Variation Of Productivity, Wages And Profitability With Location

Edward M. Miller*

Many comparisons of different areas of the country have been made with regard to such variables as wage rates or rates of growth of employment. However, little attention has been paid to such key variables as productivity or profitability. Yet, low wages could be (and are) offset by low productivity.

Perhaps even more surprising is the absence of research on differences in profitability. In theory, industrialists pick locations on the basis of anticipated profitability, and the areas with the highest profits would be the fastest growing. In spite of the theoretical importance of profitability, regional scientists have made little effort to determine how it varies with location. This paper will argue that gross profit margins can be measured from existing data, and that there are significant regional differences in profitability. Finally, comparisons of wages will be made and new indices of wage rates will be computed with industry mix controlled for.

METHODOLOGY FOR CALCULATING PRODUCTIVITY INDICES

The basic data were taken from the 1972 Census of Manufacturers. The measure of productivity used was value added divided by the number of production worker manhours. Value added is superior to value of shipments as a measure of output because it controls for differing degrees of vertical integration. The number of production worker manhours was taken as the measure of labor input since it incorporated the number of hours worked, and true labor input (direct labor plus overhead) is likely to be proportional to it. Some regions are much more likely than others to have overhead labor (accounting, research, etc.) located at the factories (where it would be included in establishment level total employment). It was believed that to include such functions for some establishments (some of which may have been for establishments in other states) but not others would be less accurate than excluding them for all establishments.

These calculations were made for all regions, divisions, states, and SMSAs for which there were data. Naturally, not all industries are represented in all areas. More importantly, the Census Bureau is prohibited by

*Tsanoff Professor of Public Affairs, Jesse H. Jones Graduate School of Administration, Rice University, P.O. Box 1892, Houston, Texas 77251.

law from disclosing information about any particular company. To avoid one firm's being able to subtract its data from the total and thus to determine another firm's submission, the Census Bureau will release data only if the industry in question has at least three companies in a particular state or metropolitan area. This disclosure rule proves a severe limitation, especially for the industries characterized by large plants, such as steel, automobiles, or tobacco.

There are, of course, numerous potential problems with using value added per production worker as a measure of labor productivity. One is that the output is measured in dollars and not in physical quantities. Since the comparisons are made between areas for a single year, the dollar values are in the same year's prices, avoiding the very difficult problem of finding suitable price deflators at the four-digit level. The possibility that prices differ significantly with location remains. If good regional price indices existed, it would be desirable to deflate the output by price indices. However, the lack of suitable price indices prevents the use of this procedure.

Fortunately regional differences in the price of manufactured goods tend to be small. Most manufactured goods are sold in national markets, and firms in different locations must price at approximately the same level in order to compete. Thus, the use of dollar values is a reasonable approximation to physical output. The ability to make comparisons using dollar values of value added was a major reason for studying the manufacturing sector. The same procedure would not work for most other sectors which sell only in local markets.

If gross profit is defined (as it is here) as value added minus payroll, there is an identity

$$\text{Value Added} = \text{Payroll} + \text{gross profit.}$$

Dividing through by manhours one has

$$\frac{\text{Value Added}}{\text{Manhours}} = \frac{\text{Payroll}}{\text{Manhours}} + \frac{\text{Gross Profit}}{\text{Manhours}}$$

This reduces to

$$\text{Labor Productivity} = \text{Average Hourly Earnings} + \text{Gross Profit per Manhour}$$

If one believes that gross profits per manhour are fixed and output prices are set as a markup on local costs, productivity is not an independent variable. Consider the house construction industry. Suppose there are two communities, one union and one non-union. They are separated by large enough distance that houses in the two communities do not compete. One would expect that in each community houses would sell for approximately the costs of construction, or the price of the materials plus the required

labor. The prices of houses in the high-wage union area will be much higher than those in the low-wage union area. One could not use value of house put in place per manhour as a measure of labor productivity because $10,000 worth of house would be quite different in the two locations, representing much less house in the union city. In particular, one could not argue that just because union labor had a higher value of output per manhour it was more productive. (This explains Allen's [1979] conclusions that unionized construction workers are more productive.) Similar problems would arise if value added was used as a surrogate for physical output in services, retail trade, or wholesale trade. This problem could even arise for a few manufacturing industries that sell in local market areas, but in most manufacturing industries competition from firms in other areas prevents prices being merely a reflection of local wages and costs.

