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Estimating County Cost of Living Indexes:The Issue of Urban Versus Rural

Laura A. Blanciforti

Edit Kranner

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by

Laura A. Blanciforti and **Edit Kranner**

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Laura A. Blanciforti
Senior Staff Fellow
National Institute for Occupational Safety and Health
Morgantown, WV 26505

Edit Kranner
Graduate Research Assistant
University of Kentucky

Abstract: This paper summarizes the outcome of a survey of cost of living/price index programs at the county level in the U.S. Additionally, it presents results of econometric analyses of price level data by counties for two states, Florida and Minnesota. Unlike previous studies that use a sample of urban counties and/or metropolitan areas, this analysis uses all units of the defined geographical area. It reviews the differences that occur from applying the same analytical methods to different data groupings, specifically, urban and rural counties. Finally, it points out issues that regional statisticians must consider when developing indexes for counties within their states.

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I. Introduction

Economists recognize the importance of accounting for price differences when comparing standards of living between geographic areas. Such variations are used to allocate education funds, for calculating income transfers, and in relocation decisions. Currently, public policy shows a trend toward giving states more control over the distribution of federal monies through block grant programs. However, many states do not have a system for measuring price differences and use the U.S. Consumer Price Index (CPI) or an index for a major city within their state to estimate divergence throughout their state. Obviously, measures of constant change or ones that include adjustments for population or income disparity are highly inaccurate as measures of price variation throughout a state. They do not account for the tastes and preferences of specific population groups of the state nor do they account for local market baskets. Rural areas, in particular, are always excluded from these calculated measures. Thus, a major task facing economists, especially those in predominantly rural states, is how to calculate geographic price differences within a state accurately.

This paper has a dual purpose. First, it summarizes the results of a survey undertaken to ascertain existing cost of living/price (COL/P) programs at the county level and reviews ways such indexes are currently measured. Second, it presents research results that are unique in scope. As far as we are aware, this is the first study in this area that is based on all units, as opposed to a sample of urban counties and/or metropolitan areas, of a geographical area. Every county whether it is urban or rural are included in this analysis and data are utilized for each of these spatial units. The econometric results from estimating prices at the county level and examining

urban and rural areas separately, are presented first for one state, Florida. Then the results from applying the same model to a second state, Minnesota, are included but with much weaker results. The conclusions serve to emphasize the strengths and weaknesses of existing approaches and seeks to determine ways to improve on current methods.

II. Previous Research

Studies that have tried to ascertain the determinants of COL/P indexes generally evaluate commonly accepted measures. These include the use of Bureau of Labor Statistics' (BLS') Family Budget (FB) Studies (USDOL 1981), the American Chamber of Commerce Researchers Association (ACCRA) Cost of Living Index (COLI) (ACCRA 1992), city Consumer Price Indexes (CPI's) (USDOL 1983 and 1984), and some state measures of price indexes. Most of these studies (Haworth and Rasmussen (1973), Cebula (1980, 1983, and 1984), Hogan and Rex (1984 and 1985) focus on metropolitan areas. A few studies focus on states (McMahon (1988 and 1991), McMahon and Melton (1978), and Cebula (1989)) or counties within a state (Kurre (1992a and 1992b)) and Langston et al (1985)). Variables are selected based on the agglomeration/congestion hypothesis, rent theory, and other factors and typically include population, population density, population growth, income, measures of housing, utilities or some other factor related to climate. Many studies use regression analysis as an explanatory tool. However, some others, as McMahon (1991), have estimated a reduced-form equation that combines supply and demand factors or, as Kurre (1992a and 1992b), have forecasted COL for counties within a state using a regression-based equation of U.S. counties. To our knowledge, no one had done the obvious, that is, to ask someone in each state agency how they measured within state variation.

III. State Survey

In the fall of 1993, we conducted a survey to determine what COL/P programs, as they are commonly described, exist within the United States. State agencies were contacted by letter (Appendix 1). Forty-one states answered our initial request or a follow-up letter sent in February 1994 yielding an 80.4% response rate (Table 1). Most respondents expressed an interest in the results of our state survey and in the final results of our project. We found not only a lack of such an index and a clear ignorance among states regarding information on how to achieve such a system, but also a lack of awareness as to the approaches used in other states. There was also a clear emphasis on the importance of this issue and an unsolicited show of support for such research.

Generally, a number of states use the ACCRA COLI, the BLS' U.S. CPI, or the BLS' city CPI. The survey ascertained that only four states have their own index. Each is very different. However, the main purpose of each is to provide a tool to equalize the purchasing power of state educational funds across counties. A description of the method used in these four states can be found in Appendix 2 and 3.[1]

The state survey results are summarized in Table 2. The four states with programs (Florida, Illinois, Minnesota, and Wyoming) follow a well-defined methodology. Florida, Minnesota, and Wyoming follow the methodology of the BLS for the U.S. CPI. Florida is considered a leader among the states in measuring cost of living differences, since it is the only state that conducts a price study annually and has been doing so for more than two decades. More importantly, Florida is the only state where the index is calculated on the basis of actual

[1] The Florida description is in Appendix 2; Minnesota, Wyoming, and Illinois in Appendix 3. Also, see Blanciforti and Kranner (1995b).

price collection in every county of the state. In other states, the COL/P studies cover only parts of the states. Minnesota did their survey only once in 1988 and compared cities outside of Minneapolis/St. Paul to Minneapolis/St. Paul. Illinois uses a BLS-based regression equation, that is, an equation using data from the old FB studies but updated using ACCRA data. Illinois' variables include per capita income, housing values, and population change for each county. In addition, some states like Alaska and Utah interpret the ACCRA and CPI data for their urban areas and compare the differences within their state. Alaska also includes the results of a private consulting company, Runzheimer International. Neither Alaska nor Utah provide a specific methodology. They more or less present the facts and tell the user the advantages and disadvantages of each survey and tell them to use their own judgment. Overall we found a strong unsolicited show of support for such an index in our survey effort.

