calculates to:

$$P_{L2010} = \frac{(2.79)(4)}{(2.79)(4)} = \frac{11.16}{11.16} * 100 = 100$$

$$P_{L2011} = \frac{(3.39)(4)}{(2.79)(4)} = \frac{13.56}{11.16} = 1.21505376 * 100 \cong 1.215 * 100 = 121.5$$

In this insistance, P_{L2011} is the same as found in previous data, prior to multiplying by 100. If the Laspeyres Index were to be at 1 in 2011, it is assumed that one could have afforded the same amount of milk in 2010 as one is consuming in 2011, given that income has not changed. An example of a Laspeyres formula in use today would be the current calculation of the Consumer Price Index within the USA, specifically within certain sub-indices. A few of these indices are shelter services, select utilities and government surcharges, and select medical care.

In other words, the Laspeyres index states how much the base year's basket of goods would cost at the current year prices. The major criticism of this calculation is that price inflation is overstated. The equation does not account for practicality of consumer spending habits. The Laspeyres price index usually overstates inflation because if the prices of certain goods increase, the consumer will either buy a substitute good or go without the good, which in turn would alter the actual weighting of the good because the consumer will now be purchasing more of another, i.e. there is a change in purchasing power.

Geometric Mean Index

The final price index equation for discussion is a geometric mean formula. This type of formula is used across mathematics, such as the Pythagorean Theorem. A

geometric mean has been found to better represent changes in a price index when comparing two years than simple arithmetic equations. Also, the formulas have been found to better estimate price relatives by better calculating the weights of goods from one year to the next. Remember, this was one of the largest criticisms of the Laspeyres and Paasche indexes.

An example of using a geometric mean over an arithmetic mean can be seen in an excerpt from Thomas and Ronald Wonnacott's , *Introductory Statistics for Business and Economics.* Assume the population for an area to be the following:

Year	Population	Increase Per Decade
1950	1,000	
1960	2,000	2 times
1970	16,000	8 times

From 1950 to 1970, the population increased from 1,000 to 16,000 or sixteen fold. By using an arithmetic mean, the two fold increase from 1950 to 1960 would be added to the eight fold increase from 1960 to 1970, divided by two decades, to state that there was an average of a five-fold increase between decades. If this were true, the population in 1970 would increase to 25,000, and hence be overstated. Using a geometric mean formula, the mean change would be:

Geometric mean $= \sqrt[n]{X_1 X_{2...}} = \sqrt[2]{2 * 8} = \sqrt{16} = 4$

This equation's findings are correct. Per decade, the average change in population was four fold. (Wonnacott 667-8) Though these types of equations have been around for hundreds of years, and discussed as being useful in price index equations since the late

1800s, it wasn't until the 1990s that the US considered them for price index calculations. This topic will be focused on later in Chapter 2 of how the Bureau of Labor Statistics calculates the Consumer Price Index and the benefits of using these equations.

In the world of price indices, there are two predominant geometric formulas, the Fisher, or 'ideal' index equation and the Törnqvist equation. The ideal formula was developed published in the1920s by economist Irving Fisher. Törnqvist's would come about in the mid 20th century. Fisher's equation is relatively simple in comparison to Törnqvist's. Fisher recognized the criticisms of Laspeyres' equation overstating indices and Paasche's equation understating them. His idea was that the 'ideal' must be the geometric mean of the two. Hence the equation:

$$P_G = \sqrt{P_L * P_P} * 100$$

$P_G = Price\ relative\ using\ geometric\ equation$

$P_L = Price\ relative\ using\ Laspeyres\ equation$

$P_p = Price\ relative\ using\ Paasche\ equation$

Fisher met early criticism of this formula by scholars such as Warren Persons. After hearing Professor Fisher speak at the March 1921 meeting of the American Statistician Association of his ideal formula, Persons wrote a short paper to discredit Fisher. In this paper, Persons provided evidence based on analysis of twelve farm crops of the time era that the Fisher equation was less 'ideal' than the geometric mean formula Persons' presented. Persons contested that not only was a geometric mean formula which used constant weights over a given period found more accurate figures for a price index, but Fisher's methods take up to four times as long to calculate (Persons 104).

Finnish statistician Leo Törnqvist is credited with this superlative index equation which reads:

$$P_T = \prod \frac{p_{ct_n}}{p_{ct_0}}^{1/2(\frac{p_{c,t_0}q_{c,t_0}}{\Sigma p_{c,t_0}q_{c,t_0}} + \frac{p_{c,t_n}q_{c,t_n}}{\Sigma p_{c,t_n}q_{c,t_n}})} * 100$$

$P_T = Price\ relative\ using\ T\ddot{o}rnqvist\ equation$

As will be discussed later, this formula looks most similar to the one that the Bureau of Labor Statistics utilizes for 61% of the price relatives in the CPI (Dalton 3). This equation is one that Warren Persons would side with because of its use of □; an average of weights. The International Monetary Fund defines the *Törnqvist* equation to be

> *A price index defined as the weighted geometric average of the current- to base period-price relatives in which the weights are the simple unweighted arithmetic averages of the values shared in the two periods.*

The Törnqvist equation uses a set of fixed expenditure proportions as weights to be used in averaging the prices of individual items within an index. The exponent of the equation is where the calculation of the weighted geometric average of prices and the arithmetic averages of weights are found. In practice, the equation will be expressed in a natural log for simplicity in graphing and analyzing periodical change. (IMF 1.202)

Earlier mention of this equation being a superlative one is defined as an equation that can be used to find a smooth function and provide flexibility in its calculation. The smoothness of the function is accredited to its flexibility over a large time series. The flexibility will be ideal when consumer habits change whether it is due to the price

changes of a good, substitution of the goods, or any other reason that may cause a drastic change in the weight necessary in the price of a commodity. A superlative equation accounts for the average of the change in price or quantity weight of the good, depending on which is being found at the time of calculation, and will show the most approximate change over a time series. This implies that consumers can alter the quantities they buy when the prices of goods change, which is certainly true in application.

Another finding with the Törnqvist equation, along with all other index equations, is that the price relatives produced are better found when a chained base approach is used rather than a fixed base period. Assuming a market where normal goods are the primary consumed and produced commodities, pending severe economic shocks, changes in goods between two successive periods, say 2012 to 2013, should show a smaller change than those that occurred from 2000 to 2013. To reiterate a major point, a chain based equation is a geometric mean equation that has consistently found results that may still be under or over the true price changes relative to weight, but they have been proven statistically more reliable a figure than those created by any fixed base equation, including the Paasche and the Laspeyres indices. Extensive research and proof of this conclusion was conducted by D.E. Wiedert in 1993. From a segment of his works titled *Essays in Index Number Theory, Vol. 1,* Wiedert showed that across five major index equations, Fisher, Paasche, Laspeyres, Törnqvist, and Vartia (another superlative equation), when compared to a fixed based approach, the chain based findings are more accurate. Diewert described an index number formula to be superlative if it is equal to a theoretical price index whose function is flexible, i.e. it can approximate to the second order. This is a powerful finding because it gives credibility to this class of superlative

index number formulas. Note that the translog functionality in the Törnqvist formula is an example of a flexible functional form, so the Tornqvist output price index formula is superlative.

The evolution of price index equations and technology available has allowed for numbers to be reported more rapid to government agencies, the data has become more accurate and we as an economy can forecast our world better because of it. Governing bodies and scholars have a better idea of where price inflation has been, where it is, and where it is going. Studies of price indices help with other micro and macroeconomic indicators. One of the major groups that studies, develops, and evolves the price index is the Bureau of Labor Statistics. Along with the study of labor in the United States, their major prerogative to report is the Consumer Price Index. In the next chapter, there will be a discussion of the Consumer Price Index. The government agency in charge of calculating the Index, the Bureau of Labor Statistics, will be described along with its history and evolution. How the Consumer Price Index is calculated currently will be displayed and we will be summarizing how the agency handles possible errors within its calculations.

Chapter 2: The Consumer Price Index (CPI)

Overview

The following section describes the means and methodology that the Consumer

Price Index as it is currently calculated in the United States. The Consumer Price Index

(CPI) is managed by the Bureau of Labor Statistics (BLS). Given that this government

agency is the governing body of the primary subject matter of this thesis, most of the

information in this section is from the BLS website, which is a free domain to the public

and is updated daily with the most current data and news pertaining to their research. The

Bureau of Labor Statistics was established in 1884 as a division of the US Department of

Labor. The BLS operates as part of the federal budget, which is decided every year.

Currently, the budget for the Bureau is $609.1 million with a proposed increase of $4.7

million in 2014. The sole purpose of BLS is found in its mission statement.[2]

> *The Bureau of Labor Statistics of the U.S. Department of Labor is the principal*
> *Federal agency responsible for measuring labor market activity, working*
> *conditions, and price changes in the economy. Its mission is to collect, analyze,*
> *and disseminate essential economic information to support public and private*
> *decision-making. As an independent statistical agency, BLS serves its diverse user*
> *communities by providing products and services that are objective, timely,*
> *accurate, and relevant. (BLS.gov)*

From an economist point of view, it makes sense for one bureau to be in charge of

economic climate indicators such as unemployment, employment, wages, and price

changes (inflation). There are several theories and much research that has found

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[2] There will be several sections of this chapter which will reference BLS's Press Release of the
Consumer Price Index as listed in *References.* These excerpts will be noted *ibid,* followed by the
respective page number from the article.

correlations between unemployment and inflation rates. One of these economic theories is the Phillips Curve, which states that there is a negative relationship between unemployment and inflation. One of the indexes developed by BLS to aid in analysis of inflation is the CPI.

