NBER WORKING PAPER SERIES

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Working Paper No. 320

NATIONAL BUREAU OF ECONOMIC RESEARCH
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February 1979

This paper is an outgrowth of a study of living arrangements supported by a grant to NBER from the Alfred P. Sloan Foundation. The research assistance of David Katz is gratefully acknowledged. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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Abstract

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No cross-sectional consumer price index is currently available by state, and the BLS's cross-sectional "family budget" index for metropolitan areas is not well-suited for cross-state analyses. In this paper we propose an algorithm for constructing a state-specific Laspeyres price index using conveniently available information from the Census of Business and the Survey of Current Business.

The index is calculated for each state (and for Census divisions and regions) for 1967 and 1972. Its characteristics are discussed, and it is used to deflate nominal per capita income by state. Comparing "real" income by state with nominal income by state, the former has substantially less variation cross-sectionally but greater variation over time (between 1967 and 1972).

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Economic analyses using cross-sectional state data are frequently hampered by the absence of a reliable, easily computed consumer price index by state. The Bureau of Labor Statistics (BLS) publishes a "family budget" for 44 metropolitan and non-metropolitan areas with a varying market bundle, and Sherwood (1975) has provided a fixed bundle price index for these same 44 areas.[1] These indexes can be used for cross-state comparisons, but 21 states do not contain a metropolitan area for which the "family budget" is constructed, and only 7 states have as much as half their population in metropolitan areas covered by these BLS indexes.

In this note we propose a state price index which can easily be calculated for any year in which the Census of Business is conducted. The critical assumptions underlying our method are: (1) there is a composite set of goods sold at retail which has insignificant cross-state variation in price; (2) there is an insignificant amount of net cross-state buying of this set of goods; and (3) the ratio of the consumption of these goods to a composite of all other commodities including personal taxes and savings is constant across states.[2]

More formally, we assume that there are some consumption items for which cross-state price variation is substantial -- e.g., housing, services, food -- and that there are other items for which competition and transferability among states keeps price variation sufficiently small so that one can assume no cross-state price variation --

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[1] The BLS also publishes separate consumer price indexes for several cities, but these are not designed for cross-city comparisons.

[2] Sufficient conditions for this are that the two composites have unitary income elasticities and zero compensated price elasticities.

e.g., durable goods including automobiles, furniture and general merchandise, wearing apparel, drugs. Call the composite good for which prices vary across states C_1 and the other good C_2. Our state price index for state j is a Laspeyres price index, L_j, defined as

$$(1) \qquad L_j = \frac{P_{1j}C_1 + P_{2j}C_2}{P_1C_1 + P_2C_2}$$

where U. S. averages of prices and quantities are taken as the base. By scaling each of the goods such that its average price is unity, $P_1 = P_2 = P_{2j} = 1.0$. For each state (and for the U. S.) income I is

$$(2) \qquad I_j = P_{1j}C_{1j} + P_{2j}C_{2j} \ .$$

Thus:

$$(3) \qquad P_{1j} = \frac{\left(\frac{I_j}{C_{2j}} - 1\right)}{\left(\frac{C_{1j}}{C_{2j}}\right)} \ .$$

As we have no way of measuring C_{1j} we assume that behaviorally C_{1j}/C_{2j} is constant across states, hence $C_{1j}/C_{2j} = C_1/C_2$. Substituting this term into (3) and then (3) into (1) yields our estimable index

$$(4) \qquad L_j = \frac{I_j}{C_{2j}} \cdot \frac{C_2}{I} \ .$$

With data available in the U. S. Statistical Abstract we have used equation (4) to construct state price indexes for 1967 and, independently, for 1972. (See Table 1.) The variables are defined as follows:

I_j = state j's per capita personal income 1967 or 1972;

C_{2j} = state j's per capita retail sales 1967 or 1972 excluding sales of food stores, gasoline service stations, eating and drinking places, building materials, hardware, and farm equipment dealers; comparable definitions of I and C_2 for the U. S. are used. (Price indexes for each census division and region as well as for each state are calculated.)

