

Four Unresolved Issues in the Construction of Regional Cost-of-Living Indices

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Introduction

The federal government allocates billions of dollars to consumers and firms, often treating the allocations as if agents resided in locations facing the same prices. There are, of course, massive differences in price levels between San Francisco and, say, Buffalo. This strikes some as unfair. The poor in San Francisco will pay much more for food and shelter than the poor in Buffalo. Should we adjust transfer payments to reflect such cost-of-living differences? When federal government measures poverty, the same thresholds are used for San Francisco as for Buffalo. Should we adjust the thresholds of the poverty line to account for differences in the cost of living?

Obviously, there is a reason the Bay area is so expensive; it is a delightful place to live. With its natural beauty and mild climate, residing in San Francisco offers many benefits that are not available to residents of Buffalo. The traditional approach to price indices – allowing agents to purchase the same bundle of goods and services – seems unfair to residents that do not have access to the many amenities of San Francisco.

For economists, there is a natural approach to this question. One would simply ask: “By what factor must I adjust the expenditures in San Francisco to leave the agent equally well-off as an identical agent in Buffalo?” As we shall see, however, the construction of such an index is a formidable problem.

In the next section, I lay out my version of the canonical model of regional differences in prices and wages. In the following section, I discuss four unresolved problems that the model presents for the indexation of the poverty thresholds or transfer payments. In the final section, I discuss whether the index should be used in the indexation transfer payments.

The Basic Haurin-Roback Model of Amenities and Prices

The basic model of location differences in modern urban economics is due to Haurin (1980) and Roback (1982). In this model, locations differ in amenities, wages, and prices. To begin our discussion, divide

all consumption goods into two vectors: those with common prices across locations, which we term traded goods, and those goods that have prices that can differ across locations. We call these goods “local” goods reflecting the fact that they cannot be traded across sites. Local goods include services such as haircuts and restaurant meals and goods such as housing and utilities that must be consumed locally. Traded goods will include the class of goods that easily shipped to various locations and so prices are approximately the same.

Let x denote the vector of traded goods and let p_x denote their prices. Similarly, let z denote the vector of local goods with prices $p_{z,j}$ where j indexes the location. If we think of consumers as living one period, we have a simple static consumer’s problem with a modest complication: Consumers must pick where to live. To keep the notation simple, suppose that there are two locations, or $j \in \{0,1\}$. The two budget constraints facing the consumer are just

$$w_0 = p_x x_0 + p_{z,0} z_0 \quad (1)$$

$$w_1 = p_x x_1 + p_{z,1} z_1, \quad (2)$$

where w_j is the wage paid in the j th city and I assume that consumers sell one unit of labor in either city.

Haurin and Roback were concerned that some cities offer better amenities than others, and some cities afford more productive resources for firms. I will ignore these productivity differences (although they may well show up in the equilibrium prices) and focus instead on the amenities that consumers value directly. Toward that end, assume that the consumer has the following utility functions across the two locations

$$U_0 = A_0 f(x_0, z_0) \quad (3)$$

$$U_1 = A_1 f(x_1, z_1), \quad (4)$$

where A_j is the (utility) value of amenities in the j th city and $f(\cdot)$ is the (direct) utility function of the consumer. I have already made a strong restriction on preferences in equations (3) and (4) by making the amenity levels separable from the commodities, but this assumption helps keep this intractable problem a bit simpler.

The consumer, when deciding where to live, solves the utility maximization problem in both cities. Thus, we may express the solutions to these utility maximization problems in terms of the indirect utility functions or

$$U_0 = A_0 h(w_0, p_x, p_{z,0}) \quad (3)$$

$$U_1 = A_1 h(w_1, p_x, p_{z,1}) \quad (4)$$

where $h(\cdot)$ is the indirect utility function. Among the many insights of Haurin and Roback, two are extremely relevant for our problem: (1) Competitive forces will require utility level to be equilibrated between the two cities so that $U_0 = U_1$, and (2) the mechanism that achieves this equilibration will be the capitalization of the amenity values in both the wages and the prices of the local goods.