The Consumer Price Index is a time series of data that reports the cost in US dollars of a specific list of goods in the United States. The specific list of goods is referred to a 'market basket' of goods. Based on surveys conducted by BLS on consumers, this market basket of goods is what an average consumer buys for daily living. The CPI has been reported every month since 1919, with the earliest price index date being reported as 1913. The Consumer Price Index is an important tool in understanding our economy because it gives an economic indication in which direction the price of goods are headed and what goods are being demanded by consumers. This is an important analytic tool for retailers, manufacturers, and the federal government in regards to fiscal policy. If the average price of goods and services are increasing, employers may want to increase their wages with a cost of living adjustment, to employees so that they will continue to work with a similar level of enjoyment. In turn, the government, federal and state, may analyze the CPI change and pass law to increase the minimum wage for workers and the payments to be given to those on government programs in order to keep pace with the standard of living. As you can see, the CPI has a large role in our economic outlook. BLS has a large task every month to collect as much data as accurately as possible and report it in the most simplistic way.

Each of the thousands of time series price indices measure the changes in consumer prices of what is called a 'target population'. The two main target populations

are All Urban Consumers, commonly noted as the 'U' population, and Urban Wage Earners and Clerical Workers, the 'W' population. As of 1990, the U population was estimated to represent eighty-seven percent of the US population. This demographic consists of all peoples living within the United States, excluding "people living in rural non-metropolitan areas, farm households, on military installations, in religious communities, and in institutions such as prisons and mental hospitals" (*The Consumer Price Index* 1-2).

The W population is a subset of the U population, which makes up roughly fifty percent of the US population. As stated in its name, this population consists of all urban workers that only have income sources from wages and clerical work, minus all the same exclusions as the U population. Some consumer groups that would be excluded from this list would be those whom are retired, part time employees, and self-employed workers.

From these two target populations; BLS has developed three major indexes which are CPI for All Urban Consumers (CPI-U), CPI for Urban Wage Earners and Clerical Workers (CPI-W) and Chained CPI for All Urban Consumers(C-CPI-U). This chapter will discuss the time series related to the CPI-U and CPI-W, with the C-CPI-U in the proceeding chapter. Along with reporting CPI-U and CPI-W, BLS has two separate indexes for each called seasonally adjusted and seasonally unadjusted. Seasonally adjusted indexes are used in most research and what BLS recommends for use in primary analysis. The seasonally adjusted index, through additional BLS research and surveying, eliminates external factors which may cause shocks in the index or in sub-indices. Some of these external factors are holidays, sales, severe weather, and harvest outputs

Each price index can measure a single good or service, or up to that full market basket of goods. Each price index uses a base year pricing of 1982-1984. This has been in effect since the fifth revision by the BLS in 1987. Overall, no price index within the umbrella of the CPI accounts for investments or investment returns on stocks, bonds, real estate of any kind, gambling winnings, or life insurance payouts. Also, any type of court appointed pay-out such as alimony or child support is not considered in the market basket of goods and services. In consideration of taxes, the CPI is not affected by changes in before tax income because the prices and quantity weights surveyed and utilized are based on the final price of goods and services. BLS will make adjustments to weights and prices of goods if there are excise taxes or an overall sales tax increase in consumer goods within that given index.

Structure of CPI

The Bureau of Labor Statistics has divided the urban population, U and W, into 38 geographic locations called index areas. Within each of these index areas exist 211 categories of goods and services to be analyzed called item strata. This creates 8,018 item area combinations of data to be collected by BLS. There are two stages of calculating the CPI. First there is calculation of the *basic indexes.* The basic indexes give the average price change within each of the 8,018 area-item combinations. Each of these combinations has a specific category and must be recorded as such. Two examples of these would be 'Electricity Index – Boston CPI area' and 'Apparel Index- Men's furnishing – Chicago'. In the basic index stage, base year pricing is 1982-1984 and the weights for each good come from sampling frame for the category area. This means that for the Apparel Index of men's furnishing in Chicago, BLS would only collect consumer

spending data within the Chicago area. The data collected on consumer weights by BLS are the Consumer Expenditure Surveys (CE). The CE consists of a Quarterly Interview Survey and a Diary Survey. The Quarterly Interview survey is a booklet for the selected consumers to complete, questioning detail consumer spending habits which would cover the 211 item strata, along with collecting demographic information of the consumer/household. The Diary Survey acts as a follow up to the Quarterly survey and is much shorter.

The second phase of the CPI structure is the calculation of *aggregate indexes.* These indexes would take the average of each of the 8,018 item strata combinations, relative to either the location or the commodity. Two examples of aggregate indexes would be an index for all electricity in the 38 geographic locations or an index for all goods in the Chicago area. When analyzing aggregate price indexes of two different geographic areas, the difference is among that area's rates of price change. For example, say that the price of all goods bought in Chicago increased 3% from October to November and in Boston they increased 5%. The CPI data tells you that the market basket of goods in Chicago has increase slower than Boston's between October and November. What the index does not conclude is that the average price levels in Chicago are lower than those in Boston. Per BLS's article on the CPI, this is a common misconception (*ibid* 4).

The largest of these aggregate indexes is the 'All Cities Average – All Items'. This is the figure most commonly looked at as that month's CPI value and is also the first value that BLS recommends for analysis of the economic climate. This Index value is displayed as a price relative. With the period of 1982-1984 as the base year, the price

relative for those years is 100. The most recent data released from BLS shows that for

October 2013, the 'All Cities Average – All Items' price relative for CPI-U was 233.546.

In other words, the price of the market basket of goods in October 2013 was over 233%

higher than they were in 1982-1984. In the monthly reports issued by BLS, they will state

the month to month changes in each item strata as a percent. The index value CPI for the

month will be in a price relative format.

BLS aggregates indexes in a couple other ways; one of which is into item strata.

The Bureau grouped the 211 strata into 8 major groups:

1. Food and Beverage
2. Housing
3. Apparel
4. Transportation
5. Medical Care
6. Education/Communication
7. Recreation
8. Other goods and services

From here, these eight groups are expanded into 70 expenditure classes, then branched

out to the 211 total item strata, and finally into substrata called entry-level items (ELIs).

This grouping could be beneficial if researchers wanted to see how an individual sector

reacts to a change in the economy. An example of this would be if the Research and

Development team at Macy's wanted to look at trends in apparel pricing for the last 25

years from September to December. BLS also developed categories of 'special

aggregation'. These indexes are 'All Energy items' and 'All Items less food and energy'.

They are configured separately because the historically high volatility of food and energy

prices can skew broad analysis of the CPI. By eliminating food and energy from the

calculations and creating what is commonly referred to as the core inflation index,

agencies can acquire a better idea of the market place. Energy and food prices take a

heavier hit when severe shocks occur such as food shortages, bad crops, oil embargos,

and war.

Sampling

Within the 38 index areas of the United States, BLS has divided this into 87 Primary Sampling Units (PSUs) which they have decided are the smallest geographic areas in which pricing is to be done. PSUs are categorized by sizes A-D. PSUs that are size A have their own set of item strata because there is a large metropolitan area with heavy influence in the marketplace. Examples of size A PSUs are Los Angeles, Chicago and New York City area. Size D PSUs would consist of much smaller urban areas in less populous states. Currently a size C is the smallest PSU and those are located in Oregon, Tennessee, Washington and smaller cities within Texas. The unique weight is given to each PSU based on CEs and other studies by BLS. Generally the size A's will have a higher weight than the C's and D's. The current weights have been in place since the last major revision to the CPI in 1998.

BLS reports that its field agents visit 24,600 price outlets and retailers every month to collect over 85,000 different prices of consumer goods in the US. (*ibid,* 14) Interestingly enough, only half of the goods and services of all goods and services data is collected within those 85,000 prices for ELIs. These substrata units are 'ultimate sampling units' by which BLS officers who visit price outlets collect their data on (ibid 13). BLS has developed a system with commodity and services strata collection that allows for maximum efficiency given their limited man power and budget constraints.[3]

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[3] The matter which BLS collects housing data is an outlier topic which will be omitted from discussion. The calculation for approximating price relatives is similar and has the same debate with commodity and services when incorporating a chained CPI compared to current methodology, which will be discussed in Chapters 3 and 4.