To provide some assessment of the quality of the SPI, we note several of its characteristics. First, the SPI does not appear to be sensitive to moderate changes in the composition of C_2. For instance, an alternative price series was derived from C'_2, defined as C_2 plus sales of eating and drinking places and gasoline service stations, thus expanding the sales base by one-fourth. The coefficient of correlation[3] between the C'_2 and C_2 series is .97.

Second, on a priori grounds we expect relative prices across states to be fairly stable over time. The correlation between the SPI (1967) and SPI (1972) is quite high, .94.

Third, we expect an accurate state price index to be highly correlated with the residual from a wage equation which holds constant age, sex, color, education, and occupation. That residual should reflect geographic differences in nominal wages due to price difference and

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[3] All correlations are population-weighted.

perhaps other factors such as amenities. Fuchs (1976) constructed such an adjusted wage based price index for states in 1969, and it is quite highly correlated with SPI (1967) and SPI (1972): 0.85 and 0.83 respectively.

Finally, the BLS publishes a regional CPI of changes in prices over time based on population weighted metropolitan area price changes. If we accept that CPI measure of regional price changes as accurate, then the population weighted SPI over the same time period should show similar price movement, if the SPI is correct. We calculated such a regional SPI for the period 1967-1972, adjusted for the U. S. CPI=125.3 (1967=100). The comparison of those regional indexes is shown below:

Region	BLS	SPI
Northeast	128.5	129.0
North Central	124.0	127.7
South	124.8	122.8
West	122.1	121.4

Both indexes show a relatively rapid rise in prices in the Northeast and, relatively slow growth of prices in the West. The indexes do not conform as well for the North Central and the South.

One important application of SPI is to deflate nominal per capita income. (See Table 2.) We observe that there is much less geographical variation in "real" income than in nominal income. In 1967 the coefficient of variation across states was 10.5 percent for real income and 16.2 for nominal income. In 1972 the coefficients of variation was again lower in real terms: 8.4 percent versus 13.2 percent for nominal income. Table 2 also reveals that there is much less geographic stability in real income over time. The correlation between 1967 and 1972 across states is only

.74 for real income compared with .98 for nominal income. The correlation in income over time is exaggerated when measured in nominal terms because of the stability of geographic differences in price.

Deflating nominal income by the SPI has a strong effect on our perception of relative living standards in the Northeast compared with the South. According to the nominal measure, the average person in the Northeast had 37 percent more income than did the average person in the South in 1967 and 28 percent more in 1972. In real income, however, the difference was only 12 percent in 1967, and the regions were approximately equal in 1972.

Although no definitive test is possible, we conclude that the proposed SPI is a good index of price differences among states and probably the best one available at the present time. Using the method proposed here, further experimentation with alternative sets of commodities to measure C_2 is warranted. Since economic analyses usually assume mo money illusion, the availability of the SPI should materially improve cross-state studies of economic behavior.

References

Fuchs, Victor R. "The Earnings of Allied Health Personnel -- Are Health Workers Underpaid?," Explorations in Economic Research, vol. 3, No. 3, Summer 1976.

Sherwood, Mark K. "Family Budgets and Geographic Differences in Price Levels," Monthly Labor Review, April 1975.

Table 1: State Price Index for 1967 and 1972 (also shown for Census Divisions and Regions).

Region/Division/State	Year 1967	1972
Northeast	1.11	1.12
New England	1.05	1.03
Maine	.91	.84
N. H.	.94	.79
Vt.	.85	.84
Mass.	1.04	1.05
R. I.	1.04	1.05
Conn.	1.11	1.13
Middle Atlantic	1.13	1.15
N. Y.	1.15	1.24
N. J.	1.12	1.13
Pa.	1.03	1.03
South	.91	.88
South Atlantic	.93	.89
Del.	.98	.92
Md.	1.08	1.01
Va.	1.00	.98
W. Va.	1.01	.98
N. C.	.88	.87
S. C.	.90	.89
Ga.	.88	.83
Fla.	.84	.76
East South Central	.90	.88
Ky.	.99	.98
Tenn.	.85	.84
Ala.	.90	.86
Miss.	.87	.83
West South Central	.88	.88
Ark.	.80	.83
La.	.95	.93
Okla.	.90	.89
Tex.	.85	.87

