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## Methodological Issues in Adjusting Earnings for Quality of Life Differences among Locations

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METHODOLOGICAL ISSUES IN ADJUSTING EARNINGS FOR  
QUALITY OF LIFE DIFFERENCES AMONG LOCATIONS

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A good deal has been written (Rosen, 1979; Roback, 1982, BBH, 1988 and other later works listed in bibliography) about measuring comparative Quality of Life (QOL) in different locations, most commonly metro areas in the U.S. or conurbations in Europe. Most frequently the QOL measure shown for a given area is its QOL score based on hedonic estimation of determinants of house price and/or return to labor over a set of areas for which appropriate data is available. Often results are shown as a given area's rank within the set with which it is being compared (BBH, 1988, for example), though it has been suggested that a quintile or other discontinuous scoring would be more robust with respect to variations in the list of independent variables (Stover and Leven, 1991).

These results are interesting, however, really only in the context of ratings or rankings or areas as in a "beauty contest". Especially given the extreme sensitivity of such results to data availability or estimating equation form (Stover and Leven, 1991) it is hardly surprising that despite a high level of interest among the "contestants", the results are hardly taken very seriously by the rest of the world and are soon forgotten. A more durable interest in QOL results is unlikely without applications of those results to particular inter-regional policy issues.

An example of an interesting example with which the author has developed some familiarity is determining income-equivalent evaluations of QOL differences among U.S. off-shore locations as a way of determining appropriate adjustments of U.S. Federal government workers' salaries located in such area relative to earnings in Washington, D.C.

## I

In understanding how Quality of Life Adjustments (QOLA) could be additive to Cost of Living Adjustments (COLA) it will be useful to review very briefly some of the major issues that have arisen in applying various methods to QOL measurement.

### Sum of rankings

The main advantage of simply summing for each area the sum of its rankings over all areas for a selected set of indicators is its operational simplicity. No information is needed except the rank ordering of a priori selected QOL indicators over the areas and no parametric estimation is required. The main disadvantage is the implicit “equal ignorance” hypothesis, i.e. that being first (last) in any one indicator adds (subtracts) just as much to QOL as being first (last) in any other indicator. A second major disadvantage is the sensitivity of the rank order to the indicators selected, which in turn is dependent on data availability. Finally, there is no way of determining the dollar amount of Quality-of-Life Adjustment (QOLA) that should be added to the otherwise computed COLA and/or how that differential might vary over the spectrum of rankings.

An additional problem with this method is that the QOL indicator list itself can be used to bias results in a particular way. For example, if the analyst wanted a particular area to show up well he/she would include a large number of descriptors of a particular element in which the area showed up well. If an area was strong in education many educational QOL indicators could be specified, say, class size, spending per student, graduation rates, percent of graduates going on to college, SAT scores, etc., etc., etc. If the same area were somewhat weak in medical services, we could minimize the effect of this by letting a single variable, say infant mortality rate serve as an overall indicator. These disadvantages make the simple rank-ordering method essentially useless in reaching consensus concerning the dollar difference appropriate to pairs of specific places.

Data requirements for a sum of rankings are both easy and difficult. Difficult in the sense that we have no criteria for which or how many individual variables should be used, even if available, except perhaps avoiding too many that are covariant. But even then, we have no standards as to how much covariance is “too much”. But the data requirements are easy in that we have no practical choice but to use whatever is available.

### Regression estimates based on revealed preference

The major strength of using a regression equation approach is the accepted theoretic basis for regarding the coefficients in revealed preference equations as reflecting the partial contribution to QOL in dollars to observed housing price or earnings differentials among individuals. Moreover, the analysis itself can select both relevant indicators and determine the marginal contribution to housing cost paid or wages received from the revealed preference for each variable. In this way an unambiguous cardinal measure of differences in QOL for any set of areas can be obtained.

