RUNNING HEAD: Cost-of-living

A Cost-of-living Index Based on Federal Fair Market Rent Data: Methodology and Validation

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Abstract

This paper describes a regional cost-of-living index developed from federal fair market rent data, supplemented with state-level data. The advantage of using these data is that they are freely available, updated annually, and are produced for every county in the country, not just for urban areas. The index is compared to other cost-of-living indices. Implications for faculty salary data used in the US News rankings are discussed.

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Higher education clearly requires an accurate, low-cost, cost-of-living index (COLI) that can address regional differences between schools. Many of the measures by which institutions of higher education compare themselves (faculty salaries, instructional expenditures, research dollars) are based on costs that vary in purchasing power across the country. Before we can make meaningful comparisons across institutions, we need to adjust for these differences. For example, faculty salaries are an important component of the US News college rankings, yet *U.S News* uses a regional cost-of-living index to adjust faculty compensation, but that index dates from 1996 (Farrell & Van der Werf, 2007).

In addition, schools often compare themselves to their peers based on the AAUP annual salary report. Yet because cost-of-living varies widely by region, a salary of $75,000 in Boston is in real terms much less than a salary of $75,000 in Ames, Iowa. As a result many schools may draw the wrong conclusions about faculty compensation by comparing raw salary data.

The drawback of most cost-of-living indices is that they exclude cost data for smaller cities and rural locations and thus cannot be used by schools located in these areas. Even *U.S. News*, which uses Runzheimer data to adjust faculty compensation in its college rankings, only uses COLI data for 300 cities; all other schools are adjusted using a statewide-average (Morse, 2007). Cost-of-living is lower in rural areas (Kurre, 2003), and we cannot simply assign cost-of-living estimates to these areas based on the nearest metropolitan area.

This paper describes a regional COLI developed from annually updated and freely available federal fair market rent data. The index is validated by comparing it to two other cost-of-living indices, and we show the large impact that cost-of-living adjustments makes on faculty salary comparisons.

Approaches to Regional Cost-of-Living Indices

While there are several different COLIs available, each has a drawback that limits its use for institutional researchers and educational scholars. The most widely known COLI is the Consumer Price Index (CPI), produced by the Bureau of Labor Statistics. The only limitation to the CPI is that it tracks changes in prices over time, and thus does not show how prices differ between regions across the U.S. (The CPI is produced for some regions and cities, but again, this is to track changes in these areas over time, not to allow comparisons between these areas).

Researchers have attempted to use regression analysis and regional variations in the data used to produce the CPI to create an interarea COLI (Aten, 2006). While the results are convincing, cost-of-living adjustments can only be created for 38 metropolitan areas, such as New York and Los Angeles. The methodology is also complex, and is not very suitable for the production of annual indices.

The Council for Community and Economic Research (CCER) publishes a regional COLI on a quarterly basis; it is known as the ACCRA COLI because the Council was formerly known as the American Chamber of Commerce Research Association. It is probably the most popular regional COLI in the United States. Data for some cities are published in the Census Bureau's annual *Statistical Abstract*, and are used on websites such as Bankrate.com and CNNMoney.com. It has also been used in a previous study of

the effect of cost-of-living on faculty compensation (Keister & Keister, 1989). Their COLI is unsuitable for use in higher education for three reasons. First, the ACCRA COLI only covers 300 cites and urban areas across the U.S., and excludes smaller cities and rural areas (more specifically, they only cover selected metropolitan and micropolitan areas). Second, not all urban areas are covered. As described below, CCER depends on members to submit data, and if no one from a region submits price data, that region will not be included in their COLI. Third, and perhaps more importantly, their methodology introduces substantial error into their index.

CCER uses chambers of commerce and other groups across the country to collect price data for almost 60 items in several different categories, such as housing, food and transportation. They provide a fairly specific manual (Council for Community and Economic Research, 2008) that CCER members collecting price data are supposed to use when collecting the data. However, the members are not professional field staff like those employed by the Bureau of Labor Statistics, and it is likely that substantial error is introduced into their estimates due to the use of amateurs (Koo, Phillips, & Sigall, 2000).