Region/Division/State	Year 1967	1972
North Central	1.01	1.03
East North Central	1.04	1.05
Ohio	1.05	1.06
Ind.	1.00	1.00
Ill.	1.04	1.07
Mich.	1.05	1.06
Wis.	1.09	1.04
West North Central	.94	.98
Minn.	.97	.98
Iowa	.90	.97
Mo.	.90	.94
N. Dak.	.92	.95
S. Dak.	.94	1.00
Neb.	.91	1.00
Kan.	1.02	1.07
West	1.03	1.00
Mountain	.95	.88
Mont.	.98	.94
Idaho	.85	.82
Wyo.	1.06	.97
Colo.	.97	.88
N. Mex.	.93	.85
Ariz.	.94	.89
Utah	.94	.87
Nev.	.97	.88
Pacific	1.05	1.03
Wash.	1.03	1.05
Oreg.	.91	.92
Calif.	1.05	1.04
Alaska	1.33	1.20
Hawaii	1.17	1.13
U. S.	1.00	1.00

Table 2: Nominal and Real Per Capita Income by Region, Division, and State, 1967 and 1972.

Region/Division/State	Per Capita Income (current dollars)			
	Nominal		Real	
	1967	1972	1967	1972
Northeast	3567	4994	3212	4419
New England	3495	4754	3316	4612
Maine	2620	3571	2874	4257
N. H.	3109	4092	3294	5190
Vt.	2775	3865	3274	4610
Mass.	3488	4870	3341	4618
R. I.	3238	4399	3116	4184
Conn.	3865	5342	3495	4708
Middle Atlantic	3590	5005	3179	4357
N. Y.	3726	5319	3239	4304
N. J.	3624	5126	3240	4538
Pa.	3146	4447	3051	4328
South	2599	3906	2859	4426
South Atlantic	2749	4131	2955	4661
Del.	3700	4983	3793	5413
Md.	3434	4897	3172	4841
Va.	2776	4258	2764	4338
W. Va.	2341	3574	2329	3632
N. C.	2396	3721	2736	4260
S. C.	2167	3448	2403	3854
Ga.	2513	3846	2847	4661
Fla.	2796	4188	3337	5505
East South Central	2241	3448	2481	3933
Ky.	2387	3601	2413	3687
Tenn.	2369	3640	2772	4318
Ala.	2166	3333	2412	3887
Miss.	1895	3063	2184	3670
West South Central	2606	3849	2964	4375
Ark.	2090	3357	2597	4025
La.	2445	3528	2571	3802
Okla.	2623	3802	2901	4286
Tex.	2704	4045	3178	4640

Region/Division/State	Per Capita Income (current dollars)			
	Nominal		Real	
	1967	1972	1967	1972
North Central	3280	4578	3243	4438
East North Central	3389	4699	3253	4464
Ohio	3212	4512	3069	4270
Ind.	3241	4391	3245	4392
Ill.	3725	5126	3595	4809
Mich.	3393	4817	3226	4527
Wis.	3153	4207	2901	4028
West North Central	3012	4281	3215	4372
Minn.	3111	4332	3213	4398
Iowa	3093	4318	3448	4462
Mo.	2993	4206	3337	4483
N. Dak.	2485	3718	2699	3914
S. Dak.	2550	3716	2701	3735
Neb.	2938	4341	3241	4353
Kan.	3009	4593	2957	4398
West	3412	4702	3319	4725
Mountain	2818	4158	2969	4731
Mont.	2759	3897	2816	4160
Idaho	2608	3635	3062	4455
Wyo.	2997	4345	2831	4477
Colo.	3086	4449	3176	5060
N. Mex.	2462	3656	2661	4281
Ariz.	2681	4300	2867	4854
Utah	2617	3745	2776	4325
Nev.	3626	5215	3724	5908
Pacific	3597	4880	3427	4723
Wash.	3481	4476	3376	4273
Oreg.	3055	4296	3364	4655
Calif.	3660	5002	3474	4823
Alaska	3629	5162	2724	4284
Hawaii	3326	4995	2837	4439
U. S.	3159	4478	3165	4480

Source: For nominal per capita income 1967 & 1972 (prelim.): U. S. Bureau of Economic Analysis, Survey of Current Business, April 1969 & April 1973.