Commodity and services strata are the primary source of data to show price changes in the Consumer Price Index. The collection of data in PSUs smaller than A's are alternated bi-monthly. A-size PSUs and certain strata are collected monthly regardless of PSU size, primarily energy and food at home. This alternating system has been found to help eliminate replicate reports and increase variance in sampling. Additional help in sampling came in a minor revision between 1978 and 1987 when point of purchase surveys (POPs) were incorporated into BLS research. Later in the fifth major revision, the US Census Bureau would begin to assist BLS by conducting Telephone POPs, or TPOPs. Both POPs methods collect surveys from retail outlets of the necessary ELIs to be collected at that time. These are then grouped into sampling categories called POPs categories. BLS has set a fixed number of POPs and TPOPs that must be conducted per PSUs in order to what they deem to be the most accurate data. The larger the PSU, the more POPs required. In September 2002, BLS began the use of computer-assisted data collection systems (CADC). These units are used by BLS officials at the price outlets to collect data and sort each ELI price collected into its one of 214 POPs categories quicker than by previous methods. Also installed in the CADCs are safeguard tools which prevent duplication and can recall the most recent collection of ELIs in that outlet to make sure there are no large discrepancies which may need to be addressed.

Current Formula

Since January 1999, the Laspeyres equation and geometric mean formulas have both been used by BLS to calculate price relatives in the CPI for all basic indexes. All but the following 13 strata use the geometric mean. The BLS website notes that the following strata remain in a Laspeyres calculation because they hold unique methods of obtaining

their respective prices and weights. These unique methods may be required because these strata are goods or services in either an oligopolistic market or there is not enough data to properly compute a geometric mean value based on the 1982-1984 period at this time:

1. Rent of primary residence
2. Owners' equivalent rent of primary residence
3. Housing at school, excluding board
4. Electricity
5. Residential water and sewage maintenance
6. Landline telephone services, local charges
7. Utility gas service
8. State and local registration, license, and motor vehicle property tax
9. Physician services
10. Hospital services
11. Dental services
12. services by other medical professionals
13. Nursing homes and adult daycare

This table is derived directly from page 20 of the Bureau of Labor Statistics press release titled *The Consumer Price Index*. The weights used in the geometric mean and Laspeyres formulas for quantity are based on findings in CE and POPs data. In the Laspeyres equation, the weights are divided by the ELI's price in the sampling period to create an estimated quantity.[4]

If the sufficient CE or POPs data could no longer be obtained for an ELI, the BLS officer uses one of three replacement measures; direct comparison, direct quality adjustment or imputation. Direct comparison methodology means that the BLS officer will evaluate the new versus old good. If there is no difference between the two ELIs at all then it is a pure substitution of value. Direct quality adjustment means that the BLS officer will have to utilize a equation in the CADC to calculate the relative price change and weight change of a ELI because the new version is somehow better than the old, yet comparable, but the old version is no longer useful in the market basket or will be

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[4] The formulas for the Laspeyres and Geometric mean equations are found in Appendix under Equation Set 1 and 2. Equation set 2 provides supplement formulas to Equation Set 1

eliminated completely by the new ELI. If imputation is necessary, then the replacement

good is far superior or completely different from its predecessor and no adjustment came

be made for that ELI. What will happen to that ELI category is that it will be removed

from the current market basket calculation of the CPI. In the next period the replacement

good price and weight from the last period will be viewed as previous price of this new

ELI. The current calculations were first established at the Seventh Meeting of the

International Working Group on Price Indices in Paris (Cage 4-5). The current price and

weights of the ELI will be measured against the initial period.[5]

Once all basic indexes are calculated, the aggregate indexes are found by

averaging the item-area combinations into their respective indexes. In order to calculate

these aggregates, three pieces of information will be required. First, input elementary

price indexes, the calculations just found, will be used for the CPI-U, CPI-W, and two of

the three versions of the C-CPI-U.[6] Next, the input expenditure weights calculated in the

basic indexes need to be weighted in respect to the consumer habits of the elementary

item category and area they fall in for that point in time. This equation aggregate weight

equation reads:

$$_{c,a,p}AW_\beta = \frac{_{c,a,p}(P_\alpha Q_\beta)}{100}$$

The equation reads that the aggregate weight of good c in area a by population p in period

β is equal to the estimated price of good c in the base period α times the estimated

quantity of good c weighted in period β divided by 100. (In order to place in a decimal

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[5] The formulas of the Laspeyres and Geometric Mean equations used by BLS are in the
Appendix under Formula Data 1.
[6] To be discussed in comparison in Chapter 3.

format) The base period α is equal to 1982-1984. Time period β refers to a reference period that is updated every two years. This period for β is a two year time frame that lags the current reference period by two years. Prior to January 2012, the β reference period was 2009-2010. Currently, the new reference period is 2011-2012.

The final piece of information needed to aggregate basic indexes is to decide on which price index formula is the best fit. Currently, the Laspeyres Index method is the chosen method with expenditure reference period for quantity weights, β, which is updated every two years. This bi-yearly update is done so that the consumer spending habits are as most current as possible, while BLS maintains their efficiency in reporting price indexes. One important assumption of using the Laspeyres model for aggregate indexes is that though β is updated with new weights, substitution of goods within or outside the market basket is zero. This could mean that a small difference in an index between two time periods may be different but not because of a change in the price of that particular commodity or the weight of it. If there needs to be any sort of revision to one of the CPI indices, BLS does have methods in place to make the changes. Once all aggregate indexes are computed, the Consumer Price Index for all cities and all items is reached. Chart 1 in the Appendix is the CPI for all urban consumers since 2010. This is currently the primary and first chart viewed in most economic studies when looking at an overall snapshot of price changes in the country.

Revisions and Errors

Since its origination in 1919, BLS has done six major revisions to the way the CPI is either calculated or how they report the index. These changes were incorporated due to

the constant research by the BLS staff, upgrades in technology, and new methods to calculate and collect data; all of which help to find more precise numbers, more efficiently, for better understanding of price changes in the US. An example of this would be that with each major revision, the base year has been adjusted to a more recent time frame. The last major revisions came in 1998 with updating consumer spending weights, geographic and housing samples, and new technology to speed up the surveying process. Another reason for updates over the years is because BLS has evaluated criticism from inside and outside scholars of how BLS conducts its studies. The biggest criticism has been that the data is far off actual figures by means of calculation or an error sampling or non-sampling (ibid 41-44).

One of the criticisms of calculation which was addressed, and worth noting at this point, came in effect in a minor revision in 1964. Recognition by BLS that events such as wartime, drought, and catastrophic weather can and do have a large shock in the price of certain goods, in particular, food and energy began the indexing of *seasonally* adjusted and *seasonally unadjusted* data. Every February since 1964, the seasonally unadjusted indexes are updated for the past five years of publication. This upcoming February, unadjusted indexes from 2009-2013 will be updated to seasonally adjusted indexes, though the unadjusted data will still be available. Per BLS guidelines, the seasonal data can only be adjusted to five years after its unadjusted data was originally reported. The basic indexes are updated first and then evaluated by BLS officers to see if seasonal adjustment of the aggregate data is necessary and, if so, to what degree.

A sampling error means that in the collection process for item strata (e.g. men's foot apparel) the prices of men's shoes sold at Wal-Mart stores were only used in the

calculation for All Cities. Non-sampling errors are primarily human error, lack of

sampling data, inputting the right data to the wrong PSU, etc. Though errors in reporting

data are becoming increasingly less, BLS will make revisions almost immediately and

release a report within one month after the error. As the Bureau states in its methodology

report (*The Consumer Price Index*, 5), with the routine that which data is collected, the

amount of data collected, the means by which it is collected, and the computerized

safeguards it has established, errors are few and far between. The use of CADCs and

TPOPs are tools that have been implemented in order eliminated criticism and improved

data quality.

Theoretically, even if the BLS adopted a methodology that on all levels of

reporting economic data was proven beyond a shadow of a doubt to be the most efficient

and precise way to go, there would still be critics. A form of technology could come

about that increases data reporting efficiency five-fold, economic theory could take a

major over haul, or some other innovation that's beyond current thought. BLS researchers

acknowledge that changes have made what was assumed to be the best methods

previously, even better. Currently there is a new methodology on the table for the Bureau

of Labor Statistics to examine for implementation, which is said to be more efficient than

the methods mentioned in this chapter. In this time of national recovery, such data is

weighed heavily on the Bureau's shoulders because the Consumer Price Index is such an

influential economic tool which provides a background and forecasting picture for

several elements of the financial situation of the US economy including consumption,

market activity and federal policies such as the tax brackets.

In the next section, there will be a discussion of the newer methodology to compute price indexes called the Chained Consumer Price Index. Similar to this chapter, there will be a brief history of the ideology and further defining of the new index followed by its current methodology as reported by the Bureau of Labor Statistics.

Chapter 3: The Chained Consumer Price Index (C-CPI-U)

Overview

The Chained Consumer Price Index for All Urban Consumers(C-CPI-U) was first listed as an index through BLS in August of 2002. It listed data from January 2000 with years 1999-2000 as the base year, which is still utilized as the base year for the Index. C-CPI-U was developed as an alternative to the CPI-U and CPI-W to better account for consumer spending habits within the urban population in particular when dealing with substitution of goods. If the price of a good increases, consumers may elect to buy less of that good and more of another or substitute that good. Previous equations used for indexing do not account for this substitution and commonly overstate price changes. The chained CPI's name derives from the equation, where monthly prices and weights are used from both the current and previous months chained together over the time series. This chaining of monthly weights together updates the 'base year' automatically and reflects the actual price changes better. The use of a superlative formula, the Törnqvist formula specifically, allows the chaining of these weights and demonstrates the substitution that occurs within month to month consumer expenditures. In other words, the C-CPI-U will calculate data that better reflects changes in the cost of living index (COLI) of the average American consumer because it incorporates the changes in the consumption habits.