The problem is that the ordinal ranking, much less the resultant quantitative measure of QOL is highly sensitive to the estimation procedure. For example, in the dependent variables in the regression equations, preferences are not well defined. Most studies use house price corrected for hedonic housing qualities and some use individuals' earnings adjusted for their human capital as the indicators of revealed preference. But we could have more than two variables to reflect revealed preference such as tax price or transport access of an area. At the other extreme we could use a single revealed preference equation, probably with house price as the dependent variable, with other revealed preference variables treated as independent QOL variable in the house price equation. Each of these options would yield different results.

The problem of which QOL variables to select is not nearly so severe as with simple sums of ranks, since the regression estimates themselves can separate the significant from less than significant ones. It is also possible to summarize the independent variables into a set of principal components via factor analysis. There is still a problem of what universe of possible variables we start from, though as a practical matter we can only pick from what is available. And even the whole set of possible QOL variables, itself will influence the final result. It is probably not an accident that climatological and physical environment variables show up as very important in most QOL studies since these data are on a comparable basis. That cultural and recreational variables don't often show up as important could reflect their low importance in perceptions of QOL, but could also

just as easily reflect the fact that little consistent data across areas is available. To the extent that regression equation estimation is to be used, it is important that the potential QOL indicator set to be used be as broad as is feasible.

There is another advantage in the case of off-shore U.S. Federal workers in that large samples of them are concentrated in a limited number of off-shore areas, which means that data on housing cost and characteristics and earnings of individual Federal worker families is a practical survey possibility. This means that the revealed preference specifically for Federal workers could be achieved. Also, this means that such revealed preference estimation could be made more frequently than every 10 years when most Census data are available.

#### Including QOL indicators in COLA

For a particular sub-class of potential QOL components it may be possible in the U.S. to represent them as part of the COLA adjustments. For example, accurate crime data are difficult to come by and just specifically what crime indicators should be included in a regression analysis is not clear. However, costs of insuring losses for crimes against property are easy to determine, even for small areas. Thus, while some indicator of crimes against people like assault, murder, etc. still would belong in the regression analysis, the “burden” on the regression analysis could be reduced by including insurance rates for fire, theft, vandalism, etc. and quantities of insurance purchased as a component of the COLA. Similar treatment could be used for other insurable perils like flood, tornado, earthquake, etc.

Similarly, public services subject to user charges could be determined from COLA, though at cost of production rather than the actual user charge. This could include things like public education, recreation and cultural services. Note there would still be the problem of normalizing for the quality of these services but that problem would be no different than the quality adjustment problem for ordinary COLA commodities. Where these services were privately produced there would be no reason to be concerned about

their inclusion in QOLA as they would already have been included in a properly specified COLA. In the same vein “remoteness of an area” could be taken care of by the weighted average transport costs to destinations important to non-military Federal personnel, provided that some agreement could be achieved over the identity and importance of these locations.

#### Administrative decision of QOLA

Despite the variety of analytical approaches to QOLA, there will still be some factors which affect QOL which cannot be handled under any of these approaches. Psychic cost of geo-physical elements like long periods of darkness, trauma of hurricane, utility of natural beauty, etc. would be examples. A special problem that arises here is that these kinds of factors likely would be unique to particular locations and/or phenomenon with low probability of occurrence even in “danger” zones, so that determining quantitative revealed preference through regression analysis likely would fail. Moreover, since neither they nor insurance against them normally would be available in the market they cannot be incorporated into the ordinary COLA. Finally, while they could be rank ordered among areas, there is nothing in that rank ordering which would give an appropriate “income equivalent value” that would compensate for any particular place in the rank ordering. We are left simply with the reality that while there would be substantial consensus that such things “mattered”, there would be no way analytically to specify by how much they mattered.

