THE CPI MARKET BASKET: A REVIEW OF ECONOMIC AND MARKETING VALIDITY ISSUES

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ABSTRACT

This article reviews economic and marketing validity issues of the Consumer Price Index (CPI) and the CPI Food at Home market basket as computed and reported by the Bureau of Labor Statistics' (BLS). It identifies a major controversy that has plagued the CPI for more than 70 years as well as addresses economic as well as marketing issues which explain the CPI's shortcomings. Specifically, it reviews the CPI literature for both food and non food components and reviews the major issues surrounding the CPI's computation methodology used by the BLS, and puts forth recent recommendations that have greatly helped reduce many of the CPI's shortcomings.

Keywords: Consumer Price Index, Bureau of Labor Statistics.

INTRODUCTION

The original impetus for the present article came from our School of Business and Economics' Marketing and Entrepreneurship Department (within the State University of New York College at Plattsburgh) acceptance, this in summer 2011, to take over the "Food Market Basket Data collection project". This project had been previously accomplished by a now defunct on-campus federally funded agency. This agency had been in charge of collecting, measuring, and reporting food price fluctuations by surveying three (3) conventional supermarkets and one Wal-Mart Supercenter, all located in the city of Plattsburgh, a rural setting (population of 22,000 people) in upstate New York, near the U.S./Canada border. The survey instrument utilized was composed of forty-one (41) food items. In September 2011, a quick perusal of the Consumer Price Index (CPI hereafter) food at home literature informed us that, within the last 20 years, major changes had occurred within food at home purchases by U.S. consumers. These changes, as reported by MacDonald (1995), were: 1. Shifts in consumer behavior such as in the case of decreased purchases in the food-at-home category because of increased purchases at restaurants; 2. Shifts in types of food purchases such as the purchasing of more "fresh" fruits and vegetables and less meat products; 3. Shifts in the Amount of new food products introduced in Supermarkets (for example, the number of new products introduced in Supermarkets increased from 5,400 in 1984 to 12,300 in 1992) and 4. Shifts in the amount and types of new retail outlets that sell food as in the case of a growing share of food sales occurring outside conventional supermarkets such as at drug stores, at warehouse club stores, at mass merchandisers (or general discount retailers), and at convenience stores as well. Because we were informed that our inherited 41-food item survey instrument dated back to 1978, we suspected that these issues and shifts had not been accounted for. Our team agreed that an assessment of our survey instrument's validity was in order. Our initial quick perusal of the CPI literature had equally revealed that there were a number of very important validity issues

as to how the Bureau of Labor Statistics (BLS hereafter) computed the CPI that remained unresolved to this day. We decided that we would conduct an exhaustive literature review of both the CPI food at home category as well as the CPI's other goods and services since CPI validity issues would concern all products surveyed by the BLS, the federal government agency responsible for computing and publishing the CPI on a monthly basis. As we are marketing scholars and had neither previous knowledge nor experience with the CPI, we believed this effort would help us, first, to best understand the "benchmark" of price fluctuation indexes in the U.S. and, second, help us make improvements to our survey instrument.

WHY THE CPI MATTERS

As stated by Schultze and Mackie (2002) "the Consumer Price Index (CPI) is one of the most widely used statistics in the United States. As a measure of inflation it is a key economic indicator. It serves as a guide for the Federal Reserve Board's monetary policy and is an essential tool in calculating changes in the nation's output and living standards. It is used to determine annual cost-of-living allowances for social security retirees and other recipients of federal payments, to index the federal income tax system for inflation, and as the yardstick for U.S. Treasury inflation-indexed bonds." Invariably, as suggested by Boskin et Al. (1998) the CPI impacts the U.S. national budget and the national debt as well.

A DESCRIPTION OF THE CPI

Essentially, the CPI is a measure of the average change in prices paid by urban consumers for a fixed market basket of goods and services including food" (MacDonald, 1995).
According to Wahl (1982) the CPI is "simply a fixed-weight index for measuring changes in consumer prices between a base period and a subsequent period, the weights being established by the typical expenditures of all consumers in the base period". The U.S. Bureau of Labor Statistics first published an index of consumer prices for food at home in 1903 (Reinsdorf and Triplett, 2004). In 1919, the CPI was expanded to include cloth and apparel. Equally occurring in 1919, the CPI started using weights which were computed from surveys of consumer purchasing patterns, this so as to distinguish the level of expenditures or relative importance of each product category included in the CPI. According to Reinsdorf and Triplett (2004), the history of economists' analysis of BLS prices indexes began with the assistance of Irving Fisher and Wesley Mitchell with the food index improvements of 1914. It is Mitchell who, in 1915, drew attention to the fact that the CPI incorrectly used Wholesale Price data (being more easily available) instead of Consumer Price data (Goldberg and Moye, 1985). Hence, at that point in time, the CPI was not accurately measuring price inflation at the consumption level, although the procedure of using wholesale price data may be excused since methods to survey the retail sector were far from being well developed.

As stated on the BLS website (WWW.BLS.GOV/CPI), the CPI is a monthly measure of the average change of the prices of eleven goods and services categories (see Table 1 at the end of the paper) and is published for two population groups: (1) the CPI for Urban Wage Earners and Clerical Workers (CPI-W) which comprise approximately 29 percent of the total population and

(2) the CPI for All Urban Consumers (CPI-U) and the Chained CPI for All Urban Consumers (C-CPI-U) which covers approximately 88 percent of the population. Every month, the BLS collects prices in 87 urban areas across the country from about 4,000 housing units who keep records of what products they have purchased and what prices they have paid. The BLS then verifies the prices paid for these products by trained representatives who either call or visit approximately 26,000 retail establishments such as department stores, supermarkets, hospitals, filling stations, and other types of stores and service establishments. In calculating the CPI, price changes for the various items in each of the 87 locations are averaged together with weights, which represent their importance in the appropriate population group. The weights of all goods and services equal 100. The weights of each good and/or service are subject to change over time. Food, for example, may at one point in time have a weight of 14.208 out of the total of 100. But if consumers find themselves spending more for energy because of increases in the cost of fuel or electricity, their food expenditures may change. The CPI measures price changes from a designed reference date. For the CPI-U and CPI-W the reference base is 1982-84 which equals 100. In the case of the C-CPI-U the reference base is December 1999 which equals 100. An increase of 16.5 percent from the reference base, for example, will be shown as 116.500.

