APPENDIX A

JOEL POPKIN AND COMPANY RESEARCH SUMMARY

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NON-FOREIGN AREA COST-OF-LIVING ALLOWANCES

Final Report

A Summary of SHWG Research Tasks

Presented to the

Safe Harbor Working Group

By

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List of Abbreviations

BLS: U.S. Bureau of Labor Statistics.

COLA: Cost of living allowance.

COLI: Cost of living index.

CPI: Consumer price index.

JPC: Joel Popkin and Company.

MSRP: Manufacturer's suggested retail price.

OPM: Office of Personnel Management.

SHWG: Safe Harbor Working Group.

SOW: Statement of Work.

TAG: Technical Advisory

Executive Summary

Most Federal employees and United States Postal Service workers in Alaska, Hawaii, Guam, Puerto Rico and the U.S. Virgin Islands receive a cost-of-living allowance (COLA) based on differences in the price level between these areas and the Washington, DC area. This report is a summary of findings from the research undertaken to evaluate the current methodology used by the Office of Personnel Management (OPM) for estimating cost-of-living differences between the COLA areas and the Washington, DC area. The research was conducted on behalf of the Safe Harbor Working Group (SHWG) which consists of representatives from OPM and Federal employees in COLA areas. Specific details on the research and other nuances may be found in the reports on individual research tasks.

The research objectives, grouped into eight separate tasks, covered virtually all aspects of price index estimation. The main yardstick used to evaluate and guide improvements in the COLA program methodology is the concept of cost-of-living. It is argued that a price index does not necessarily measure the true difference in the cost-of-living across areas. Therefore, an important part of the research was to identify non-price factors, i.e. items that affect the cost of living but cannot be folded into a price index for one reason or the other, and to articulate options for accommodating them within the COLA program methodology.

The research was fulfilled employing a variety of techniques, ranging from the review of literature to the collection of primary data and model estimation. The broad scope of the investigation uncovered numerous suggestions for changes to the current methodology used to determine COLA payments. The suggestions for change can be grouped into five major categories. The first category consists of technical modifications that might be made to price index formulation and estimation. These are suggestions regarding the choice of expenditure weights, correcting for the lag with which data on expenditure weights become available, techniques for aggregation, and the use of a multi-income model. An example of one such suggestion is the use of democratic expenditure weights in place of plutocratic expenditure weights. Democratic weights give equal importance to the expenditure patterns of all persons. Plutocratic weights attach greater importance to the expenditure patterns of high-income individuals. Most suggestions for change under this category are just as likely to cause the COLA price index to increase as to cause it to decrease. However, the changes in either direction are expected to be very modest.

The second category of suggested changes concerns techniques for data collection. These suggestions cover ground such as the use of sampling and survey techniques, the role of employee surveys, the periodicity of surveys, and

the type of price data to be collected. One broad suggestion is that OPM could make greater use of survey techniques, especially with respect to the use of employee surveys. To limit the strain on resources, neither current price surveys nor new surveys that might be introduced need to be conducted on an annual basis. Limiting the periodicity of surveys also allows the addition of depth to each survey. The impact of most of these changes on the level of the COLA price index is not known.

The third category of changes may be described as the introduction of new concepts for the measurement of prices. In particular, these are suggestions for change regarding the concepts used to measure prices for shelter and medical services. The current procedures are conceptually outdated and in need of revision. It is suggested that OPM make use of the rental-equivalence technique for measuring shelter prices and implement procedures to control for differences in housing quality across areas. It is also suggested that OPM implement as many changes as feasible to better measure out-of-pocket costs faced by employees for the purchase of medical goods and services. Revisions to the housing methodology are expected to cause modest changes to COLA price index for all areas except Hawaii. There might be significant decreases in the shelter price index for COLA areas in Hawaii. The impact of changes that might be made to the medical services index is not known.

The fourth category of changes consists mostly of procedures for accommodating non-price factors within the COLA program. These suggestions extend the scope of the COLA program beyond just the price index concept and are designed with the objective of making COLA payments a better reflection of cost-of-living differences between COLA areas and the Washington, DC area. Options for adding flexibility to the price index methodology or developing a system of allowances for non-price factors are described in the report. Some of the non-price factors that could be accommodated by these procedures are the availability and quality of medical services, public transport, and schooling in the COLA areas. Other significant non-price factors are the need for air travel, climatological conditions, and (possibly) income taxes and government services. The accommodation of non-price factors can be expected to lead to an increase in COLA payments.

The fifth and final category of suggestions concerns the articulation of objectives for the COLA program. Whether or not some research findings are implemented and exactly how they are implemented depends in part on the objectives of the COLA program. For example, the treatment of income taxes in the COLA program depends on the concept of earnings OPM wishes to equalize across areas. The same is true of the role locality pay might play in the COLA program. If the price-index approach for setting COLA rates is retained, the base earnings used to determine COLA payments should include the locality pay received in the Washington, DC area (or the locality pay in whichever area is

chosen to serve as the base for the COLA program.) In general, the clear articulation of objectives will serve as a useful guide to the development of methodological and empirical improvements.

The various suggestions for change, if implemented, require careful planning and development in the near future. The OPM methodology also could be subjected to periodic review to ensure procedures are being implemented properly and are kept up to date. For these reasons, consideration should be given to the appointment of a technical advisory committee. This committee would assist OPM in the process of making revisions in its methodology and could also be used to resolve technical and statistical issues that arise inevitably. A final point to note is that implementing the entire set of changes, or even a subset of the changes, suggested by the research may require the removal of the current 25 percent statutory ceiling on COLA rates.

Non-foreign Area Cost-of-Living Allowances

Draft Final Report
A Summary of SHWG Research Tasks

Most Federal employees and United States Postal Service workers in Alaska, Hawaii, Guam, Puerto Rico and the U.S. Virgin Islands receive a cost-of-living allowance (COLA) based on differences in the price level between these areas and the Washington, DC area. This report is a summary of findings from the research undertaken to evaluate the current methodology used by the Office of Personnel Management (OPM) for estimating cost-of-living differences between the COLA areas and the Washington, DC area. The research was conducted by Joel Popkin and Company (JPC) on behalf of the Safe Harbor Working Group (SHWG) which consists of representatives from OPM and Federal employees in COLA areas. An adviser to both JPC and SHWG was the Technical Advisory Group (TAG) composed of leading experts on cost-of-living issues.

The focus of this report is on the implications of JPC's research for OPM's methodology. The report does not describe the nuances of the research. Nor does the report contain specific details on the findings. Those can be found in the reports on individual research tasks. This report mostly makes reference to the qualitative implications of research findings, namely, whether COLA rates can be expected to increase or decrease if a specific research finding is implemented. If the change in COLA rates is unpredictable, it is indicated as such. It should be kept in mind that the qualitative implications of the research are generally more reliable than the quantitative results. In other words, it is possible to state with greater confidence that a given change to the COLA methodology will cause COLA rates to go up (or down) than the confidence we can attach to the prediction that COLA rates will go up (or down) by a specific percentage.

The report is organized as follows: Section 1 summarizes the principal objectives of JPC's research. General issues regarding the measurement of cost-of-living are covered in Section 2. The research methodology is presented in Section 3. Principal findings of JPC's research and their implications for OPM's methodology are discussed in Section 4. Most of the italicized terms that appear in the text below are defined in the attached glossary.

1. Objectives of the Research

The purpose of JPC's research was to conduct a methodological and empirical review of the present system of price comparisons between the COLA areas and the Washington, DC area. The specific issues to be researched were

described in a Statement of Work (SOW) drafted by JPC under the direction of SHWG and TAG. Table 1 presents a list of the research tasks in the SOW.

It can be seen from Table 1 that the research agenda in the SOW covered most aspects of *price index* estimation. In particular, all aspects of OPM's methodology were subject to review and critique and many were subject to detailed research. An underlying premise of the research was that the yardstick used to guide improvements in the COLA program methodology should be the concept of *cost-of-living*. As discussed in Section 2 below, measured differences in price levels across areas do not necessarily equal the relative cost of living across areas. Therefore, the research agenda included topics extending beyond the traditional boundaries of price indexes.

The first task of the research was to review and critique the model currently used by OPM (Task 1). This part of the research was used not only to identify what OPM does, but also what it does not do. Another goal of this phase of the research was to identify research issues that may not have been specifically identified in the SOW. The review and critique of OPM's model was followed by research into how other major organizations deal with the issues of compensating employees for cost-of-living differences across areas (Task 2.1.) The purpose of this task was to identify procedures in use at other organizations that might be fruitfully applied to OPM's COLA program. Some portions of the research under this task were completed by members of TAG.

The remainder of JPC's research was focused on individual elements of OPM's methodology. The choice of the elements subjected to detailed research was based primarily on comments received by OPM over the past several years regarding its methodology. Most of these comments were received from individual employees and organizations acting on behalf of

Table 1

SHWG Research Tasks in the Statement of Work

Task 1:   Critique of COLA model now used by OPM
      1.a: Assessment of existing OPM model
      1.b: Identification of further research

Task 2:   Level-of-living issues
      2.1:   Literature research and research on how other organizations deal with these issues
      2.2:   Enumeration and discussion of special needs by area to the extent not covered in other major research tasks
      2.3:   Local weights versus base-area weights for aggregating price relatives
      2.4:   Single-income level versus multiple-income level approach

Task 3:   Housing
      3.1:   Development of alternative models
            3.1.a: Rental-equivalency approach
            3.1.b: Owner-user-cost approach
      3.2:   Hedonic methods for comparing homeowner and renter costs
      3.3:   Empirical testing of the housing model

Task 4:   Specific expenditure categories other than housing
      4.1:   Transportation
             4.1.a: Private transportation
             4.1.b: Public transportation
     4.2: Medical
     4.3: Education

Task 5: Income related costs

Task 6: Locality pay

Task 7: Other issues
      7.1:   Environmental issues
      7.2:   Non-quantifiable price factors
      7.3:   Quality-of-life issues

Task 8: The base area

Task 9: Time-to-time analysis of housing data.

employees. OPM also had concerns regarding how contemplated changes in methodology might be implemented. As part of the Safe Harbor process, employee and OPM concerns were distilled into a research agenda by SHWG with the assistance of TAG. Some items on the research agenda owe their inclusion to the differences in environmental and living conditions that affect the cost of living in COLA areas relative to the Washington, DC area but whose impact is not reflected in OPM's price index.

Following the review of methodologies used by OPM and other major agencies, the research turned to the identification of special needs in the COLA areas and the Washington, DC area and procedures for dealing with them (Task 2.2.) In general terms, special needs may be thought of either as the need for unique goods and services in an area or the lack of reasonable access to certain goods and services. In either event, they present the problem of determining the relative cost of an element of a consumer's budget without being able to price that element in both the *base area* and the comparison area. Special needs, therefore, are examples of *non-price factors* affecting the relative cost of living.

Non-price factors were also the subject of research under Task 7. The focus of this task was on the conditions of the environment and other characteristics of COLA areas and the Washington, DC area that affect the quality of life and, by implication, the cost of living in these areas. The specific problems addressed by this part of the research were the indirect costs of environmental conditions. An example is traffic congestion. Other than the aggravations associated with a lengthy commute, traffic congestion imposes real costs in terms of fuel consumption, auto service, air quality, etc. These types of costs are not typically picked up in their entirety by a straightforward price index computation.