A chained weighted system is already in use by the US government. The Bureau of Economic Analysis (BEA) adopted a chain-weight methodology in 1996 to calculate

the Real Gross Domestic Product of the US. The equation uses the growth rate of the previous year as the base combined with the growth rate of the current year. According to officers at the BEA, at the rate of the overall speed of output increasing exponentially every year, the idea of having a single base year would pose a practical problem in analysis. An example of this would be how personal computer prices and quantities have changed in the last 20-30 years. In the 1980s, computers took more time to produce, costs much more per unit, and were not as highly demanded in a home or business compared to a television. Since then, computer demand has increased based on marketing, and capabilities within them have increased. The units are being more efficiently produced, and the average price for a unit has significantly decreased. A chain-weighted methodology which would account gradually for the progression of computer production, consumption, exporting, etc. in the economy makes more sense to use than having what would be an out dated single base year of far inferior product (Macroeconomics 49).

A similar attitude has been adopted by BLS when critiquing the CPI-U and CPI-W index, hence the move toward the C-CPI-U. The Laspeyres methodology, geometric means, and any other previously used formulae by BLS do not account for substitution or quality assurance bias. As mentioned early, if sufficient CE or POPs data could not be obtained for an ELI, the BLS officer had to use one of three systems to replace the commodity in the index. The single base year pricing and weights, even at the two year interval replacement approach in use, may be a severe misrepresentation of the ELI or even entire item strata. An example of this would be the electronics strata in regards to tablets. The tablet is a newer personal electronic device which combines the benefits of a media player, a camera and laptop computer into one unit. Apple's iPad has remained

similar in price, but the number of units sold has increased nearly 500% since first hitting

the market in 2010. (Yahoo! Finance 1-2) This large increase in quantity sold leads one to

assume that the weight of importance of a tablet (i.e. iPad) will be significantly different

each year to the present. In this case, both the inability of the index to account for the

advancement in technology of the good (quality assurance bias) and the preferences of

consumers to buy tablets over laptops or media players (substitution bias) would cause

overstatements of the true cost of living index. The C-CPI-U aids in reducing both of

these current problems, a point mentioned in *Macroeconomics: Sixth Edition.* The

authors make an editorial discussion of this because of their recognition for the need to

adjust methodology of price indexing but not enough concrete research to make their

discussion any more than a scholarly note (51-2).

Methodology

Before the mechanics of the C-CPI-U are addressed, it is important to note that

this methodology does not completely eliminate all erroneous behavior in the calculation

of price indexes. The collection of data from PSUs is conducted in the same matter as

with the CPI-U and CPI-W and therefore is a calculation of only a sample of the entire

economy. Also, there is a fault of constructing the index by using a superlative equation

because it depends upon expenditure data which is only available at a lag. These

Consumer Expenditure Surveys are reported annually, but collected monthly. Due to

several factors such as the speed of which the consumers mail the surveys back to BLS

and the speed at which the BLS officers can input the data, correct annual data are not

available in full for BLS analysis for nearly a complete calendar year. BLS recognized

this and decided the best accommodation was to have C-CPI-U for each month reported

in three stages; initial, interim and final. As more expenditure data is reported, the more accurate the data becomes throughout the three stages.

The first stage is called the "Initial" C-CPI-U. This data is reported every month and is initially very similar to the CPI-U figures. For any given Initial C-CPI-U, the figures will hold until the next revision which will occur one year from that month, called the Interim C-CPI-U. These revisions are based on the receipt of CE surveys and POPs data. One year from the Interim, once more expenditure data is received and clarified, the Final C-CPI-U for that period is reported. For example, in December 2013, the Initial C-CPI-U will be released for November 2013. At the same time, the Interim C-CPI-U for November 2012 will be published, along with the Final C-CPI-U for November 2011. The methodology of calculating the C-CPI-U begins similar to CPI-U and CPI-W indexes but diverges at the aggregation process. This is due to the lag in consumption pattern data that needs to be collected for final C-CPI-U figures. While there will continue to be a lag in the proper cost of living adjustments, this will dissipate as technology increases the speed at which consumption and ELI data is collected and will be referenced as a check against the commonly under/overstated indices of Laspeyres and Paasche.

Currently, the C-CPI-U follows the same fundamental two step technique as the CPI-U and CPI-W indexes of reporting basic indexes first, then combining these basic indexes into larger groups to form aggregate indexes. The Törnqvist equation is not used in the basic indexing phase because there is not the sufficient expenditure data available. The combination of Laspeyres and Geometric mean formulas are used in the first stage of calculating the input elementary price indexes for the Initial and Interim C-CPI-U, just like in the CPI-U and CPI-W, but the Final C-CPI-U has a different approach. Most

commodity and services data is collected bi-monthly, as discussed before. In all but the Final C-CPI-U, the 'off cycle' data will assume the same values of what was last reported. The Final C-CPI-U utilizes a geometric mean formula of adjacent months to calculate the off cycle figure. This equation is shown as Equation Set 3 in the Appendix. (ibid, 33) This begins the first of several processes that implement a chaining or combining two years into one price relative calculation.

The next step is the calculating input elementary weight indexes. For the Initial and Interim C-CPI-U indexes, the weighted formula is similar to the CPI-U and CPI-W except that for prices use the β year estimate. This eliminates the use of a base year weighting which is updated every two years. For the Final C-CPI-U, the Törnqvist index is used by chaining the CE survey information of adjacent months for each item-area combination in order to calculate the weights. An excerpt from BLS's methodology report best describes the process.

> *First the monthly expenditure for the item is summed across all 38 areas to obtain a US monthly item expenditure; second, the US monthly item expenditure is allocated among all 38 elementary areas according to each area's relative expenditure share for the item during the current period and preceding 11 months. (ibid 36)*

In other words, each monthly weight for an item is taken at the reported le vvels of that month in that area and incorporates the previous 11 months' weights of that area along with all other areas to reach the estimated expenditure figure. (This formula is shown as Equation Set 4 in the Appendix.)

The third step of creating aggregate indexes in the C-CPI-U is to input the found weights and prices into an index equation. For the initial and interim C-CPI-U indexes, the geometric mean formula is used first to find month to month changes of price relatives. Next, the found relative is multiplied by an adjustment factor, noted by BLS as λ, which is historically found to be the difference between the geometric mean's and Törnqvist's findings. This λ is utilized to close the gap between the findings of each of the respective formulas to what can be thought of as a median value. Finally, this calculated index is multiplied by the previous month's C-CPI-U value to obtain the actual value to be used in that month's index.[7] By using the Törnqvist formula of chaining month to month price and weight data, consumer behavior of substitution of goods based on price changes is accounted for. The equations for these aggregate formulas for the initial and interim C-CPI-U are under Equation Set 5 of the Appendix and the final C-CPI-U is Equation Set 6 (ibid 38-9). Using data created by BLS, the Federal Reserve Economic Database (FRED) can be utilized to see the C-CPI-U in all stages that are able to be reported. An excerpt for the last three years is developed by Chart 2 in the Appendix.

Chapter Four will discuss the current political issues around the possible utilization of the Chained Consumer Price Index in place of the current methodology. Critiques by the members of the federal government, national news research, and current economic scholars will be mentioned. With the United States looking for answers and help for an ever increasing national deficit, the Chained Consumer Price Index is an option and its implementation has been hotly debated since early 2013.

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[7] Note that the use of 'final' as not used in order to distinguish the figures used in an initial or interim index compared to a final C-CPI-U.

Chapter 4: Political Economy of the Chained Consumer Price Index

The superlative equation used for C-CPI-U indexing has been proven by BLS and outside researchers to provide more accurate and efficient time series data of price changes within the economy by implicitly inputting substitution bias into the model and by replacing a single base year weight with a combined (chained) month to month time period. There are two theoretical drawbacks to the C-CPI-U index: data cannot be seasonally adjusted, and the chained indices are reported in the three levels with the final C-CPI-U being two years after the initial report. Both of these faults will be increasingly less problematic as more data is collected and by the evolution of methodology of sampling by BLS. The history, evolution, and current status of the CPI and BLS demonstrates this theorem if not by its six major revision in a hundred year span, but also by its own drive to release this chained index to supplement the current methods until it is accepted by the government as the primary economic indicator of inflation in goods and services. The CPI-U and CPI-W should not be eliminated from analysis, but should be replaced as the primary tool if there is a more accurate index out there.