The major challenge faced by the BLS in computing the CPI is to accurately compute a price index that is "representative" of "true" price changes of products purchased by consumers in U.S. Markets. In view of products, it must first chose to survey the prices of a representative sample of products being purchased, taking into account "new products" entering the market which may affect the prices of existing products. It must equally take into consideration the "quality improvements" of some products which may also affect the prices of existing products. It also needs to select a representative sample of retail outlets that includes new types of outlet formats which may sell products at a different price level and affect the prices at which products are sold at conventional outlets. For example, in view of choosing a representative sample of existing retail outlets as well as incorporating new types of outlets, the BLS uses a survey called the telephone point-of-purchase (TPOPS). Outlets are sampled from the TPOPS frame in proportion to their estimated sales within each of the goods and services category.

In essence, if the BLS desires that the CPI accurately measure and report price changes in the goods and services it surveys, it needs, for the least, to insure the following four aspects: first, that the "level of expenditures" per good and service category surveyed is representative of consumer purchasing behavior; second, that "new products" that enter the market be represented in the samples of goods and services surveyed; third, that "quality changes" in products be represented and accounted for in the samples of goods and services surveyed; and finally, that "new retail shopping outlets" be included in the outlet sample so that their impact on prices paid by consumers be accounted for. Hence, updating the CPI to correctly account all of these four market changes begin occurring, this on a non-delay basis is at the heart of the CPI's accuracy and, as we shall see, what characterizes the CPI's historical development.

CHALLENGES FACED BY THE BLS IN COMPUTING THE CPI

In their final report, the 1995 Boskin Commission clearly acknowledged the multitude of major challenges faced by the BLS in computing the CPI by stating the following: "Hence, the

very first point the CPI Commission made in its report was that inflation was inherently difficult to measure in a complex dynamic market economy" (Boskin et Al., 1998). Their answer to the question why changes in the cost of living are so hard to measure was most revealing of these challenges: "How to obtain information on who is buying what, where, when, and how in an economy, and then to aggregate it into one or a few measures of price changes raises a host of complex analytical and practical problems" (Boskin et Al., 1998). To illustrate the momentous challenges faced by the BLS, they put forth the following 4 points: First, they noted that there were literally millions of goods and services available in a modern economy and that for example, a single supermarket could contain some 30,000 differently priced items and that a Wal-Mart store could offer over 40,000 priced items; Second, that new products were being constantly introduced while existing ones were either being improved or disappeared; Third, that relative prices of different goods and services changed frequently in response to technological innovations and other factors affecting costs and quality which in turn led consumers to change their buying patterns; Finally, that as the U.S. had become richer, demand had increasingly shifted from goods to services, and, as well, to characteristics of goods and services such as enhanced quality, more variety, and greater convenience. They concluded: "But all these factors, plus others, means a larger fraction of what is produced and consumed in an economy is harder to measure than decades ago when a large fraction of economic activity consisted of a smaller number of easier to measure items such as hammers and potatoes". Interestingly, the 1995 Boskin Commission, in its final report, acknowledged the many challenges faced by the BLS, by stating: "The dimensionality of this task is difficult to convey, and we would not wish our recommendations for improvements to detract from our admiration for, and support of, the basic program as it has evolved and improved over the years."

THE CPI'S FOUR MAJOR PROFESSIONAL REVIEWS

A review of the CPI literature by Reinsdorf and Triplett (2004) suggests that between the 1930's and 2002, four major professional reviews of the CPI took place, each constituting a milestone in the history of the CPI. According to them, although a professional review of the CPI took place in 1933-34 by an Advisory Committee appointed by the American Statistical Association, the 1944 Mitchell Committee corresponds to the CPI's first professional review. This, they contend, was because the 1944 Mitchell Committee's recommendations were not only practical but equally conceptual with more in-depth discussions as well as larger in scope. The second major professional review was conducted in 1961 by the Stigler Committee which was appointed by the U.S. Bureau of the Budget. The third major professional review was made by the 1995 Boskin Commission which was appointed by the Senate Finance Committee. Finally, the fourth and latest major professional review was conducted by the 1999 Committee on National Statistics of the National Academy of Sciences Panel (CNSTAT panel hereafter) which was funded by the BLS and, was largely a response to the 1995 Boskin Commission review. In the following paragraphs, we shall summarize each review's impact on the CPI.

THE 1944 MITCHELL COMMITTEE: THE CPI UNDERESTIMATES INFLATION

The first professional review of the CPI according to Reinsdorf and Triplett (2004) took place under the auspices of the 1944 Mitchell Committee. Interestingly, as reported by Reinsdorf and Triplett (2004), initially, the most vocal CPI critics were the authors of the 1944 Meany-Thomas report, who held that the BLS "understated" price inflation in computing the CPI. This occurred during the Second World War when, because of necessary shortages/rationing in support of the War effort, prices were under inflationary strains. The U.S. government had to intervene by setting price controls as well as price subsidies to maintain the affordability of many goods. It is at that time that the CPI controversy gained national coverage, this especially with the 1944 Meany-Thomas report that vehemently disputed the CPI's accuracy in reporting price inflation. Examining the period from January 1941 to December 1943, George Meany and R.J. Thomas, respectively from the American Federation of Labor (AFL) and the Congress of Industrial Organizations (CIO), calculated that food price inflation had been 74.2% during that period as compared with the BLS's CPI reported rate of 40.2%, which, in effect, according to them, "understated" food price inflation by 34%. In terms of all goods and services measured by the CPI, the BLS reported a 23.4% rise in the cost-of-living for that same period of time whereas the 1944 Meany-Thomas calculated a 43.5% rise in prices.

It is at that point in time that the 1944 Mitchell Committee was formed and concluded that the effects of the unaccounted sources of biases within the CPI identified by the 1944 Meany-Thomas report were, either much smaller than claimed, or, that they were absent. As stated by Reinsdorf and Triplett (2004), the BLS vigorously disputed the Meany-Thomas report's contention that the cost-of-living index underestimated inflation by almost half, a position that was largely supported by the outside experts on the 1944 Mitchell Committee. Most interestingly, the 1944 Mitchell Committee recommended that the BLS change the name of its CPI index. The new name adopted by the BLS in September 1945 became "The Consumers' Price Index for moderate Income Families in large cities". Importantly, the 1944 Mitchell Committee, in response to the Meany-Thomas report estimates, produced their own estimates of the probable size of the CPI error. This is something that would equally be done later by the 1995 Boskin Commission, with the difference that they would claim that inflation was "overstated" rather than understated, as was claimed by CPI critics during the Second World War (Reinsdorf and Triplett, 2004). The 1944 Mitchell Committee concluded that, for the January 1941 to December 1943 period, the combined effects for all the unaccounted sources of bias by the CPI, as stated in the Meany and Thomas report, might have been no more than 3 to 5 percentage points above the CPI rate reported by the BLS.