Another set of research issues was concerned with some general aspects of constructing a price index. These were issues regarding the choice of a base area (Task 8) and the choice of *expenditure weights* (Task 2.3.) A related issue was the use of a multiple-income approach by OPM even though COLA rates in all areas are the same for all income levels (Task 2.4.) The primary focus of these tasks was to estimate the impact on COLA rates of changes to current methodology. One general issue for research was the impact of changing the base of the COLA price index from the Washington, DC area to the national average. Another task was estimating the impact of substituting expenditure weights from COLA areas for the national-average expenditure weights presently used in the COLA price indexes.

One of the more complex research tasks concerned the housing component of the COLA price index (Task 3.) The OPM methodology, which uses mortgage payments on houses as the principal component of the housing

cost index, is somewhat outdated. It is similar to an approach the BLS abandoned in 1983 after several years of criticism. The BLS now estimates housing costs using the concept of *rental-equivalency*. Rental-equivalency measures the cost of consuming *shelter services* derived from a stock of housing. Mortgage payments, by contrast, are substantially a measure of investment in housing. Another major shortcoming in OPM's methodology is the relatively few controls for differences in housing quality across areas. Part of the research objective was to estimate the extent of the resulting bias and determine the feasibility of controlling for housing quality in future estimates of the OPM price index.[1]

Other major components of the COLA price index that came in for research scrutiny were the transportation and medical components (Tasks 4.1 and 4.2.) In addition, JPC analyzed techniques for incorporating the relative cost of education into the COLA index (Task 4.3.) The transportation index computed by OPM consists of two major items: automobile related costs and the cost of air transportation. The primary research objective was to evaluate specific assumptions used by OPM regarding automobile prices, gasoline consumption, airfares, etc. One issue concerning the medical index was the availability and quality of medical services in COLA areas. The other task was to seek improvements that might lead to better estimates of out-of-pocket costs for medical goods and services. The relative cost of education was excluded from OPM's COLA price index until 1997. The research task in this context was to determine the appropriateness of OPM's current method and the articulation of alternatives, if necessary.

A common thread binding the transportation, medical, and education issues is travel. The geography of the COLA areas dictates that the majority of travel is by air rather than by land-based transport. Further, much of this travel might be motivated by the lack of quality medical care or schooling facilities within the COLA area. The research objective was to ascertain the validity of these notions regarding the need for air travel in COLA areas and to determine methods for incorporating this phenomenon into the COLA price index (or to find a suitable alternative.)

The penultimate issue for research was the feasibility and impact of incorporating government taxes and services into the COLA model (Task 5.) Differences in income tax rates across areas have an obvious impact on take-home earnings. Thus, even if all price differences have been accounted for, the take-home earnings of Federal employees in COLA areas could still differ from

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[1] A residual topic for research is to contrast findings on housing from the present research with the findings implicit in data gathered by OPM from a survey of Federal employees in 1992/93 (Task 9). The completion of that research, however, is scheduled for completion following the writing of this report.

the take-home earnings of their counterparts in the Washington, DC area. Of course, income taxes (together with other taxes) are offset, at least in part, by the provision of government services and the primary research objective was to develop methodologies for including government taxes and services into the price index and estimate their impact on COLA rates.

Having computed a price index, it is necessary to determine the concept of earnings to which it should be applied so that cost-of-living allowances may be computed. Determining the appropriate concept was the subject of research under Task 6. More specifically, the objective was to determine whether the *locality pay* received by Federal employees in the Washington, DC area should be part of the base earnings used to compute COLA. The appropriate choice of base earnings is also an issue for the determination of pension and insurance contributions on part of the employer and the employee. A related issue is the treatment of pension and insurance contributions within the COLA price index and the suitability of current procedures followed by OPM.[2]

2. Measuring and Compensating for Cost-of-Living Differences

Economists define the cost of living as the minimum level of expenditure necessary to attain a specific level of well being. Changes in the cost of living are defined as the change in the minimum level of expenditure needed to maintain the same level of well being. For the COLA program, this would mean asking the following question: what minimum level of expenditure is necessary in a COLA area for Federal employees in that area to be just as well off as Federal employees in the Washington, DC area?

The appropriate tool for answering the question posed above is the *cost-of-living index (COLI)*. A COLI measures the cost of all items that affect an individual's well being in one area relative to the cost of the same items in another area. The area chosen to appear in the denominator is usually referred to as the *base area*. The list of items that could affect individual well being is fairly large and can be classified into two major groups. One group consists of items that are bought and sold in the marketplace ranging from bread to automobiles to recreational services. All items in this group have a market price directly associated with them. This set is commonly referred to as a consumer's *market basket*.

The second group consists of items that do not have prices associated with them but might affect a consumer's well being. Measuring the relative cost of these items is either not feasible or requires alternative procedures. Examples

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[2] A secondary research objective of Task 6 was to evaluate the possibility that jobs in COLA areas are misclassified relative to jobs in the Washington, DC area. However, even if jobs in COLA areas tend to be under graded, the COLA program is not the appropriate avenue for redress. Therefore, that part of the research is not discussed in this report.

are air and water quality, hurricanes, remoteness, government services, etc. All of these factors have an impact on living conditions and, by inference, on the cost of living. This set of items is referred to as *non-price factors* in this report. Non-price factors can be ignored for purposes of cost-of-living estimation only if it is the case that they do not vary over time or differ across space. Otherwise, ignoring non-price factors leads to a bias in measures of the cost-of-living. The only remaining question is the extent of the bias in the estimate.

The tool most commonly used to approximate differences in cost of living over time or across areas is the *price index*. A price index measures the change in the cost of buying a *fixed* market basket of goods and services. The OPM COLA index is an example of place-to-place price comparisons and the Consumer Price Index (CPI) estimated by the BLS is an example of time-to-time price comparisons. Neither index is a true cost-of-living index. One reason is that both indexes exclude non-price factors from their market basket. The other reasons are technical, encompassing issues such as the choice of an index number formula, procedures for handling changes in the quality of goods and services, procedures for incorporating new goods and services into the index, etc.[3]

A slight elaboration of the aforementioned issues is helpful for understanding the many points raised in the remainder of this report. Non-price factors are important because they indirectly lead to expenditures to forestall deterioration in well being. For example, deterioration in air quality can force expenditures on items that otherwise would not have a place in a consumer's market basket. The choice of an index number formula is important to account for the fact that consumers can adapt their purchasing habits in response to price changes without affecting their level of well being. If the price of apples were to increase, for instance, consumers can adapt by buying more oranges, which are now relatively cheaper. Index number formulas that are better at handling such *substitutions* lead to more accurate measures of changes in the cost of living. Quality change is an issue because higher prices could signal better quality. In general, if procedures for separating quality change from price change are not put into place, a price index is likely to either overstate or understate changes in the cost of living. The introduction of new goods and services, e.g. cellular phones, raises the well being of consumers. Therefore, price indexes need to adapt over time to incorporate new goods and services in a manner that lead to more accurate estimates of the cost of living.

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[3] These types of issues are covered in "Toward a More Accurate Measure of the Cost of Living," Final Report to Senate Finance Committee from the Advisory Commission to Study the Consumer Price Index, December 4, 1996. The report, more commonly known as the Boskin Commission report, has raised controversy over its estimates of the bias in the CPI. However, it is a useful summary of the reasons why most price indexes are only able to approximate changes in the cost of living.

When measuring changes from one year to the next, a price index can be a very close approximation to the true change in the cost of living. That is because over the course of a year consumers are unlikely to have changed their purchasing patterns by much, quality change is relatively small, and new goods and services have very little market penetration. Similarly, non-price factors rarely show much movement from one year to the next. Thus, while a price index is not likely to be a true measure of the change in the cost of living, the extent of the bias in any single year will be small. However, the cumulative effect of the year-to-year biases can be fairly significant and care must be exercised in interpreting differences in price indexes separated by periods of several years.

The problem of measuring differences in cost of living across areas is akin to comparing two widely separated points in time. Purchasing patterns can vary considerably between areas, the quality of goods and services (and the outlets in which they are purchased) can be quite different, and goods and services that are widely available in one area may be entirely missing in the other areas. By the same token, non-price factors assume greater importance in measurement across point in space. For these reasons, the COLA program, whose foundation is a *place-to-place price index*, needs to be cognizant of the potential biases and procedures for rectifying them.

The first option is to use price index formulas that are likely to be closer approximations to the cost-of-living index. Generally speaking, these are indexes that incorporate the purchasing patterns of both the comparison area and the base area.[4] The use of these formulas would limit the bias arising from the substitutions consumers make in their expenditure patterns as they move from one area to another. The estimation process itself should use as many procedures as feasible to control for differences in the quality of items across areas.

With regard to non-price factors, one option is to modify the traditional price index formulas. Strictly speaking, a price index is a weighted sum of *price ratios*, where the weights refer to the proportion of total expenditures going towards individual items that are priced in the COLA area and the base area. Two means for building flexibility into a price index are as follows: (1) Allow the weights to add up to more than 100. This is useful for accommodating expenditures believed to arise from unique conditions in COLA areas. (2) Replace selected price ratios with *cost ratios*. A price ratio is formed by pricing the same quantity of a good or a service in two areas. A cost ratio would allow the quantities to differ between the two areas in the interest of taking account of local circumstances. As an example, a cost ratio could be used to determine the relative cost of utilities so that allowance may be made for the higher consumption necessitated by extreme winter conditions in Alaska.

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[4] Examples of such index number formulas are the Fisher's Index and the Tornqvist Index.

An alternative to building flexibility into a price index is to consider a supplemental system of allowances that can accommodate the relative cost of non-price factors. Allowances can also be used in lieu of quality adjustments for certain goods and services. For example, it is especially difficult to measure the quality of medical and education services. A key difference between allowances and price indexes is that allowance levels are usually guided by subjective judgement.

A final option is to abandon the price index approach altogether and replace it with a *locality pay* system. The strict application of locality pay would require the payment of wages equal to those in private sector in any given area. The underlying assumption is that local private-sector wages incorporate the effects of both measurable price differences and non-price factors affecting the cost of living. Otherwise labor would relocate to places where local wages were in excess of the local cost of living.

In summary, the measurement of cost-of-living differences across areas is a difficult task. Many sources of bias in price index formulas that are of little importance in estimating changes in the cost of living from one year to the next assume far greater significance in place-to-place measurement. Non-price factors also assume greater importance in a place-to-place context. Therefore, it is often necessary to consider a mixture of approaches for determining the appropriate level of COLA for different areas. A common practice is to use a supplementary system of allowances to compensate for the shortcomings of a pure price index approach.

3.   The Research Methodology

JPC employed a variety of techniques to fulfill the research tasks assigned to it in the SOW.   As directed by the SOW, the research began with a review of the literature and a review of COLA programs at OPM, the United Nations, the Department of Defense and the Department of State. The methodology used by BLS for estimating the CPI was also reviewed in great detail. If published documentation on the procedures were not sufficiently clear JPC followed up with interviews of knowledgeable personnel at the relevant agency. JPC also reviewed employee comments and other materials provided by OPM on the history of the COLA program. JPC staff also visited all of the COLA areas with the exception of Nome, Alaska. The field visits were useful in establishing contact with local government agencies in the COLA areas and for gathering a variety of data on issues such as transportation, education, and government taxes and services.