In April 2013, President Obama included in his budget for 2014 a proposal to start utilizing the chained CPI index to compute how the government benchmarks certain programs such as tax brackets, social security COLA, and veteran benefit payments. As reported by Jeanne Sahadi of CNN:

> *It would slow the growth rate in all federal payments that are adjusted annually for cost of living. These include Social Security benefits, civilian worker and military pensions, veterans' benefits, and Pell Grants…It would also slow*

*changes to tax parameters that go up with inflation – and that could mean somewhat **higher taxes** for many filers. Measures adjusted for inflation include income tax brackets, the standard deduction, phase-out levels for tax credits and contribution limits to 401(k)s.*

- *Jeanne Sahadi, CNN*
April 2013

According to estimates by the Congressional Budget Office, implementation of the Chained CPI index would result in a $340 billion budget deficit reduction by 2023 (USA 2013). The major direct spending savings would be in the Social Security program, accounting for $127 billion. Revenues would be generated by the tax parameter increases over the ten year span. The demographic of the population which would see the largest increases in their tax brackets would be those in the $20,000 - $40,000 annual range (Zornick 2-4). This plan was put into the budget by Obama to show a sort of bipartisanism. This would incorporate the government spending cuts that the Republican Party does like with trying to change the tax bracket system in place, which is a goal of the Democratic Party (Sullivan 2-3).

Reducing the federal deficit and utilizing the most statistically accurate information in national economic reporting are important and ideal concepts, but several groups are looking at the repercussions of those whom would be negatively affected. The Social Security Administration constructed data demonstrating the average Social Security beneficiary would on average lose $658 a year with the new C-CPI-U index in place. Assuming the retirement age of 65, this benefit would nearly double in cuts when the recipient reached age 75 and would accumulate for a loss of $8500 in benefits paid by age of 80. [8] The CPI does report what the average market basket of goods cost in the current timeframe. The elderly have a much different basket in that they pay for higher

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[8] Refer to Chart 3 in Appendix

medical costs than the average consumer. For those who rely on Social Security income and/or Veteran benefits, the cost of living adjustment currently does not keep pace with the increase in prices of medical expenses and health care. Therefore, if the elderly and disabled are already struggling to support their health, the annual $658 loss of income would not make circumstances any better. Opponents to the chained CPI in respect to this matter would be those individuals who depend upon Social Security (AARP) and the majority of democrats.

Coinciding with this, those in the $20,000-$40,000 tax brackets are already struggling to make a decent living. As of 2010, the poverty line for the average household in the US is just $22, 314.[9] With the Chained CPI in place, though the tax increase may seem small at .3%, that $60-$120 may be the difference between a family buying a week's worth of groceries or having a few extra dollars set aside for an emergency room or doctor's co-pay. This is not to say those not close to poverty do not pay anything at all. Based on tax figures of 2009, a household income of $200,000 would have to pay an additional $400-500 annually. (*Who Pays?* 127-8)

One of the most recognized and respected critics of the full utilization of the C-CPI-U for Social Security disbursement is Dean Baker, a co-founder of the Center for Economic and Policy Research (CEPR), located in Washington D.C. [10]The CEPR's mission statement indicates its goal in 'presenting issues in an accurate and

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[9] Information taken from povertyusa.org but initially collected from *Income, Poverty, and Health Insurance Coverage in the United States: 2010*, US Census Bureau; *Current Statistics on the Prevalence and Characteristics of People Experiencing Homelessness in the United States*, updated July 2011, Substance Abuse and Mental Health Services Administration.

[10] . He was a professor at Bucknell University then later worked as a consultant for the World Bank, the Joint Economic Committee of the U.S. Congress, and the OECD's Trade Union Advisory Council.

An Evaluation of the Proposal to Implement a Chained Weight CPI

understandable manner, so that the public is better prepared to choose among the various policy options.'(CEPR.com)

On the CEPR website, there are two articles which best demonstrate Dr. Baker's point of view in a policy decision and political stand point. The first of these was a press release on April 5, 2012, listing several quotes from Dr. Baker about the expected proposal by President Obama's budget to implement the Chained Consumer Price Index. Baker contested that the President and his policy makers are not making sense. The implementation of the C-CPI-U would decrease Social Security benefit .3% annually. This would mean that after ten years of being on a fixed Social Security income, beneficiaries would be receiving 3% less income. The President also proposed increasing taxes on the wealthy but these increases would not only be ineffective in the overall economic deficit picture but for more aid to the Social Security System. In tackling both policy and politics in this matter, Baker stated:

> *Using the chained CPI to calculate benefits would have a much larger impact on the income of most retirees than President Obama's tax increases last year did on the wealthy. For a couple earning $500,000 a year, their taxes went up by $2,300 a year. That is less than 0.5 percent of their pre-tax income and a 0.6 reduction of their after tax income. Since Social Security is about 70 percent of the income of the typical retiree, switching from the current index to the chained CPI would be a reduction in income of more than 2 percent, more three times that of the tax increase to the wealthy.*

> *It is worth noting that Social Security in law and in practice has been kept out of budget negotiations. This makes the proposal on the chained CPI all the more unfortunate. While there will eventually have to be an agreement to address the projected long-term shortfall in Social Security's funding, President Obama is proposing to make a cut to benefits while getting zero in terms of increased revenue for the program. This is not the approach of someone who values the Social Security program (Barber 1).*

Additionally, it can be hypothesized by Baker's final statements of the press release that if BLS were able to publish an elderly Consumer Price Index which would complement the C-CPI-U, he would give his support to the President's policy change. In fact, BLS has been developing an experimental price index for the elderly population noted as CPI-E. In Charts 7 and 8 of the Appendix, you can see the differences that exist between the two current indices and the experimental group. Overall, price increases for the elderly population is larger than the CPI-U and CPI-W.

In *Thoughts on the Chained CPI, Social Security, and the Budget* states, Baker states that the C-CPI-U is in fact a better approximation than the CPI-U process currently being used, but it is not for the consumption habits of elderly people. An ideal index would be the difference between the CPI-U and the CPI-W because it would eliminate the workforce population and include only those dependent on government programs and other benefits. The strata of consumption that elderly people spend their money on have much less substitution capabilities than the rest of the population. Housing, health care, transportation and food are the primary consumption needs of elderly people (Baker 1-3). The percent of income devoted to housing and health care for elderly people is much higher compared to the rest of population because the older population requires a higher quantity of medical care and these treatments cost more per unit than that of the rest of population because of advanced technology and specialization. One of these highly expensive costs predominantly used by the elderly population is hospice care and senior housing. According to Caringinfo.org, an organization established to help families in understanding their hospice care options, the daily expense for hospice care ranges from $140-$300 a day.

Dr. Baker continues to elaborate the elderly need for Social Security by recapping how the housing market collapsing and the loss of pensions of the older population have created this stronger need. With this, Baker reminds the reader that Social Security funding is to be completely separate from the general budget. It is a system operated by the collection of tax dollars and that is where the proper reforms need to take place. This point is seen earlier by the quote from his press release. Baker's final critique of the Chained CPI matter is that the government is trying a tactic of 'statistical manipulation' of numbers in a way to create the illusion of the government proactively solving the debt problem, but covering their respective party's platform at the same time. He states that in the 1990s, colleagues from the BLS have been pressured by the federal government to report numbers that would lower what the government pays out in benefits; even though there was no BLS research to support the issue.

The final section of the paper will discuss the opinions and conclusion drawn by the author. These opinions and conclusions will be based on the author being a student scholar of economics, a concerned citizen of the United States, the data presented in this paper, and a third party perspective. There appears to be a clear decision to be made about implementing the C-CPI-U but those critical decision makers may be influenced in a way that overcomes logic.

Chapter 5: Conclusion and Recommendations

The Bureau of Labor Statistics developed the chained consumer price index (C-CPI-U) in order to more accurately report price changes of commodities and services in the US. There is much discussion about this calculation currently because if implemented, it would greatly affect government spending on programs such as Social Security and Veteran benefits. After comparing the current methods to the C-CPI-U index, with proof from outside resources, the chained methodology is more accurate than its predecessors. I believe that the major controversy lies in the political repercussions policy makers will face within their own parties and their constituents. The implementation of the Chained Consumer Price Index will reduce the deficit, but will reduce benefits to millions of individuals whom depend on Social Security and Veteran compensation income. As unpopular a decision this may be, the numbers do not lie. Our country is in a financial crisis and we have the answer staring at us in the face.

The political implications are recognized, but perhaps the powers in charge should think outside of the box. The Social Security System was a brand new system that was enforced to protect the elderly, disabled and war veterans. It was developed in a time of the Great Depression when the nation didn't have much money to work with. But the government made it work.

Using BLS data, specifically the figure in Appendix Chart 8, Baker notes that the elderly population faces a .2-.3 % higher inflation problem than the rest of the population. By cutting the Social Security benefits .3% a year while trying to tackle higher inflation rates, the elderly community will be worse off with the new system. Baker proposes that the CPI-E receive further funding for research and development in order to have the most accurate figures when to calculate price increases. This figure will be more effective and accurate in policy procedures, but also with public opinion. As Baker puts it, "While this would involve some expense, we will be indexing more than $10 trillion in Social Security benefits over the next decade. It makes sense to try to get the indexation formula right" (Baker '*Thoughts*' 3).

The Federal Government should implement the C-CPI-U index as the primary index for economic analysis. The nation is still in recovery from one of its great economic recessions and this is means to help close the budget gap. It only makes sense to use the most accurate data procedures in calculating how to drive a national economy. The errors of analysis are statistically becoming less as newer and more precise methods are being implemented by the nation's bureaus in charge of reporting economic data. The criticism of the C-CPI-U not reflecting the index of the elderly has already been addressed with the development of the experimental CPI-E. The BEA, a government agency much similar to BLS, is using chained weighted GDP data to construct and report indexes. It's not logical for one federal agency to use a higher evolved formula of data calculation and not another if the means are available. In fact, a report from the BEA, in regards to their change to a chained price index methodology, states that officers found

too many practical problems in analysis with the old equation, aka the equation currently mainstreamed by BLS for CPI.