The Meany-Thomas report is important because it clearly identified and discussed a number of unaccounted biases in how the BLS measured the CPI which, according to them, precluded it from accurately measuring and reporting price inflation. Most importantly, these biases have been re-addressed numerous times over the last 70 years and remain relevant to this day (although the CPI is now judged by its critics, this especially since the late 1970's, to overestimate price inflation). As stated by Reinsdorf and Triplett (2004), the 1944 Meany-Thomas report identified the following five "unaccounted for market conditions" by the CPI which in their

case, they claimed, contributed in having the CPI "underestimate" inflation : First, they contended that, during the January 1941 to December 1943 period, consumers were often forced to "substitute" more expensive varieties of goods for ones that had disappeared from the marketplace because of wartime shortages or "product line upgrading"; second, they alleged that consumers were often forced into more expensive dwellings because of shortages of affordable housing; third, lower-quality varieties of products often replaced higher-quality ones which occurred when manufacturers relabeled a lower grade item as a higher grade one (they gave the example of the deterioration in the quality of shoes manufactured during the wartime effort); the fourth and fifth unaccounted market conditions by the CPI argued by Meany and Thomas, were about "forced lifestyle changes" that incurred additional costs for consumers such as increased consumption of restaurant meals due to "meat rationing" as well as the entrance of women into the labor force and, extra costs incurred by consumers from migrating between cities to fill wartime jobs.

Historically, the CPI was referred to as a "cost-of-living index" (COLI hereafter). An important part of the 1944 Mitchell Committees' response to the 1944 Meany-Thomas report was a clarification of the conceptual goal of the BSL's cost-of-living index, as the CPI was often referred to at the time (Reinsdorf and Triplett, 2004). At that point in time, the term "cost-of-living index" was interpreted in at least three different ways: First, as a price index that holds constant the cost of living (which corresponds to the current standard interpretation); Second, as a fixed basket index that covered a family's entire budget; and Third, as the cost of attaining the standard of living deemed appropriate compared to the cost of a possibly lower standard of living in some previous period. Most importantly, the 1944 Mitchell Committee's view was that the CPI or cost-of-living index ought to measure only the influence of prices on the cost of living, not the influence of other factors such as those underlined by the 1944 Meany-Thomas Report. Hence, the substitutions that consumers experienced such as "forced uptrading", increased dwelling rents, diminishing quality of goods, and lifestyle changes were to be considered outside of the CPI's domain or realm. It is to clarify that nonprice influences on welfare were out of the CPI's scope as well as to avoid confusing the CPI with an index that measured few changes in the standard of living that the 1944 Mitchell Committee recommended that the BLS change the CPI's name to that of "Consumer Price Index for Moderate Income Families in Large Cities" (Reinsdorf and Triplett, 2004). In fact, at that point in time, the CPI was most representative of a straightforward "cost-of-goods index" (COGI hereafter) than of a COLI.

THE 1961 STIGLER COMMITTEE: THE CPI OVERESTIMATES INFLATION

The second professional review of the CPI according to Reinsdorf and Triplett (2004) took place under the auspices of the 1961 Stigler Committee. As reported by them, in 1957, the Joint Economic Committee conducted an investigation of employment, growth, and price levels. In subsequent hearings, the need for reliable price statistics emerged as a minor theme. A paper by economist Kenneth Arrow, who argued for a COLI objective for the CPI because of the importance of commodity substitution behavior by consumers, caught considerable attention. Subsequently, the U.S. Bureau of the Budget contracted with the National Bureau of Economic Research which appointed, in 1961, a Price Statistics Review Committee chaired by George Stigler. Two major positions taken by the 1961 Stigler Committee summarize its contribution to improving the CPI's

accuracy: first, the Committee agreed with the consensus by participants of the Second World War era who recommended that the CPI ought, in principle, to reflect the effects of substitution as exercised by consumers in buying cheaper goods/brands when these were available. According to Reinsdorf and Triplett (2004), the 1961 Stigler Committee went beyond the 1944 Mitchell Committee in stating unequivocally that the measurement concept for the CPI ought to be the cost of staying on an indifference curve. Second, the Committee was first to discuss a rather new market phenomenon occurring at the time, that of "voluntary substitution", this in contrast with the "forced uptrading" that had characterized Second World War consumer markets. In this, the Committee recognized that the CPI, in using fixed weights for each product category it surveyed for consumer expenditures, was not taking into account the effects of substitution when consumers would purchase alternatives goods or services that would save them money. More importantly, the CPI, in using these fixed weights, could not accurately measure price changes, and in contrast with the CPI's underestimating price inflation during the Second World War, it would now "overestimate" prices. Because the BLS in computing the CPI used a Laspeyres index corresponding to an arithmetic mean that could not account for substitution, the 1961 Stigler Committee recommended that the BLS periodically estimate price changes by using a Paasche index version of the CPI to gage the size of the bias from substitution never accurately accounted for by the CPI. The Paasche index uses a geometric mean that equals price elasticity to 1 instead of 0, as in the case of the Laspeyres index, and assumes the existence of substitution. Hence, when consumers would substitute lower priced items for higher priced items, this effect could be accounted for and consequently price changes would be reported more accurately. The 1961 Stigler Committee not only addressed the unaccounted substitution bias by the CPI but equally the CPI's unaccounted biases of changes in the quality of products, the treatment of consumer durables, and the price effects of new products. A major recommendation put forth by the 1961 Stigler Committee was that the BLS use probability sampling in view of how it chose samples of products and outlets to survey price changes. This procedure, the Committee contended, would be the only way to guard against biases due to an unrepresentative selection in the variety of products as well as retail store outlets. According to Reinsdorf and Triplett (2004), of all the 1961 Stigler Committee's recommendations, this was the one that would have the most important effect in helping improve the CPI's accuracy in measuring price changes.