The empirical portions of the research were completed using data gathered from a variety of sources. Secondary data were collected from sources

such as local and Federal government agencies, private companies, the Internet, etc. JPC also prepared customized tabulations from micro data acquired from agencies such as the BLS and the Census Bureau. A major source of data for the project was a survey of Federal employees in the COLA areas and the Washington, DC area. The survey was designed to address a range of issues in the SOW including housing, transportation, education and medical services. Distributed to approximately 15,700 Federal employees, the survey resulted in 6,756 responses. There were over 1,000 responses from the Washington, DC area. The employee survey was supplemented by a survey of real estate agents to explore alternatives for the housing component of OPM's price index. This survey was mailed to approximately 12,000 real estate agents and resulted in 894 responses. The actual number of useful responses was a multiple of this number because each realtor was asked to provide information on several housing units. As mentioned above, some data were also gathered during JPC's field visits to the COLA areas.

The research and analysis was conducted primarily by JPC staff members. JPC's in-house expertise on measurement of cost of living was supplemented with advice from members of TAG. The TAG members also contributed research reports on some of the SOW tasks. Most of those are listed in the bibliography. Outside expert opinion was also solicited on selected research tasks.

4. Research Findings

4.1. General Aspects of Price Index Estimation

The principal steps required for the construction of a price index are as follows: (1) Choose an index number formula. (2) Survey households to determine expenditure patterns and select a market basket. (3) Survey households to determine the outlets from which purchases are made and use the findings to select a sample of outlets from which price data will be collected. (4) Conduct an initial survey of the outlet sample to select the specific goods and services whose prices will be used to represent the main expenditure categories in the market basket. (5) Visit the selected outlets on a routine basis, collect and verify price data, and compute the price index.

The five steps outlined above can be implemented in a variety of ways. The procedures used by the BLS to estimate the CPI were used as the primary standard for an evaluation of OPM's methods. In addition, JPC reviewed existing literature on price indexes and the methodologies used by the United Nations, Department of State and Department of Defense for guidance.

A price index is an expenditure-weighted sum of price ratios. Index number formulas differ from one another in their choice of expenditure weights

and the specific weighting scheme used to aggregate the price relatives. An index number formula would ideally incorporate expenditure patterns of Federal employees not only in the Washington, DC area but also in the COLA areas. This is necessary for capturing the substitutions employees make within their spending patterns as they "relocate" from the Washington, DC area to the COLA areas. Data on expenditure patterns in the Washington, DC area are available from the *Consumer Expenditure Survey (CES)* sponsored by the BLS. Unfortunately, sufficiently detailed data on the spending patterns of consumers in COLA areas do not exist and would have to be gathered by surveying Federal employees in the COLA areas. However, that is potentially an expensive undertaking and the results may not be statistically reliable for COLA areas such as Maui or the Virgin Islands where the number of Federal employees is fairly small.

If it is not feasible to incorporate the expenditure patterns of employees in the COLA areas, the second best option is to use only the expenditure weights for the Washington, DC area. In technical terms, this means using the *Laspeyres* formula for comparing the price levels in COLA areas with the price level in the Washington, DC area.[5] The price index formula estimated by OPM, however, uses neither COLA-area weights or weights for the Washington, DC area. The OPM index instead uses national-average expenditure weights derived from the CES.

The reason given by OPM for the use of national-average weights is that it computes indexes for three different income level groups: low-income; middle-income; and high-income. Therefore, OPM needs detailed expenditure data by income level and those are available only at the national-average level. However, the steps taken by OPM to implement a multiple-income approach are mostly superficial. A true multiple-income approach requires the estimation of separate price indexes for each income group. This includes the derivation of expenditure weights, selection of a market basket, selection of outlets, and the conduct of price surveys. Finally, such an approach would culminate in the setting of a different COLA rate for each income-level group. OPM's procedures are mostly confined to the use of different expenditure weights at the highest levels of aggregation for each income level. Except in the case of its housing component index, the same price data are used to represent each income level. Finally, the various indexes are aggregated to produce a single COLA rate for all income levels.

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[5] The Laspeyres formula is generally recognized as an upper-bound estimate of the cost-of-living index. However, under certain assumptions regarding consumer behavior, the Laspeyres formula can also be a close approximation to the cost-of-living index. It should be kept in mind that regardless of the price index formula that is used, several factors can drive a wedge between a price index and the cost-of-living index. These factors have been mentioned in the report and include quality differences, availability of goods, and non-price factors.

Even though the application of the multiple-income is largely superficial, it leads to the use of untested assumptions and adds to the complexity of estimating price indexes. Dropping the multiple-income approach would enable OPM to use expenditure weights for the Washington, DC area in its price index. This would be in keeping with the choice of the Washington, DC area as the base for the COLA program. The use of national-average expenditure weights should be retained only in the event the base area is switched from the Washington, DC area to the national average.

Replacing national-average weights with Washington, DC area weights is expected to cause only a slight change in index levels. They are just as likely to up as down. Dropping the multiple-income approach could lead to a slight decrease in index levels for all COLA areas. One way to limit the decrease, and to restore the "flavor" of the multiple-income approach, is to adopt the use of *democratic* expenditure weights. Under this approach, expenditure weights are first computed for each individual present in the sample for the consumer expenditure survey. A simple average of these weights is then taken across individuals to represent the overall average. Thus, each individual is given the same importance in the calculation of the overall expenditure weights. By contrast, traditional weight calculations give greater importance to the expenditure patterns of high-income individuals. It has been estimated that the expenditure weights in the CPI, which are also derived from the CES, reflect the spending pattern of families at the 75th percentile of the expenditure distribution. Because democratic weights assign relatively greater importance to lower- and middle-income consumers, indexes that use them are considered more representative of the overall change in the cost of living.

No matter what expenditure weights are chosen for use in the COLA price index, it will be the case the data on them will be available only with a lag. The lag will be two to three years at a minimum. Because place-to-place price indexes require that expenditure data pertain to the current time period, the expenditure weights should be adjusted prior to their use in the price index. This adjustment requires that expenditure levels on each item be inflated to account for the change in prices between the date of the expenditure survey and the date of the OPM price index. The weight for each expenditure category then has to be recomputed based on the inflation-adjusted data. The resulting weights are known as *relative importances*. The impact of this procedure on the level of the COLA indexes is expected to be small but will depend on how out of date the expenditure survey data are and the extent to which the rate of price change varies across items in the market basket.

Closely related to the choice and estimation of expenditure weights is the selection of the market basket that will be priced in the COLA areas and the base area. One point that can be made right away is that there is no reason why the market basket should be the same for all COLA areas. Differences in local

tastes and availability of items should be kept in mind while choosing market baskets to represent each COLA area. For similar reasons, outlet selection could be allowed to vary across areas as well.

By necessity, a market basket is a sample of items chosen to be representative of what consumers buy in the marketplace. Since the market basket is a sample from the universe of goods and services, the same is true of the prices of the items in the market basket. As a result, any price index contains a degree of error or *sampling variance*. The art in the selection of a market basket is to minimize the extent of the variance. With that in mind, OPM's COLA price index could benefit from the greater use of statistical techniques for the selection of items to include in the market basket. If feasible, this means the use of *probability sampling* to select items for pricing. Not all items would have the same probability of inclusion in the market basket. Items with a higher level of expenditures would be assigned a higher probability of selection, but items on which expenditures are relatively low would also be included in the market basket on a probabilistic basis.

A related step that could be taken is to increase the "depth" of item selection to reduce the sampling variance in prices collected by OPM. For goods and services, this would mean pricing more brands and varieties of foods, apparel, appliances, etc. For medical services, this means pricing a greater variety of drugs and medical services. For shelter services, this means greater coverage of neighborhoods and zip codes in the COLA areas and the Washington, DC area. The impact of implementing these procedures on the level of the COLA price index is not known. However, the use of these procedures would improve the precision of the index. In other words, with or without a revision in OPM's procedures, the index level for an area may be estimated to be 125 (Washington, DC area = 100). But the estimate based on the use of probability sampling and greater depth in item selection will be held with greater confidence in the sense that it is likely to be closer to the true level of the index.

Once items have been selected for pricing, it is important to ensure that the specific brand and model priced in a COLA area matches the one priced in the Washington, DC area. It is also desirable to price items in similar outlets in the two areas since the quality of service provided by an outlet can affect the price of an item.[6] While OPM strives to achieve brand-model-outlet matches, its procedures are not transparent. More specifically, it has not clearly articulated the procedures it follows in the event that it cannot find the intended brand or model in the intended outlet in both areas. It would be useful to develop transparent guidelines in this regard so that consistent procedures may be applied across areas and over time.

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[6] Exceptions to the brand-model-outlet matching rule may be made as necessitated by special needs in an area. This point is addressed further in the section on non-price factors.

A conspicuous feature of OPM's methodology is the small extent to which it makes use of survey techniques to guide the selection of items and outlets and to improve its understanding of the expenditure patterns of its employees.[7] At a minimum, a survey of employees could be used to guide the selection of outlets from which price data are collected. Such surveys are usually referred to as *point-of-purchase surveys (POPS)* and require much less detail than expenditure surveys. The selected outlets can themselves be surveyed in a process known as *outlet initiation* to guide the choice of item brands and models that will be subsequently priced. Employee surveys can also be used for several other functions. For example, data on housing characteristics could be gathered from employees to adjust shelter prices for differences in the quality of housing across areas. Other potential uses are the monitoring of assumptions underlying difficult to price components of the index such as medical services, education and transportation. Employee surveys can also provide useful input for the determination of allowances for non-price factors that affect the cost of living.

Greater use of employee and outlet surveys and greater depth in item selection could strain the resources available to OPM for the estimation of COLA price indexes. To compensate for the strain on its resources, OPM could switch from annual price surveys to a three-year cycle of price surveys. The three-year cycle could be implemented in one of two ways. One option is to survey each COLA area only once every three years. In other words, only one-third of the COLA areas and the Washington, DC area would be surveyed in any single year. The second option is to survey all areas every year but to limit the scope of the survey in any given year. Under this option only one-third of the market basket would be priced in any single year. COLA rates can be adjusted in the interim using inflation data derived from consumer price indexes for the base area and the COLA areas.

4.2. Housing or Shelter Services

A major component of any price index is the housing component. There are two main deficiencies in the housing model used by OPM at the present time. One shortcoming arises from the failure to adequately adjust housing costs for differences in characteristics of housing across the COLA areas and the Washington, DC area. The second shortcoming lies in the definition of housing costs in OPM's price index. OPM defines housing costs as the sum of expenditures on mortgage or rent payments, real estate taxes, utility costs, homeowner's or renter's insurance, home maintenance, and telephone services. However, the major element of this measure of housing expenses – mortgage payments – fails to separate the cost of purchasing and maintaining a house (an

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[7] OPM last conducted a survey of its employees in 1992/93. The survey was titled "Federal Employees Housing and Living Patterns Survey." However, survey techniques are not yet an integrated part of OPM's price index methodology.

investment asset) from the cost of consuming the flow of services generated by the house. The investment component of housing does not belong in any price index seeking to measure the relative cost of *consumption*, whether over time or across space, just as one would not include the cost of acquiring financial assets in a consumption price index.