Some firms, such as Runzheimer International, provide cost-of-living data by regional area for a fee. Because they are for-profit firms, they do not make their methodology transparent, but in Ruzhemier's case it is clear that they use a combination of primary data collection and statistical modeling (Runzheimer International, 2007). The main drawback of these data for the typical researcher is the cost, which can easily reach thousands of dollars for only a handful of regional comparisons. For example, a few years ago Runzheimer quoted one of the authors a price of $1,000 for every city comparison with the author's city. Such a high cost precludes use of the index for many

schools, especially if the school has large numbers of institutions in their peer groups, or if the institution needs to use updated data every year. It is also not clear what data are available for non-urban areas.

Finally, many different websites offer cost-of-living data, usually to allow job-seekers to calculate potential salaries in new destinations. They usually do not provide details of how the index was constructed. A COLI measure for a small town, for example, may actually have been derived from a much larger area, and will not accurately reflect the cost-of-living for that town. Without detailed knowledge of how an index was constructed, most institutional researchers would be reluctant to use it in their analyses. Second, of those that are freely available and also describe their methodology, the regions are usually limited to major urban areas, such as cities that fall within a Metropolitan Statistical Area.

Methodology

Our regional COLI is based on the U.S. Department of Housing and Urban Development's (HUD) Fair Market Rent (FMR) data. These data, published annually, list the 40th percentile rents for apartments of differing number of bedrooms for every county in the country. HUD uses these data to determine payments for housing vouchers and rents for Section 8 housing.

For our COLI, we used the 40th percentile rents for two bedroom apartments. Because housing is the largest component of any COLI (it comprises over 40% of the Bureau of Labor Statistics' CPI), these data should yield a relatively accurate measure. In addition, housing costs are likely to be highly correlated with other costs, such as food and services. The ACCRA COLI listed above has a very strong positive correlation (.98)

with its housing costs sub-index. More importantly, the HUD FMR data are available for every county in the country, are updated annually by HUD, and are freely available from the federal government. These data have been used by other researchers to develop a regional COLI (Curran, Wolman, Hill, & Furdell, 2006; Walden & Sogutlu, 2001).

The main problem with using only the FMR data is that this assumes that housing captures all the cost-of-living differences across regions. Clearly, cost-of-living may vary across counties for other reasons. In addition, Curran et al. (2006) show that housing costs vary by region more than other costs, such as groceries and health care. They argue that any COLI measure based solely on housing will thus overstate cost-of-living differences between regions.

We address this issue by supplementing the county-level FMR data with state-level data on other cost-of-living costs. Our criteria for including additional cost-of-living data in our COLI were 1) they must be publicly available or available for a nominal fee, 2) they must be produced annually, as institutional researchers usually require the most current data, while academic researchers are often interested in older data (such as adjusting faculty salaries in older faculty surveys), 3) they should be data used in the CPI (our justification for including the data in our COLI), and 4) it must be available at either the county or state level. We have located three datasets that meet these criteria, all at the state level.

The first is the cost of a gallon of regular gasoline, collected and published by the Energy Information Administration, a provider of energy statistics for the federal government (Energy Information Administration, 2006). In 2006 this cost ranged from $2.02 to $2.59 (see Table 1). The second is the average community hospital expense per inpatient day, collected by the American Hospital Association (American Hospital

Association, 2007). Actual medical charges are notoriously difficult to collect, in part because doctors and hospitals charge different amounts based on the type of insurance and patient's ability to pay. This is a measure of how much a hospital in a state spends per inpatient per day, and should be correlated with actual medical costs across regions.[1] In 2005 this cost varied from $733 to $2,246 (2005 is the latest data available at the time of this writing). The third is the average cost of undergraduate public tuition, fees, room & board (National Center for Education Statistics, 2007). In 2006 this varied from $8,506 to $17,708.

The main issue to be decided for any COLI is what weights to use for the various costs data. That is, how much should housing contribute to the overall cost-of-living, as opposed to transportation, etc.? Table 2 shows the weights used by the major categories in the CPI (see Bureau of Labor Statistics, 2007, chapter 17). Because housing is the major contributor to cost-of-living, and in order to avoid having housing costs contribute too much to our index, we adopt the same weight for housing costs as the Bureau of Labor Statistics. We then increased their weights for transportation, medical care and education so that the sum of the weights equaled 100. Because housing is almost half of the CPI, this in essence means that the Bureau weights for these three areas were almost doubled.