Another major recommendation by the 1961 Stigler Committee was that the BLS should re-orient the CPI towards a cost-of-living index (COLI) rather than simply reporting price changes as in the case of the "cost-of-goods index" (COGI). This recommendation, if adopted, would gradually move the CPI closer to becoming a "welfare or "constant utility" utility index. As reported by Reinsdorf and Triplett (2004), the BLS's initial reaction to this recommendation was quite negative. Their rationale at that point in time was based on both the lack of research showing how to estimate a COLI and, on the BLS's doubts about the suitability of the COLI for the purpose or objective of the CPI. Interestingly, the BLS would eventually reverse itself and adopt the COLI as a conceptual framework but this would occur three years after the 1995 Boskin Commission, hence, 37 years later.

An article by Janet Norwood (1964) is indicative of how a BLS "supporter" (as opposed to a BLS "critic") perceived most of the recommendations put forth by the 1961 Stigler Committee. Acknowledging that the CPI was being criticized for overstating both the cost of living and

inflation, Norwood (1964), who was Commissioner of Labor Statistics at the time, stated that the CPI was a good measure of the changes in the purchasing power of the average family represented in the CPI index. She equally stated: "The CPI is based on a fixed market basket. That is, the weights of the mix of goods and services purchased during the base period are held constant from year to year until a major revision occurs. We keep the market basket constant deliberately because we want to keep fixed the living standard represented by that market basket. Our purpose, to the extent possible, is to isolate price changes from other changes which may occur in living standards". Interestingly, Norwood (1964) seemed pleased to report that the BLS had recently began to utilize a new consumer expenditure survey program that used the Census Bureau data collection of consumer expenditures as a basis for revising the CPI weights. Hence, her position vis-à-vis the 1961 Stigler Committee suggests that she, like the BLS, supported a COGI rather than a COLI as the CPI's objective.

THE 1995 BOSKIN COMMISSION: THE CPI OVERESTIMATES INFLATION

The third professional review of the CPI according to Reinsdorf and Triplett (2004) took place under the auspices of the 1995 Boskin Commission. It is interesting to note that, as reported by Wahl (1982), from 1965 till February 1982, hence a period of a little more than 17 years, the CPI had not registered one single monthly decline. In a 1995 article, MacDonald estimated that the CPI-U food at home, the nation's principal indicator of changes in retail food prices, "overestimated" inflation of food prices between 1 to 1.9 percentage points per year, this beginning around 1978.

According to Reinsdorf and Triplett (2004), it is after a remark on upward bias in the CPI in a testimony by Federal Reserve Chairman Alan Greenspan that the Senate Finance Committee appointed an Advisory Commission to study the CPI. That commission became known as the Boskin Commission, after its chair, Michael Boskin. Most interestingly, when the Boskin Commission was appointed in 1995, hence thirty-four years after the 1961 Stigler Committee, the BLS had still not implemented most of the 1961 Stigler Committee's major recommendations aimed at bringing the CPI into closer alignment with a COLI (Reinsdorf and Triplett, 2004). For example, the weights used to distinguish relative product category expenditures were not updated frequently enough; new goods that did not fit into the existing item structures of the CPI were not introduced early.

In its report, the 1995 Boskin Commission produced its own estimate of the probable size of the error in the price inflation reported by the CPI. According to its computations, the CPI had been overstating the change in the cost of living by about 1.1 percentage points per year, this well before the 1990's (Boskin et Al., 1998). They reported that over a dozen years, the cumulative additional national debt from over indexing the budget by using the CPI could amount to more than 1$ trillion (Boskin et Al., 1998). According to them, the over indexing of government outlays and tax brackets had had a direct impact on the Federal Deficit and debt. Also, as suggested by Boskin and Jorgenson (1997) "because the CPI component price indexes are inputs into the national income accounts, an overstated CPI implies that real GDP growth has been understated".

The 1995 Boskin Commission not only quantified the extent to which the CPI had overstated inflation but quoting previous studies as well as their own, they specifically addressed

four "upward biases" present in the CPI methodology used by the BLS. These biases were called "upward biases" because they contributed in having the CPI "overestimate" the rate of inflation. Table 2 (at the end of the paper) lists all four "upward biases' and their respective estimates (as reported in Boskin et Al., 1998).

The first "upward bias" discussed and estimated corresponds to the "Upper Level Product Substitution Bias". The upper level product substitution bias occurs any time a product "among" a category is substituted for another. For example, this bias occurs when consumers purchase beef instead of chicken because a promotional sale results in a lower price for beef. This "substitution" by consumers, historically, had not been accounted for by the CPI. The 1995 Boskin Commission estimated this bias to be 0.15 of a percentage point. The second "upward bias" discussed and estimated by the Commission corresponds to the "Lower Level Product Substitution Bias". A "lower level product substitution bias" occurs any time a product "within" a category is substituted for another. For example, this occurs when consumers purchase Mackintosh apples instead of Red Delicious apples because a promotional sale results in a lower price for Mackintosh apples. This "substitution" by consumers was equally not accounted for by the CPI. The 1995 Boskin Commission estimated this bias to be 0.25 of a percentage point. Hence, both unaccounted "product substitutions" by the BLS in computing the CPI was estimated by the 1995 Boskin Commission to add-up to 0.40 of a percentage point (Boskin et Al., 1998).

The third "upward bias" discussed by the 1995 Boskin Commission was that of "outlet substitution". As reported by the 1995 Boskin Commission, in view of changes occurring in retail store formats, the BLS had been computing the CPI as follows: "Outlets are chosen and rotated every five years from a point-of-purchase survey, asking consumers where they purchase goods and services, with probabilities of outlet selection proportional to expenditures. There is thus approximately a 20 percent refreshing per year. The prices are collected and compared within outlets. No account is explicitly taken of substitution across outlet types, as might be expected with the evolution of retailing" (Boskin et Al., 1998). The 1995 Boskin Commission estimated that the outlet substitution bias corresponded to 0.10 of a percentage point. Interestingly, this bias is still an issues as illustrated by the title of a journal article by Hausman and Leibtag entitled "CPI Bias from Supercenters: Does the CPI know that Wal-Mart Exists?" which was published in 2009, hence, 14 years after the 1995 Boskin Commission (Boskin et Al., 1998).

The fourth "upward bias" discussed as well as estimated by the Boskin Commission was that of New Product /Quality Changes. This bias occurs when either new products and/or quality improvements impact prices. Here it is important to note that prices may not necessarily be lowered. Still, over time, prices generally will fall. This bias was estimated to be 0.60 of a percentage point and is larger than the upper level and lower level substitution bias combined.