IV. The Estimation

To begin our analysis we needed a data source that contained a calculated index by counties. The Florida Price Level Index (FPLI) satisfied that requirement. The FPLI for 1990 is the dependent variable in our model. It is a spatial price index that indicates differences in the cost of purchasing a specific market basket of goods and services across the counties of Florida. Therefore, it measures geographical differences in the cost of living within the state. The statewide average is 100, and the counties are compared to this average. The values of the index in 1990 ranged from 87.26 to 112.79. The other variables considered in our model are population density, population growth, housing values, tourism, competition in retail trade, and the quality of schools. These variables were chosen from practical considerations. It was felt that when one considers factors affecting the cost of living one thinks about general conditions as the cost of housing, the quality of schools, the availability of jobs for other household members, the

environment, and accessibility to other things - stores, amenities, recreation, transportation links, etc.

IV.A. Description of Independent Variables

The independent variables and their rationale are given below. Average values are presented in Table 3. Population is expected to affect the cost of living. Population density, the population of a county divided by its area, and population growth, the change in population over five years, were used. Generally, greater population density, the average number of residents of a county per square mile, normally results in higher demand and higher prices. At some point in growth the effect of population can slow down or be offset by economies of scale. Goods can be produced cheaper in larger communities. Thus, greater population density could also increase competition and lower costs and prices. The overall effect would be positive on the cost of living. But, beyond a certain level of density an area may become less attractive to live in, because of associated externalities such as pollution and crime. Also, this variable was expected to have a different effect in rural and urban areas. Generally, the expected effect of population density on the cost of living is ambiguous.

Population growth indicates the average annual growth in the number of residents of a county between 1985 and 1990. It is expressed as a percent. Faster growth implies more demand for goods and services and is expected to result in higher prices. This effect can be offset by economies of scale, its expected effect on the price level is ambiguous.

Housing is also expected to affect the cost of living. In fact, housing is the largest expenditure item in most consumers' budgets. The median value of an owner-occupied one-family home that occupies less than 10 acres of land and has no business source on the property was used. Owner-occupied homes include housing units where the owner or co-owner lives in the

unit and the mortgage may or may not be fully paid. This variable provides information about costs of housing, one of the major items of a market basket. A direct positive relationship is expected between this variable and costs.

The percentage of total housing units built in 1989 and from January to March of 1990 was also considered. This variable estimated by the Bureau of Economic and Business Research of the University of Florida (Floyd et al 1994) is an indicator of growth in the county. Generally, more houses mean more people and increased demand. However, the percentage of new housing units is a very similar measure to the population growth rate. Because of the effect of economies of scale the sign of this variable could turn out to be either positive or negative in the equation and because we already included a measure of growth this variable was excluded.

Per capita income, total income divided by county population, was also considered. Total income includes wages and salary, self-employment income, both farm and non-farm, interest, dividends, royalties and rental income, social security and railroad retirement income, public assistance and welfare income, and all other income. An increase in income shifts the budget constraint outwards raising demand and implying a positive relationship between this variable and the cost of living. However, the introduction of this variable resulted in a high degree of multicollinearity between income and housing.[2] Therefore, income was excluded from the final model because of its inherent multicollinearity with the cost of living.

Employment in a community or the availability of work was also expected to be an important indicator of costs. Typically, the fewer people employed means less income resulting in lower demand and prices. It follows that there is a positive relationship between the number

[2] Variance inflation factors rose from 3.6 to approximately 6.

employed and the cost of living. The number of persons working in hotels and other lodging places, that is, the number of people employed full or part time, including salaried officers and executives of corporations, during the pay period including March 12, was used to measure employment. This variable was also expected to be an indicator of the attractiveness of a county. This number reflects a greater number of tourists in the county manifesting itself in increased demand for certain goods and services and higher prices. Tourism is an important industry in many counties and states. In Florida, tourist attractions as Disney World, NASA, the Keys, etc. are a reason to include this variable in the model. This variable is expected to have a positive sign.

We also considered the percentage of labor force working outside of the county as an important indicator of costs. A higher proportion of people working outside of the county of their residence can explain variations in demand for consumer goods and services. Counties with high concentration of better quality residential areas, where prices are normally higher than at other places, may have a positive effect on the price index of the county. On the other hand, a high percentage of people working outside of a county can result from the inability to afford housing in the county of the work place implying a negative relationship. The expected sign is therefore ambiguous. However, this variable had insignificant results and was therefore excluded.

The number of retail establishments per thousand people divided by population, and the location quotient (LQ) in retail trade were considered as indicators of competition. An establishment is a single physical location where business is conducted or where services or industrial operations are performed. It is not necessarily identical to a company or enterprise of one establishment or more. Scaling the number of establishments by the size of the population provides a measure that is more comparable across counties. A greater number of establishments is associated with increased supply, more competition, and lower prices. Its impact was expected

to be negative.

The LQ for retail trade is a measure of relative concentration and specialization of retail trade in a county (Isserman 1980). It indicates self sufficiency of a county in retail trade activity. This variable is calculated from employment data that compares the share of retail trade activity in each county to the state's economy. We chose to compare the individual counties to the structure of the state economy and not to the structure of the U.S. economy as is usually done with this concept. The formula used here is the following.

$$LQ_{rc} = \frac{E_{rc} / E_c}{E_{rs} / E_s} = \frac{E_{rc} / E_{rs}}{E_c / E_s}$$

where E is the number of people employed in the retail trade sector; the subscript r refers to the retail sector, c specifies the county and s the state. The first numerator represents the percent of local employment in retail trade, similarly, its denominator represents the percent of state employment in retail trade. The second numerator measures the county's share of the state's employment in retail trade, and is a proxy for the county's ability to produce; while its denominator is the county's share of the state's employment and is a proxy for the county's ability to consume. The LQ provides an estimate of the difference between a county's production and consumption, in this case the difference between the supply of retail trade activity and its demand. If LQ equals one it means that the county has the same proportion of its employment in that sector as the state does. Therefore, local supply just meets demand through local production. If it is less than one then there are not enough retail stores. Note from Table 3 we see that the LQ is greater than one for urban and less than one for rural areas. To be more precise the size of the retail activity is not large enough to meet the demand of the county in rural areas. From this we

can conclude that in the counties with location quotient less than one, prices must be higher. On the other hand, if a location quotient is higher than one, the county has an excess supply of employment in retail activity implying more competition and lower prices. It could also mean that people from other counties come there to shop. In the case of Florida this could be partly from tourism, since Florida as a whole state is considered attractive to tourists. Therefore, a positive sign would indicate that retail trade is a larger part of the county's economy. A negative sign would imply that as retail trade becomes a greater part of the county's economy its price index declines probably indicating increased competition in that activity.