Gross profit in manufacturing is not an exogenous variable that is constant at all locations but is a residue left after the payroll and cost of materials have been deducted from value of output. For manufacturing, prices are not set as a markup on local costs but are the result of national factors, such as national demand and supply or price leadership by national firms. This makes gross profit variable, reflecting the differences between national product prices and local costs. Thus gross profit can and does vary between locations. Locational theory suggests that firms will seek locations where this gross profit is large.

Where productivity is unusually high, there are a number of possible beneficiaries. One possibility is the workers. The evidence (see below) of a correlation between wages and productivity suggests they get at least some of the benefits of high productivity. In some cases land owners benefit. (They are much more likely to receive the rents for industries such as mining, agriculture, or even retail trade where output per worker is likely to be much higher on one tract of land than on another.) Since taxes vary with location, state and local governments probably receive some part of the difference. Finally, as noted above, owners of capital probably receive much of the difference in the form of differences in profit rates.

With the data available, quite a few variables cannot be controlled for. One is the degree of market power. Factories in one location may show higher profits and productivity than those in another area not because they really have higher productivity, but because they had enough market power to raise prices substantially above long-run marginal costs. If there is no control for industry mix (or only a control at the two digit level), this can be a serious problem. Since certain industries have substantial market power, comparing value added per worker for a community whose leading industries have market power to that for another community with competitive industries can be very misleading. Fortunately, most such differences are controlled for by making comparisons across four-digit industries. For instance, Rochester, New York, has a value added per man hour that is among the highest in the nation, being over twice the national average. This is probably due to the presence of Kodak, Xerox, and Bausch and Lomb. These firms have substantial market power and high

markups over the cost of production. Their gross profits include not only a normal return on invested capital but also a return to a heavy investment in research and development and well-recognized brand names.

There is one other factor that minimizes the importance of differences in market power. The Census Bureau will publish data on a particular industry only if there are at least three firms in the industry in that state or metropolitan area. Thus the industries for which there are data are typically the competitive industries, minimizing the problems of non-competitive pricing.

Since one firm's market power typically raises prices of all firms in the industry, controlling for industry mix helps control for differences in concentration among communities. A similar argument would apply for such variables as short-run supply and demand considerations and capital intensity, for which data are not available. Failure to control for such variables is much more serious for studies of all manufacturing or at the two-digit level than it is when industry mix is controlled for at the four digit level.

TABLE 1

Productivity, Wage, and Profit Margin Indices for States and Regions

	Productivity	Wages	Profit Margin
Northeast	101.9	103.8	97.1
New England	96.8	96.6	101.9
Maine	88.5	91.8	97.2
New Hampshire	74.6	87.6	80.7
Vermont	82.1	90.4	89.5
Massachusetts	104.5	99.0	109.7
Rhode Island	97.0	93.2	109.7
Connecticut	93.3	96.2	93.4
Middle Atlantic	104.4	106.7	95.8
New York	116.9	107.1	96.5
New Jersey	94.3	104.3	95.9
Pennsylvania	94.4	101.6	97.7
North Central	102.4	110.2	97.2
East North Central	101.7	111.8	95.4
Ohio	104.0	106.5	99.4
Indiana	98.3	102.2	90.7
Illinois	106.9	108.5	99.6
Michigan	100.4	111.3	91.4
Wisconsin	104.3	103.6	103.1
West North Central	97.2	98.6	100.6
Minnesota	107.6	108.2	108.6
Iowa	106.3	112.0	94.1
Missouri	85.5	94.2	96.6

TABLE 1 (Continued)