As stated by Johnson, Reed and Stewart (2006) the "BLS has maintained that the evidence on quality bias and its direction are much less clear than for substitution bias". In view of new goods and how they would get accounted for by the BLS, they pointed out that new goods could enter the CPI computations in one of the following three ways: First, during repricing, if a sampled item was no longer available in the sampled outlet, the data collector would then "substitutes" to the most comparable item still remaining in that outlet and begin pricing it; Second, new goods could also enter the CPI sample through sample rotation (for which, as stated earlier, there are many critics that hold that the BLS has been much to slow in doing so); Finally, there was the case

of new goods that would not fit neatly into the existing CPI structure. These new goods would be introduced into the CPI only when a major revision of the item structure would occur. The 1995 Boskin Commission recommended that all four "upward biases" needed to be quickly addressed and remedied by the BLS. As will be seen later in the paper, many of the 1995 Boskin Commission recommendations would eventually be adopted by the BLS, especially the COLI framework which became the CPI's measurement objective in 1997. But as a reminder, our earlier identified "Adaptation Lag factor" was still occurring within the CPI .

THE 1999 CNSTAT PANEL

The fourth and latest professional review of the CPI, according to Reinsdorf and Triplett (2004), was done under the auspices of the 1999 Committee on National Statistics of the National Academy of Sciences (CNSTAT hereafter). Interestingly, while 34 years had elapsed between the 1961 Stigler Committee and the 1995 Boskin Commission, only 4 years separated the 1999 CNSTAT panel and the latter Commission. According to Reinsdorf and Triplett (2004): "The CNSTAT review of the CPI is most memorable for it partial retreat from the Stigler Committee's recommendation of the use of a COLI as the measurement concept for the CPI". The 1995 Boskin Commission had also recommended that the BLS adopt a COLI as the CPI's objective. This ambivalence by the 1999 CNSTAT panel is also observable in view of when the BLS adopted, in 1999, the use of geometric means that replaced the Laspeyres formula used in computing the CPI which required seasonality adjustments. This move to geometric means by the BLS accounted as well as helped correct substitution biases for most basic component indexes in the CPI. According to Reinsdorf and Triplett (2004) "Nevertheless, it was unclear to the panel that the geometric mean index would always be superior to the seasoned Laspeyres index". This ambivalence is again observable in the CNSTAT panel's views on the issue of outlet substitution bias: "The panel's review of the available evidence suggested that outlet substitution bias was significant enough to be a matter of concern, but they doubted whether researchers would be able to produce sensible, reproducible estimates for adjusting for quality differences between outlets. They therefore concluded that BLS had little choice but to continue research on the effects of outlet characteristics on prices" (Reinsdorf and Triplett, 2004).

According to Berndt (2006) the 1999 CNSTAT panel differed from the 1995 Boskin Commission in four important respects: first, it was much larger in that it consisted of thirteen members versus the 1995 Boskin Commission's five members; second, its composition was more diverse, including not only economists, such as in the case of the 1995 Boskin Commission, but equally a sociologist, a psychologist, and two statisticians; third, while the majority of the members of the 1995 Boskin Commission agreed with the appropriateness of a COLI framework for evaluating the CPI, by contrast, the 1999 CNSTAT panel "took nothing for granted, and started from scratch, vigorously arguing at considerable lengths among themselves on these and many issues". Finally, the CNSTAT panel took place during the late 1990s booming and exuberant economy which enabled it to operate at a more leisurely and academic pace than the 1995 Boskin Commission.

THE CPI'S MAJOR CONTROVERSY: THE ADAPTATION LAG FACTOR

It is our contention that the major controversy that has consistently "afflicted" the CPI corresponds to the unrelenting slow pace at which the BLS's has been updating the CPI in accurately reflecting changing consumer market conditions in the U.S. economy. This controversy, as may be observed from the preceding four milestone reviews, has been occurring since the mid-1940 or, for over 70 years. The BLS's "slow paced" adaptation to market changes, or what we term the "adaptation lag factor", has invariably as well as directly affected the CPI's accuracy in reporting price inflation of goods and services surveyed by the BLS. As an example of this "adaptation lag factor", the 1995 Boskin Commission reported that the time it took the BLS to include new products such as VCR's, microwave ovens, and personal computers in its sample of products for which it surveys consumer purchases and collects price data at retail outlets, was 10 years after they had penetrated the U.S. market. Most importantly, by then, their respective prices had fallen by 80% or more (Boskin et Al., 1998). This type of slow paced adaptation has been, in our opinion, a recurrent phenomenon with the CPI as computed by the BLS.

In our view, historically, two distinct groups, formed mostly of economists, have either supported or criticized the BLS's slow paced adaptation and actions in making the CPI reflect changing economic market conditions and consumer behavior responses: the first group has consisted of BLS "supporters" such as, for example, members of the 1942 Mitchell committee, Norwood (1964), as well as members of the 1999 CNSTAT panel, who, throughout the years, have mostly agreed and defended the BLS's slow pace in making the CPI better account for market and consumer behavior changes (hence, accurately measure price inflation). The Second group, we believe, has consisted of CPI "critics" such as, for example, the authors of the 1944 Meany-Thomas report, a majority of the members of the 1961 Stigler committee, MacDonald (1995), members of the 1995 Boskin CPI commission, and as shall be seen later in the paper, Leibtag (2006), Volpe and Lavoie (2007), Hausman and Leibtag (2009), and Greenlees and McClelland (2011), who all hold that the BLS is much too slow in updating the CPI's computational methodology, with the very important consequence that, as may be observed, the CPI has, over many decades, either been greatly "understating" or "overstating" price inflation of the goods and services it surveys.