Short of arbitrarily eliminating these factors as relevant, some non-analytical means must be found to specify how much they mattered. There is, of course, a rather long tradition of adding to compensation of Federal employees for environmental disamenities, going back at least to World War II, when pay rate premia of 25% or 50% were paid to armed forces personnel in certain hazardous categories like at sea, in a submarine, in a combat zone, etc. More recently, place specific salary allowances have been used extensively by the U.S. State Department, the United Nations and other international agencies. The amounts of these premia were not derived from any statistical analysis but

were simply specified arbitrarily. The same could be done for any off-shore area, though in a non-emergency situation just who and/or how the premia would be established is not clear. Administrative determination by Office of Personnel Management (OPM) without appeal would seem politically unacceptable. One possibility is that the determination could be guided by identification of important factors and their weight on some simple 5-point scale as determined in a survey of Federal workers in Washington relevant other areas. Another alternative is negotiation between OPM and Federal employee trade unions.

That at least part of the QOLA problem seems not resolvable analytically seems certain. On the other hand, careful use of revealed preference regression estimation and incorporating QOLA into COLA where possible should reduce the problem of administration only a relatively small part of the overall QOLA.

## II

At least within the formal literature of economics, probably the first attempt at QOL measurement also was a response to a need by a Federal agency, in particular in a study conducted by the Midwest Research Institute (MRI) for the Environmental Protection Agency (EPA) (Liu 1975a, 1975b). Since I was a reviewer of the methodology used, I was familiar with the rationale behind that effort. The purpose of the MRI study was to provide a metric of “environmental well-being”, including measures of both socio-cultural and physical well-being. It also was required that the metric be simple to understand and execute.

The MRI methodology was very simple as one could imagine. About 50 indicators of “well-being” were assembled for each of 100 metro areas, based mainly on data-availability. Regions were ranked from 1 to 100 on each of the indicators, the ranks added, and the area with the lowest total sum of ranks judged the best, the region with the



highest sum being judged worst and the others ranked in between according to their sum of individual criteria rankings. That the results were dependent on what data was available was apparent. So too was the sensitivity of the rankings to the equal weighting of indicators, but no way of avoiding these biases was seen as available. That the results could be quickly and easily compiled likely is the main reason that similar methodologies have been used in most of the systems that have been utilized in non-academic media like Rand-McNally Places Rated Almanac, Money Magazine's annual survey of best places to live (Boyer and Savageau, 1993; Money Magazine, 1991, 1993 and 1998), and various ad hoc efforts appearing in newspapers and popular magazines from time to time.

While more recent simple ranking summation systems have sometimes made greater efforts to locate data for indicator variables and occasionally employed limited differential weighting of individual indicators based on a priori judgment, they also suffer from many of the shortcomings of the original MRI effort. Without attempting a specific detailed critique of individual rating systems, it has been generally recognized that there are a number of problems (Leven, 1990).

The most important advance over earlier systems came with Sherwin Rosen's formulation of a revealed preference concept as a way of letting the data define the weights on each environmental variable (Rosen, 1979). This means we can infer what people like about a place from what they are willing to pay to live there. Initial estimates using this concept for a limited number of places were formulated (Roback, 1982) and later for some 254 individual counties (BBH, 1988) based on 1 in 1000 data on households from the 1980 Census. The basic construction is to determine individual house prices and individual worker earnings, the former as a function of dwelling characteristics and area QOL measures and the latter as a function of a worker's human capital characteristics and the same QOL measures. A Box-Cox transform of the two estimating equations was used to determine the appropriate weighting of the coefficients on individual variables in obtaining the weighted sum of the coefficients from the two

equations. In this way, the “data” are allowed to generate the “weights” rather than some arbitrary specification.

Thus, the Rosen-Roback-BBH, et al method seemed to offer a solution to the most easily understood and frequently cited objection to earlier QOL studies, namely the arbitrary weighting of individual elements and instead substituted a theoretically sound basis for criteria weighting. But important as this advance was, it still left a number of unresolved problems in practical application. For example, while Rosen-like systems even let the data select which of a longer list of available independent variables actually are statistically significant, and so should be included, it can only select the most significant variables from an arbitrary inventory of data availability. In BBH, for example, the wage and house price equations determined 16 out of a total list of more than 50 available indicators as being significant. There is no way of testing whether any of these variable would have emerged as significant (much less have had the same numeric coefficients) if the total data inventory had more, or even just different variables.