Productivity, Wage, and Profit Margin Indices
for States and Regions

	Productivity	Wages	Profit Margin
North Dakota	74.0	79.7	99.2
South Dakota	76.6	74.3	103.3
Nebraska	94.0	95.3	78.5
Kansas	84.2	83.8	94.1
South	91.6	86.8	107.0
South Atlantic	96.4	90.5	105.1
Delaware	73.7	85.1	88.3
Maryland	97.6	93.6	99.6
District of Columbia	156.8	109.3	91.3
Virginia	93.7	89.8	106.3
West Virginia	83.1	92.4	114.3
North Carolina	96.5	92.7	101.7
South Carolina	93.8	95.6	93.8
Georgia	95.4	91.1	103.8
Florida	95.1	88.9	103.3
East South Central	89.3	87.9	102.9
Kentucky	85.8	94.3	100.1
Tennessee	88.1	86.1	110.2
Alabama	94.8	92.1	115.0
Mississippi	77.6	81.4	101.1
West South Central	96.8	88.5	103.4
Arkansas	82.5	79.7	110.4
Louisiana	116.5	93.4	107.4
Oklahoma	93.0	87.0	104.3
Texas	111.6	89.9	116.6
West	111.3	110.9	105.3
Mountain	94.9	99.0	106.3
Montana	88.3	91.4	120.6
Idaho	104.2	125.5	92.3
Wyoming	75.1	88.2	114.7
Colorado	93.4	101.4	93.8
New Mexico	90.0	80.0	112.6
Arizona	133.9	102.9	133.1
Utah	120.9	89.9	138.0
Nevada	107.3	97.2	119.4
Pacific	110.8	115.7	99.9
Washington	113.0	120.4	100.2
Oregon	123.6	126.9	101.4
California	106.1	107.4	98.2
Alaska	116.9	126.1	165.5

SUMMARIZING THE DATA

These detailed, industry-by-industry calculations occupied several thick printouts, far too much data to present here. It is obviously necessary to calculate summary measures of productivity. One might like to calculate weighted indices of productivity where each industry had the same weight in each area. This could not be done because there are virtually no industries that are represented everywhere. The industries either do not exist (such as ship building in Colorado) or disclosure regulations prevent the required data from being revealed. Since indices with national weights could not be calculated, a series of indices was calculated using local weights.

The question asked was what would be the value added if each local industry with data had the average productivity of the rest of the nation for that industry. The actual 1972 value added was divided by this hypothetical value added to give the observed value added as a percentage of the hypothetical value added, or the productivity index (See Table 1). The results are also shown on the attached maps.

This index compares local productivity with productivity of the rest of the nation using local weights. This procedure thus gives high weight to the industries which are important to an area (and for which the government can publish data). In using these numbers, this should be kept in mind. A statement that Oregon industries (such as sawmills) have high productivity, as do New York industries (such as apparel), may have few implications for the efficiency of a new automobile plant in either location.

REGIONAL DIFFERENCES IN PRODUCTIVITY

There are regional differences in productivity. Productivity tends to be highest in the West and lowest in the South. In the South, 1972 productivity was running 8% below the national average while in the West it was 11% above the national average. The low productivity for the South was especially surprising since it had been expected that with more modern factories productivity would be higher there. Productivity in the traditional Industrial Belt of the Northeast and the North Central states was slightly above the national average (by 2%).

There were a few interesting patterns within the regions. Although productivity for the Northeast was slightly above the national average, the patterns were quite different for its two divisions. New England was about 3% below the national average while the Middle Atlantic states were 4% above the national average. In the North Central Region, the West North Central states have a productivity below the national average. Finally, the high productivity in the West is primarily in the Pacific Coast states, with the Mountain states actually about 5% below the national average.

In considering locations for new plants, it should be realized that many variables influence productivity and that productivity from existing plants is a poor indicator of many of these variables. Frequently, different plants in the same industry produce different types or qualities of output. In