We also considered two other factors associated with urbanization - poverty and crime. The poverty rate or the percentage of people below poverty level is expected to have a negative impact on the cost of living since it was felt that a high proportion of people with low income results in lower demand. Also the crime rate per one hundred million people in 1991 was calculated from the 1992 rate and data on change from 1991 to 1992, since this was the closest to the analyzed year (1990). Higher crime is usually associated with greater concentrations of people and/or lower public expenditures on safety. An increase in this variable is expected to have a positive effect on the cost of living.

Finally, two dummy variables were created to reflect the quality of schools and recreation. For education we defined a dummy variable for the existence of a university or college in the county. Only counties with universities and colleges that have 10,000 or more students are included. These counties are Alachua (University of Florida, Gainesville), Broward (Nova University, Fort Lauderdale), Dade (University of Miami, Coral Gables), Hillsborough (University of South Florida, South Jacksonville), Leon (Florida State University, Tallahassee), Palm Beach (Florida Atlantic University, Boca Raton) and Orange (University of Central Florida, Orlando).

Existence of a university or college in the county indicates higher demand for housing and other goods and services. It is also a measure of quality of education in a county. Universities produce education that dissipates in a number of ways. One is the production of better educators and administrators. Often the local community is used for training/practice sites for student teachers and the universities produce well-educated personnel. This variable is expected to have positive effect on the community and the index.

And, a variable reflective of recreation, suncoast was created as an indicator of the attractiveness of a county. When a county has a seacoast or direct access to an ocean, it usually means more tourists, higher demand and higher prices. It can also mean a greater supply of goods through shipping.[3] We limited our interest to counties located in the southern part of the state. The included counties are St. Lucie, Martin, Palm Beach, Broward, Dade, Monroe, Collier, Lee, Charlotte, Sarasota, Manatee. The expected sign of this variable was also positive.

For certain variables, it was obvious that the effects would be quite different at different levels of concentration of economic activity. This supported the idea of dividing the sample of counties into urban and rural and performing separate analyses. A dummy variable was again defined with a value of 1 when the county is part of a Standard Metropolitan Statistical Area (SMSA), and 0 otherwise. This variable is not used in the overall regression but only for the purpose of separating counties into urban and rural.

IV.B. The Results

The equation results are presented in Table 4. The equation is estimated for all data and data subdivided into urban and rural. Generally, we find the results to be satisfactory with regard

[3] Cebula (1980) argued that an SMSA located on a seacoast would be desirable as a transhipment point and affect the demand for location/land in the SMSA.

to the direction of signs and statistical significance. We find higher indexes with a greater population density in all counties and in all urban counties. However, this was not true for rural counties.[4] We find that changes in population growth over the last 5 years lowers the index in Florida while increased housing values raise the index. Housing is the most significant variable, accounting for most of the explanation in the index. Also, hotel employment produces the expected positive effect. A check for multicollinearity finds our variance inflation factors to range from 1.24 to 2.93 so collinearity is not a problem. With regard to heteroscedasticity, our calculated values are close to 1 while critical values are close to 2. Therefore, we fail to reject the null hypothesis.

Comparing the urban and rural counties results (refer back to Table 3), rural index values are generally lower; all variables related to population are lower; similarly for employment; the LQ is less than 1; and, poverty is higher and crime lower in rural relative to urban areas. Because the rural equations are weaker in terms of significant variables we estimate the urban and rural equations separately. These results are also presented in Table 4. Housing and population density and the suncoast dummy dominate the urban equation. Unexpectedly, crime and education does not. For the rural areas, housing is the only variable that dominates this equation. A lowering in density and a reduction in retail activity results in higher indexes, though neither variable was significant for rural areas. The right hand side of Table 3 contains results from including the crime variable and improves the results only slightly.

The question that occurs is: are the urban rural results different because the explanatory variables are truly capturing differences in the prices of the urban and rural counties or is there

[4] See explanation of urban-rural above.

something inherent in the way the data are collected and aggregated that is causing this difference.[5] The following presents results for urban and rural counties.

IV.B.1 Revised Model Including Urban-Rural Results

Revised equations for the model are presented in Table 5. The equations are estimated for all data and data subdivided into urban and rural counties. Variables are included to more appropriately reflect conditions in Florida. Generally, we find the results to be satisfactory with regard to the direction of signs and statistical significance. Housing is the most significant variable, accounting for most of the explanation in the index, in all models. We find median rents and/or housing to account for most of the significance. Rents seem to be more important in urban areas and housing in rural areas. We considered a number of other variables but found the most satisfactory results from focusing on housing and/or rent. Housing, median rent, and the suncoast dummy dominate the urban equations. Unexpectedly, crime and the presence of a college education do not. For rural areas, housing dominates these equations. A lowering in population density and a reduction in retail activity results in higher indexes, though neither variable is very significant for rural areas. This is confirmed in Table 6 by examining variations in rural data only.