Assuming that $h(\cdot)$ is strictly increasing in income, we may invert our indirect utility functions to obtain the corresponding expenditure functions or

$$w_0 = e^{(U/A_0, p_x, p_{z,0})} \quad (3)$$

$$w_1 = e^{(U/A_1, p_x, p_{z,1})}. \quad (4)$$

Assuming that $U_0 = U_1 = U$, we may now define the regional cost-of-living index,

$K_R(U, A_1, A_0, p_x, p_{z,0}, p_{z,1})$, to be just

$$K_R(U, A_1, A_0, p_x, p_{z,0}, p_{z,1}) = \frac{e^{(U/A_1, p_x, p_{z,1})}}{e^{(U/A_0, p_x, p_{z,0})}}. \quad (5)$$

The index $K_R(\cdot)$ is what Samuelson and Swamy (1974) term an “economic index” because it relies on the consumers’ preferences.

The regional cost-of-living index answer the question: “By what factor must I adjust income in city one relative to the base city (city $j = 0$) in order to leave the consumer indifferent between the two locations?” As such, the index provides the theoretically correct adjustment for a host of economic problems including the indexation of government transfer payments across disparate sites, the measurement of cost-of-living differences across different cities, the indexation of taxes burdens across location (see Albouy, 2009), or how to define poverty levels in a way that reflects the differences in amenities and prices across locations.¹ For workers who are employed in competitive markets, the Haurin-Roback model suggests that we need only compare the earnings of identical workers in order to know the value of their regional cost-of-living index. Similarly, one could adjust poverty thresholds by, say, the ratio of earnings for college educated workers in the two cities, except for the fact that regional cost-of-living index depends on the utility levels of the relevant consumers.

An important question, therefore, is “When is the regional cost-of-living index independent of the utility level?” It turns out, that if preferences are homothetic, we may express the expenditure function as $\frac{U}{A_j} \phi(p_x, p_{z,j})$ so that the regional cost-of-living index may be expressed as

$$K_R(A_1, A_0, p_x, p_{z,0}, p_{z,1}) = \frac{A_1^{-1} \phi(p_x, p_{z,1})}{A_0^{-1} \phi(p_x, p_{z,0})}. \quad (6)$$

Pollak (1989) shows that homothetic preferences are both sufficient and necessary for this index to be independent of the value of utility level. The intuition for this result is simple. Because all income elasticities are equal to one when preferences are homothetic, the chosen level of utility does not

¹ This index is directly analogous to the Konüs (1939), or true, cost-of-living index that is theoretical exact measure of the cost of living between two time periods. As a result, the properties of Konus index are also valid properties of the regional cost-of-living index.

matter because the only difference between the very wealthy and the very poor is the scale of consumption.

The assumption of homothetic preferences would, therefore, allow us to construct *the* regional cost-of-living index from information on earnings levels in competitive markets; see Black, Kolesnikova, and Taylor (2009). This would avoid the problem having to measure variations in local goods' prices, in amenities, and in consumption bundles. Unfortunately, there is a consensus within economics – and there are precious few consensuses in economics – that preferences are not, in fact, homothetic. Income elasticities are not uniformly equal to one. This, as we shall see, greatly increases the complexity of the implementation of the regional cost-of-living indices.

Empirical Implementation of the Regional Cost-of-Living Index

When faced with implementing a cost-of-living index to measure the price changes over time, the U.S. Department of Labor's Bureau of Labor Statistics shifts from a cost-of-living index to a "price index." A price index specifies a set of goods and services to be purchased and then proceeds to measure the cost of purchasing that bundle of goods. A popular price index is the Laspeyres type price index, which may be defined as

$$L(p_1, p_0, x_0) = \frac{p_1 x_0}{p_0 x_0}. \quad (7)$$

If the bundle x_0 is chosen to be the consumption in the base period, then we know that the Laspeyres index will overstate changes in the cost of living between period one and the base period zero because it fails to account for the consumers' substitutions among commodities as relative prices change. The best available evidence is that this substitution bias is relatively modest – Braithwait (1980) estimates it to be about 0.4% a year – so ignoring this bias is palatable.