THE CPI AND RECENT DEVELOPMENTS IN THE LAST TEN YEARS

As reported to Johnson, Reed, and Stewart (2006) subsequent to the 1995 Boskin Commission recommendations made public in their December 1996 report, the BLS made major advancements in addressing many of the Commissions' recommendations. Essentially, the 1995 Boskin Commission recommended that the BLS address the following four biases: Substitution (upper and lower level); new goods bias; quality bias; and outlet substitution bias. As mentioned previously, in 1997, the BLS first re-affirmed a "cost-of-living" index as an objective for the CPI's conceptual framework. In 1998, in view of the outlet substitution bias issue, the BLS changed its outlet rotation procedure to better account for the changes occurring in the retail sector of the U.S. economy. Hence, the CPI went from rotating 20 percent of the outlet sample each year to 25 percent so that the entire sample was rotated every 4 years instead of 5 years (Johnson, Reed, and Stewart, 2006). It addressed the substitution bias by way of accounting for price elasticity instead

of assuming it away. Specifically, as stated earlier, in 1999, geometric means were introduced in the CPI computation methodology which helped better account as well as reduce the upward bias resulting from upper level substitution. In view of the lower level substitution bias, in 2002, the BLS started producing a "Chained Consumer Price Index for All Urban Consumers" (C-CPI-U) which used a Tornqvist formula which replaced the Laspeyres formula which assumes zero substitution by consumers. The Laspeyres formula remained in use mostly for housing and medical care product categories. Excluding rent and owners' equivalent rent, Johnson, Reed, and Stewart (2006) report that "only one-seventh of the weights in the CPI still use a Laspeyres formula to calculate basic indexes". In view of the "quality bias", due to major advances in the field of hedonics, the BLS expanded the use of hedonic models to better account for changes in the quality of products (Berndt, 2006). In view of the "new goods bias", the BLS instituted procedures to introduce new goods more quickly into the CPI index by having more frequent updates to the item samples. Finally, in 2002, the BLS began updating expenditure weights based on consumer expenditure surveys every 2 years as opposed to roughly every 10 years in the past.

It may then be asked what impact did the revisions/changes made by the BLS to the CPI methodology have on its measure of price inflation. According to Berndt (2006) a positive impact had occurred: in June 1999, the U.S. General Accounting Office (GAO) initiated a study identifying methodological changes the BLS made to the CPI since the 1995 Boskin Commission. It asked the opinion of the four remaining members of the 1995 Boskin Commission as to how much of the bias in the CPI remained after changes were implemented by the BLS. The four former members of the 1995 Boskin Commission estimated that the changes brought by the BLS had reduced the annual upward CPI bias from 1.1 percentage points to between 0.73 and 0.90. It is, hence, puzzling to us to read what financial advisor Howard Simons wrote in 2004, a few years after the BLS had made major changes to its CPI computation methodology: "The CPI is a Laspeyres Index …. and is known to be an imperfect inflation measure. It ignores economic realities such as price elasticity of demand, substitution and technological improvement, so-called hedonic adjustments aside" (Simons, 2004). This quote would seem to suggest that some financial advisors were not fully aware of the BLS's latest efforts to improve the CPI's accuracy in measuring inflation. Interestingly, as reported by Berndt (2006), although the CPI is still acknowledged by some to be upward biased, hence overstate inflation, it has been found by others that in the case of some its goods and service categories, the CPI is likely to have been downward biased, hence, understating inflation. Berndt (2006) cites the following studies as examples: first, in a study by Nordhaus (1997) on the price of light, corresponding to the CPI's Energy product category, Nordhaus argued that, using CPI methods, its price increase would have been overstated by around 1.4 percentage points per year, this since about 1800; second, in view of Nordhaus' (1997) reported downward bias, Hulten (1997) argued that if this bias were true for the overall CPI as well as constant over time, then the implied standard-of-living for U.S. households in 1800 would have been implausibly low; third, and still in relation to Nordhaus'(1997) reported downward bias, a study by Gordon (2004) calculated that had the bias in the overall CPI been 1.4 percentage points annually since 1800, then the 1800 median household would have able to purchase only 1.3 pounds of potatoes per day, with nothing left over to pay for shelter, clothing or other goods. In addition, Gordon (2004) presented persuasive evidence that in the case of apparel, due primarily to the inability to link style changes reliably, there has been a downward bias over

time (and Berndt believes this downward bias to still be the case in 2006); finally, a study by Gordon and vanGoethem (2005) also documented a CPI downward bias for shelter, caused in part by the non response of tenants to CPI surveys who had moved just as rents were being increased. Interestingly, Berndt (2006), states that because of improvements brought by the BLS in its surveys since the mid-1980s, the CPI shelter downward bias is likely to be negligible. According to Berndt (2006) the BLS's major unfinished business was that of improving the accuracy of the CPI in accounting for the product category corresponding to medical care.

THE FOOD AT HOME CPI IN THE LAST TEN YEARS: THE LINGERING OUTLET SUBSTITUTION BIAS

Still, for many economists, the earlier reported important changes adopted by the BLS, beginning in 1997, so as to reduce the CPI's known upward bias in reporting price changes and inflation, were not enough nor done fast enough. Here we specifically review the "food at home" CPI literature since the publication of the CNSTAT panel recommendations in 2002. Leibtag (2006) reported that the CPI measure of food inflation was based on a selection of stores that had not been updated quickly enough to reflect the amount of food sold through big box stores. Leibtag (2006) estimated that annual food price changes as measured by the CPI had averaged an increase of 3% since the mid-1980s. Nontraditional food retailers such as Wal-Mart, Costco, and Target had gained more of the consumer for dollars since the mid-1990s: the share of sales going to traditional retailers such as conventional supermarkets had fallen from 82 percent to 69 percent by 2003. Previous studies had demonstrated that food prices at non-traditional retailers such as supercenters (Wal-Mart, Target) and wholesale clubs (Sam's, Costco) were on average 8-27 percent lower than at large supermarkets. However, these comparisons over store formats had not accounted for quality or package size. In conducting a study of dairy products and eggs, Leibtag (2006) found that dairy prices for similar package sizes were between 5 to 25 percent lower at nontraditional retailers than at traditional supermarkets.

Volpe and Lavoie (2007) investigated the competitive price effect of Wal-Mart supercenters on national brand and private label grocery prices in New England. As compared with conventional supermarkets, they found that Wal-Mart priced national brand goods 6 to 7 percent lower and that in the case of private label goods, prices were 3 to 8 percent lower. As compared to private label goods, supercenters had a greater impact in lowering prices on national brands. As national brands appeal to higher income consumers and that private label goods appeal to lower income consumers, they posited that what would explain their finding that Wal-Mart had lower prices for national brands than for private label goods was that private label goods, while universally cheaper than national brands, have higher markups. Conventional supermarkets, in facing Wal-Mart's lower price strategy, had increased their use of private label goods. Finally, Wal-Mart's lower prices were found to be most significant for both national brand and private label Groceries and dairy products and, least significant for national brand meat.