The key difference between housing and financial assets is that the former produces a flow of consumption services, namely, shelter. What matters from the point of view of a consumption price index is the cost of that flow of services or the cost of shelter. It is for this reason that the BLS, which until 1982 used an approach like the OPM model for measuring homeownership costs for the CPI, revised its approach in 1983. Since that time, the BLS has used the *rental-equivalence approach* to measure the cost of shelter for homeowners. By this method, homeowner costs are measured by the rent that homeowners could obtain for their house.

On methodological grounds, there is no doubt that OPM's housing cost model would be improved by focusing on the cost of shelter services. The choices before OPM are the rental-equivalence approach and the *user-cost* model. On the surface, the user-cost model is closest to the approach presently used by OPM. The principal difference is that the user-cost model recognizes that home ownership costs can be offset by capital gains on the property.[8] Conversely, capital losses can add to the cost of home ownership. The user-cost model is appealing in the sense that it focuses mostly on direct out-of-pocket costs incurred by homeowners on the consumption of shelter services. However, empirical estimates of the user-cost model require the making of several assumptions and, even under most reasonable assumptions, user-cost indexes of shelter services display considerable volatility.

In contrast, the rental-equivalence model rests on fewer assumptions and is easier to implement. Rental-equivalence indexes of shelter services also show far greater stability over time than either the user-cost indexes or OPM's current housing index. Finally, the rental-equivalence model places homeowners and renters on the same conceptual footing. For homeowners, the cost of shelter services is the rent they could obtain on their house. For renters, the cost of housing is the rent they pay their landlord. The advantage of this is that OPM could drop the distinction it presently needs to maintain between homeowners and renters for the sake of measuring housing costs.[9] For these reasons, the

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[8] The user cost of shelter services is defined as the sum of mortgage interest payments, interest earning foregone on home equity and other direct costs less capital gain.

[9] If a distinction continues to be made between homeowners and renters (for example, if rental equivalency is not adopted), procedures for aggregating across the two groups need to be revised. OPM should first compute an overall shelter index combining homeowners and renters and then combine the shelter index with the other major component indexes, namely, goods and services, transportation, and miscellaneous. This will cause the level of the total index to go up

rental-equivalency approach is the superior of the two options that could be used to replace OPM's present methodology. Regardless of the method chosen, the expenditure weight for housing will need to be adjusted to conform to the new concept of shelter services. The effect of this will be minor.

JPC conducted tests of the rental-equivalency model using data gathered from surveys of Federal employees and real estate agents. During the first phase of the test, reported data on the rental values of owner-occupied and rental properties in COLA areas were compared to rental values in the Washington, DC area. No attempts were made to control for differences in housing quality across areas during this stage. Both the employee and realtor surveys showed that switching to the rental-equivalency model might have a significant impact on the price index for shelter services in many COLA areas. The index is expected to decline significantly for the COLA areas in Hawaii and Guam. The COLA areas in Alaska are likely to be least affected by the change.

Much of the downward impact on the shelter price index can be expected to be negated if it is the case that housing quality in COLA areas is inferior to housing quality in the Washington, DC area and appropriate steps are taken to measure this difference in quality. During the second phase of the empirical testing, JPC applied two models for measuring differences in housing quality across areas. One model, known as the *hedonic model*, was estimated using data from both the employee and realtor surveys. The other model, known as the *matched model*, was estimated using data from the realtor survey. The hedonic model decomposes the rental value of a home into its characteristics. In other words, using appropriate statistical techniques, it is possible to estimate the value of housing characteristics such as the number of bedrooms, the number of bathrooms, square feet of living space, etc. Once the prices of individual characteristics are known, estimates can be made of the rental value of a home for any given set of characteristics. In this manner, a shelter price index can be estimated for any COLA area for the same set of housing characteristics as are available in the Washington, DC area.

Under the matched-model approach, rental data are collected only for homes that fit a pre-specified profile. For example, one may specify a model home 15 years of age, with three bedrooms, two bathrooms, and 1,500 square feet of living space. Given these specifications, the price of shelter services would be gathered only for homes that fit this profile. Because of practical constraints, the matched-model approach is not able to capture as many characteristics of housing as the hedonic model.

Estimates of the hedonic model from both the employee and realtor surveys show that housing quality in most COLA areas is significantly inferior

in some areas and go down in other areas. However, the magnitude of the change in all areas is expected to be small.

to that in the Washington, DC area. Housing in Rest of Alaska, Puerto Rico and the Virgin Islands appears to be the most inferior among all the COLA areas. Once differences in housing quality are incorporated into the *rental equivalence* model, it is estimated that the shelter price index might be marginally higher than the OPM housing price index for most areas in Alaska, Guam, and Puerto Rico. The shelter price index for the Virgin Islands might decline a bit relative to the OPM model estimate. However, in most areas of Hawaii, the rental-equivalence shelter price index is expected to be significantly lower than the levels generated by the OPM model even after quality differences are taken into account. The results from the matched-model approach are in general agreement with the findings from the hedonic rental-equivalence model.

The main lesson that emerges from the empirical tests is that, regardless of the concept used to measure the cost of shelter services, it is important to implement techniques that can control for differences in housing quality between the COLA areas and the Washington, DC area. Hedonic models are more powerful and flexible than the matched-model approach. However, hedonic models are also very demanding with respect to data requirements. The matched-model approach may be preferred if those data requirements prove difficult to satisfy.

A related point that emerged from the employee survey is that OPM could drop its present strategy of pricing homes only in selected neighborhoods in the COLA areas and the Washington, DC area. Not only is this procedure operationally cumbersome, it might also be unnecessary because employees appear to be widely scattered across neighborhoods within their area of residence. This is especially true of the Washington, DC area where it is impossible to pinpoint neighborhoods in which Federal employees are concentrated. Broadening the scope of the housing price survey is also consistent with the objective of reducing the sampling variance of the overall price index. Caution must be exercised, however, to avoid the extremes of low-income and high-income neighborhoods in any area.

As part of the empirical testing of the housing models, JPC also conducted a test to determine whether a payment might be necessary to elicit responses from real estate agents. This was done in the interest of ascertaining the feasibility of using real estate agents as the primary source of shelter price data in the future. The test showed conclusively that some form of payment would be needed to draw a satisfactory response rate from real estate agents. The alternative is to use employee surveys. A disadvantage of an employee survey as the sole source of data on shelter prices is that it might generate an upward bias in the price index. A final alternative is to use an approach similar to that used by the BLS. Trained field agents can be dispatched to interview homeowners and renters in each area. The shelter price quoted by the interviewee would then be subject to on-the-spot validation by the field agent. A

final advantage of this approach is that the housing sample could be extended beyond homes rented and owned by Federal employees only.

4.3. Transportation

The transportation component of the COLA price index is best described as a cost-ratio. This can cause a bias relative to a price-index approach if the quantities over which costs are computed in a COLA area differ from the quantities over which costs are computed in the Washington, DC area. In some instances such a "bias" might be in the desired direction. For instance, the quantity of gasoline consumed might be allowed to vary across areas because of differences in road conditions or environmental conditions. These types of adjustments can also be handled within a price-index framework by making an adjustment to the gasoline price relative for differences in fuel efficiency. The main arguments in favor of a price-index approach are as follows: (1) It would make the transportation-index methodology conform with that used for other component indexes. (2) The price-index approach would be less sensitive to assumptions currently made by OPM regarding automobile trade cycle, etc.[10] The cost-ratio approach could be retained in the event certain special needs must be accommodated and it is hard to do so within a price-index approach.

To estimate a private transportation price index, OPM assumes that new cars sell at the Manufacturer's Suggested Retail Price (MSRP) in all areas.[11] This cuts against the grain of a general methodological rule that a price index should measure transaction prices to the fullest extent possible. There is also a fair amount of evidence suggesting that new cars rarely sell at MSRP. Of course, the discount or premium relative to MSRP can vary from person to person and from one model of car to another. Based on tests conducted during visits to the COLA areas, it is JPC's opinion that it is feasible to estimate the average discount or premium relative to MSRP for new cars in the COLA areas and the Washington, DC area. Therefore, OPM should consider using transaction prices instead of MSRP for new car prices. One way to implement this is to estimate discounts or premiums relative to MSRP by a survey of car dealers in all areas every three to five years. This estimate could be used to adjust MSRP-based price relatives in the interim. It is expected that new car price relatives based on transaction prices will be higher than the price relatives based on MSRP because cars sell for a greater discount in the Washington, DC area.

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[10] It is also easier to implement techniques such as geometric averaging within a price index framework. Geometric averaging is more consistent with the cost-of-living concept and, absent the use of weights, should be used for averaging price ratios of different models of cars, etc.

[11] Because of other factors that go into determining the cost of buying an automobile, this does not mean that automobile costs are equal across areas. These factors include dealer markups, additional shipping costs, and local taxes.

JPC also examined other assumptions made by OPM for the calculation of a cost ratio for private transportation. These are assumptions regarding the trade cycle of a car, gasoline consumption, frequency of repair, and depreciation. The research showed either that OPM's assumptions are satisfactory or that data suitable for testing the assumptions are not available. Given the lack of data to test some assumptions (e.g. the assumptions regarding car depreciation) it follows that it is also not possible to alter the subjective nature of those assumptions. The one assumption OPM might consider revising is its trade-cycle assumption. OPM assumes that new cars are bought every four years and driven 15,000 miles per year. Based on findings from the employee survey, OPM could assume a five-year, 12,000-mile trade cycle. However, no compelling evidence was found indicating that the trade cycle varies across areas. In OPM's cost-ratio approach, changing the trade cycle assumption could have a minor impact on the transportation index. The effect can be estimated by re-calibrating OPM's worksheets.

An important component of the cost of private transportation is insurance coverage. Estimating the relative cost of auto insurance is a routine task under normal circumstances. The problem confronting OPM and the Federal employees is the lack of specific types of insurance coverage for cars in Guam, Puerto Rico and the Virgin Islands.[12] Uninsured motorist coverage is not available in Guam and Puerto Rico, and in the Virgin Islands the maximum amount of coverage available for bodily injury is below the minimum mandated in the DC area. This is essentially a "missing goods" problem. In theory, it is possible to compute a hypothetical price for the missing insurance policy in a COLA area. However, this requires detailed data on accident rates classified by type of motorist (based on insurance coverage) and the resulting value of the claim. Even if such data were available and hypothetical prices could be computed,[13] the question would remain whether it is adequate compensation for the *lack* of coverage. Thus, the best means for addressing this problem is within an allowance for non-price factors.

The public transport index estimated by OPM does not include any form of public transport other than air transport. Incorporating public bus or taxi fares into the price index would be a relatively easy task. However, regardless of the resulting price relative, the overall price index is unlikely to change much because of the small weight that would be given to these modes of transport. Another issue is the convenience and quality of local public transport. The Washington, DC area enjoys a more extensive network of public transport than any COLA area. The employee survey revealed that public transport is more frequently used in the Washington, DC area than in other areas and rates higher than in other areas with respect to attributes such as schedule, location of stops,

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[12] OPM makes adjustments for the missing coverage but the extent to which these adjustments are sufficient is unknown.