Even beyond these problems is that of estimating form. Using the identical data set assembled by BBH, Stover and Leven (1991) show different coefficient values arising from changing the estimation format. For example, noting that the human capital coefficients explained little of earnings differentials among workers compared to the large share of house price differences explained by housing characteristics, they converted to a single house price revealed preference equation where expected earnings in a region, determined by human capital descriptors, was included as an independent variable in the house price equation. In this formulation a higher wage is regarded as an “amenity” itself. There are arguments both for (Gyourko and Tracy, 1992) and against (Gabriel, Matthey and Wascher, 1997) this kind of estimating transformation, but the point here is that such transformation makes a big difference even in just the ordinal rankings of places, much less dollar-equivalent cardinal measures of their absolute contribution to QOL. And even more a priori reasonable estimating formats could be generated, each of which in general would produce differences in dollar-equivalent ratings. So, it is important to note how sensitive

QOL ratings and rankings among places are with respect to the potentially significant QOL variable data which happen to be available in any application and to the estimating format used to determine individual variable weightings, even when derived from a single theoretically consistent revealed preference conception. Another variation in the treatment of a large number of potential QOL components would be to summarize them as a set of principal components; this was done in at least one published study, though in a context of neighborhood rather than inter-state differences in QOL (Leven and Mark, 1977).

From the foregoing argument it would seem that a compensating dollar differential to account for QOL differences could be determined if (implausible as it might seem) a fully determinate QOL estimating equation or equations could be formulated and made operational so that inter-area differentials in house prices and/or earnings were fully explained by the QOL equation(s) for house prices and earnings. But not so. Just as in principle there is virtually no end to the independent environmental variables that potentially could affect the choice of house price or earnings differentials among locations, so too there is no clear limit to the dependent variables, that is those objects of locational choice that could reveal preference for environment. In the Rosen *et al* and Stover-Leven formulations it was assumed that environmental preference was revealed by an individual's choice of house price and/or earnings. But preference could also be revealed by choice of other dimensions of space specific consumption. For example, in addition to (or instead) of "voting with their feet" to accept high-priced housing or lower-wage jobs in return for high QOL, people might just as well be willing to pay higher taxes, accept fewer or poorer public services, tolerate more remoteness or live with less congenial neighbors for better QOL as otherwise specified. Indeed, Gabriel, Matthey and Wascher find evidence that environmental amenities may in part be capitalized in the prices of locally traded private goods. This is certainly true of house prices, but even things as simple as restaurant meals might have higher prices in attractive locations, reflecting the higher land rent required in producing them.

In a similar vein, instead of looking at low taxes as something a locator would insist upon in order to tolerate low QOL, lower local taxes (or superior public services) themselves could be seen as arguments of the revealed preference for higher house prices. Thus, it becomes very difficult to specify a priori just which variables are best regarded as arguments of QOL and which as the dependent variables which reveal QOL selection. Similarly, there is no a priori basis for deciding how many simultaneous equations there should be.

Fortunately in the application being considered here, it is not necessary to measure the absolute value of QOL at different locations. Rather, it is to determine a compensating payment that would be equivalent to differentials in QOL at different locations. This is fortunate because the absolute value objective really cannot be achieved. For one thing we have no theoretic construct which indicates how to identify how non-traded components of the environment (i.e. darkness, heat or cold) add to QOL in the way that their unit prices makes it possible to identify how traded goods add to Gross Domestic Product. And even if we could identify them we would have no practical way of determining the contribution of each element to QOL short of achieving complete identification in whatever set of QOL equations we chose to specify. Achieving a dollar measure of the absolute difference between QOL in the Washington, D.C. area and COLA areas in a way that would be invariant with respect to measurement specifications is simply not possible, given data limitations and absence of a coherent theory of the arguments of a QOL function.