Our index was created in three steps. First, we matched our IPEDS population of all 2-year or 4-year, public or private not-for-profit degree-granting colleges and universities to the county-level FMR and state-level data described above. The state-level matching is trivial, but the county-level matching is not, in part because IPEDS

[1] Hospital services are included in the CPI. The one difference between this measure and the CPI measure is that the CPI derives data from surveys of respondents, who use hospital bills to report costs (Bureau of Labor Statistics, 2007). Our measure of cost of hospital services is based on hospital expenditures rather than hospital billing.

does not provide the county name of institutions. The HUD FMR data is published with a 10-digit code based on the Federal Information Processing Standards (FIPS) geographic code. The first five digits correspond to state and county. The last five digits specify township, and are only used for the New England states.[2] To get the appropriate code for each college and university, we used the 2007 Geographic Names Information System (GNIS) database from the U.S. Geological Service. The GNIS was developed by the U.S. Geological Survey to be the "official repository of domestic geographic names data" (USGS, http://geonames.usgs.gov/domestic/index.html), and contains not only names of cities, but also places such as schools. We first matched on place name, using the name of the institution from the appropriate IPEDS Institutional Characteristics data file. We then merged non-matches with the GNIS data again, this time matching on state and city name (after deleting duplicate city names within each state in the GNIS file). Finally, we hand match any remaining non-matches. Many of these non-matches are institutions from cities that span multiple counties, such as Atlanta and New York City.

Second, we took our four cost measures and standardized them using the average cost across the colleges and universities in the dataset. With this approach, we implicitly assumed that each county within a state has the same cost for transportation, health care, and education. Third, we then multiplied each cost measure by the weights reported in Table 2 and summed them. The result was a measure that takes a value of 100 for a school if their cost-of-living is the average cost-of-living in the dataset. Schools

[2] As far as we can tell, the county-level data are mapped to the townships by HUD, so the HUD data are collected at the county level. However, occasionally metropolitan statistical area data are mapped to the townships. This means that different townships in the same county may have different FMRs, and that we cannot merge by county name.

with costs of living greater than 100 are located in more expensive regions, and those with less than 100 in less expensive areas than the average school.

Results

We report two sets of results. First, we attempt to validate our measure by comparing our results with two other COLIs. Second, we show what happens to faculty compensation when cost-of-living is taken into account, using the national universities and liberal arts colleges from the most recent *U.S. News* ranking. We refer to our measure as HECOLI, for Higher Education Cost-of-Living Index.

Validation

Given the discussion above, the most reliable COLI is probably the interarea COLI based on data from the CPI and regression analysis. Aten (2006) creates COLI data for 2003 and 2004 for 38 metropolitan areas, and we compared our index to her 2004 data. We also purchased the ACCRA COLI data for the second quarter of 2006, and compare our data to the ACCRA data. Because both of these COLIs use the average price in their dataset to create their indices, we adopt the same approach. In other words, we created our measure to match the areas in their indices, and did not merge and standardize prices over colleges and universities as we do later in the paper.

Rather than use correlations to validate our approach, we used bivariate regressions and scatterplots. Correlations are poor measures of association, and can give misleading results. It may be possible to get a high correlation, even if our measure of cost-of-living yields far different numbers than the CPI-based or ACCRA measure (for a discussion of these issues see Achen (1977; , 1978)). Conversely, the bivariate regression equation yields two useful numbers for judging validity. If the two COLI measures

match exactly for every region in the dataset, the regression coefficient should equal 1, and the R^2 should yield 1 as well. In a scatterplot, the data points should all lie on a 45 degree line.

Table 3 shows the results of the bivariate regression analysis. Comparing our measure with the CPI-based regression COLI, the regression coefficient is .88, slightly less than 1, with an R^2 of .64. This indicates that for cities with a low cost-of-living, our measure on average tends to be lower than the CPI-based measure, and the reverse is true for cities with a higher cost-of-living. This can be seen in the corresponding scatterplot in Figure 1, where the dashed line indicates the 45 degree line, and the solid line indicates the regression coefficient from the first column in Table 3. Our measure appears to perform most poorly for the three cities rated as most expensive by the CPI-based COLI: Honolulu, New York, and San Francisco.

The bottom half of Table 3 shows the mean difference between the two measures, the mean of the absolute value of the difference (because large positive and negative differences can yield a low mean difference), and the minimum and maximum differences. On average, there appears to be little difference between the two measures, but the mean of the absolute value indicates an average difference of 5.9 points. The large minimum and maximum values correspond to San Francisco and Honolulu, respectively.