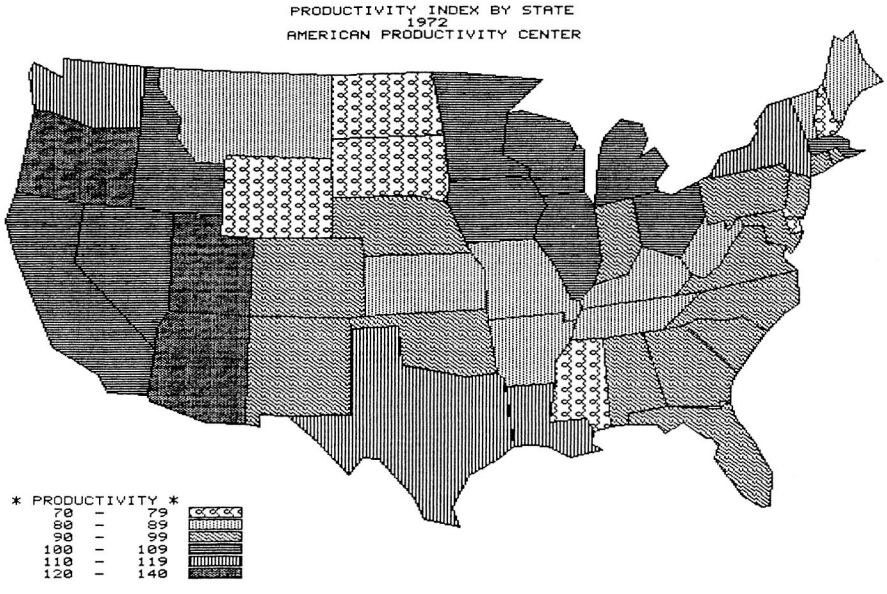

Figure 1

addition, existing plants are often obsolete or burdened with old work rules. An area that has low productivity in existing plants might suffer no productivity disadvantage in new plants.

WAGES

A similar procedure was followed in calculating the wage level. The average wage for each of the 450 manufacturing industries was calculated by dividing the total production-worker payroll by the number of production-worker manhours to give production-worker wages in dollars per hour. A weighted index was constructed using local production-worker manhours as weights. The total wage that would be paid if each industry in the area paid the national average wage was calculated. The actual wage bill was expressed as a percentage of this potential wage, giving local wages as a percentage of the national level.

The resulting index is an indicator of whether an industrialist seeking a location should expect to pay above average or below average wages for his industry. It is less useful for the potential worker seeking a job since he may earn much more in a machinery factory paying low wages for the machinery industry than in a textile factory paying high wages for the textile industry. The results are given in Table 1 and are shown on the Wages map.

The pattern of wages observed was very similar to that found in other studies. Wages are lowest in the South and highest in the West. It is interesting to see that this pattern is not due merely to differences in

industrial mix but also holds even when the mix is controlled for at a very high level of detail (four-digit).

Wage levels and productivity tend to move together. Differences in productivity tend to offset part of the advantage of low wages. For instance, wages in the South are about 8% lower than in the rest of the nation, but the output per manhour is typically 4% lower, leaving the advantage in output per dollar of wages less than would have been deduced from the differences in wages alone. The West has wages that run about 11% higher than the national average, but it also has output per manhour of that is about 11% higher than the national average, with the result that the West does not have the disadvantage in labor costs its above-average wage rates would suggest.

This strong relationship between levels of productivity and wages was also observed in the divisional data and in the data for the states. There are enough states to permit a statistical test of a wage productivity relationship. Thus a regression for the states of the productivity ratio on the wage ratio was run. The result was (standard error in parenthesis):

$$\text{Wage ratio} = .384 + .664 \underset{(.084)}{\text{Productivity Ratio}}$$

$$R^2 = .56$$

The relationship was statistically significant. States with low wages also have low productivity. Those interested in industrial location may want to consider the possibility of lower productivity offsetting part of the gains from lower wages in low wage areas.

There are of course a number of mechanisms that could produce the observed correlation between wages and productivity. High wages could cause firms to substitute capital for labor, resulting in high labor productivity in high wage areas. In fact some researchers have attempted to estimate the elasticity of substitution between capital and labor using two-digit data on the assumption that the major mechanism causing differences between states in labor productivity are differences in capital intensity induced by differences in wages (Moroney [1972], Ferguson [1963], Griliches [1967]). Such an analysis depends on the assumption (among others) that there is a single technology employed in each two-digit industry. In actuality, each two-digit industry is composed of a number of separate industries employing different technologies and having different skill requirements, capital intensities, and degree of market power. The mix of these industries between different states differs quite widely. This author believes that attempts to work at the two-digit level without standardization for industry mix is likely to lead to serious error. The work reported on here shows that standardization for differences in industrial mix is possible.