The importance of having the most accurate statistics is crucial for nearly any aspect of life that involves planning. When planning a work commute, people rely on weather analysts to forecast the chances of good or rough driving conditions. Despite common criticisms, the weathermen of our time are predicting the weather better than before because of the adaptation of statistics. Dan Wilks, a Cornell University professor, writes a series called *Statistical Methods in the Atmospheric Sciences* which utilizes least-squared methodology and linear regression models to help forecast precipitation levels, red line storm areas more accurately, and identify areas and may be subject to extreme heat and for how long. In baseball the development of 'data analtyics' like earned run average, on base percentage and player's batting average help managers and clubhouse people analyze who should be in the starting lineup. This deep analysis of statistics was popularized by the 2011 movie *Moneyball*, which told the true story of the Oakland Athletics in 2002 a team that went from basically the worst team in Major League Baseball to one of the best in a matter of a year. Keeping with its respective terminology, the Chained Consumer Price Index is the home run our country needs to begin to bring us out of our $2.7 billion deficit.

When it comes to the correct calculation of the Consumer Price Index, it is vital to have the most accurate information. The data that is reported by the Bureau of Labor Statistics is reviewed in depth by businesses, corporations, small business owners, manufacturers, and the US government. The difference between using the current methodology of the consumer price index and the new chain consumer price index is

only a difference of three tenth of a percent. It doesn't seem like much but that three tenths of a percent over 10 years for 1 individual result in a loss close to $700. Now take $700 times the millions of people on social security or veterans payments and you have $44 billion that the federal government could be misallocating in its $2.7 trillion budget. If we as a country can adapt to a new calculation for the Consumer Price Index and save $44 billion in the federal deficit then who knows what other programs may be in need of statistical overhaul.

As an American citizen, I do not wish for any hard working American who has dedicated 30+ years of their lives to be stripped of their retirement income. Our veterans should receive compensation for their service to our country. I am not proclaiming an end to political parties which have been a part of our democratic system since the 1790s. I simply want to see a reduction and eventual depletion of the $17 trillion deficit. As an economist, I present a solution with the implementation of the Chained Weighted Consumer Price Index. Theoretically and in several projections, the C-CPI-U will work. It is an unpopular choice because of the ripple effects it will have on political parties, public policies, the money set aside to distribute to veterans, disabled elderly Americans, and the poor, but it is the most practical. The Bureau of Labor Statistics and President Obama need to sway the majority to believe in the greater good of the financial history of our country and have the C-CPI-U utilized as the standard measure of inflation today.

Chart 1

CPI-U : All Items
2010 - 2013 (Seasonally Adjusted)
Source: Federal Reserve Bank of St. Louis

Chart 2

C-CPI-U: All Items
2010- 2013 (Unseasonally Adjusted)

Source: Federal Reserve Bank of St Loiuis

Chart 3

Cumulative Social Security Benefit Cuts from Chained CPI
for Average Earner Retiring at Age 65

Age of Social Security Beneficiary

65   70   75   80   85   90   95

Cumulative Benefit Cuts in Constant 2012 $

-$307

-$1,841

-$4,631

-$8,660
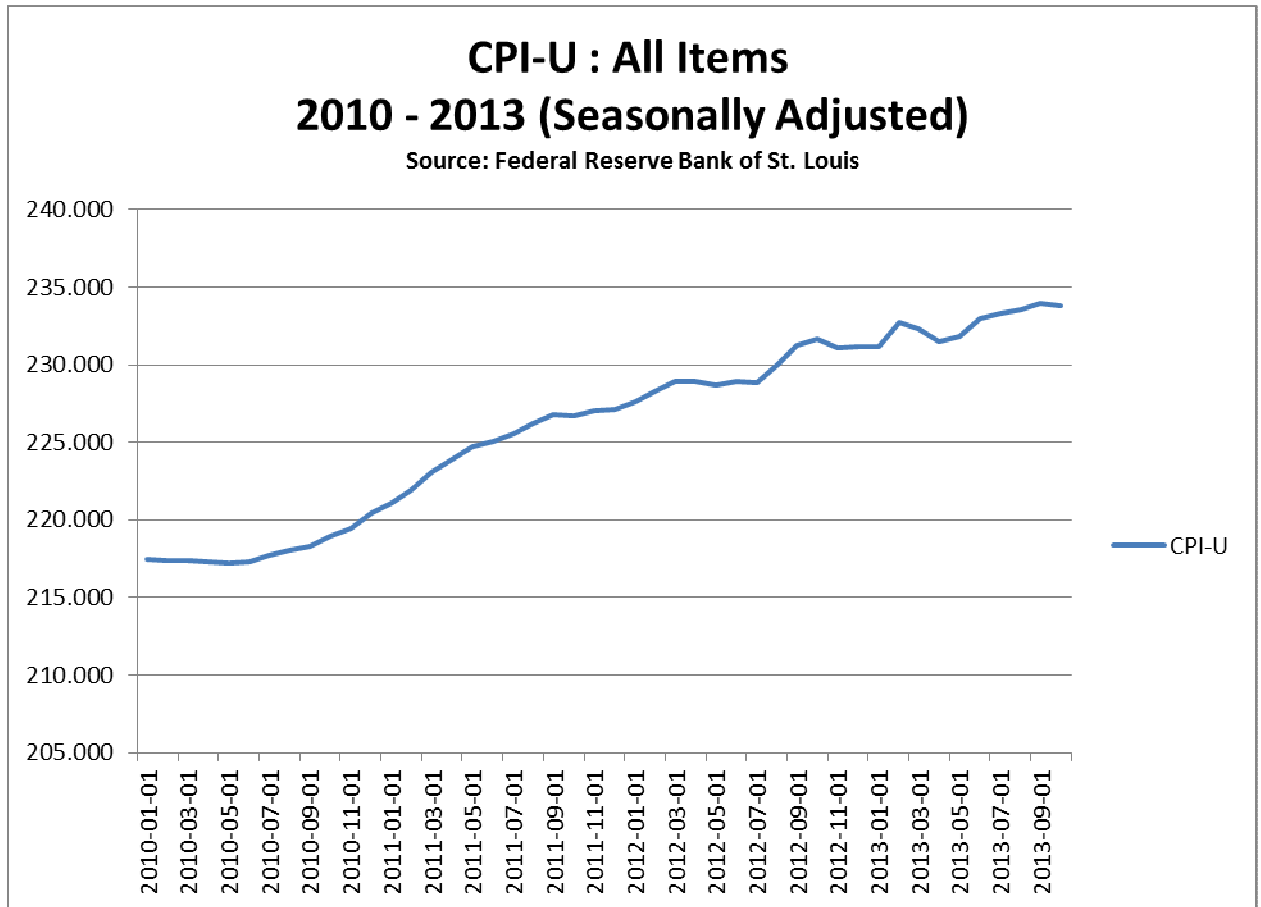
-$13,910
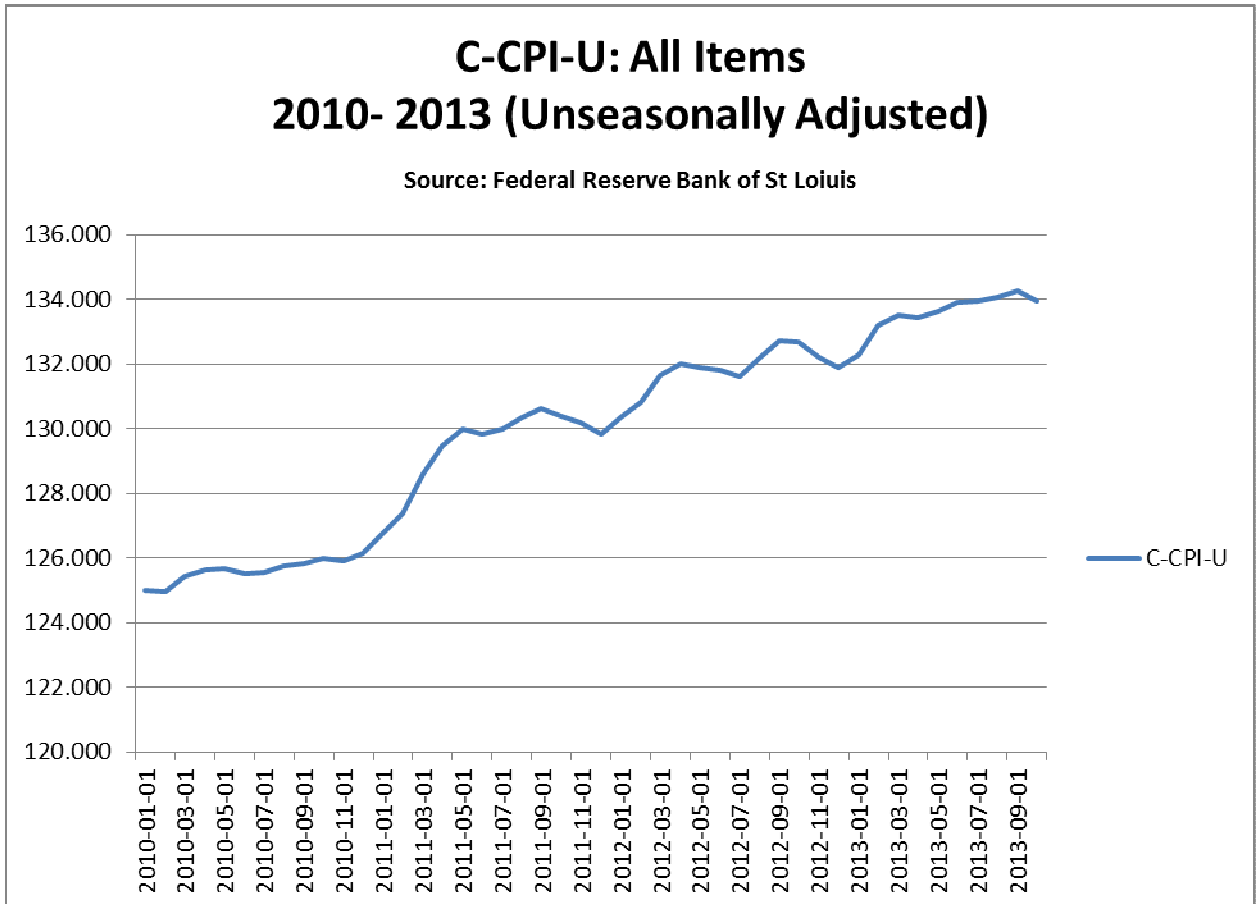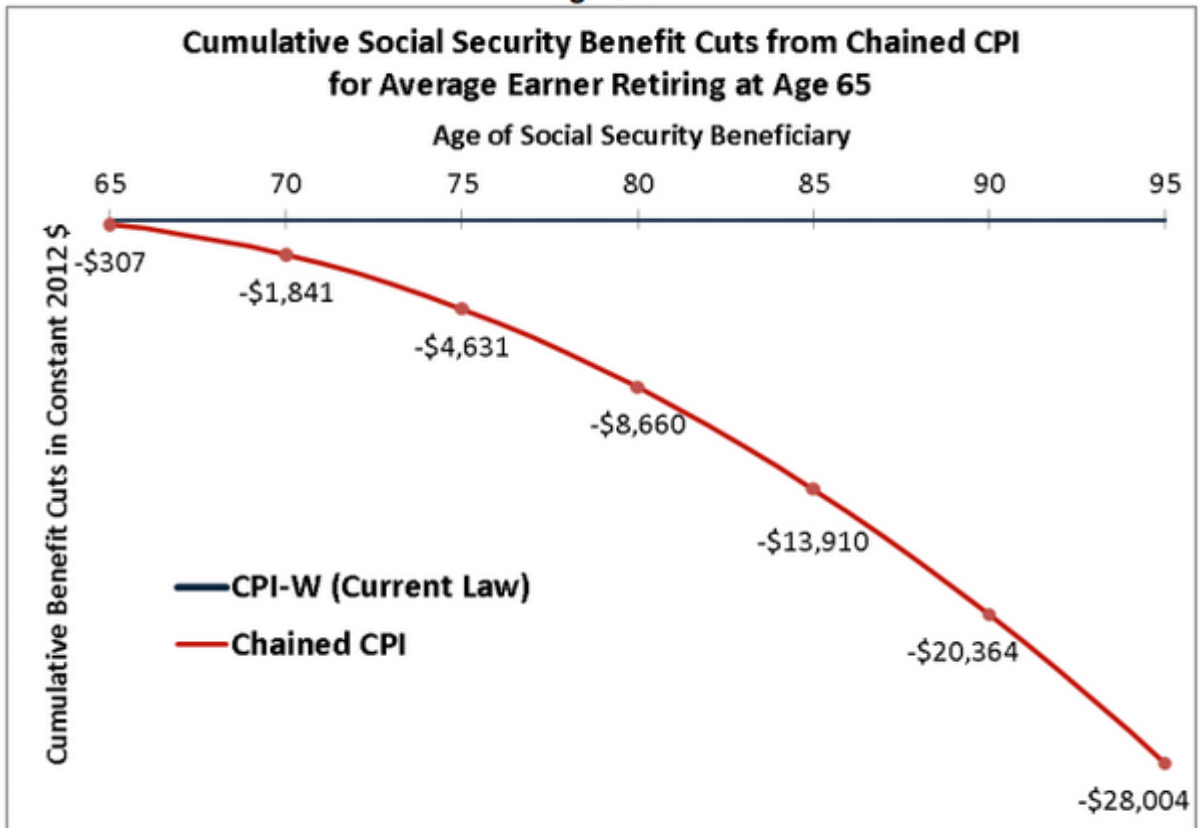
-$20,364