IV.B.2 The Minnesota Results

Finally, knowing there might be a possibility to strengthen our results by replicating our Florida (FL) equation for another place, we attempted this replication for Minnesota (MN).[6] There are many differences in the ways these two indexes are designed, e.g. MN focuses on a metro-nonmetro sample. Finally, an initial analytical attempt is made on Wyoming data with even

[5] Appendix 2 contains a brief description of the FPLI methodology. Simmons (1973 and 1988) also discuss the index in more detail. This issue stems from the fact that the urban-based CPI focusses on the expenditures of urban households as well as where urbanites shop.

less successful results than for MN. Table 7 presents average values of selected variables for MN and FL. The average price index values are lower in MN compared to FL indicating a somewhat lower cost of living in MN. The population density indicates that there are 0.105 people per square mile in MN compared to 237.7 in FL, a relative difference of 2,264. The population has grown almost 16 percent each year of the last five years in FL and barely one percent in MN.[7] Median housing values are higher by more than $22,000 in FL. But, income per capita is similar in both places varying by $2,500 per capita. The location quotient in retail trade is 1.19 in MN, similar to FL's urban pattern, and considerably higher than FL's average. This number indicates that MN on average has an excess supply of employment in retail activities, reflective of high competition and lower prices. Finally, there are only 5 counties with universities[8] in MN and 7 in FL. The index value for MN is from 1988. It is also a spatial index. It ranges in values from a low of 82.4 to a high of 102.2, not as wide a gap as FL's.[9] Referring to table 8 for MN, both population density and population growth are positive and somewhat significant. While FL's population growth has a negative effect on its index, this is not occurring in MN. It may be that MN has not reached the point where economies of scale have taken over. Housing, the largest component of these types of indexes, is positive and highly significant, as expected. The location quotient in retail trade is also positive and significant. An increase in the value of the location quotient tends to increase the index value in MN. And, neither hotel employment nor the

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[6] Again, see Appendix 2 for Florida and Appendix 3 for Minnesota.

[7] The FL data are from 1990 and the MN data are from 1988.

[8] Note these are counties with universities or colleges of 10,000 or more students.

[9] Note that Monroe, Dade, and Broward counties usually have the highest index values for FL, i.e. higher than MN's high value. These three counties are the Florida Keys, Miami, and Fort Lauderdale.

education dummy are significant for MN. The education dummy is negative indicating that having a college in one's county tends to lower the index, a somewhat unexpected result.

In this first attempt at replication, we were unable to ascertain a variable similar to FL's suncoast dummy. MN has lakes for fishing and warm weather recreation, and skating and ski resorts for cold weather activities. We are currently exploring some of these options for a local indicator of price changes. Generally, the results for MN did not prove to be as exceptional as we thought might occur at the beginning of our research so that we are continuing to explore other approaches.

V. The Implementation

Next, I would like to discuss the difference between price and COL indexes and then discuss the implementation issues. COL and price indexes are not the same though used interchangeably. A price index, such as the CPI, is a Laspeyres index and measures the change in the cost of purchasing a fixed market basket of goods that people buy at two different points in space or time. It is an index of price ratios weighted by budget shares. The key theoretic point is that the market basket remains the same for everyone.

A COL index measures the cost to live at two different points. The COL index defines the market basket based on actual purchases by a specific population subgroup required to attain a given 'standard of living'. The COL is the ratio of the lowest amount spent to buy the goods that provide that standard at two different sets of prices: the base point and the new point. The important concept here is that the COL measures the effect of price changes on the cost of the base period's living standard at the new prices while the price index only measures the price change of purchasing the base period's consumption basket in the new period. A COL index

would allow the basket to vary as long as the same standard of living is maintained.[10]

The market basket or the set of goods that define the standard of living can change for two places but for most practical purposes are usually kept the same. This is the point where both a price and COL index could be the same. For the most part keeping the types and quantities of goods fixed at two places is not much of an issue when comparing adjacent counties or states because we do not expect goods to change very much at nearby places. But, when comparing states or, on a broader scale, countries, where more variation occurs in the types and quantities of goods, this would be more of an issue. The difficulty is that a standard of living has to be defined and estimated in some way and maintained at some base period level.[11]

Calculating the cost of living depends on knowledge of the cost function and of the reference utility level. Generally, to obtain this information requires the estimation of a complete system of demand with some compromise as to what system to estimate. From the application of duality theory we know that the cost function can be approximated from total expenditures, we need some level of quantities to be priced. So we have come full-circle to the concept of a fixed market basket.

The Florida data are set up as a market basket comparing counties at one point in time to a state average. Because the goods are defined in a general fashion and not for a specific standard of living the Florida index is a price index. But, by a small stretch of the imagination, one can look at those items as the goods used to live at one point in time.

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[10] From a practical perspective, data collection for the CPI allows for some flexibility in the goods priced so that market baskets do vary for both the CPI and COL index. Also, the standard of living for calculating the COL index is difficult to define and keep constant causing that market basket to change as well.

[11] Here, period refers to a base point. It is typically associated with time but place is substitutable.

Note in practice the various approaches to determining a cost of living or price index are based on a method of aggregates. However, prior to undertaking the construction of an index, decisions must be made in terms of the desired goal (e.g. a cost of living versus price index noting price change, adjusting salaries for a specific population group, or expensing the cost to live at one place versus another); how much expense one is willing to incur in terms of time and money for data collection; how precise one needs to be (i.e. how much variance one would allow). If we follow the BLS methodology then we rely on a series of samples - a sample defining the population or consumer group, a sample of items purchased by the consumer group, a sample of outlets where these consumers shop, etc. Should the sample be a truly random sample or a stratified random sample and on what criterion should this stratification be based? That is, do we want to select a few random counties to represent the whole population or a few counties from a number of geographical groupings or geographic locations, or would we want to select counties containing major retail centers and, further, how do we define these centers for rural population groups? Therefore, the initiation of a project to develop within state price indexes requires major decisions as to the population group; locations; the sample size; the number of households to include in an expenditure survey; the number of outlets to sample in a point of purchase survey; a manageable number of expenditure categories; a realistic number of items to be priced within an expenditure category; a representative number of outlets and types of outlets where items should be priced; the rules defining how to select an item group should be specified, and, ways to deal with conflicts, such as more than one item satisfying the same specifications must be predefined; and how should the item to be priced be selected; and finally, what kind and amount of variation should be built in the survey to assure true randomness.

VI. Other Issues

There are three theoretic statistical issues, often mentioned in index estimation theory: time reversal, factor reversal, and circularity[12]. Time reversal means that the percentage change in two years should calculate to the same number irrespective of the selected base year. Factor reversal means that a quantity index multiplied by a price index equals the change in the expenditure index between the two periods. And, circularity means that if we are comparing three things - A, B, and C - then the ratio of A to B multiplied by the ratio of B to C should equal the ratio of A to C.