Unfortunately, we have no such luxury when comparing the consumption behavior of agents across cities. Consumers in Buffalo and San Francisco face much different prices for housing, and we

know that consumers with the same utility level will respond to relative prices by selecting different consumption bundles in these two cities. Consumers in Buffalo should consume more housing than consumers in San Francisco because housing is dear in San Francisco. Hence, the first unresolved problem:

Problem 1: When prices differ across locations, how does one select different consumption bundles to reflect differences in relative prices?

The issue, however, is further complicated because the amenity level in San Francisco may be higher than the amenity level in Buffalo. Most people prefer mild climate of the Bay Area to the bitter cold and snow of Buffalo. The Buffalo resident should consume more of the local goods and the traded goods in order to leave the resident indifferent between living in Buffalo and San Francisco. This gives rise to our second unresolved problem:

Problem 2: When amenities differ across locations, how does one select different consumption bundles across locations to compensate for amenity differences?

Our next unresolved issue is one that plagues standard intertemporal cost-of-living indices as well. As I noted above, in the absence of homothetic preferences, the cost-of-living index given in equation (5) is a function of the level of utility chosen to make the comparison. Thus, the cost-of-living index for the very poor may be much quite different than the cost-of-living index for middle class. Again, the issue comes down to the consumption bundles selected. The poor may spend a greater fraction of their income on housing and food than the middle class; hence, higher prices for housing may affect the poor more than the middle class. Our third unresolved, therefore, is:

Problem 3: In the absence of homothetic preferences, how do we select the base utility level?

Of course, my version of the Haurin-Roback model is quite simple. It presumes individuals value all cities equivalently.² But a quick look at migration patterns of people, however, shows a remarkable tendency for staying in the same location. For instance, in the Public Use Micro Sample of the 2000 Census, 61 percent of Americans whose highest education attainment is a high school degree report residing in their state of birth. Moreover, for each state in the United States, a majority still reside in the state of their birth. This lack of migration has led many to posit a heterogeneous preference for residing in one's "home town" or at least in close proximity. One might think this arises because people value living close to family and old friends, but it also may reflect that people have city-specific human capital that affects their value of the city. Toward that end, now assume that

$$A_{j,i} = a_j + \varepsilon_{j,i} \quad (8)$$

where a_j reflects the common evaluation of the j th city's amenities and $\varepsilon_{j,i}$ is the i th person's idiosyncratic valuation of the amenities in the j th city. This modest step toward realism greatly complicates the construction of our cost-of-living index.

To see why, consider the value of the cost-of-living index required to leave the i th person indifferent between our two locations. This, of course, is just a slight modification of equation (5):

$$K_R(U, \alpha_1, \alpha_0, \varepsilon_{1,i}, \varepsilon_{0,i}, p_x, p_{z,0}, p_{z,1}) = \frac{e^{(U/(\alpha_1 + \varepsilon_{1,i})), p_x, p_{z,1}}}{e^{(U/(\alpha_0 + \varepsilon_{0,i})), p_x, p_{z,0}}}. \quad (9)$$

While only a slight modification, it presents very different identification and estimation problems. The individuals' valuations of the amenities associated with the location where they live are now idiosyncratic. One might expect, for instance, that the current residents of Detroit in 2011 – given the numerous and severe economic shocks to the city – are people with relatively strong idiosyncratic taste

² It also presumes that consumers have identical preferences for goods and services, which is quite unrealistic as well. As this is problem also affecting standard cost-of-living indices, I will ignore the complexities associated with relaxing this assumption.

for living in Detroit. In contrast, in 1961 when the Detroit economy was booming, presumably many of the residents were people with much smaller idiosyncratic taste for living in Detroit.