[13] JPC's field visits suggest that the data that would be needed are not readily available.

etc. But knowing that public transport in the Washington, DC area is superior does not in itself yield an adjustment factor that could be applied to the price relative for public transport. The convenience of public transport in the Washington, DC area also needs to be balanced against the traffic congestion in the area. Unfortunately, objective methods for valuing the relative convenience or inconvenience of public transportation are not available. The most suitable resolution for this issue is probably to be found within an allowance for non-price factors.

Air transport costs estimated by OPM take partial account of the geographic location of the COLA areas which dictates that the average distance traveled by air from the COLA areas is greater than that traveled from the Washington, DC area. However, there is a need to recognize two additional factors. One is that air travel out of COLA areas is often necessitated by the lack of adequate medical or schooling facilities. This compels a higher frequency of air travel on part of Federal employees in the COLA areas. The other factor is that short-haul air travel substitutes for car or bus travel in many COLA areas. This is especially true of the need for inter-island travel in Hawaii.

There are three options for pursuing solutions to the need for greater air travel in COLA areas. One option is to seek remedy within an allowance for non-price factors. The remaining two options are to modify the price index. One way to modify the price index is to increase the weight for air travel without a corresponding reduction in any other weight. This will mean that the sum of expenditure weights will exceed 100. This is similar to computing a cost-ratio for air travel in which the quantities purchased are assumed to be much higher in the COLA areas. Determining the appropriate quantities would be the subject of an employee expenditure survey designed to answer these types of questions.

Another way to modify the price index is to retain the current weight for the air travel component but to inflate the price relative. To some extent, this is already done by OPM because the flight destinations chosen by OPM are generally a greater distance from the COLA areas than the Washington, DC area. An additional adjustment that could be made to capture the greater need for short-haul air travel is to think of air travel as a means to an end. Travel over a short distance could be achieved either via land-based transportation or via air transportation. Both modes of transport serve the same function. The cost of short-haul travel in an area could be computed as a weighted-average of the cost of air travel and land-based travel from that area. The cost of land-based travel would receive a higher weight in the Washington, DC area and the cost of air travel a higher weight in the COLA areas. The weighted-average cost of short-haul travel in COLA areas could now be compared to the cost in the Washington, DC area. By allowing the weights to vary between the COLA areas and the Washington, DC area, such a cost ratio of short-haul travel would now take account of the greater need for air travel in COLA areas.

4.4. Medical Goods and Services

There were two areas of concern regarding the medical component of OPM's price index. The first task was to design a methodology that would measure *out-of-pocket* costs faced by employees for the purchase of medical goods and services. The second task was to investigate disparities in the availability and quality of medical care across areas and to seek appropriate remedies.

Health care expenditures are one of the very few types of expenditures where the person buying the good or service is not paying the full cost. To calculate the cost of health care in COLA areas relative to the Washington, DC area, OPM needs to calculate the level of out-of-pocket costs employees incur in the different areas. This can be relatively straightforward for items such as non-prescription drugs. However, for any item or service covered by an insurance plan, the comparison becomes complicated. Different employees may be quoted different prices depending upon their health insurance coverage and personal circumstance. Even if the price quoted is the same across employees, the employee's share of the cost can vary depending on the terms of the health plan or whether or not the employee has satisfied the deductible. A final complication is that insurance plans and health service options available to Federal employees in the COLA areas and the Washington, DC area are not identical.

The methodological steps OPM could take to revise its medical component index are as follows: (1) Change and increase the number of items priced to represent prescription and non-prescription drugs. (2) Price hospital services as opposed to hospital room charges. (3) Increase the number of physician services priced and use more specific definitions. (4) Focus on collection of out-of-pocket costs for items covered by insurance. (5) Include insurance plans outside of the Federal Employee Health Benefits (FEHB) program in the premium calculations. (6) Collect data on a wider range of payment types for all insurance related items. (7) Survey employees to improve selection of medical outlets, doctors, type of medical services, etc. (8) Improve the method for measuring the relative cost of deductibles.

Not all of the changes suggested above are easy to implement. The cost of implementing some of the changes may also be high in view of the fact that the medical component index has a relatively small weight in the overall price index. This means that any given revision will have a small impact on the level of the overall index. Even if its proves infeasible to fully measure out-of-pocket costs, serious consideration should still be given to implementing some of the suggested changes. For example, changing and increasing the number of non-prescription drugs priced would be straightforward. Similarly, pricing hospital services, especially outpatient services, in place of room charges should be

feasible and would serve as a better proxy of out-of-pocket costs. The impact of these changes on the medical price index is not known.

Determining the appropriate compensation for differences in the quality of medical care across areas is near impossible. While the academic literature has made advances in measuring quality change for specific types of medical procedures, there is no method available that could be applied to medical services in their totality. The main problem is the lack of a unique definition of output for medical services. Indirect techniques, such as a patient's willingness to pay for a specific service, are stumped by the lack of data. Therefore, JPC does not believe that it is feasible to account for differences in the quality of medical care across areas in the COLA program.

An issue related to the quality of medical care is the availability of medical services. If certain types of medical services are not available in a COLA area, then employees will find it necessary to travel outside the area to obtain those services. The employee survey showed that employees in COLA areas are far more likely to seek medical services outside their area of residence in comparison to employees in the Washington, DC area. The vast majority of these trips were not covered by insurance plans. Two important reasons cited for travel were inpatient surgery and diagnostic services. On the other hand, there was also a fair amount of travel for routine services such as dental and optical services. On balance, the conclusion that emerges from the employee survey is that OPM should consider compensating employees for travel necessary for medical reasons to the extent that it is not covered by medical insurance. Some procedures will have to be developed to ensure that the travel was undertaken out of necessity.

4.5. Education

Until 1997, OPM did not include education in the market basket for its price index. Excluding education could be justified under the assumption that the quality of public schools in COLA areas is no different from the quality of public schools in the Washington, DC area. Over time, however, enough evidence had accumulated to show that this assumption might not be justified. Thus, starting in 1997, OPM included a price relative for grade K-12 private schools in its price index. The price relative was adjusted to reflect the higher rate of utilization of private schools in most COLA areas in comparison to the Washington, DC area. The COLA areas most affected by this change were Oahu, Guam, Puerto Rico and the Virgin Islands.

The change introduced by OPM in 1997 is a step in the right direction. However, it is not necessarily the most desirable treatment of the education component in the context of the COLA program. From the point of view of compensation policy, it is important to recognize that the consumption of

education is strictly dichotomous. A family either consumes education or it doesn't. Moreover, for families that consume education, it can be a significant expenditure. This means that introducing education into the price index on the same footing as, say, ice cream, can be problematic. The expenditure weight attached to schooling would be too high for employees who don't consume education and too low for those who do consume education. This could be a serious concern in COLA areas where the majority of families with children in school make use of private schools.

Another reason for changing OPM procedures is that the utilization of private schools appears to be a necessity in many areas. The private school utilization rate among Federal employees in the Washington, DC area is only slightly above the national average. However, the employee survey showed that the utilization rate in Puerto Rico and the Virgin Islands is three to four times the rate in the Washington, DC area. The rate in Oahu and Guam is about double the rate in the Washington, DC area. To some extent this is caused by lower tuition rates in the COLA areas. On the other hand, average household income levels of Federal employees in the COLA areas are well below the average in the Washington, DC area.[14] On balance, therefore, the much higher rate of private school utilization in these COLA areas is evidence of a necessity driven by the relatively poor quality of public schooling.

The suggestion that emerges for the COLA model is that OPM should consider implementing an education allowance for grade K-12 schooling. Data on private school usage, coupled with evidence on income levels and tuition rates, suggests that COLA areas with the clearest need for an education allowance are Oahu, Guam, Puerto Rico and the Virgin Islands. The allowance rate can be determined administratively or via statistical modeling. Procedures to this effect are outlined in JPC's research report on education. Implementing an education allowance will have a significant effect on the compensation of employees with children in grades K-12. However, the overall cost of the COLA program is not likely to change much. Under present procedures, the education component in a COLA price index yields a small dividend for all employees in that COLA area. An education allowance would yield a larger dividend, but only to a fraction of the employees in the area.

If an education allowance is not implemented, consideration should be given to the creation of two COLA rates. One COLA rate – for employees without children in school – would be based on a price index that excludes education. The other COLA rate – for employees with children in school – would be based on an index that includes education. The expenditure weights will differ between the two indexes. In the index that includes education, OPM

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[14] This statement refers to the fact that the grade level of the average employee in the COLA areas is well below the grade level of the average employee in the Washington, DC area. The statement should not be taken to mean that COLA payments are not at the right level.

should continue to adjust tuition price relatives using private school utilization rates. However, the utilization rates should be adjusted for differences in income levels and tuition rates (if feasible) between the COLA areas and the Washington, DC area.

Another research task for JPC was to review evidence on the availability of college programs in COLA areas and the associated need for education-related travel. Based on a review of previous research sponsored by OPM and the analysis of data from the employee survey, JPC concluded that the availability of college programs is more restrictive in the COLA areas than in the Washington, DC area. Thus, consideration should be given to implementing procedures for compensating employees for part of the difference between in-state and out-of-state college tuition rates. The procedural options are similar to those described for grade K-12 schooling. But determining an appropriate allowance for college tuition or ascertaining the extent to which the use of out-of-state colleges is driven by need is more difficult because personal choice and academic performance play an important role in determining where a child goes to college.

The lack of a full range of college programs in COLA areas does generate additional need for out-of-state air travel. The best way to accommodate this need is within the transportation component of the price index. Failing that, the additional need for air travel should enter into consideration when an allowance is determined for non-price factors. Some options in this regard were presented above in the section on transportation.

4.6. Income Taxes and Government Services

Due to practical considerations, income taxes and government services are not often included as part of the market basket for a price index. However, it is generally accepted in the theoretical literature that there is a need to account for all forms of taxes in a cost-of-living model. By incorporating some taxes into a price index, such as property and sales taxes, but not others, such as income taxes, one can get a misleading picture of changes in the cost of living. For example, if a locality were to eliminate income taxes and shift the burden of revenue collection to property taxes, a price index would indicate an increase in the cost of living when in fact no increase has occurred. Once all taxes are folded into a cost-of-living model it also becomes necessary to account for the presence of government services. Much of what is taxed is returned in the form of government services and it is the gap between taxes and services that matters for purposes of estimating the cost of living. The practical hurdle is the derivation of reasonable empirical estimates of the levels of taxes and services by area.

As part of its research, JPC developed a methodology for incorporating income taxes and government services into the COLA model. Empirical estimates of the effect on COLA rates were also developed using detailed data on income tax liabilities and government expenditures on services for each COLA area and the Washington, DC area. The extent to which income taxes and government services should be folded into the COLA model depends on the objectives of the COLA program. If the objective of the COLA program is to equalize gross earnings across areas, income taxes and government services can be largely ignored. The only exception that arises is the case of a local government imposing a tax on COLA payments. In that event, employees in that area should be compensated for the taxes on COLA. The only government that imposes a tax on COLA at the present time is the government of Hawaii. It is estimated that COLA rates for employees in Hawaii would increase modestly if this policy were to be implemented.