These theoretic statistical issues are important for an interregional or interstate index. Circularity should hold so that comparisons can be made among different places. Time reversal is important because one would want to create an index that could be carried over throughout the years. In addition, one would want place reversal, that is, just time reversal applied to space. The factor reversal test could be somewhat problematic since it requires a quantity index. But, quantities are typically derived from expenditures and result in pseudo-quantity indexes. Thus, indexes of some composite of goods in the factor reversal test should never fail when looking at groups of items.

VII. Summary

An idealistic oversimplification of the problem can be summarized as follows. We are concerned with price movement alone or changes in consumption resulting from that price movement. A true COL index compares the utility derived from consuming the goods. That

[12] These tests are summarized in Banerjee (1976), Frisch (1930), and Pollak (1971). In addition, the identity, commensurability, determinateness, and a base test are mentioned. Other authors, for example, Kravis (1984) and Marris (1984) also include the properties of transitivity, base-invariance, preference-conservation, and the absence of bias.

utility translated into an indifference surface reflects a certain preference scale and is analogous to a standard of living, that is, different amounts are consumed to achieve the same level of satisfaction. The true COL index is then the ratio of costs required to maintain the same standard of living at two points, in time or space. However, the true COL index is still an abstract concept that cannot be measured exactly. Generally, the standard of living or indifference surface does not usually stay the same in two periods but it may when comparing two places at one point in time. Ideally, defining expenditures or utility or pure price movement would entail coverage of all commodities. This is impractical from a cost or efficiency point of view. Given we are focusing on counties or a spatial concept, we must be realistic about how much the relevant preference orderings will differ between two places, since price, income, tastes and even utility all can and do change. But, some of these changes may not be major! The definition of a reference preference ordering with a reference basket of goods reflecting consumption patterns for a reference place seems to be the most appropriate way to approach the problem. So we return to the place we started, how do we proceed to answer the question, solve the problems and minimize the weaknesses that violate the theory from a practical perspective?[13]

VIII. Conclusions and Suggestions for Further Research

The most interesting finding of this paper is the one that comes to light after partitioning the data and estimating the regression equations for two different groups of counties. Though precise procedures for price collection based on the BLS methodology secure the comparability of the county indexes, the econometric results indicate that the explanatory variables that determine these indexes are not homogeneous in space. Therefore, applying the same data collection

[13]See Blanciforti (1996) for more on this theoretical dilemma.

methodology to all places, especially to those distinguished as urban and rural, does not provide an accurate measure. Data for rural areas, in particular, should be defined in a heterogeneous fashion to more accurately predict price or cost of living measures.

Additionally, further research should focus on detecting other factors that can explain differences in prices among rural areas, as well as, between urban and rural areas. One area to focus on may be the counteracting effects of economies and diseconomies of scale between urban and rural areas.

Since housing is the major component of these indexes and the major component of consumer spending, constituting about 38% of the Florida index, housing should be considered as the driving force of these indexes and be treated separately. For example, an index could be created containing all expenditures other than housing. And, it may be that the prior methodology would be consistent for both urban and rural areas for items other than housing.

Finally, it also may be worth spending time examining the other subcomponents of these indexes. It may be that an examination of the subcomponents as food, clothing, etc. may help us to observe some patterns and relationships that may lead to better predictors of living costs. We might find that some of these other subcomponents are not necessary. It may be that only a few items such as housing, food, and clothing may explain the entire spatial index and those subcomponents should be the only ones that a data collection procedure should utilize. The next step would be to determine if these three subindexes can, in fact, be the best predictors of spatial patterns and relationships of prices and living costs.

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Table 3. Mean Values of Some Relevant Variables for Florida*

VARIABLE	ALL	URBAN	RURAL
Index	95.14 (4.99)	97.70 (4.30)	92.80 (4.44)
Population	194.35 (331.07)	369.66 (413.91)	34.08 (34.64)
Population Density	237.70 (433.95)	444.99 (560.05)	48.18 (46.48)
Population Growth	15.73 (11.52)	17.89 (9.84)	13.75 (12.68)
Income per capita	15534 (4459)	17976 (4508)	13301 (3053)
Median House Value	64100 (22285)	75581 (16701)	53602 (21730)
New Houses Constructed	4.19 (1.93)	4.05 (1.93)	4.32 (1.94)
Unemployment Rate	6.02 (1.29)	5.66 (1.17)	6.35 (1.32)
Hotel Workers	2101 (4738)	4152 (6237)	225 (731)
Hotel Employment	1.50 (2.24)	2.18 (2.60)	0.87 (1.67)
Location Quotient in Retail Trade	0.96 (0.24)	1.07 (0.18)	0.87 (0.25)
Poverty Rate	15.66 (5.81)	12.48 (4.55)	18.57 (5.33)
Crime Rate	5.51 (2.99)	7.31 (2.45)	3.86 (2.45)
Education	7	7	0
Suncoast	11	9	2
Number of Counties	67	32	35

*Standard Deviations are in Parentheses.

Table 4. Results for the 1990 Florida Price Level Equation, without and with a crime variable.

	ALL	URBAN	RURAL	ALL	URBAN	RURAL
Intercept	86.743*	87.159*	85.957*	86.957*	85.234*	87.764*
	(1.202)	(2.705)	(2.065)	(1.171)	(3.188)	(2.257)
Population Density	0.002*	0.002*	-0.0006	0.002*	0.002*	0.002
	(0.001)	(0.001)	(0.0106)	(0.001)	(0.001)	(0.010)
Population Growth	-0.048***	-0.033	-0.050	-0.031	-0.029	-0.009
	(0.025)	(0.049)	(0.042)	(0.026)	(0.049)	(0.047)
Crime Rate				0.0003**	0.0002	0.0004***
				(0.0001)	(0.0002)	(0.0002)
Hotel Employment	0.276**	0.232	0.280	0.241**	0.179	0.492
	(0.128)	(0.142)	(0.465)	(0.125)	(0.149)	(0.466)
Housing	0.0001*	0.0001*	0.0002*	0.0001*	0.0001*	0.0001**
	(0.00002)	(0.00003)	(0.00004)	(0.00002)	(0.00003)	(0.00005)
Location Quotient for Retail Trade	-2.102***	0.080	-2.534	-2.989**	0.294	-4.316**
	(1.216)	(2.297)	(1.882)	(1.251)	(2.293)	(2.095)
Suncoast	3.119*	4.143*	1.763	3.328*	3.988*	2.721
	(0.856)	(0.969)	(2.202)	(0.837)	(0.973)	(2.202)
Education	1.523***	2.140**		0.418	1.335	
	(0.847)	(0.900)		(0.971)	(1.165)	
R^2	.87	.87	.82	.88	.88	.83
Adjusted R^2	.86	.83	.78	.86	.83	.79
F Value	57.24	23.05	20.80	53.70	20.55	19.49