Problem 4: How do we adjust the cost-of-living index for changes in the idiosyncratic tastes for locations?

Discussion

In the last section, I described several problems that exist in the implementation of regional cost-of-living indices. In this section, I ignore the difficult issues in constructing such an index, and I pose a different question: Should we use the index to adjust transfer payments for differences in the “cost-of-living” index? The largest federal transfer payments are already indexed to local prices, at least implicitly. The OASDI benefits are indexed to the earnings of participants so that residents of San Francisco will receive otherwise higher payments than identical residents of Buffalo because nominal wages are higher in San Francisco than in Buffalo. Because the benefit schedule is nonlinear, the exact nature of the implicit index is difficult to ascertain.

Upon retirement, many seek out locations where the weather is warm and prices are low. Should we seek to reduce the social security payments of retirees who accumulated large benefits by selling their labor services in San Francisco who then exploit the low prices offered on the Gulf Coast of Florida? Or, should we encourage this behavior?

Any payment is implicitly indexed. Offering the same cash value or the same level of medical services in San Francisco as Buffalo are implicitly constructing indices, albeit very different ones. One naïve view of this issue is that individuals in San Francisco should receive higher payments than residents of Buffalo (or residents of rural Appalachia) to compensate them for higher prices they face. This, of course, ignores the fact that the poor on San Francisco have received benefits from their location that have been capitalized into prices. It also presumes, however, that it is economically efficient for the poor to consume the amenities of the Bay area.

Let me offer some evidence to the contrary. In a paper with Gates, Sanders, and Taylor (2002), I argue that the concentration of gay men in San Francisco and other cities with high property prices reflects the fact that the demand for amenities of many cities is luxury good: the rich (or those with relatively modest housing demand) will prefer the expensive cities more than the poor.

Similarly, in Black, Kolesnikova, and Taylor (2009) we note that the returns to schooling in San Francisco are much lower than the returns to schooling in such low-housing price cities as Pittsburgh and Houston. For instance, in 1990, men with a bachelor's degree in San Francisco earned 0.38 log points more than men with a high school degree. In contrast, this differential was 0.53 log points in Pittsburgh and 0.54 log points in Houston. We demonstrate that such differentials are consistent with the simple Haurin-Roback model with housing being a necessity and the demand for locational amenities being a luxury. While this issue is far from settled, it seems wrongheaded to attempt to undo the incentives that markets have created without careful study.

That the labor market solves this formidable problem in such a decentralized environment is remarkable; it is one of the many great accomplishments of Adam Smith's Invisible Hand. It is instructive to think about how the market does it. Firms, of course, do not like paying higher wages so when local economic conditions deteriorate firms limit their wage compensation. The housing market and other locally traded goods will generally see a fall in relative prices, however, that mitigates the decline in consumption that the fall in wages would generate.

Similarly, in booming markets, firms increase wages to retain their workforce and recruit new workers. Again, the housing market will reduce some of this increased compensation through increased prices. These price increases, both for labor and for local goods, are probably contributing to economic efficiency. To the extent that housing a worker in San Francisco is more expensive than Buffalo, we want to provide firms with the correct incentives to consider Buffalo as a location for their production

and provide firms choosing to locate in San Francisco the appropriate incentives to economize on their use of labor.

What is far from obvious is that we want government encouraging transfer payment recipients to pick the Bay Area over Buffalo. Compensating residents of San Francisco for the higher prices of the Bay Area is undoing the incentives for relocation that the market has provided. While one would not want to arbitrarily rule out such compensation, I would want to see a coherent, sensible model that would justify such compensation.

The danger of adjusting the poverty thresholds is that many will view this as “evidence” of the need for such indexation of transfer payments. Currently, the Census Bureau plans to adjust the poverty thresholds largely by differences in the price of shelter. In my view, this is fatally flawed. To see why, consider the following thought experiment: You are guaranteed the same consumption bundle in both San Francisco and Buffalo, but you get to choose where you consume. Tastes differ, but I expect that I will see most of you in the City by the Bay.

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