Wages may be based partially on ability to pay, resulting in high productivity firms paying high wages. High labor quality could lead to both high wages and high productivity. There are a number of hypotheses that are

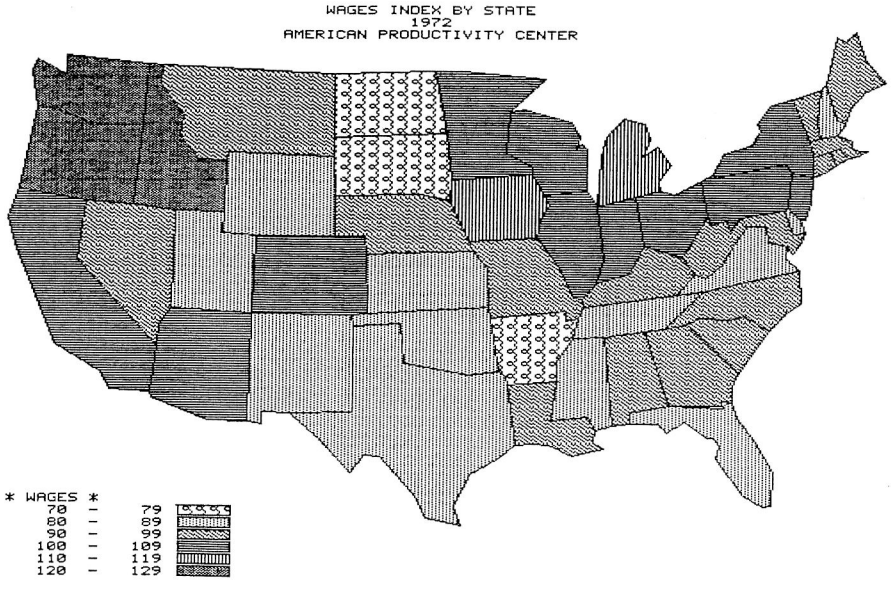

Figure 2

consistent with data. Thus these results are presented in the hope of inspiring further work by others that may cast light on the causal relationships.

PROFITABILITY

Using the Census of Manufactures data, it is possible to calculate a gross profit margin by region. This is done by subtracting the total payroll from the value added and then dividing the remainder by the value of shipments. Since value added is essentially value of production minus raw materials, parts, packaging, and energy, the remainder after subtracting labor costs is a gross margin, roughly equivalent to contribution to overhead. It includes not only profit as normally defined but also interest payments, fringe benefits, purchased services (including repairs and insurance), and services typically provided off-site such as accounting or research. Since many of these expenses would occur wherever the plant was located, excluding them in the comparisons of different locations is reasonable. These gross profit margins are included in the tables and are shown in the map of gross profit margins. They are the first published measures of profitability by region. It is hoped that they (possibly updated) will be used in future studies of the determinants of industrial location and rates of growth.

Some systematic differences in profitability by region were found. Gross profit margins appeared to be higher in the "Sunbelt" than in the "Snowbelt." The Northeast and the North Central both had profits margins that were below the national average by about 3%. In contrast, the margins for

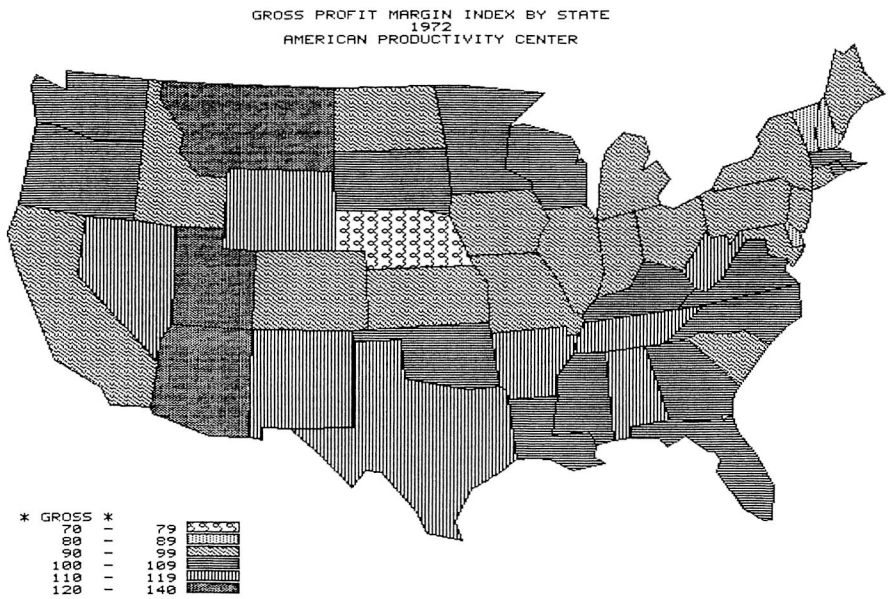

Figure 3

the West average over 7% above the national average. The highest profit margins appear to be in the South, where they were running 7% above the national average.