However, determining differentials relative to Washington, D.C. can be achieved simply by identifying between- location price differentials for as many appropriate QOL components as practically can be achieved, either by directly purchasing (as most food products) or obtaining them implicitly by purchasing other products, in the way that most climatic characteristics come with housing at any location.

Some items can potentially be purchased directly at the same terms in any market (example: national magazine subscription). No QOL adjustment is required for these items.

Some items can be purchased directly in some or all markets, but the terms on which they can be purchased will vary with location (Price example: appliances at discount stores. Quality example: live theater. Availability example: fresh fruit. General example: transportation to all other markets). Compensating COLA adjustments could be made for these differences in much the same way as for other commodities, though there may be special problems with some of the commodities which are considered QOL components.

Some other items cannot be purchased directly in any markets (example: sunshine). For these items we need simply to compute the compensating dollar amount either from 1) their coefficients in a QOL equation or simultaneous equation set; 2) from the price and conditions of purchase/consumption of a "proxy" commodity (example: safety from crime or natural disaster might be measured by appropriate casualty insurance rate differentials between the Washington, D.C. area and the off-shore areas); 3) by administrative consensus based on area characteristics and/or government employee opinions as shown in surveys similar to those of the US State Department(1993) or International Civil Service Commission(1995).

As discussed the possibilities for achieving sufficient identification in a QOL model so that robust results may be obtained and consensus may be reached as to the amount of compensation differential for each of the QOL components are remote. Specifically, we have to determine the dollar difference required to compensate workers for a difference in a QOL component, not just that one area is better than another in some physical measure of QOL. Say a difference in number of days of sunshine.

We are not, however, without the possibility of achieving guidelines as at least to identifying the appropriate elements of QOL for which either proxy prices or administrative

judgments can be made. Specifically, while coefficients from QOL equations cannot reliably be regarded as measures of compensating income variation, with some qualification QOL research using revealed preference equations suggests some consistency at least in identifying the significant independent variables. It is not possible to test this in any rigorous way since the data available means that different variables were included in different studies. In the one study where the significant variables were selected from a larger set by the analysis itself (BBH, 1988) at least the kind of variables selected were more or less similar to the limited sets used by others such as Gyourko and Tracy (1992), Cebula and Vedda (1973), Graves (1976), Hoch and Drake (1974), and Dalkey (1972). In the Stover-Leven study the independent variables were exactly the same 16 as used by BBH and taken from the same data set, but the selection of the same 16 from a larger set by BBH was not replicated by Stover and Leven since it was there intention to test the robustness of findings with respect to estimating equation specification only

We should also take some comfort from the fact that QOL research findings indicate that QOL differences across areas are usually modest. True, the dollar equivalents of QOL differences between individual within-city neighborhoods revealed by hedonically adjusted house price differentials are quite large as shown by Little (1976) and Leven and Mark (1976). People apparently care quite a bit about neighborhood characteristics, especially socio-economic characteristics of their neighbors. On the other hand, apparently satisfactory neighborhood characteristics can be met by at least some neighborhoods in almost any large city or county. For example, Bayless (1979) analyzed regional differences in college professors salaries, adjusted for academic rank and “quality” of the college or university. He found that faculty would give up only about 2% of their academic salary for a half of a standard deviation of air pollution reduction. For a half standard deviation increase in population size or decrease in density full professors might give up 3 per cent of salary but the much larger numbers of faculty at lower ranks would give up less than 1%. In general, while faculty, and presumably others, would give up something for cleaner air, lower density or bigger scale, they wouldn’t give up very much.