Another potential objective for the COLA program is to equalize net earnings across areas. Net earnings are defined as gross earnings less income taxes plus the receipt of government services. However, while it is feasible in methodological and empirical terms to incorporate income taxes into the COLA model, accounting for government services presents problems on both counts. One important methodological hurdle is that government services are not uniformly distributed across the population. For instance, some households consume education services while others do not. Another problem is defining the level of benefit accruing to a household. That too will differ from household to household and by the type of government service. The empirical problems lie in controlling for differences in government productivity and the cost of delivering government services across areas.

Therefore, incorporating both income taxes and government services into OPM's price index model is not likely to be feasible. Under the assumption that equalizing net earnings across areas is the goal of the COLA program, there are two options for accounting for income taxes and government services. The first option is to incorporate income taxes only into the price index model and accommodate differences in government services across areas in the allowance for non-price factors. The second option is to include both taxes and services as part of the bundle of non-price factors. When only tax differences are taken into account in the price index model, COLA rates are expected to decline everywhere except in Hawaii where the tax regime is virtually identical to the one in the Washington, DC area. This prediction is based on the tax regimes in existence in 1998. The outcomes could easily change if tax laws are revised.

A corollary finding from research into this issue regards the subject of whether or not there should be a Federal income tax on COLA payments. If the COLA program is designed to equalize net earnings across areas, i.e. if the OPM price index or the allowance for non-price factors takes account of differences in

tax regimes across areas, an explicit tax on COLA payments should be avoided. Since COLA rates under such a model would be set at levels that equalize net earnings across areas, a tax on COLA would mean that the real net earnings of employees in COLA areas will be below the level in the Washington, DC area. If the COLA program is designed to equalize gross earnings across areas, a tax on COLA would contradict this objective by definition. Of course, other objectives that might be conceived for the COLA program might yield different answers with respect to the taxation of COLA payments.

4.7. Treatment of Retirement and Insurance Savings

As is the case with income taxes and government services, the market baskets for price indexes do not normally include a savings component. That is because most indexes are concerned with the measurement of current-period consumption costs. However, in a place-to-place context, it is desirable not only to equalize the real value of consumption across areas but also to equalize the real value of savings across areas. If Federal employees are assumed to stay in COLA areas following retirement, they require the same real value of savings as employees in the Washington, DC area so that they can enjoy the same level of real consumption upon retirement. Retirement and insurance savings have two components. One part is the contribution of the employer and the other part is the contribution of the employee. JPC's research shows that two separate steps need to be taken to equalize the real value of these savings between the COLA areas and the Washington, DC area. With respect to the contribution of the employer (i.e. the Federal government), the earnings base for the computation of retirement and insurance benefits should be defined to include COLA payments.

With respect to employees, the issue is how best to define the price of savings in COLA areas relative to the Washington, DC area. This price relative would then be included in the COLA price index with an expenditure weight corresponding to the proportion of income going towards retirement and insurance savings. The most feasible procedure in this respect is to set the savings price relative equal to the value of the price index for all consumption items combined. Consumption items include all non-saving items in the market basket for the price index. An alternative procedure is to exclude retirement and insurance items from the market basket but to apply the resulting price index to the gross earnings of employees to compute COLA payments. In either event, employee compensation will increase by the same amount. Employees can use this increase to raise their level of contribution to the retirement and insurance accounts.

4.8. Locality Pay

Most Federal employees in the Washington, DC area are entitled to locality pay. However, Federal employees in the COLA areas are excluded from

the provisions of the Federal Employees Pay Comparability Act (FEPCA) authorizing locality pay. The two questions that arise in this context are as follows: (1) Should Federal employees in COLA areas receive locality pay, either in addition to or as a substitute for COLA payments? (2) Does the locality pay received by employees in the Washington, DC area have role to play in the setting of COLA rates? In more general terms, the issue for analysis under this task was whether wage data have a role in measuring and compensating for cost-of-living differences between the COLA areas and the Washington, DC area.

There is some evidence that wages and prices are correlated across areas. Individuals require a higher wage rate to move to a higher cost area. Conversely, individuals are willing to take a pay cut to move to low cost areas. In a perfect world, the wage gap between any two areas will mirror the price gap as long as environmental amenities (i.e. non-price factors) are similar across the two areas. If one area offers fewer environmental amenities, individuals would demand a wage premium over and above that suggested by price differences alone before moving to that area. This means that wage gaps across areas could signal differences in the cost of living more accurately than measured differences in price levels. In this perfect world, then, wage indexes could substitute for price indexes for the setting of Federal employee wages outside of the Washington, DC area. No additional allowance for non-price factors would be needed because the wage index would implicitly incorporate the labor market valuation of environmental amenities and disamenities.

The perfect-world scenario suggests that employees in COLA areas could be compensated in one of two ways. One method is to use a price index in combination with an allowance for non-price factors to set COLA rates. This represents a direct attempt at measuring cost-of-living differences across areas and compensating employees for those differences. The alternative method is to use locality pay. Under this method, employees in COLA areas would receive the prevailing private-sector wage in their area of residence. There would be no other allowance. Under either method, the real income of Federal employees in COLA areas would be the same as the real income of Federal employees in the Washington, DC areas. That is because of the presumed correlation between wages and prices across areas and the assumption that private-sector wages incorporate the value of non-price factors.

However, JPC's research indicates that the presumptions underlying the scenario outlined above are suspect on both methodological and empirical grounds. The observed correlation between wages and prices is not as strong as one would desire and is likely to be even weaker across areas widely separated by geographic, economic and cultural factors. While locality pay could still be used as a substitute for COLA payments, it is not likely to lead to the same level of real earnings for Federal employees in the COLA areas as in the Washington, DC area. If equalizing real earnings remains the paramount objective of the

COLA program, it would be preferable to set COLA payments based on the estimation of price indexes and non-price factor allowances.

The other question regarding locality pay is whether the locality pay received by employees in the Washington, DC area has a role to play in the setting of COLA rates. The short answer to this question is, yes. If the price-index approach for setting COLA rates is retained, JPC's research shows that the base earnings used to determine COLA payments should include the locality pay received in the Washington, DC area.[15] If that is not done, the real earnings of employees in the COLA areas will remain below the real earnings of employees in the Washington, DC area.

4.9. Non-price Factors

It was explained earlier in this report that a price index is only an approximation of the true difference in cost of living across areas. One reason is that not all factors that affect the cost of living have a price directly associated with them. And even though some factors may be folded into the price index in principle, it is often difficult to do so in practice. As a result, some factors must be dealt with outside the framework of the price index. Those factors have been referred to as non-price factors through the course of this report.

The list of non-price factors is long. Factors that have been mentioned in the report are as follows: the availability and quality of medical care; the adequacy of public schooling and college programs; the need for air travel necessitated by the lack of schooling and medical care; the need for air travel arising from the geography of the COLA areas; traffic congestion; the availability and convenience of public transport; the gaps in auto insurance coverage in some COLA areas; and potential disparities in government services. Other non-price factors that have not yet received mention in this report but were analyzed as part of the research are as follows: air and water quality; crime rates; economic and housing characteristics of an area; and climatological conditions, such as, temperature, hurricanes, earthquakes, and hours of daylight.

Non-price factors can be accommodated in the COLA program by one of two methods, or by some combination of the two. The first principal method is to modify the price index. Some options for modifying the price index have been raised at various points in the report. To recapitulate, one could inflate the expenditure weight for selected items without a corresponding reduction in the weights for other items. This means that the sum of expenditure weights for items included in the price index will exceed 100. Another option is to adjust the price relatives for selected items for known differences in the need for those

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[15] This should also be done for the sake of computing pension and insurance contributions. If some other area replaces the Washington, DC area as the base for the COLA program, locality pay for that area should be included in the definition of base earnings.

items. For example, the price relative for gasoline can be adjusted for known difference in gas mileage across areas caused by environmental conditions. A third option is to use cost ratios on a selective basis as a substitute for price ratios. This is another way to allow for differences in the need for items. For instance, environmental conditions in Alaska necessitate a higher level of consumption of utilities. Rather than take a simple price ratio of heating fuel, it might be more desirable to compute a cost ratio where the quantity of fuel consumption is allowed to vary between Alaska and the Washington, DC area.

While modifications to price indexes are feasible, they can only be made on a selective basis and cannot possibly accommodate all non-price factors whose influence is diffuse and pervasive. Therefore, it is often necessary to consider implementing an allowance for non-price factors to use as a supplement to COLA payments based on price indexes. The review of cost-of-living programs at agencies such as the United Nations, Department of State, etc. shows that the use of supplementary allowances is a common practice. Data gathered by JPC reveal that there are sufficiently large differences in non-price factors between the COLA areas and the Washington, DC area to warrant the consideration of an allowance for them. Two points need to be emphasized in this context. The first point is that care should be taken to avoid double counting. If the price index has already been modified to accommodate a non-price factor, that factor should be dropped from consideration in the setting of a supplementary allowance. The second point is that, just like the valuation of goods and services, the valuation of non-price factors should be done relative to the Washington, DC area. Such valuations may show in some instances that the Washington, DC area rates lower than the COLA areas.

In principle, the allowance for non-price factors may be determined either by statistical modeling or by subjective means. Statistical modeling would be based on "quality-of-life" models estimated by several economists to rank urban areas in the United States. One weakness of statistical modeling is that the ranking of urban areas varies considerably from one quality-of-life model to another. The statistical models are not free of subjectivity either. It is possible to manipulate the rankings of areas by selective inclusion or deletion of non-price factors from the model. From the point of view of the COLA program, the insurmountable problem is the lack of data and sufficiently large number of observations to estimate satisfactory quality-of-life models. Therefore, implementing an allowance for non-price factors in the COLA program will require the use of subjective criteria. This is also the usual practice at other agencies that use allowances for non-price factors to supplement COLA payments based on measures of price differences.

5. Conclusions

This report has summarized the findings from the research undertaken to evaluate OPM's methodology for estimating cost-of-living differences between areas in Alaska, Hawaii, Guam, Puerto Rico, the U.S. Virgin Islands and the Washington, DC area. The research objectives, grouped into eight separate tasks, covered virtually all aspects of price index estimation. The main yardstick used to evaluate and guide improvements in the COLA program methodology was the concept of cost-of-living. It was argued that a price index does not necessarily measure the true difference in the cost-of-living across areas. Therefore, an important part of the research was to identify non-price factors, i.e. items that affect the cost of living but cannot be folded into a price index for one reason or the other, and to articulate options for accommodating them within the COLA program methodology.

The research was fulfilled employing a variety of techniques, ranging from the review of literature to the collection of primary data and model estimation. The broad scope of the investigation uncovered numerous suggestions for changes to the current methodology used to determine COLA payments. The suggestions for change can be grouped into five major categories. The first category consists of technical modifications that might be made to price index formulation and estimation. These are suggestions regarding the choice of expenditure weights, correcting for the lag with which expenditure weights become available, techniques for aggregation, and the use of a multi-income model. An example of one such suggestion is the use of democratic expenditure weights in place of plutocratic expenditure weights. Democratic weights give equal importance to the expenditure patterns of all persons. *Plutocratic weights* attach greater importance to the expenditure patterns of high-income individuals. Most suggestions for change under this category are just as likely to cause the COLA price index to increase as to cause it to decrease. However, the changes in either direction are expected to be very modest.