THE RELATIONSHIP BETWEEN REGIONAL PRODUCTIVITY, WAGES, AND PROFIT MARGINS

A series of tests of the relationship between the wage rates, profit margins, and productivity were run using the regional ratios. The basic data were the productivity, wage, and profit margin ratios for the 450 four-digit industries and for the four Census Regions (Northeast, North Central, South, and West). While not all industries were represented in all regions, there were 1788 observations, which are enough to provide a high degree of statistical significance. The ratios had been standardized by dividing the regional value by the national averages, thus making data for different industries comparable.

A regression of the wage ratio on the productivity ratio gave:

$$\text{Wage Ratio} = 67.8 + .312 \underset{(.011)}{\text{Productivity Ratio}}$$

$$R^2 = .288$$

The estimated coefficient is sufficiently in excess of the standard error that there is virtually no chance of the relationship being due solely to chance. Thus when a particular industry in a region has above average productivity, its wages are likely to be above average. Some of the possible causal mechanisms for this relationship have been discussed above. Each increase in productivity of 1% appears to be associated with an increase in wages of about .3%.

Having shown that wages appear to be closely related to productivity, the next question is whether there is a similar relationship between profitability and productivity. A regression of the profitability ratio on the productivity ratio gave:

$$\text{Profitability Ratio} = 91.4 + \underset{(.036)}{.086}\ \text{Productivity Ratio}$$
$$R^2 = .0037$$

Thus, profitability tends to increase with productivity and the relationship is statistically significant. If a region has above average productivity in a particular industry it is likely to have above average profitability. The effect of productivity on profitability is probably attentuated by the tendency for high productivity regions to also have high wages.

An additional question is whether, given the relationship between profitability and productivity, there is any tendency for the low wage region to be more profitable. Needless to say, the fact that productivity and wages are correlated does not prevent them from being included in the same equation, although it increases the standard errors. A multiple regression equation shows:

$$\text{Profitability Ratio} =$$
$$99.5 + \underset{(.0435)}{.124}\ \text{Productivity Ratio} - \underset{(.075)}{.120}\ \text{Wage Ratio}$$
$$R^2 = 451\%$$

Thus, if there is any independent effect of wages on profitability, it is more likely to be negative than positive. However, the coefficient is small enough so that there is a 10.7% chance that it is actually positive rather than negative. This relationship between wages and profitability is surprisingly weak given the popular belief that being in a high wage area puts one at a fatal disadvantage. With wages controlled for, the effect of productivity on profitability is increased. Thus, there is a tendency for the industries within a region which are above the national average for their industry in productivity also to have above average wages and profitabilities.

RESULTS FOR METROPOLITAN AREAS

Similar calculations were performed using the metropolitan area statistics. They are shown in Table 2 for the fifty most important manufacturing centers.

A set of comparisons was also made for each industry between the average productivities, wages, and profitabilities, in the metropolitan areas and the country as a whole. Weighted averages were then calculated (as was done above) using weights based on the urban area (or more specifically, the number of production worker manhours reported for specific