* Significant at 99% level. Standard errors are in parentheses.
** Significant at 95% level.
*** Significant at 90% level.

Table 5. Results for 1990 All Florida, Urban and Rural Counties, with and without housing

	ALL	URBAN		RURAL	
		With Housing	Without Housing	With Housing	Without Housing
Intercept	82.37*	82.10*	85.71*	83.26*	80.94*
	(0.99)	(1.99)	(1.60)	(1.01)	(2.05)
Housing	0.000087*	0.000066*		0.0002*	0.0001*
	(0.00002)	(0.00002)		(0.00001)	(0.0003)
Median Rent	0.014*	0.016*	0.019*		0.014
	(0.003)	(0.003)	(0.003)		(0.011)
Crime Rate	0.0002**	0.0003**	0.0002		
	(0.0001)	(0.0001)	(0.0002)		
Suncoast	2.564*	2.833*	3.930*		
	(0.861)	(0.816)	(0.779)		
Education	1.958**	1.943**	2.593**		
	(0.948)	(0.960)	(1.028)		
Number	67	32	32	35	35
R^2	0.87	0.89	0.86	0.76	0.77
Adjusted R^2	0.85	0.87	0.84	0.75	0.76
FValue	78.7	42.4	42.1	103.3	53.4

* Significant at 99% level. Standard errors are in parentheses.
** Significant at 95% level.

Table 6. Variations on Rural Only

Intercept	84.58* (1.308)	84.83* (1.390)	83.21* (0.943)
Housing	0.0002* (0.00002)	0.0002* (0.00002)	0.0002* (0.00002)
Location Quotient for Retail Trade	-2.34* (1.586)	-2.69 (1.682)	
Population Growth	-0.05** (0.031)		-0.08** (0.032)
R^2	0.81	0.78	0.80
Adjusted R^2	0.79	0.76	0.78
F Value	43.7	55.4	62.2

* Significant at 99% level. Standard errors are in parentheses.
** Significant at 95% level.

Table 7. Comparison of Mean Values of Minnesota and Florida*

VARIABLE	MINNESOTA	FLORIDA
Index	88.77 (4.50)	95.14 (4.99)
Population	49.39 (122.94)	194.35 (331.07)
Population Density	0.105 (0.38)	237.70 (433.95)
Population Growth	0.997 (0.02)	15.73 (11.52)
Median House Value	41792 (15674)	64100 (22285)
Income Per Capita	12996 (2135.2)	15534 (4459)
Hotel Employment/Workers	242.06 (1071.37)	2101 (4738)
Location Quotient in Retail Trade	1.19 (0.25)	0.96 (0.24)
Education	5	7
Number	87	67

* Standard deviations are in parentheses.

Table 8. Regression Results for Florida & Minnesota

	MINNESOTA	FLORIDA
Intercept	54.332*	85.001*
	(12.73)	(1.21)
Population Density	0.790**	0.002*
	(0.40)	(0.0001)
Population Growth	22.221***	-0.061**
	(13.30)	(0.027)
Hotel Employment	0.0001	-0.189
	(0.0001)	(0.138)
Median House Value	0.0003*	0.0002*
	(0.00001)	(0.00001)
Location Quotient for Retail Trade	1.270*	-2.283***
	(0.44)	(1.333)
Education	-0.187	1.695***
	(0.59)	(0.928)
R^2	0.96	0.84
Adjusted R^2	0.95	0.83
F Value	294.25	53.61

* Significant at the 99% level. Standard errors are in parentheses.
** Significant at the 95% level
*** Significant at the 90% level.

Appendix 2 Description of the Florida Price Level Index

The Florida Price Level Index (FPLI) was developed by Simmons (1973, 1988) through a mandate with the State legislature. The methodology follows the basic statistical concepts of the BLS for the CPI. Florida opted to use a price index since the requirements of the family budget approach in time and money were exorbitantly high. Florida is considered a leader among the states in measuring cost of living differences, since it is the only state that conducts a price study annually and has been doing so for more than two decades across counties.[1]

The FPLI was calculated first in 1972. In that year, a cluster analysis on the following variables for each county: the 1970 populations, the ratio of population change from 1960 to 1970, the 1960 median family income, the median value of an owner-occupied house in 1970, 1970 median rent, and the 1971 population density, was used to create 10 homogeneous groups. The county with the largest number of state employees and school teachers was selected from each of the homogeneous groupings to be representative of the group. Two additional counties were included for statistical variability. These 12 counties were considered to be an excellent geographic representation since they accounted for 60 percent of all state employees and teachers and 58 percent of the state's population. The index for the 55 counties not in the sample was estimated using simple regression analysis based on variables reflecting cost of living differences for the 12 counties in the sample. The variables included in this regression equation were the population growth rate from 1960 to 1970, the average family income in 1970, the median gross rent in 1970, the dollar volume of retail sales in 1971, and the number of people aged 45 and over

[1] Since 1972 the FPLI has been calculated every year except for 1979 when statewide budget problems cut that expenditure item.