The second category of suggested changes concerns techniques for data collection. These suggestions cover ground such as the use of sampling and survey techniques, the role of employee surveys, the periodicity of surveys, and the type of price data to be collected. One broad suggestion is that OPM could make greater use of survey techniques, especially with respect to the use of employee surveys. To limit the strain on resources, neither current price surveys nor new surveys that might be introduced need to be conducted on an annual basis. Limiting the periodicity of surveys also allows the addition of depth to each survey. The impact of most of these changes on the level of the COLA price index is not known.

The third category of changes may be described as the introduction of new concepts for the measurement of prices. In particular, these are suggestions for change regarding the concepts used to measure prices for shelter and medical services. The current procedures are conceptually outdated and in need of

revision. It is suggested that OPM make use of the rental-equivalence technique for measuring shelter prices and implement procedures to control for differences in housing quality across areas. It is also suggested that OPM implement as many changes as feasible to better measure out-of-pocket costs faced by employees for the purchase of medical goods and services. Revisions to the housing methodology are expected to cause modest changes to COLA price index for all areas except Hawaii. There might be significant decreases in the shelter price index for COLA areas in Hawaii. The impact of changes that might be made to the medical services index is not known.

The fourth category of changes consists mostly of procedures for accommodating non-price factors within the COLA program. These suggestions extend the scope of the COLA program beyond just the price index concept and are designed with the objective of making COLA payments a better reflection of cost-of-living differences between COLA areas and the Washington, DC area. Options for adding flexibility to the price index methodology or developing a system of allowances for non-price factors were described in the report. Some of the non-price factors that would be accommodated by these procedures are the availability and quality of medical services, public transport, and schooling in the COLA areas. Other significant non-price factors are the need for air travel, climatological conditions, and (possibly) income taxes and government services. The accommodation of non-price factors can be expected to lead to an increase in COLA payments.

The fifth and final category of suggestions concerns the articulation of objectives for the COLA program. Whether or not some research findings are implemented and exactly how they are implemented depends in part on the objectives of the COLA program. For example, the treatment of income taxes in the COLA program depends on the concept of earnings OPM wishes to equalize across areas. The same is true of the role locality pay might play in the COLA program. If the price-index approach for setting COLA rates is retained, the base earnings used to determine COLA payments should include the locality pay received in the Washington, DC area (or the locality pay in whichever area is chosen to serve as the base for the COLA program.) In general, the clear articulation of objectives will serve as a useful guide to the development of methodological and empirical improvements.

In conclusion, the various suggestions for change, if implemented, require careful planning and development in the near future. The OPM methodology also could be subjected to periodic review to ensure procedures are being implemented properly and are kept up to date. A technical advisory committee might be appointed to assist OPM in this process and to resolve technical and statistical issues that arise inevitably. A final point to note is that implementing the entire set of changes, or even a subset of the changes,

suggested by the research may require the removal of the current 25 percent statutory ceiling on COLA rates.

Glossary

Note: Italicized terms that appear within a definition are defined elsewhere in the glossary.

Base area: The area chosen to serve as the base for purposes of computing a *price index*. The base area for the COLA program is the Washington, DC area.

Consumer expenditure survey: A survey of households designed to determine the distribution of expenditures across items that make up a household budget (also referred to as the *market basket*.) Households are asked to indicate how much they spend on each item in their budget. The survey results are used to determine the proportion of income going towards different items in the *market basket*.

Cost of living allowance (COLA): The allowance given to employees in an area to compensate for differences in the cost of living between that area and the base area. A common practice is to first estimate a *price index* and then use it to determine the increment to wages and salaries that will be paid as a cost-of-living allowance. A COLA is often supplemented by other allowances to account for factors not captured in the *price index*.

Cost of living index (COLI): An index that determines the minimum level of expenditure necessary in an area to attain the same level of well being as attained by households in the *base area*. Direct estimation of cost-of-living indexes is generally infeasible. Under some restrictive assumptions, certain formulations of *price indexes* can be used to measure a cost-of-living index. Generally speaking, however, *price indexes* are only approximate measures of the cost of living.

Cost ratio: The cost of purchasing an item in an area relative to the cost of purchasing that item in the base area. The cost of an item is the product of its price and the quantity purchased. The quantity purchased may be allowed to differ between the comparison area and the *base area*. In that event, the cost ratio will differ from the *price ratio*.

Democratic weights: A particular way of computing *expenditure weights* to represent the expenditure patterns of a population of households. *Expenditure weights* are first computed for each individual household participating in a *consumer expenditure survey*. The weights for each item are then averaged

across all households in the sample. The term "democratic" is used to reflect the fact that households are given equal importance in this averaging process.

Expenditure weights: Expenditure weights are dollar expenditures on individual items expressed as a proportion of total expenditures. Depending on the items included in a household's budget, dollar expenditures on individual items may be expressed as a proportion of income. (Also, see *relative importance*, *democratic weights* and *plutocratic weights*.)

Hedonic model: A statistical model that is used to decompose the price of a commodity into the value consumers attach to individual characteristics of that commodity. For example, the price of a house could be decomposed into the value consumers attach to housing characteristics such as the number of bedrooms, the number of bathrooms, square feet of living space, etc. These models are used to compare the prices of commodities across areas (or over time) when their qualities (in terms of characteristics) are known to differ across areas (or over time.) (Also, see *matched model*.)

Laspeyres index: The Laspeyres formula for a *place-to-place price index* uses *expenditure weights* that reflect the expenditure patterns of households in the *base area*. Strictly speaking the *expenditure weights* should be for the same time period as the one in which price data are collected. If price data and expenditure data are not contemporaneous, the *expenditure weights* are usually converted into *relative importances*. An alternative to the Laspeyres formula is the Paasche formula that uses *expenditure weights* derived from the expenditure patterns of households in the comparison area. The Laspeyres formula is generally recognized as an upper bound to the *cost-of-living index* and the Paasche formula is generally recognized as the lower bound.

Locality pay: Locality pay is given to most Federal employees working in the contiguous 48 states. The purpose of locality pay is to adjust Federal salaries over a nine-year period so that the gap between private sector and Federal salaries in any given locality is reduced to no more than 5 percent in favor of the private sector. Locality pay was authorized by the Federal Employees Pay Comparability Act of 1990.

Market basket: The list of items purchased in the market by the typical household. Prices of these items are collected in the *base area* and the comparison area for the sake of computing a *price index*. Data on expenditures on these items are collected in the *consumer expenditure survey*.

Matched model: An alternative to the *hedonic model* for comparing the prices of items across areas when they are known to differ in quality. Under this approach, price data are collected only for those models of an item that are known to match across areas. In the case of housing, for example, only a certain

model of home would be priced in each area. Based on a pre-specified list of characteristics, the model home in each area would contain a certain number of bedrooms, baths, etc.

Non-foreign areas: States and territories of the U.S. outside of the contiguous 48 states. The following non-foreign areas are covered by the COLA program: Alaska, Hawaii, Guam and Northern Mariana Islands, Puerto Rico and the U.S. Virgin Islands.

Non-price factors: Factors that affect the cost of living in area but whose cost, relative to the *base area*, cannot be readily incorporated into a *price index*. Examples include quality of schooling and medical care, extreme climate conditions, air and water quality, and road congestion.

Outlet initiation: Initial visits to selected outlets in which price data are to be collected on a routine basis. These visits are designed to secure the cooperation of the store managers and to select the specific brand-size-model combinations of items that will be priced in that store in the future.

Out-of-pocket medical costs: Expenditures by consumers on medical goods and services that are not reimbursed by their medical insurance company.

Place-to-place price index: A *price index* that compares the price level in one area with that in another area. The price index computed by OPM for the COLA program is an example of a place-to-place price index. (Also, see *Laspeyres index* and *time-to-time price index*).

Plutocratic weights: An alternative to *democratic weights*. Data from a *consumer expenditure survey* are used to compute average expenditures on individual items. The average, taken across households, implicitly gives greater importance to households whose expenditure levels are higher. Average expenditures on individual items are then expressed as proportions of average total expenditures to yield *expenditure weights*. The consumer price index computed by the Bureau of Labor Statistics uses plutocratic weights.

Point-of-purchase survey: A survey of households designed to determine the outlets in which households shop for specific items. The results are used to select outlets from which price data will be collected.

Price index: A weighted average of *price ratios*. The weights used are *expenditure weights* reflecting the proportion of total expenditures devoted to items included in the price index. (Also, see *Laspeyres index*, *place-to-place price index*, *time-to-time price index*, and *COLI*.)

Price ratio (or price relative): The unit price of an item in the comparison area expressed as a ratio of the unit price of the matching item in the *base area*. Price ratios are also used to express the relative change in prices between two time periods. (Also, see *cost ratio*.)

Probability sampling: A statistical procedure for selecting the brand-size-model combination of items to price in the various areas. Specific brand-size-model combinations are usually selected during *outlet initiation*. Better selling items are given a higher probability of selection.

Relative importance: An *expenditure weight* adjusted to reflect changes in prices over time. Expenditure amounts on each item in the *market basket* are inflated to account for the change in the price of that item between the date of the *consumer expenditure survey* and the current time period. The inflation-adjusted expenditure data are then used to re-compute the proportion of total expenditures going towards each individual item.

Rental equivalence: The rental value of an owner-occupied property. Alternatively, the amount it would cost a homeowner to rent a property identical to the one he or she owns. Used to measure the cost of *shelter services*. (Also, see *user cost*.)

Shelter services: The flow of consumption services produced by a stock of housing.

Substitution: The substitutions made by consumers in response to changes in the price of an item relative to the prices of other items. For example, an increase in the price of apples might prompt consumers to purchase more oranges. At least part of this substitution can be made without deterioration in well being.

Time-to-time price index: A *price index* that compares the price level in one time period with the price level in another time period. (Also, see *Laspeyres index* and *place-to-place price index*.)

User cost: An alternative to *rental equivalence* for measuring the cost of *shelter services*. User cost is defined as the sum of mortgage interest payments, the interest earnings foregone on home equity and other direct costs less the capital gain (or loss) on the house.

Bibliography

Advisory Commission to Study the Consumer Price Index (Boskin Commission). "Toward a More Accurate Measure of the Cost of Living," Final report to the Senate Finance Committee, December 4, 1996.

Betts, Julian R. "Does School Quality Matter? Evidence from the National Longitudinal Survey of Youth." Review of Economics and Statistics, May 1995, Vol. LXXVII, No. 2.

Blomquist, Glenn C., Mark C. Berger, and John P. Hoehn. "New Estimates of Quality of Life in Urban Areas." American Economic Review, March 1988, Vol. 78, No. 1.

Card, David and Alan B. Krueger. "Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States." Journal of Political Economy, 1992, Vol. 100, No. 11.

Christensen, Laurits and Dale Jorgenson. "The Measurement of U.S. Real Capital Input, 1929-
1967." The Review of Income and Wealth, December 1969, Series 15, No. 4.

Coleman, James S., et al. Equality of Educational Opportunity. Washington, DC: Government Printing Office, 1966.

Congressional Budget Office. "Comparing Federal Salaries With Those in the Private Sector," July 1997.