-$28,004

CPI-W (Current Law)

Chained CPI

Source: Social Security Administration, 2012.

Chart 4

Relative importance of expenditure categories in Consumer Price Indexes for three population groups, December 2011

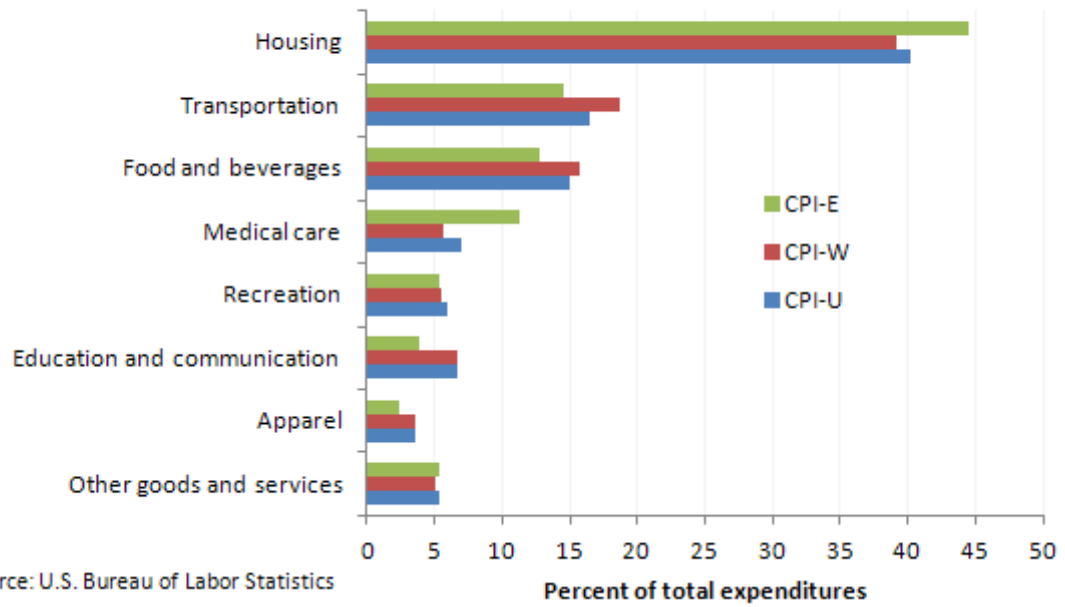Source: U.S. Bureau of Labor Statistics

Chart 5

Percentage changes in the CPI-U, CPI-W, and CPI-E by major expenditure group, December 1990--December 1995.

```
Expenditure Groups          CPI-U      CPI-W      CPI-E

All items:
  Total                     14.7       14.1       15.9
  Average annual rate        2.8        2.7        3.0

  Food and beverages        12.2       12.1       12.2
    Food at home            12.3       12.0       12.1
    Food away from home     10.8       10.8       10.9
    Alcoholic beverages     18.3       18.2       18.0
  Housing                   14.7       14.3       15.1
    Shelter                 17.3       17.1       18.1
  Apparel and upkeep         4.2        4.0        6.6
  Transportation             9.4        9.6        8.6
  Medical care              32.3       32.2       33.8
    Medical care commodities 22.2      21.5       23.1
    Medical care services   34.6       34.6       37.1
  Entertainment             16.0       15.4       18.2
  Other goods and services  28.3       26.6       25.1
    College tuition         49.6       47.7       43.4
```

Equation Set 1

$$_{a,i}R^G_{[t;t-1]} = \prod_{j\varepsilon\, a,i}\left(\frac{P_{j,t}}{P_{j,t-1}}\right)^{\left(W_{j,POPS}\,/\,\sum_{k\varepsilon\,i}W_{k,POPS}\right)}$$

$$_{a,i}R^L_{[t;t-1]} = \frac{\sum_{j\varepsilon\, a,i}(W_{j,POPS}\,/\,P_{j,POPS})P_{j,t}}{\sum_{j\varepsilon\, a,i}(W_{j,POPS}\,/\,P_{j,POPS})P_{j,t-1}}$$

where

$_{a,i}R^G_{[t;t-1]}$ and $_{a,i}R^L_{[t;t-1]}$, are, respectively, the geometric and Laspeyres price relatives for area-item combination, a,i, from the previous period, t-1 (either 1 month or 2 months ago), to the current month, t;

$P_{j,t}$ is the price of the jth observed item in month t for area-item combination a,i;

$P_{j,t-1}$ is the price of *the same item* in time t-1;

$P_{j,POPS}$ is an estimate of the item j's price in the sampling period when its POPS was conducted; and

$W_{j,POPS}$ is item j's weight in the POPS, which is defined in detail below.