in 1970 for each county.[2] In 1973 the original 12 counties plus 19 more counties selected by stratified random-sampling were included. The same procedures as used in 1972 resulted in the variables: net migration as a percent of population from 1970 to 1972, the number of hotel and motel rooms, the cost of a standard house, and the percent change in population from 1970 to 1973 and, similarly, the population growth rate from 1960 to 1970; being included in the non-surveyed prediction equation. In 1974, the last year when indexes were estimated for out of sample counties the variables included were: a central index, the number of restaurant seats per capita in 1973, the unemployment rate from March 1973, and the percent of wage and salary workers in March 1973. Since 1974, price collection has been conducted in all 67 counties.[3]

The FPLI calculates an index in each county based on a state-wide average for each time period. It measures the differences between counties in the cost of purchasing a specific market basket of goods and services. There are 118 items included in the Florida market basket.[4] Items are priced as single or multiple priced office items or as field items. These items form five major categories: food (includes 26 items), housing (25), transportation (17), apparel (16), and health, recreation and personal services (27). Office items do not come from retail sales outlets but are collected from other sources. These sources include mail surveys of doctors, dentists,

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[2] These five variables were chosen after stepwise regression had been applied to a list of 75 variables resulting in 12 and these 12 variables were reviewed for statistical variability. Note that these five variables were not selected on the basis of providing the best determinants of price level but based on being highly associated with observed price level differences and, therefore, yielding the best predictor of prices. (See Simmons 1988, p. 211.)

[3] Today, a private company collects this information at a cost of approximately $250,000. Florida is currently reviewing its methodology with an eye at cost cutting. (See Denslow et al, 1996)

[4] The original survey included 111 items. This item list varies slightly to conform to changing items in the U.S. CPI.

optometrists or of private insurance companies, and utilities, for example, the Public Service Commission. The distinction between single and multiple office items arises because some items have a unique price throughout the county while others do not. An example of single priced items would be hospital rates or driver license fees while multiple priced items would include personal service items. Statistically multiple pricing is desirable because it provides variability in the data.[5] Generally, field items are items where prices are collected by a field representative at a retail sales outlet. These include over 70 items and are such things as foods, automobiles, clothing, furniture, electronics, toiletries, and alcohol. Each item in the FPLI is weighted according to the BLS's CES.

The retail outlets to be included in the sample survey are chosen by using a random selection technique within item groups stratified by outlet size.[6] Since housing is a difficult commodity to price, its price is obtained indirectly using a hedonic approach (Bellante and Killion, 1976). To obtain housing prices a standard house is specified and the Department of Revenue estimates the market value for this house in each county. For rental prices, a mail survey is used to gather detailed information on apartments and other rental prices. Then the effect of different attributes (number of bedroom, bathrooms etc.) on the rent is calculated by regression analysis. A standard apartment is established and the rent for a nonstandard apartment is estimated by using these

[5] A replication design is included in the data collection procedures to ensure statistical variation and randomness. In Florida's case, prices are divided into three groups. Groups 2 and 3 have 3 replication each. Each replication is treated as an independent sample of data.

[6] For most items priced in retail outlets prices must be obtained at a minimum of three different outlets per county. When an item cannot be priced at the requisite number of outlets in a county then a price from a larger adjoining county is used instead or in part. Items that are not available in a particular county are substituted with a similar item. For items that are priced at more than one type of outlet, the average price for each type is weighted by the market share of each type to determine the county average price for that item.

regression results. These now standardized apartment rents are weighted according to the number of units available to make up the average rental price for each county.

Average prices for each item for each county converted to Dade County relative prices. (Price of each item in Dade County is assigned a value of 1.00 which serves as the base price.) The county average relative price for each item is weighted by the appropriate item weight then, the sum of these weighted item indexes make the initial county index. The final step involves weighting the initial index by the population. For each county the index is multiplied by its population. This weighted index for each county is summed and then divided by the total population for the state which gives the statewide average index. This value is divided into the initial index values and multiplied by 100 to produce the final FPLI by counties. This index shows how much above or below the state average it costs to purchase the given collection of goods and services in each county. Population weighted category indexes are calculated for each county as well.

Appendix 3. Descriptions for Minnesota, Wyoming, and Illinois

MINNESOTA

A study of cost of living differences among Minnesota communities was conducted in 1988. The cost of living study in Minnesota employs a method similar to the one developed in Florida, except the price collection in Minnesota does not cover every county and the index calculation is somewhat simplified. Prices were collected in a sample of subregions selected to be representative of all regions of the state. The sample included the Twin Cities metro area and 26 other communities within the state. The Twin cities area consisted of seven counties. The other 26 communities included five major cities outside the metro area, eleven cities that are regional centers, and ten subregional centers. Retail prices were obtained from stores in each of the sample communities. Home prices, rents, insurance costs, property taxes, and a few others were collected from government agencies. The market basket for Minnesota consisted of 83 goods and services that were priced in each community and 20 additional items assumed to cost the same across the state, so that their prices were not collected in each community.

Prices in the 26 communities were compared to the Twin Cities metro area. A relative price index was computed by dividing the price in a community by the item's price in the metro area. The relative price index for the 20 items assumed to cost the same across the state was 100. The final index was then calculated by weighting an index of relative price differences for each item by the fraction of the budget spent on each item by a typical metro area household determined from BLS's CES. The weighted relative price indexes are aggregated into a price index for each community. Based on results from the sample cost of living indexes were estimated for all 87 Minnesota counties.

Compared to Florida, the Minnesota study has some limitations. First, unlike Florida, they did not use stratified sampling techniques to weight prices in different stores. Second, they did not have access to data on housing prices regarding characteristics of the houses (age, size, etc.). However, this problem was addressed by using median housing prices, rather than average prices. Also, data were not collected on apartment rents. And third, a slightly smaller share of the household budget was priced. That is, 103 items were included in their market basket compared to Florida's 118.

WYOMING

The Wyoming Cost of Living Study is a biannual survey of prices in 15 selected cities and towns of the state.[7] Prices are collected for 140 items adopted from the CPI. Most of this data is obtained by pricing at retail stores twice annually, the Wednesday, Thursday, and Friday, following New Years Day and the Fourth of July. Rental data on houses, apartments, and mobile homes are collected from newspapers for the three months prior to the actual date of price collection. Prices of some goods and services are collected by mail. For example, utility prices are obtained from the utility companies that serve the state and from the Public Service Commission of Wyoming, and hospital costs are collected by letter from hospitals across the state.