An analysis of prior research does seem to indicate quite specific principles to be followed in coming to a simple, understandable and theoretically defensible method for determining income-compensating QOL differentials. It should be understood, however, that the specific methods to be employed in a particular application will depend on data availability and sensitivity testing of various QOL estimating formats beyond what has been done in existing studies. In particular we would want an estimating procedure that would produce very similar results for modest changes in the exact list of variables used to specify “environment”.

In an actual application, the first stage would be to identify those elements of QOL that can be purchased in the market. We can just add them to the price index used to monitor COLA, in general. This will not bias any COLA adjustment, simply make COLA dependent on more commodities, in particular those that we believe are part of QOL and which are sold in the market. Note also, there is no need to fear a “mistake” here. Adding in an additional market commodity that under other tests would not show up as part of QOL would simply result in a more detailed but otherwise unbiased specification of COLA. Turned around, this logic says simply that we should be sure that COLA includes any commodities purchased in the market that would influence QOL or serve as a proxy for that influence. This part of the process for determining compensating differentials for QOL does mean that the market basket for the COLA adjustment may vary from one COLA area to another.

A very simple example of this would be to include property insurance rates as a proxy for “crimes against property” which independently probably could be shown to influence house prices, for example. But even if this were so, as prior research on QOL suggests would be the case, it would make no difference since the coefficient of “rates of crime against property” in a house price equation could not be taken as a measure of the income compensation needed to offset its effect on QOL, unless the QOL model were fully specified in a way that limitations discussed earlier indicated.

In short, we just have to make sure that COLA includes differences between the Washington D.C. area and relevant off-shore areas, in insurance rates for any hazards to individuals for which insurance is available. These would include differentials in cost of insurance for crimes against property, mainly normal home owners coverage and comprehensive coverage on automobiles and recreational vehicles. Such hazard insurance likely should include fire, earthquake and flood insurance, and insurance on jewelry or other scheduled property.

Hazards for which insurance is not normally available like insurance to cover crimes against people or bad weather will require special treatment, but within the ordinary COLA framework, elements of QOL other than insurance can and should be included. In particular the COLA specifications should be carefully reviewed to see that representative cultural and recreational purchasable commodities, personal tax rates and government services for which user charges are assessed are included.

The second stage is to identify elements of QOL that are not sold explicitly as commodities. Examples would be mean temperature, humidity, distance from the ocean, proximity to a major university or medical center, or access to wilderness areas. Here we face some problems of ambiguity, but prior research can indicate variables which show up consistently in revealed preference equations. Also, even the “places-rated” literature, while falling far short of any reasonable estimate of the value of a particular characteristic often rests on a data base which may be rich in a variety of educational and cultural variables as in the Rand-McNally Places Rated Almanacs. The essential test for whether a variable should be included as a non-marketed element of QOL is that there should be a statistically significant revealed preference for it in an appropriate QOL model. There are, however, some research design problems even in performing such a straightforward test. One problem is the choice of estimating format, i.e. a single or simultaneous equation system with linked equations for revealed preferences on housing prices, earnings rates, tax levels, etc., etc. As indicated in earlier discussion of past research it seems preferable



to use a single equation for house price adjusted for average earnings (adjusted for human capital characteristics), tax rates, etc., along with hedonic characteristics of housing. Part of the problem here is that this format would depend on generating observations for individual households. Depending on Census data in the U.S., these could be generated for States, but not more recently than for 1990.

Alternatively, it might be possible to generate housing data from a survey specifically of Federal personnel, perhaps even specific to particular off-shore locations. . Alternatively we could use simply the median value of some “standard house” in each area as the dependent variable, or simply median house price if survey limitations could not support more detailed specification.