Turning to the ACCRA measure, the results are very similar. The regression coefficient is .89 with an R^2 of .75. The scatter plot in Figure 2 reveals the same relationship as in Figure 1. The large outlier at the top of the figure is New York City. The mean, minimum and maximum differences are similar as well, with an average absolute

value difference of 5.7 points. The large maximum difference is New York City at +73 points; the next largest difference is +24 points.

In sum, comparing our measure with two other COLIs indicates that our relatively simple approach yields a measure that is comparable to both the CPI-based measure and the ACCRA measure. On average, our measure deviates about 6 points, with a tendency to poorly predict very expensive locations such as New York City. We should note that there is no guarantee that either the CPI-based COLI or the ACCRA COLI are "correct," in that they can be considered a completely accurate measure of cost-of-living. As Curran et al. (2006) note, all cost-of-living measures are biased and flawed to some extent. Thus, we expect our measure to be highly congruent with other existing measures, but we believe it is unreasonable for it to perfectly match other measures. Most importantly, unlike these other indices, HECOLI provides a cost-of-living measure for every county, and thus every college and university, in the country.

Impact on faculty compensation

To understand the impact of cost-of-living adjustments, we collected faculty salary data from the 2006 IPEDS Faculty Salaries data, and calculated the average faculty salary for full, associate and assistant professors for schools listed as national universities or liberal arts colleges in the 2007 *U.S. News* college rankings. We then ranked each school based on their average faculty salary, adjusted the average faculty salaries using the HECOLI for 2006, and recalculated their rank based on this adjusted faculty salary.

Results for both sets of schools are shown in Figures 3 and 4. As before, we have plotted a 45 degree line on each graph. If the cost-of-living adjustment did not make a difference, we would expect all schools to fall on the 45 degree line. If schools fall below

the line, they are assigned a much lower rank than they should have, using the unadjusted data. If schools fall above the line, they are assigned a much higher rank than they should have, using the unadjusted data.

We can see that the schools form a fairly large point cloud in both cases, although the point cloud for liberal arts colleges is not as widely dispersed. For both sets of schools, it is clear that many schools may be unfairly penalized when using unadjusted salary data. We have highlighted some of these schools in the two graphs. The ranking for University of Nebraska, for example, changes from 82nd to 35th, while Centre College changes from 62nd to 23rd. Other schools, because they are located in more expensive locations, drop in the rankings. UCLA, for example, drops from 11th to 61st when using the faculty salaries data adjusted for cost-of-living. Not surprisingly, many of the schools located beneath the 45 degree line are located in the Midwest, which tends to have a low cost-of-living, while many of the schools above the 45 degree line are located in California or expensive cities in the Northeast such as Boston, New York, and Washington.

Discussion

Almost twenty years ago, Keister & Keister (1989) demonstrated the effect of cost-of-living adjustments on faculty salaries, using the ACCRA COLI discussed above. Despite their article, the use of cost-of-living adjustments for salary or other expenditure data have not been widespread in higher education. We believe this is likely due to the lack of data for rural and suburban locations in the ACCRA data. Most schools have at least one peer institution that lies outside a major urban area, so the ACCRA data have little use for them. Scholars analyzing all 2-year or 4-year institutions in the country ace the same problem with the ACCRA data.

We believe that federal fair market rent data, combined with other state-level data on the cost of living, have the potential to provide a free, annually updated cost-of-living index that would be available for every postsecondary institution in the country. Our cost-of-living index provides similar results as those based on the CPI and the widely-used ACCRA index produced by the Council for Community and Economic Research. Unlike these measures, ours provides data for every county in the United States, and unlike Runzheimer and other for-profit cost-of-living data, our approach uses freely available data.

Of course, all cost-of-living measures contain some error, and one could argue that it would be better to use unadjusted expenditure data instead of adjusted data, when we know that the adjustment is not perfect. However, we should bear in mind that the unadjusted data can also be considered to contain error, in that these data do not reflect the true cost-of-living for a college or university. Thus two schools may appear to both spend $20,000 per student according to IPEDS data, but if one school is in San Francisco, and the other in Iowa, the latter school is undoubtedly getting more for its $20,000 dollars that the former. Yet using the unadjusted data would lead the researcher (or their statistical program) to treat each school equally. We agree with Curran et al. (2006), who state that

> While we acknowledge that all existing cost-of-living indices contain biases and defects…, we believe that the test should be whether applying a well-constructed, though imperfect, cost-of-living index yields a better understanding of the world than would ignoring these differences and not adjusting for regional variations in the cost of living at all p. 2463.