In an article entitled "CPI Bias from Supercenters: Does the BLS know that Wal-Mart Exists?" Hausman and Leibtag (2009) reported that the retail sector of the U.S. economy had witnessed immense changes that had begun before the new millennium: for example, they reported that Wal-Mart supercenters began selling food in 1998 and had became the largest U.S. grocery

chain by year 2002. Citing a study by Little (2004), they reported that supercenters (Wal-Mart, Kmart, Meijer, etc.), warehouse clubs (Sam's Club, Costco, and BJ's), and mass merchants (Wal-Mart, Kmart, and Target, etc.) which Little classified as "high-spend" expenditure stores (in contrast to "low and medium spend stores such as convenience stores) accounted, in 2003, for 24.8 percent of food expenditures in the U.S., with supercenters alone accounting for 45.6 percent of the category. In particular, Wal-Mart had become the largest supermarket chain in the United States, accounting for 14 percent of food sales while not being present, at the time, in many regional markets. When Sam's Club (owned by Wal-Mart) food sales were included, Wal-Mart's market share moved up to 18 percent. By year 2003, according to Little (2004), Wal-Mart's food sales, excluding Sam's Club food sales, had supermarket-related revenues approximately 51 percent larger than runner-up Kroger, and larger than the combined revenues of Albertsons and Safeway, respectively the third and fourth largest supermarket chains.

Hausman and Leibtag (2009) in analyzing the BLS procedure in computing the CPI, specifically took issue with what they believed caused two upward biases: First, they argued that the BLS's "linking procedure" used to incorporate new retail outlets in its sample of stores assumed that "quality adjusted" prices at Wal-Mart were exactly equal to prices at conventional supermarkets. Hence, the BLS procedure would, when including a Wal-Mart store in its outlet sample, link the lower Wal-Mart price to the higher conventional supermarket price in such a way as to remove any differences between both prices. According to them, the BLS in producing the CPI, made the implausible assumption that all price differences between supercenters and other stores were due to quality differences, nothing else. They argued that there was no empirical evidence that showed this to be the case. This bias is still in existence according to Greenlees and McClelland (2011). As they state: "The implicit assumption used in the CPI is that any cross-sectional differences in the prices charged in different outlets for the same item are attributable to outlet-related variation in "quality": stores offering lower prices may be less conveniently located, offer more limited product selection or hours of operation, and so on. Intuitively, in a state of static equilibrium in which outlets offer different prices there must be exactly offsetting differences in outlet quality. If not, one outlet would increase its share of the market". As pointed out by Hausman and Leibtag (2009), many past studies had shown that supercenters, mass-merchandisers, and warehouse clubs had in effect dramatically increased their market share and that these increases were not solely the result of "quality" differences.

Second, they argued that although the BLS updated its samples of store every four years as well as the goods and services in the market basket, they took issue with the "expenditure weights" which according to them were not updated quickly enough. It is important to note that although their article was published in 2009, it was based on a 2004 Conference presentation. Most interestingly, Berndt (2006) reported that the BLS had been, since 2002, updating expenditure weights based upon consumer expenditures every two years instead of the roughly every ten years in the past. Although Hausman and Leibtag (2009) acknowledged that the BLS had updated the outlet sampling procedure to a full rotation being done every four years instead of every five years, they simply considered the BLS "linking procedure" to be tremendously flawed.

Finally, Hausman and Leibtag (2009) in conducting a study to investigate the effect of supercenters, mass merchandisers, and wholesale club stores on food prices, found that Wal-Mart offered identical food items at an average price about 15 to 25 percent lower than traditional

supermarkets. Moreover, Wal-Mart's entry into a new geographic market created two different "price effects": first, a "direct" price effect by offering a lower price option to consumers; second, Wal-Mart created an "indirect" price effect by causing traditional supermarkets to lower their prices. According to them, the BLS "linking procedure" which cancelled out Wal-Mart's lower prices captured only the "indirect" effect, not the "direct" effect. Most importantly, Hausman and Leibtag (2009) concluded that annual food at home inflation was to high by 0.32 to 0.42 percentage points.

Greenlees and McClelland (2011), in studying the impact of the appearance and growth of new types of retail outlets on food prices found that the upward impact on prices from increased item quality had offset most, but not all, of the downward impact of lower priced outlets. Hence, in a strategy to protect their profit margins, they report that warehouse club stores, for example, had decided long ago to trade "low prices" for "increased sizes. They stated that their study's results offered by no means conclusive evidence of CPI bias but that "item quality" and "outlet Characteristics" were not negligible factors and warranted more research.

THE CPI AND MARKETING VALIDITY ISSUES

It may be noted that all of the CPI's four major biases (substitution, new products, quality changes, and outlet substitution) pertain to both the fields of economics and marketing. Substitution biases, whether "lower" or "upper" level, concern consumer behavior, an important field of study in marketing. The same may be said about "new products" and "quality changes". Outlet substitution specifically corresponds to the field of marketing channels with a special emphasis on retailing.

Validity in the social sciences such as for example Sociology, Psychology, Economics and Marketing corresponds to insuring that a measurement instrument measures accurately what it claims to be measuring, not something else (Zikmund and Babin, 2010). As mentioned previously, our inherited food at home survey instrument was composed of forty-one (41) food items. In September 2011, as our team began using this survey instrument, the following five (5) issues quickly came to our minds: these corresponded to the survey Instrument's: 1. Source; 2. Timeliness; 3. Number of items; 4. Item composition; and 5. Rural vs. Urban settings. In view of the first issue, we were never informed from what scientific basis/source the list of 41-food items originally came from. We assumed that it corresponded to a previous version of the list of food at home items surveyed by the BLS. We were told that, in 1977, the list had previously comprised 68 food-items, and that this number was scaled down to 48 items in 1983, this by another on-campus organization before it was transferred over to the now defunct federally funded agency. In view of the second issue, our inherited list of 41-food items dating back to 1983 was already 28 years old by 2011. More importantly, it was thought important to inquire about the present "Benchmark" in terms of the most scientific and currently available list of food items used by the U.S. Bureau of Labor Statistic in measuring, computing and reporting the Consumer Price Index (CPI) food at home price fluctuations. In view of the third issue, we found that, in 2012, the BLS verified the prices of 76 different food items in its report which, compared with our list of 41-food items, corresponded to 85% more food items surveyed. In view of the fourth issue, a quick perusal of the list of 41-food items revealed that 69% of the 41 items corresponded to "private-label

brands". We wished to verify if this proportion was similar or different to the list of food items used by the BLS in publishing the CPI. Finally, we desired to inquire if our list of 41-food items should not be "adapted" or modified when food price data is collected in a "Rural" area or setting such as our city of Plattsburgh. For example, the fixed Market Basket used by the CPI is designed to measure changes in the prices paid by "Urban" Households. To that effect, in 2012, the BLS, in computing the CPI each month, sampled 4,000 households located in 87 urban areas which kept records and reported prices they paid as well as collected price data from 26,000 retail establishments. Hence, adapting the Urban based food Market basket to produce a "Rural Food Market Basket" would seem to be a valid idea.