The 140 items surveyed are aggregated into six categories: housing (40.7%), transportation (17), food (15.8), recreation and personal care (13.6), medical (6.9), and apparel (6.0). Similar to many other states, weights are obtained from the BLS's CES. Wyoming calculates a comparative

[7] Prices at one time were collected in one town of every county. However, counties of less than 5,000 persons did not have enough stores to provide prices for every item. The sample was reduced to 15 selected cities.

index and an inflation index. The comparative index shows how the 15 selected cities and towns across the state differ relatively. The inflation index is calculated for the state and five regions and not all 15 places.

ILLINOIS

There is no special price collection in Illinois. Differences in the cost of living by counties for 1991 were estimated using a BLS-based regression equation and data on 1989 per capita income, housing values, and population change for each county[8]. Results were normalized to a statewide average using first a county population weighted mean, and then an unweighted mean giving equal weight to each county. Illinois' main purpose in calculating county indexes is like almost anywhere to provide guidelines for distributing educational aid. The population weighted mean is more relevant for such purposes, whereas the unweighted mean is more relevant for individuals deciding to relocate.

As mentioned, Illinois uses a BLS-based regression equation, that is, an equation using data from the old BLS family budget studies but updated using ACCRA data. Since the BLS' family budget were defined in the sixties and updated annually by CPI estimates, Illinois has measured some conglomeration of CPI and ACCRA price movements. A measure of this type may be useful depending on its purpose.

[8] See McMahon 1988 and 1991.

Table 1. Responses of the States

	NO RESPONSE;	DON'T DO IT	USE CPI	USE ACCRA	OWN METHODI	PREV. ATTE
-1,LA3 ALA	x					
ALASKA			x	x		x
R-I CNA		x				
ARKANSAS		x				
C.ALEFORNLA			x			
COLORADO				X		
CONNECTICUT		x				
DELAW.A-R.E			X	X		
D.C.			X	X		
FLORIDA					X	
GEORGIA			X			
HAWAII			X			
IDAHO			X			
LLINOIS						
LND [ANA						
OWA						
KANSAS						
KENTUCKY						
LOUISIANA		X				
MAINE		X				
MARYLAND		X				
MASSACHUSETTS		X				
MICHIGAN	X					
MTNNESOTA					X	
MISSISSIPI	X					
MISSOURI			X			
MONTANA		X				
tiEBRASKA	X					
NEVADA		X				
NEW HEMPSHIRE		X				
NEW JERSEY			X			
NEW MEXICO	X					
NEW YORK		X				
NORTH CAROLINA	X					
NORTH DAKOTA		X				
OHIO				X		
OKLAHOMA				X		X
OREGON	X					
PENNSYLVANIA		X				
RHODE ISLAi*ID		x				
SOUTH CAROLINA				X		
S0 = DAKOTA		X				X
TENNESSEE		X				
TEXAS		X				
UTAH			x	x		
VIRGINIA				X		
WASHINGTON		X				
WEST VIRGINIA	X					
WISCONSIN	X					
WYOMING					X	
TOTAL	**10**		**11**		**4**	**5**
51 - 100%	**19.6**				**7.8**	**9.3**

Table 2. The **Existing cost of Living Methods for States**

	FLORIDA	MINNESOTA		ILLINOIS
Purpose	distribute education funds			
Price Collection -where	all the 67 counties	the twin cities metro area plus 26 "outstate" communities	15 selected communities	no specific price collection; uses ACCRA data and calculates cost of living for the counties using the BLS based regression equation, and data on per capita income, housing values and population change fcr each county
-when	annually, at a particular point of time in the year	once, in 1988	biannually on 2-3 days following New Years and Fourth of July	
-how	-pricing at retail stores -mail and phone survey -data available through state agencies	-pricing at retail stores -data collected by gov. agencies (housing, prop. taxes,rents, etc.)	-pricing at retail stores -mail and phone survey -newspaper (rents)	
Market basket -number of items	118	83+20	140	n. a.
-weights	BLS Consumer Expenditure Survey			
	Housing 37.9% Apparel 7.3 Transportation 18.2 Food 21.5 Health, Recr. and Pers. Serv. 15.1	Housing 41.17% Transportation 18.66 Apparel 5.87 Food 16.24 Health, Recreation and Other 18.06	Housing 40.7% Transportation 17.0 Food 15.8 Recreation and Personal Care 13.6 Medical 6.9 Apparel 6.0	
The **Index - Base of Comparison**	population weighted state average - 100	the metro area price index - 100 (for each item and overall)	state average = 100	1. population weighted statewide mean 2. unweighted state average

1 21) **additional items are included for wetghung purpores, but pica were not obtained r0t them in different commutuues. They are assumed to cost the scar everywhere**

Appendix 1. Letter

Pegicrat Researcn institute

West Virginia University

voverroer :0, 1993

Director
Division of Policy
Office of Management and Budget
Office of the Governor
PO BOX AM
Juneau AK 99811

Dear Colleague:

We are working on a research project to develop a method to create a state and substate price index using West Virginia as an example. Would you kindly let us know if you have a price collection or cost of living data system or any information on this subject in your state.

We are at a very preliminary stage of our work and would like to know if other states have a state and substate price index. We would like to learn about the existing methods for price collection and comparison systems of other states. We would like to know what method, if any, is used to compare consumer prices and living costs of different subregions (for example counties) within your state. Information about the kinds of goods, the data collection process, and the methods of analysis that are considered for the comparisons also would be very useful for our research.

Though it is widely perceived that costs of goods and services differ across geographic areas, we believe that few states have a system for measuring regional price differences. We hope our research can provide a framework to measure relative price level differences across subregions of a state and determine relative living costs across those subregions.

We thank you in advance for any information you can provide.

Sincerely,

Laura L. Blanciforti

Dr. Laura Blanciforti
Assistant Professor

and

Edit Kranner
Research Assistant

Ow **mailing iddre5a:**
Re3ional Researca Institute
West Virguua University
PO BOX 58:5
MORGA`TOWN WV 26306-6825

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