Given the choice, and the analyses presented here, the choice is clear: higher education researchers should adjust their data for regional cost-of-living differences.

Finally, we noted at the beginning of the paper that *U.S. News* adjusts for cost-of-living in their undergraduate rankings, but that they use data from 1996. While U.S. News claims that they use data this old because they do not wish the rankings to fluctuate each year due to changes in the cost-of-living (Farrell & Van der Werf, 2007), it is likely that cost also plays a role in their decision. U.S. News purchased their data from Runzheimer, which is known for the expense of their COLI data.

More importantly, their argument makes little sense. Their argument boils down to this: *U.S. News* would rather use old (and thus incorrect) cost-of-living data to make sure that their rankings do not change much. Yet the ostensible goal of the rankings is to determine the "best" colleges, not to create a static listing of colleges and universities. The analysis presented here indicates the impact that a cost-of-living adjustment makes on rankings based on faculty resources. If the cost-of-living between regions has not changed much during the past decade, then perhaps their approach, while not justifiable, has not really affected how schools are ranked. On the other hand, if the cost-of-living in different regions has changed much during the past decade, then *U.S. News* has been incorrectly ranking schools based on their use of old cost-of-living data.

In an attempt to shed light on this, we have used CPI data publicly available on the Bureau of Labor Statistic's website to calculate the change in the cost of living from 1996 to 2006. The table shows the change during this period for all the metropolitan areas that are available. As can be seen, there is quite a bit of variation in the change in the cost of living during the past decade, from a low of +23% for Honolulu to +42% for San Diego. Bear in mind also that these are changes for major urban areas; it is likely

the cost of living did not rise as dramatically for rural areas. Thus, we can conclude that *U.S. News*'s approach of using old cost-of-living data is introducing substantial error into their rankings.

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Table 1. Summary of Data Elements Used in 2006 HECOLI

Construct	Measure	Mean	SD	Min.	Max
Housing	50th percentile fair market rent, 2 bedroom apt.	$729	$245	$421	$1,536
Transportation	Gallon of regular gasoline	$2.12	$0.10	$2.02	$2.59
Medical care	Hospital cost per day	$1,471	$350	$733	$2,246
Education & communication	Undergraduate tuition, fees, room & board	$11,806	$2,341	$8,506	$17,708

Table 2. Weights Used in CPI and HECOLI

		HECOLI	
	CPI weight	Weight	Data level
Food and beverages	15.0	0.0	-
Housing	42.7	42.7	County
Apparel	3.7	0.0	-
Transportation	17.2	33.4	State
Medical care	6.3	12.2	State
Recreation	5.6	0.0	-
Education & communication	6.0	11.7	State
Other goods and services	3.5	0.0	-
Total	100.0	100.0	

Table 3. Bivariate Validation Regressions

	CPI-Regression COLI - 2004	ACCRA COLI - Q2 2006
Intercept	13.990	11.175***
	(13.097)	(2.955)
HECOLI - 2004	.878***	
	(.131)	
HECOLI - 2006		.888***
		(.029)
R^2	.64	.75
N	27	310
Difference		
Mean	1.7	0.0
|Mean|	5.9	5.7
Minimum	-13.8	-19.6
Maximum	28.3	73.1