FUTURE RESEARCH

After gaining a solid understanding of the CPI's strengths and weaknesses, we foresee the following three research opportunities: First, we would want to assess our inherited 41-item food at home survey instrument's convergent validity this in view of the latest CPI food at home survey instrument published by the BLS. As mentioned earlier, since our inherited 41-item survey instrument dates back to 1983, this study would help us observe as well as compare the magnitude and direction of any resulting differences between both survey instruments. Using the latest (2013) CPI food at home list of items, we would make sure to collect supermarket/grocery data for at least three consecutive months. The second and third research opportunities would seek to replicate two parts of Volpe and Lavoie's (2007) research findings: First, we would want to assess if their findings of Wal-Mart's supercenters competitive price effects on grocery prices in New England would be similar in magnitude and direction in our upstate New York rural city of Plattsburgh (which also has a Wal-Mart supercenter); Second, we could conduct a study which would focus on the competitive effects of Wal-Mart supercenters on national and private-label grocery prices and establish if our findings based on Plattsburgh's Wal-Mart supercenter replicate those reported by Volpe and Lavoie (2007) in New England.

CONCLUSION

Although an important number of major recommendations made by the 1995 Boskin Commission have been adopted by the BLS in rendering the CPI more accurate in accounting for consumer behavior (both upper and lower level substitution, new product adoption, and quality changes) and Market changes (outlet Substitution), no other major revision by an appointed Commission or Committee has occurred since the 1999 CNSTAT panel. According to many economists, especially in view the food category and outlet substitution effects, the BLS still suffers from what we have termed the "adaptation lag factor". Studies undertaken within the last 10 years since the publication of the CNSTAT panel report such as those by Hausman (2003), Leibtag (2006), Volpe and Lavoie (2007), Hausman and Leibtag (2009), Greenlees and McClelland (2011) reveal that the CPI as well as the CPI-U food at home, still keeps overestimating price inflation by virtue of not correctly accounting the real impact of major changes that have occurred in the Retail sector of the U.S. economy, especially the major impact of Supercenters (such as Wal-mart) on retail prices as well as the still not properly accounted for

impact of "quality changes on prices**.** In view of outlet substitution, many economists believe that validity issues still plague the CPI as a measurement of price changes and inflation. Interestingly, outlet substitution bias, as estimated by the 1995 Boskin Commission corresponded to 0.10 percentage points out of the total 1.10 percentage points when all four sources of upward biases (upper level substitution, lower level substitution, new product/quality changes, and outlet substitution) are added. It actually was the lowest contributor to the CPI's upward bias, lower than upper level substitution which was estimated to be 0.15 percentage points.

In our opinion, what could best explain the CPI's long lasting controversy which we identified as an "adaptation lag factor" is what lies at the heart of the following quote by Simons (2004) who, almost 10 years ago, stated the following: "The CPI-U is subject to huge political pressures; government contracts, labor union agreements and escalators for social security are linked to its value". This idea of a political arena surrounding the CPI was equally expressed by Berndt (2006) who stated: "It is clear that the rise and fall of public interest in price measurement issues, including the Boskin Committee report and its legacy, needs to be interpreted in the political economy context of Congress and the White House attempting to deal with growing budget deficits…..". Reinsdorf and Triplett (2004) offered the following quote by Ostrander (1944) which stems from the time of the first professional CPI review by the 1944 Mitchell Committee and for which we believe best illustrates the impact of politics on the CPI: "It is not often that a price index, a tool of statisticians, becomes an object of political debate". Recently, a New York Post headline posted on the internet read "Ex-stats Insider: Time to Trash Outdated CPI". The New York Post Internet article by John Crudele stated that Keith Hall, former head of the Bureau of Labor Statistics, was of the opinion that the Consumer Price Index was broken and needed to be fixed (Crudele, 2013). We would not agree with "trashing" the CPI. Although the last ten years of food at home CPI research is characterized by mostly outlet substitution issues, as we have reported, there is sufficient controversy that maintains that not all goods and services surveyed by the BLS have suffered of an upward bias (for example, shelter and apparel). It is our opinion that too much effort has been invested over too many years by too many experts, this, in improving the CPI's accuracy, so as to abruptly put it to rest.

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TABLES

Table 1 Consumer Price Index Expenditure Categories, July 2012 (Adapted from BLS Website)

Expenditure category	Relative importance Jun. 2012
	100.000
All items…….	14.208
Food…….	8.552
Food at home……	1.228
Cereals and bakery products……..	1.941
Meats, poultry, fish, and eggs……	0.889
Dairy and related products…….	1.266
Fruits and vegetables……..	0.941
Nonalcoholic beverages and beverage materials……...	2.287
Other food at home……	5.656
Food away from home…….	
	10.005
Energy……	6.108
Energy commodities……	0.214
Fuel oil……	5.794
Motor oil…….	5.612
Gasoline (all types)……..	3.897
Energy services……	3.045
Electricity…….	0.852
Utility (piped) Gas service ……...	
	75.787
All items less food and energy……...	19.763
Commodities less food and energy commodities…….	3.554
Apparel…….	3.173
New vehicles……	1.973
Used cars and trucks……	1.719
Medical care commodities……...	0.949
Alcoholic beverages…….	0.793
Tobacco and smoking products……	
	56.024
Services less energy services…….	31.411
Shelter……...	6.432
Rent of primary residence……	23.766
Owners' equivalent rent of residence……...	5.391
Medical care services……	1.605
Physicians' services…….	1.533
Hospital services……..	
	5.772
Transportation services…….	1.145
Motor vehicle maintenance and repair……...	2.407
Motor vehicle insurance…….	0.792
Airline fare……..	

Table 2: Estimates of Biases in the CPI Based Measures of the Cost-of-Living (Percentage Points per Annum) by the 1995 Boskin Commission (Source: Boskin et Al., 1998)

Source of Bias	Estimate
Upper Level Substitution Bias	0.15
Lower Level Substitution Bias	0.25
Subtotal	0.40
Outlet Substitution Bias	0.10
New Product/Quality Change Bias	0.60
Subtotal Total	0.70
Grand Total	1.10
Plausible Range	(0.80 to 1.60