TABLE 2

Productivity, Wages, and Profitability by City

City, State	Number of Employees	Value Added	Productivity Ratio	Wage Ratio	Profitability Ratio	No. of Industries Included in Average
Chicago, IL	909.6	17,573.8	0.974	1.074	0.924	50
Los Angeles-Long Beach, CA	778.9	15,234.9	1.015	1.042	0.985	166
New York, NY-NJ	949.2	15,120.8	1.228	1.087	0.950	189
Detroit, MI	551.6	11,694.3	1.048	1.142	0.886	70
Philadelphia, PA-NJ	495.7	9,189.9	0.969	1.043	0.942	185
Newark, NJ	271.8	5,608.6	0.986	1.030	0.937	87
Cleveland, OH	268.9	5,220.9	1.044	1.070	0.957	78
St. Louis, MO-IL	250.2	5,161.1	0.936	1.013	0.993	89
Boston, MA	266.5	4,918.9	1.083	1.037	0.975	83
Rochester, NY	142.2	4,390.6	0.927	1.060	0.993	19
Houston, TX	162.7	4,179.4	1.210	1.017	1.048	57
Pittsburgh, PA	262.8	4,163.9	0.886	1.013	0.730	53
Dallas-Fort Worth, TX	230.0	4,075.7	0.954	0.882	0.993	78
San Francisco-Oakland, CA	184.8	3,807.9	1.212	1.222	1.019	83
Minneapolis-St. Paul, MN-WI	199.0	3,734.8	1.051	1.070	0.970	73
Milwaukee, WI	200.0	3,700.0	0.996	1.108	0.926	49
Cincinnati, OH-KY-IN	157.6	3,561.2	0.978	1.008	1.038	47
Baltimore, MD	180.1	3,476.2	1.009	0.941	0.958	18
Buffalo, NY	151.7	3,146.3	0.955	1.111	0.861	32
Louisville, KY-IN	113.4	3,022.8	1.127	1.038	1.101	15
Kansas City, MO-KS	118.8	2,902.4	1.074	1.036	1.039	41
San Jose, CA	134.4	2,873.1	1.252	1.182	1.093	23
Anaheim-Santa Ana-Garden Grove, CA	131.0	2,734.4	1.053	1.041	0.994	46

TABLE 2 (Continued)
Productivity, Wages, and Profitability by City

City, State	Number of Employees	Value Added	Productivity Ratio	Wage Ratio	Profitability Ratio	No. of Industries Included in Average
Greensboro-Winston-Salem-High Point, NC	138.0	2,593.4	0.934	0.998	0.907	25
Indianapolis, IN	122.5	2,525.3	0.947	0.970	0.936	22
Atlanta, GA	132.4	2,472.3	1.056	0.943	0.983	38
Seattle-Everett, WA	108.6	2,234.7	1.299	1.291	1.096	20
Dayton, OH	118.8	2,152.9	0.859	0.999	0.861	17
Gary-Hammond-East Chicago, IN	99.4	2,159.0	0.899	0.994	0.779	6
Columbus, OH	102.4	1,989.2	1.007	0.981	0.984	22
Providence-Warwick, Pawtucket-RI-MA	131.9	1,959.9	0.998	0.905	1.154	19
Jersey City, NJ	95.3	1,899.2	0.942	1.081	0.799	28
Toledo, OH-MI	91.2	1,878.9	1.195	0.995	1.166	16
Denver-Boulder, CO	95.5	1,849.8	0.956	1.000	0.930	21
Allentown-Bethlehem-Easton, PA-NJ	110.4	1,805.6	0.805	1.054	0.872	21
Youngstown-Warren, OH	86.6	1,749.5	0.970	1.002	0.950	10
Akron, OH	94.4	1,686.2	1.021	1.078	0.839	11
Portland, OR-WA	86.4	1,596.9	1.160	1.148	0.991	41
Grand Rapids, MI	74.9	1,515.4	1.050	0.992	1.102	24
Hartford, CT	86.4	1,395.5	0.966	0.933	0.955	15
Phoenix, AZ	71.9	1,370.0	0.931	1.158	0.963	7
Memphis, IN-AR-MS	64.2	1,352.4	0.850	0.874	0.961	25
Albany-Schenectady-Troy, NY	66.9	1,322.0	0.927	1.001	1.069	12
Miami, FL	86.0	1,219.0	0.859	0.893	1.023	40
Syracuse, NY	60.5	1,205.3	1.002	0.972	1.079	16
Paterson-Clifton-Passaic, NJ	75.5	1,179.4	0.811	1.058	0.966	32
Springfield-Chicopee-Holyoke, MA	62.1	1,157.7	0.984	0.916	1.083	17
Canton, OH	57.6	1,151.6	0.985	1.076	0.926	9
Bridgeport, CT	63.7	1,137.6	1.058	1.049	1.120	83
Birmingham, AL	68.9	1,123.8	0.956	0.920	1.004	16
Standard Consolidated Areas						
New York, NY New Jersey	1,622.0	28,352.9	1.099	1.072	0.948	293
Chicago, IL NW Indiana	1,009.0	19,732.8	1.007	1.063	0.931	231