Equation Set 2

$$W_{j,POPS} = \alpha \, E \, f \, g \, b \, / \, M \, B$$

where

α is the proportion of the total dollar volume of sales for the ELI relative to the entire POPS category within the outlet (called the outlet's *percent of POPS* for the ELI);

E is an estimate of the total daily expenditure for the POPS category in the PSU half-sample by people in the U-population (called the *basic weight*);

f is a *duplication factor* that accounts for any special subsampling of outlets and quotes;

g is a *geographic factor* used to account for differences in the index area's coverage when the CPI is changing from an area design based on an old decennial census to a design based on a more recent census;

b is the number of times the ELI was selected to represent the item stratum, divided by the total selections for the item stratum, in the PSU half-sample;

M is the number of quotes with usable prices in both months t-1 and t for the ELI-PSU half-sample; and

B is the proportion of the item stratum's expenditure accounted for by the ELI in the region.

$$P_{j,POPS} = P_{j,0} \, / \, [IX_{j,0} \, / \, IX_{j,POPS}]$$

where

$P_{j,0}$ is the price of the jth item at time 0 (when it was initiated or chosen for the sample);

$IX_{j,0}$ is the value of the price index most appropriate for the jth item in period 0, the time it was initiated; and

$IX_{j,POPS}$ is the value of the same price index in the POPS period (period *POPS*).

Equation Set 3

Imputation of Off-Cycle Indexes, C-CPI-U estimation

$$_{i,a,p}IX_{[a,t]} = \left(_{i,a,p}IX_{[a,t-1]} *_{i,a,p} IX_{[a,t+1]} \right)^{1/2}$$

where

p = population (Note: C-CPI-U is produced for the urban population only.)
a = CPI elementary area
i = CPI elementary item
t = year and month
α = base-period reference month
$_{i,a}IX_{[0;t]}$ = index of price change for elementary item (i) in area (a) from base period (0) to month (t)

Equation Set 4

Estimation of monthly expenditures at the elementary level

Estimated monthly expenditures

$$_{i,a,p}(\hat{P}\hat{Q})_t = \sum_{i,a\in i,A}^{a} {}_{i,a,p}(PQ)_t * \left(\frac{\sum_{t\in T}^{T} {}_{i,a,p}(PQ)_t}{\sum_{i,a\in A,\ t\in T}^{a}\sum^{T} {}_{i,a,p}(PQ)_t} \right)$$

where

p = population (NOTE: C-CPI-U is produced for the urban population only.)
a = CPI elementary area
i = CPI elementary item
A = all CPI elementary areas ("U.S. city average")
P = price
Q = quantity
t = month
T = time period covering month (t) and 11 months prior to month (t)

Equation Set 5

Initial and interim C-CPI-U upper-level aggregation formula

Initial C-CPI-U
Long-term price change

$$_{I,A,p}IX^{Gi}_{[z;y,t]} = {}_{I,A,p}IX^{Gr}_{[z;y-1,12]} * \prod_{n=1}^{t} {}_{I,A,p}IX^{Gi}_{[y,n-1;y,n]}$$

Interim C-CPI-U
Long-term price change

$$_{I,A,p}IX^{Gr}_{[z;y,t]} = {}_{I,A,p}IX^{T}_{[z;y-1,12]} * \prod_{n=1}^{t} {}_{I,A,p}IX^{Gr}_{[y,n-1;y,n]}$$

Initial C-CPI-U
Month-to-month price change

$$_{I,A,p}IX^{Gi}_{[t-1;t]} = \lambda \prod_{i,a \in I,A} \left(\frac{_{i,a}IX^{LarG}_{[\alpha;t]}}{_{i,a}IX^{LarG}_{[\alpha;t-1]}} \right)^{i,a,p}S_{\beta}$$

Interim C-CPI-U
Month-to-month price change

$$_{I,A,p}IX^{Gr}_{[t-1;t]} = \lambda \prod_{i,a \in I,A} \left(\frac{_{i,a}IX^{LarG}_{[\alpha;t]}}{_{i,a}IX^{LarG}_{[\alpha;t-1]}} \right)^{i,a,p}S_{\beta}$$

where

p	=	population (Note: the C-CPI-U is calculated for the urban consumer population only.)
a	=	CPI elementary area
A	=	all elementary areas ("U.S. city average")
i	=	CPI elementary item
I	=	all elementary items ("all-items")
t	=	month
y	=	year
λ	=	adjustment factor (Note: λ =1.)
z	=	base period of the aggregate index (NOTE: the All-Items, U.S. City Average C-CPI-U index has a base-period of z=December 1999.)
α	=	base period of the elementary index (i) in area (a)
$_{i,a}IX_{[\alpha;t]}$	=	lower-level index of price change from period (α) to month (t) for item (i) in area (a)
$_{i,a}IX_{[\alpha;t-1]}$	=	lower-level index of price change from period (α) to month (t-1) for item (i) in area (a)
$_{i,a}S_{\beta}$	=	expenditure in reference period (β) for item (i) in area (a) as percent of total expenditures in reference period (β) for aggregate item (I) in aggregate area (A)
$IX^{T}_{[z;t]}$	=	aggregate-level C-CPI-U Tornqvist index of price change from period (z) to month (t) for aggregate item (I) in aggregate area (A)
$_{I,A,p}IX^{G}_{[z;y-1,12]}$	=	aggregate-level C-CPI-U interim index of price change from period (z) to month (t) for aggregate item (I) in aggregate area (A) (Gr= geometric mean, interim indexes; G$_i$=geometric mean, initial indexes.)

Equation Set 6

Final C-CPI-U upper-level aggregation formula

Long-term price change

$$_{I,A,p}IX^T_{[z;t]} =_{I,A,p} IX^T_{[z;t-1]} *_{I,A,p} IX^T_{[t-1;t]}$$

Month-to-month price change

$$_{I,A,p}IX^T_{[t-1;t]} = \prod_{i,a \in I,A} \left(\frac{_{i,a}IX^{L \text{ or } G}_{[\alpha;t]}}{_{i,a}IX^{L \text{ or } G}_{[\alpha;t-1]}} \right)^{\frac{_{i,a,p}S_{t-1} +_{i,a,p}S_t}{2}}$$

where

p	$=$	population (Note: the C-CPI-U is calculated for the urban consumer population only.)
a	$=$	CPI elementary area
A	$=$	aggregate area
i	$=$	CPI elementary item
I	$=$	aggregate item
z	$=$	base period of the aggregate index (NOTE: the U.S. city average—all-items C-CPI-U index has a base period of z=December 1999.)
α	$=$	base period of the elementary index (i) in area (a)
t	$=$	month
$_{i,a}IX_{[\alpha;t]}$	$=$	lower-level index of price change from period (α) to month (t) for item (i) in area (a)
$_{i,a}IX_{[\alpha;t-1]}$	$=$	lower-level index of price change from period (α) to month (t-1) for item (i) in area (a)
$_{i,a}S_t$	$=$	expenditure in month (t) for item (i) in area (a) as percent of total expenditures in month (t) for aggregate item (I) in aggregate area (A)
$_{i,a}S_{t-1}$	$=$	expenditure in month (t-1) for item (i) in area (a) as percent of total expenditures in month (t-1) for aggregate item (I) in aggregate area (A)
$_{I,A}IX^T_{[z;t]}$	$=$	aggregate-level C-CPI-U Tornqvst index of price change from period (z) to month (t) for aggregate item (I) in aggregate area (A)

Appendix for Superlative Indices

When discussing a superlative index, the most referred to phrase would be 'smooth'. Price indices measure relative change of a good, or group of goods over a fixed period of time. A Superlative equation takes the data set and treats prices and quantities equally across periods allowing for substitution. They are proportioned and provide close approximations of cost of living indices and provide guidelines for constructing price indices. In other words, by taking a second derivative, second order, or a logarithm of the data set, which a superlative index commonly does, the smooth line formula is developed. With this, predicting future trends of the index and better understanding the historical movements are features of the superlative formula, making them the favored formulae for calculating price indices.

The International Monetary Fund released in 2009 *Export and Import Price Index Manual: Theory and Practice*. It is a heavily cited manual with reasoning by the parties involved in constructing the data, but also providing the history and theoretical reasoning for the current price indexing practices. In here, the authors state that 'economists prefer the superlative indices because they treat prices and quantities in both periods being symmetrical. Two different superlative equations consistently yield very similar results and behave in very similar ways.' (1.142) Because superlative indices require price and trade share (consumption) data for both of the periods to be chained, the trade share data may not be available as soon as the price data. Updated the trade share annually based on consumer surveys and ELI officer findings is beneficial because it will not only reduce the margin between initial indices (Laspeyres and Paasche) but will also update new

commodities and drop old ones as needed for the best picture of consumer consumption

patterns and indexing the relative price. (1.243)

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