Note: standard errors in parentheses.
* p<0.05, ** p<0.01, *** p<0.001

Table 4. Percentage Change in the Consumer Price Index, 1996-2006

Urban area	% change
San Diego, CA	41.8%
Boston-Brockton-Nashua, MA-NH-ME_CT	36.6%
San Francisco-Oakland-San Jose, CA	34.9%
Los Angeles-Riverside-Orange County, CA	33.6%
Tampa-St. Petersburg-Clearwater, FL	33.1%
Miami-Fort Lauderdale, FL	32.7%
New York-Northern New Jersey-Long Island, NY-NJ-CT-PA	32.2%
Seattle-Tacoma-Bremerton, WA	31.8%
Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD	30.3%
Minneapolis-St. Paul, MN-WI	29.2%
Denver-Boulder-Greeley, CO	29.1%
Detroit-Ann Arbor-Flint, MI	28.9%
Washington-Baltimore, DC-MD-VA-WV	28.8%
Pittsburg, PA	28.4%
Dallas-Fort Worth, TX	27.8%
Portland-Salem, OR-WA	26.8%
St. Louis, MO-IL	26.7%
Houston-Galveston-Brazoria, TX	26.6%
Cincinnati-Hamilton, OH-KY-IN	26.1%
Chicago-Gary-Kenosha, IL-IN-WI	26.0%
Cleveland-Akron, OH	25.7%
Kansas City, MO-KS	25.4%
Anchorage, AK	24.2%
Atlanta, GA	24.2%
Milwaukee-Racine, WI	22.8%
Honolulu, HI	22.7%
U.S. city average	28.5%