Deaton, Angus. "Getting Prices Right: What Should be Done?" The Journal of Economic Perspectives, Winter 1998, Vol. 12, No. 1.

Eberts, Randall W. and Mark E. Schweitzer. "Regional Wage Convergence and Divergence: Adjusting Wages for Cost-of-Living Differences." Economic Review, Federal Reserve Bank of Cleveland, 1994, Vol. 30, No. 2.

Expert Committee on Family Budget Revisions. "New American Family Budget Standards," May 1980.

Fisk, Donald and Darlene Forte. "The Federal Productivity Measurement Program: Final Results." Monthly Labor Review, May 1997, Vol. 120, No. 5.

Gabriel, Stuart A., Joe P. Mattey, and William L. Wascher. "Compensating Differentials and Evolution of the Quality-Of-Life Among U.S. States," Mimeograph, Revised February 1997.

General Accounting Office. "Federal/Private Sector Pay Comparisons," December 1994 (GAO/OCE-95-1).

Gillingham, Robert. "Measuring the Cost of Shelter for Homeowners: Theoretical and Empirical Considerations." The Review of Economics and Statistics, 1983, 254-265.

Gillingham, Robert and John Greenlees. "The Impact of Direct Taxes on the Cost of Living." Journal of Political Economy, August 1987, Vol. 95, No. 4.

Goodman, John and John Ittner, "The Accuracy of Home Owners' Estimates of House Value." Journal of Housing Economics, December 1992, Vol. 2, No. 4.

Gyourko, Joseph and Joseph Tracy. "The Structure of Local Public Finance and the Quality of Life." Journal of Political Economy, August 1991, Vol. 99, No. 4.

Gyourko, Joseph, Matthew Kahn, and Joseph Tracy. "Quality of Life and Environmental Comparisons," in Edwin S. Mills and Paul Cheshire (eds.), The Handbook of Applied Urban Economics. Forthcoming.

Hanushek, Eric A. "The Economics of Schooling: Production and Efficiency in Public Schools." Journal of Economic Literature, September 1986, Vol. 24.

Hanushek, Eric A., John F. Kain, and Steven G. Rivkin. "Teachers, Schools, and Academic Achievement." National Bureau of Economic Research, Inc., Working Paper No. 6691, August 1998.

Kennedy, Peter E. "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations." American Economic Review, September 1981, Vol. 71, No. 4.

Kokoski, Mary F. "Consumer Price Indices by Demographic Group." U.S. Department of Labor, Bureau of Labor Statistics, Office of Prices and Living Conditions. Working Paper 167, April 1987.

Kokoski, Mary F., Patrick Cardiff, and Brent Moulton. "Interarea Price Indices for Consumer Goods and Services: An Hedonic Approach Using CPI Data." U.S. Department of Labor, Bureau of Labor Statistics, Office of Prices and Living Conditions. Working Paper 256, July 1994.

Kravis, Irving B., Alan Heston, and Robert Summers. "World Product and Income: International Comparisons of Real Gross Product." Baltimore and London: The Johns Hopkins University Press, 1982.

Kravis, Irving B., Alan Heston, and Robert Summers. "International Comparisons of Real Product and Purchasing Power." United Nations International Comparison Project: Phase II. Baltimore and London: The Johns Hopkins University Press, 1978.

Kravis, Irving B., Zoltan Kenessey, Alan Heston, and Robert Summers. "A System of International Comparisons of Gross Product and Purchasing Power." United Nations International Comparison Project: Phase One. Baltimore and London: The Johns Hopkins University Press, 1975.

Lane, Walter and John Sommers. "Improved Measures of Shelter Costs." Proceedings of the Business and Economic Statistics Section, American Statistical Association, 1984.

Leven, Charles L. and Jonathan H. Mark. "Revealed Preferences for Neighbourhood Characteristics." Urban Studies, 1977, Vol. 14.

Maddala, G.S. Econometrics, New York: McGraw-Hill, 1977.

Malpezzi, Stephen, Gregory H. Chun, and Richard K. Green. "New Place-to-Place Housing Price Indexes for U.S. Metropolitan Areas, and Their Determinants." Real Estate Economics, 1998, Vol. 26, No. 2.

Moulton, Brent. "Interarea Indexes of the Cost of Shelter Using Hedonic Quality Adjustment Techniques." Journal of Econometrics, July 1995, Vol. 68, No. 1.

Office Of Personnel Management. "Cost-of-Living Allowances (Nonforeign Areas); Interim Rule. Report on 1996 Surveys Used to Determine Cost-of-Living Allowances in Nonforeign Areas; Notice." Federal Register, March 25, 1997, 5 CFR Part 591, 14188-14273.

Office of Personnel Management, Office of Compensation Policy. "A Model for Estimating Housing Costs for the COLA Program," September 1, 1994.

Palmquist, Raymond. "Estimating the Demand for the Characteristics of Housing." Review of Economics and Statistics, August 1984.

Pollak, Robert A. "The Consumer Price Index: A Research Agenda and Three Proposals." The Journal of Economic Perspectives, Vol. 12, No. 1, Winter 1998.

Pollak, Robert A. "Group Cost-of-Living Indexes." American Economic Review, May 1980, Vol. 70, No. 2.

Ridker, Ronald G. and John A. Henning. "The Determinants of Residential Property Values with Special Reference to Air Pollution." The Review of Economics and Statistics, May 1967, Vol. XLIX, No. 2.

Roback, Jennifer. "Wages, Rents, and the Quality of Life." Journal of Political Economy, December 1982, Vol. 90, No. 6.

Runzheimer International. "Availability and Cost of Selected Higher-Education Degree Programs In COLA Areas." Report submitted to the Office of Personnel Management, June 1992.

Runzheimer International. "Availability and Cost of Selected Medical Procedures in COLA Areas." Report submitted to the Office of Personnel Management, June 1992.

Runzheimer International. "K-12 Education, Puerto Rico vs. DC Area." Report submitted to the Office of Personnel Management, December 1991.

Samuelson, Paul. "International Factor-Price Equalisation Once Again." Economic Journal, June 1949, Vol. LIX, No. 234.

Samuelson, Paul. "International Trade and Equalisation of Factor Prices." Economic Journal, June 1948, Vol. LVIII, No. 230.

Shapiro, Irving, Matthew D. Shapiro and David W. Wilcox. "Quality Improvement in Health Care: A Framework for Price and Output Measurement." American Economic Review, May 1999, Vol. 89, No. 2.

Simpson, Hilery. "How do Wages in San Juan Compare to Wages on the Mainland?" Compensation and Working Conditions, Winter 1998.

Simpson, Hilery. "How do Wages in Alaska Compare to Wages on the Mainland?" Compensation and Working Conditions, Fall 1998.

Simpson, Hilery. "How do Wages in Hawaii Compare to Wages on the Mainland?" <u>Compensation and Working Conditions</u>, Summer 1998.

Stover, Mark Edward and Charles L. Leven. "Methodological Issues in the Determination of the Quality of Life in Urban Areas." <u>Urban Studies</u>, 1992, Vol. 29, No. 5.

Technical Advisory Group. "The Concept of Equilibrium as Applied to Housing and Other Markets." (prepared by Harold Watts), June 1999.

Technical Advisory Group. "Memo on Using Housing Prices as a Basis for the Cost of Housing Services." (prepared by Alan Heston), June 1999.

Technical Advisory Group. "A Comparison of Expenditure-based Weights with Population-based Weights." (prepared by Harold Watts), December 1998.

Technical Advisory Group. " Review of BLS Family Budget Program." (prepared by Eva Jacobs), December 1998.

Technical Advisory Group. "Variation in Price Relatives Across Items, COLA Areas and Years." (prepared by Alan Heston and Harold Watts), August 1998.

Technical Advisory Group. "Compensation Comparisons." (prepared by Alan Heston), May 1998.

Technical Advisory Group. "Analysis of Pay Differentials for Non-Federal Employees as Measured in Locality Pay Surveys." (prepared by Harold Watts), August 1997.

Technical Advisory Group. "The Three Income Levels Issue." (prepared by Alan Heston and Harold Watts), 1997.

Thibodeau, Thomas (ed.). <u>House Price Indices</u>, Boston: Kluwer Academic Publishers, 1997.

Triplett, Jack (ed.). <u>Measuring the Prices of Medical Treatments</u>. Washington, DC: Brookings Institution Press, 1999.

Triplett, Jack. "Price and Technological Change in a Capital Good: A Survey of Research on Computers," in Dale Jorgenson and Ralph Landau (eds.), <u>Technology and Capital Formation</u>, Cambridge: The MIT Press, 1989.

Triplett, Jack. "The Economic Interpretation of Hedonic Methods." <u>Survey of Current Business</u>, 1986, Vol. 66, No. 1.

Triplett, Jack. "Concepts of Quality in Input and Output Price Measures: A Resolution of the User-Value Resource-Cost Debate," in Murray Foss (ed.), <u>The U.S. National Income and Product Accounts: Selected Topics</u>, Chicago: National Bureau of Economic Research, Studies in Income and Wealth, Vol. 47, University of Chicago Press, 1983.

United Nations, International Civil Service Commission, "United Nations Common System of Salaries, Allowances and Benefits," May 1997.

United Nations, International Civil Service Commission, "A Guide to the Mobility and Hardship Scheme," May 1997.

United Nations, International Civil Service Commission, "Calculation of Post Adjustment Indices," September 1994.

United Nations, International Civil Service Commission, "The Post Adjustment System: What it is, how it works," May 1994.

United Nations, International Civil Service Commission, "Guidelines for the Determination of Post Adjustment Classification," May 1994.

United Nations, International Civil Service Commission, "Coordinator's Manual for Cost-of-Living Surveys," April 1993.

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Overseas Cost-of-Living Allowance (OCOLA) Program."

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Frequently Asked Questions (FAQ): Overseas COLA Program."

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Overseas Housing Allowance (OHA) Program."

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Overseas Housing Allowance (OHA): Frequently Asked Questions (FAQ), Updated 11/20/98."

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "CONUS Cost of Living Allowance (COLA): 1998 Rates."

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "CONUS Cost of Living Allowance (CONUS COLA): Frequently Asked Questions and Answers

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Basic Allowance for Housing (BAH)."

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Basic Housing Allowance Frequently Asked Questions, Updated 12/30/97."

U.S. Department of Labor, Bureau of Labor Statistics. "Measuring State and Local Government Labor Productivity: Examples from Eleven Services," June 1998, Bulletin 2495.

U.S. Department of Labor, Bureau of Labor Statistics. "Measurement Issues in the Consumer Price Index." Report submitted to the Joint Economic Committee of the U.S. Congress, June 1997.

U.S. Department of Labor, Bureau of Labor Statistics. BLS Handbook of Methods, April 1997, Bulletin 2490.

U.S. Department of Labor, Report on the American Workforce, 1997.

U.S. Department of Labor, "Three Standards of Living for an Urban Family of Four Persons," Bulletin No. 1570-5, 1969.

U.S. Department of State, "Post (Hardship) Differential."

U.S. Department of State, "Indexes of Living Costs Abroad, Quarters Allowances, and Hardship Differentials, October 1998."

U.S. Department of State, "Indexes of Living Costs Abroad, Quarters Allowances, and Hardship Differentials, January 1998."