In any case, there are a number of possibilities for determining regression coefficients for each of the potentially significant non-marketed QOL components for which data is available. All of the coefficients could be estimated separately, but problems of multi-collinearity could be substantial. All coefficients could be estimated simultaneously, but the identification of the subset with significant coefficients could be very sensitive to the universe of variables examined. Stepwise regression could prove a superior estimating technique, but so too could running regressions against principal components of the data set. Finally, estimations might even be made against dependent variables other than house price, or maybe against several dependent variables simultaneously. Answers to these kinds of computational questions cannot really be derived a priori, but would require a good deal of statistical experimentation once data had been assembled, a formidable task in itself..

The other problem with the identification of significant QOL variables is that the determination would depend on the universe of potential variables for which data might be available or could be generated in later stages of research. But even here, we can note that past research suggests that the identification of significant variables would be sensitive to the composition of the full data set itself. But we must start with some a priori notion

of what data to assemble. And it is not very helpful to suggest that we should assemble data on everything that might affect QOL. Past research suggests that climatic and macro-geographic data are likely to matter, such things as temperature, rainfall, days of sunshine, population scale and density, coastal location, etc. It also has shown that crime rates, taxes, and school characteristics likely are important, but they already are already can be allowed for in COLA adjustments. So too are medical and transportation services, even though their importance has not been demonstrated in prior QOL research, mainly due to lack of suitable data. Also, as per earlier discussion insurable hazards can be included in COLA, so they do not need concern us in the QOL calculations themselves in so far as appropriate COLA are separately applied to salary differentials among areas.

Perhaps it should be noted that these kinds of strategic considerations in what to include in QOL adjustments in this research mean that an overall index of QOL independent of COLA cannot be compiled. But the purposes of this kind of inter-regional application can be achieved by making sure that significant components of QOL are somehow allowed for somewhere in the overall COLA/QOL system, not the measurement of an absolute QOLA itself. In fact, it might be helpful if we labeled the resultant system as a whole a COLA/QOLA system, standing for Cost of Living Adjustment/Quality of Life Adjustment system, where it is understood that the QOLA part will include elements of overall utility equalization not already included in the COLA part.

This does mean that data for QOLA should certainly go beyond climatic and macro-geographic items, though these should be covered quite broadly as earlier research makes clear that they are significant. What is not included in COLA, and due to lack of data have not been tested convincingly for impact on QOLA are non-marketed cultural, recreational and educational facilities. Neither have socio-economic characteristics of the population, but these raise a special research issue. Past research (Little, 1976 and Leven and Mark, 1977) clearly indicates that they make quite a difference at the level of an individual neighborhood, it is not at all apparent that they make a difference at the level of a metropolitan area, much less a whole state. All big cities, it might be claimed, regardless

of their overall QOL image, do have high quality neighborhoods which those who can afford them can select. And all states do have within them some communities with socio-economic characteristics that would appeal to almost any locators; family characteristics occupational composition and income distribution, for examples. Such socio-economic data is quite easy to assemble at least in Census years.

In sum the “universe” of potentially significant QOLA variables probably can be limited to non-marketed cultural, recreational, educational facilities and services and socio-economic characteristics of the population. Many of the potentially relevant items are apparent, but others not, or are more controversial. Finally, in future surveys of Federal employees which might be undertaken, it would seem very useful to include questions on Federal employees’ use of non-marketed cultural, recreational and educational facilities and the features of these facilities and the socio-economic characteristics of the area’s population they found most important. The survey instruments used by the U.S. Department of State and the United Nations could be consulted for the development of these questions.

A third stage in any application would be to calculate the appropriate QOLA for any elements found to significantly affect QOL. As noted earlier, a discrete ranking of QOL among places does not tell us the amount of compensating variation in income required to equalize utility between any pair of places. Simply knowing that, say Seattle ranked 22<sup>nd</sup> and St. Louis ranked 190<sup>th</sup> among 300 places (Money Magazine, 1998) tells us nothing about how much of a pay increase should be given to someone reassigned from Seattle to St. Louis in order to compensate them for loss of QOL. Further, even if we know the numeric scores achieved in constructing the rankings the difference in QOL points would not tell us either, unless we knew the “value” of a point of QOL.