Source: U.S. Department of Labor, Bureau of Labor Statistics

Figure 1. Relationship between CPI-Regression COLI and HECOLI

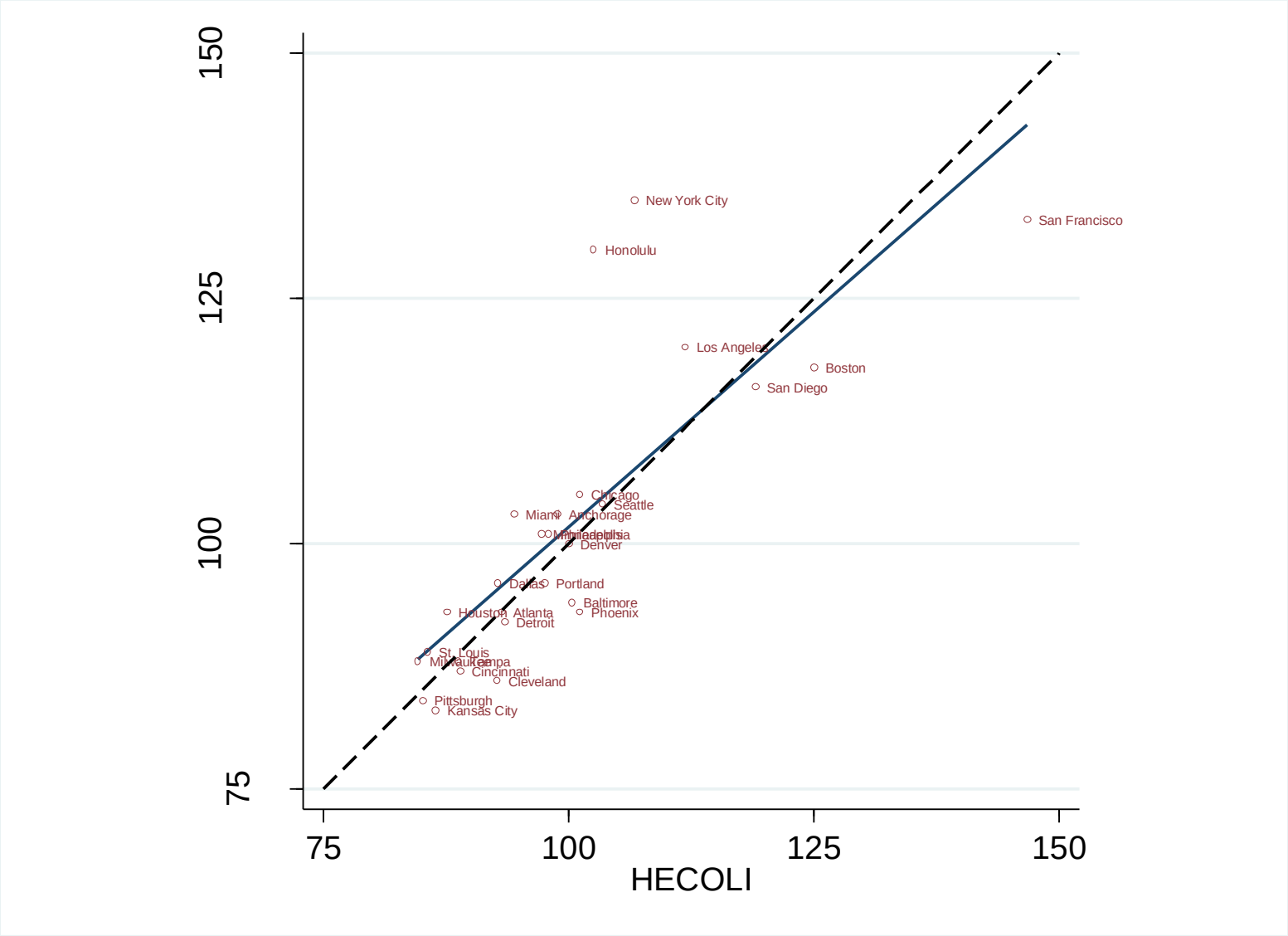

Figure 2. Relationship between ACCRA COLI and HECOLI

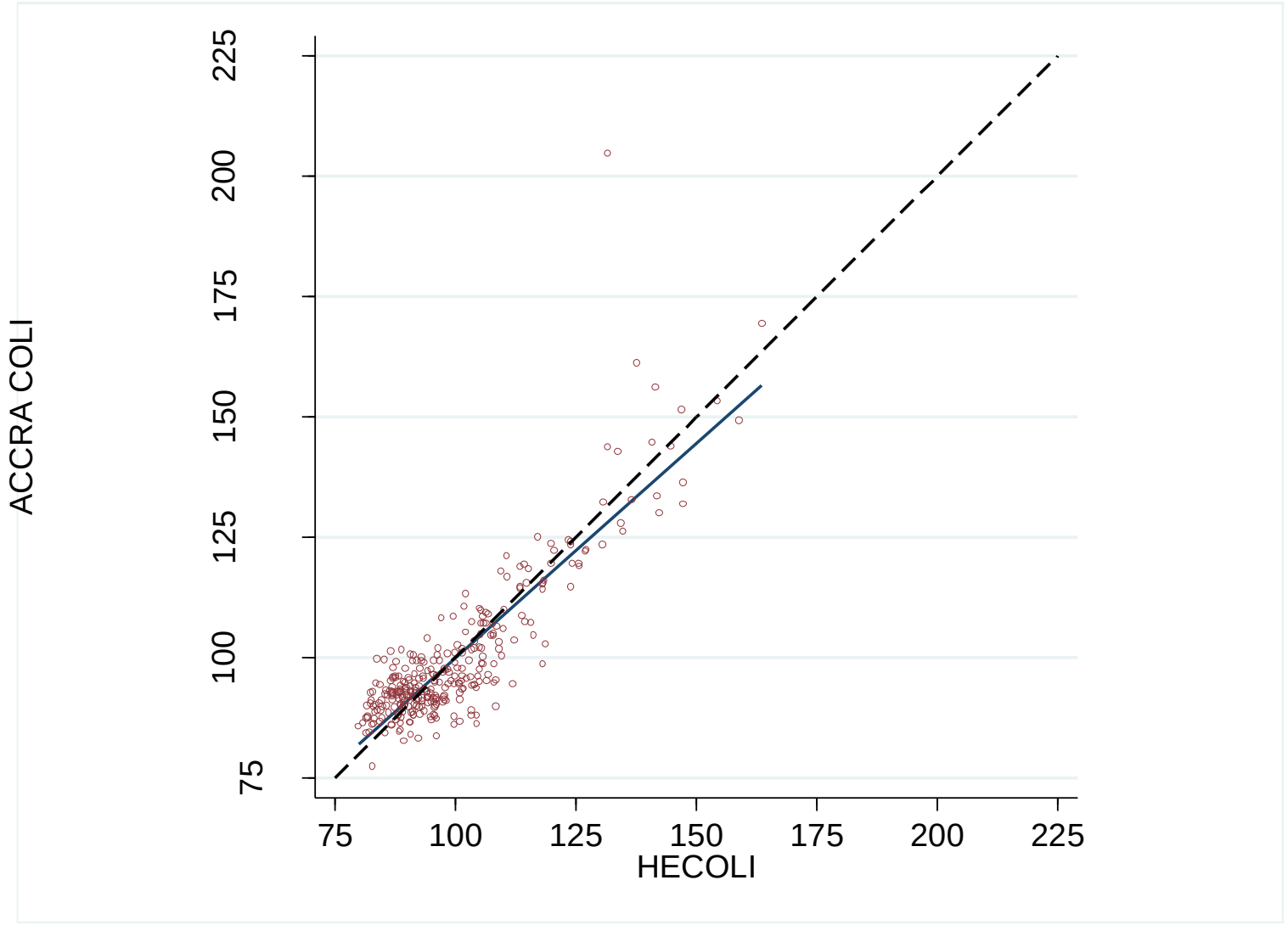

Figure 3. Unadjusted and Adjusted Faculty Salaries, 2006 National Universities

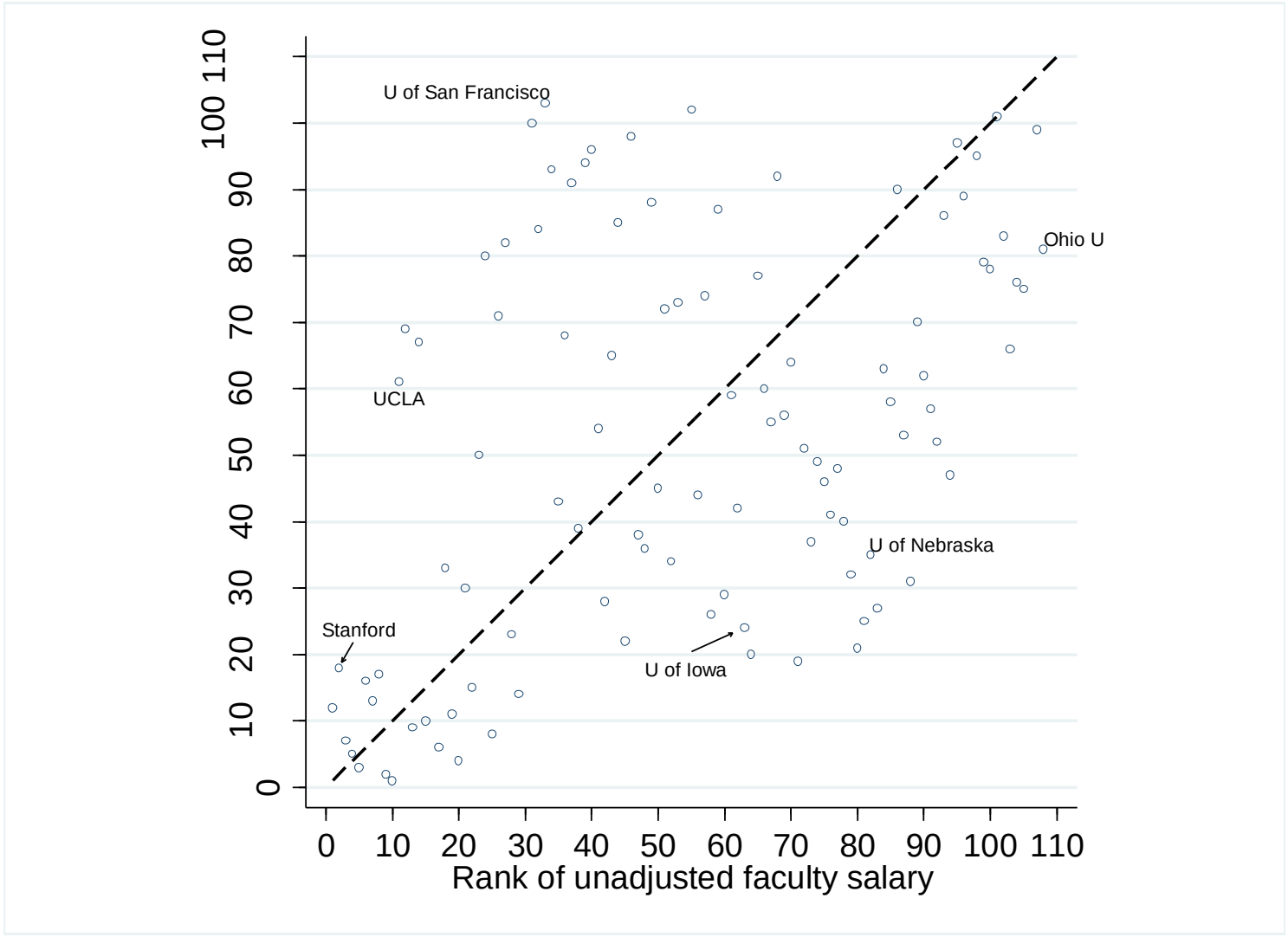

Figure 4. Unadjusted and Adjusted Faculty Salaries, 2006 Liberal Arts Colleges