In principle, the dollar amount of housing cost differential accounted for by QOL components as opposed to difference in hedonic characteristics of housing might look like a measure of utility difference, but there are several reasons why this would not be so.

First, the numeric difference could depend on the number of places rated, as preferences between any two specific places could depend on how many other possible locations were contained in the comparison set. Second, the difference would depend upon the number and identity of different dependent variables supposed to reveal differences in QOL preferences. Third, the coefficients on individual coefficients of dependent variables would depend on the number and identity of the independent variables introduced. This would be the case whether the independent variables were selected a priori or from regression estimates from a larger set of variables, the larger set itself selected a priori and or determined by vagaries of data availability. Only if a completely determined model of QOL were achieved could the sum of the coefficients on QOL variables be regarded as a measure of the QOL in that place; but there is no test as to whether a model would be completely determined. For example, where the coefficients summed to 100% of housing price and we assumed that all preferences for QOL were reflected in house prices, one might be tempted to take the sum of the sum of the coefficients on all non-hedonic variables as a cardinal measure of QOL; but this begs the question of which variables are hedonic characteristics of the house and which of the area surrounding it. There is no non-arbitrary way of doing this. The problem, of course, is there no conventionally agreed upon definition of QOL nor any non-arbitrary specification of its determinants.

Thus, we are faced with resorting to some kind of consensus measure of the importance to QOL of various non-marketed components not otherwise measured by proxy components in the price index used to set of COLA. This would probably be a relatively small share of the total potential number of QOL components. The way we might do this is by some kind of employee survey, informed expert opinion or administrative negotiation in some system similar to that used by the U.S. State Department or the United Nations or other international agencies to assess appropriate COLA differentials between locations.

Another reason for seeking a consensus solution is that house prices may be a poor indicator of QOL in off-shore areas, in particular. Consider, for example, that most

people would think of Hawaii as having a high QOL, and indeed house prices in that State are high. But informal opinion would also think of Alaska as having a very severe environment reflecting a low QOL. But house prices are high there too, and further research might show that the explanation was not differences in hedonic characteristics of housing between the two States, but an inelasticity of supply that makes house prices high in both places. In both places assembly costs of construction inputs likely is high compared with the mainland average and in both places the supply of development sites is limited, in Hawaii by restrictive zoning and concentration of land ownership in native trusts and in Alaska by the prevalence of permafrost and transport inaccessibility.

True, in most continental U.S. metro the elasticity of supply of housing would be very high. Even in large metro areas like New York, additional building sites likely are more or less continuously available on a declining land price gradient. Also, supply price of non-land inputs to housing is much less variable than in remote off-shore locations. Accordingly, the implicit assumption in the revealed preference literature of an infinitely elastic supply of housing seems justified.

In contrast, assuming infinitely elastic housing supply in off-shore areas seems much more questionable. For example, the high consensus that Hawaii's high QOL is supported by high house prices there. But while a consensus view likely is that Alaska has low QOL, it too has high house prices, even hedonically adjusted. The explanation in partly high supply prices of non-land inputs in both Hawaii and Alaska. But even more important are the inelastic supplies of building sites in both States. In Hawaii this is due to concentrated land ownership in a small number of land trusts along with a very restrictive zoning system. In Alaska, big as it is, most of the land is inaccessible and even in urban areas much is unimprovable due to scattered permafrost locations. Accordingly, we cannot calibrate reliable revealed preference models for many, maybe most, off-shore U.S. locations without adjusting observed prices for supply inelasticity.

In Europe restrictions on urban development vary greatly from one country to another, but generally are less severe than in Hawaii or Alaska, for example. But they are generally much more severe than in most U.S. metro areas. Thus, U.S. style revealed preference models cannot be applied uncritically in Europe in reaching QOL conclusions without prior determination of the range of housing supply elasticities across conurbations that would be found there. But in itself that would be a major new research initiative.

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