TABLE 3

Productivity, Wage, and Profit Ratios
For Metropolitan United States

Two Digit SIC Code	Industry Name	Average Productivity	Average Wages	Average Profit Margin
20	Food	1.056	1.082	0.959
21	Tobacco	0.595	1.021	0.468
22	Textiles	0.991	1.032	0.921
23	Apparel	1.142	1.045	0.921
24	Lumber	1.214	1.153	0.971
25	Furniture	1.016	1.024	0.942
26	Paper	0.921	0.983	0.921
27	Printing	1.113	1.082	0.987
28	Chemicals	0.957	1.017	0.939
29	Petroleum	1.025	1.070	1.060
30	Rubber & Plastics	0.979	1.011	0.844
31	Leather	0.950	1.019	0.880
32	Stone, Clay & Glass	0.956	1.038	0.866
33	Primary metals	0.984	1.015	0.947
34	Fabricated metals	1.049	1.042	1.031
35	Machinery, non-electrical	0.999	1.016	0.943
36	Electrical machinery	0.965	0.984	0.930
37	Transportation Equipment	1.018	1.000	1.066
38	Instruments	1.002	0.980	0.979
39	Miscellaneous manufacturing	1.011	1.009	0.927
	All Manufacturing Average	1.025	1.034	0.947

metropolitan areas for indices of productivity and wages, and the value of shipments in specific metropolitan areas for the index of profitability).

For each industry, the sum of the value added was divided by the sum of the production worker manhours to give a measure of the productivity in the metropolitan areas for which there were data. (Of course, there were no published data for many cities.) This figure was divided by the corresponding national productivity to give the metropolitan productivity as a percent of the national. An unweighted average of these figures showed productivity in metropolitan areas to be 2.5% above the national average. This provides direct evidence on productivity in cities, supplementing the previous evidence which had inadequate control for industry mix (Carlino, Sveiklauskas, and Yezer and Goldfarb).

A similar procedure was applied to wages. They were found to be 3.5% above the national averages. Since this figure exceeds the 2.5% average metropolitan advantage in productivity, labor costs appear to be higher in metropolitan areas.

Calculations were made for profits. Profits in metropolitan areas were found to average 5.2% below the national average. This result is not surprising in view of the higher labor costs.

Table 3 shows the averages of the four digit values (unweighted) of the metropolitan productivity, wage, and profitability ratios for each two digit industry grouping.

A major handicap in doing studies of metropolitan versus non-metropolitan areas is the absence of any totals for metropolitan areas. The researcher has to compute his own totals by adding up the published data for the individual metropolitan areas. Since data are published only if there are three or more companies, the metropolitan areas with only one or two companies in an industry are excluded. For most industries, a significant proportion of total industry capacity is in those cities with less than three companies. Since a total for all metropolitan areas cannot be computed, it is impossible to derive figures for the non-metropolitan areas by subtraction. The most that can be done is to compare the metropolitan areas for which there are data with the rest of the country.

The percentage differences reported here between metropolitan averages and the national averages are small. This is to be expected since most manufacturing takes place in metropolitan areas, and the metropolitan areas are included in the national averages. One would prefer to make comparisons between metropolitan and non-metropolitan areas, but as noted above data for non-metropolitan areas cannot be obtained. This is a deficiency the Census Bureau could easily correct.

CONCLUSIONS

There are significant differences between regions, states, and metropolitan areas in productivity, wages, and profitability. Frequently, an area that has an advantage in wage rates finds part of this advantage offset by lower productivity. There are interesting correlations between many of the variables. Like many research projects, this one raises more questions than it answers. Having shown the types of interesting data that can be constructed, it remains to combine data of this type with data from other sources to construct a complete model that would explain the way the world actually works.

REFERENCES

Allen, Steven G. "Unionized Construction Workers are More Productive," *Center to Protect Worker's Rights* (November 1979).

Bensen, Stanley M. "Education and Productivity in U.S. Manufacturing: Some Cross-Sectional Evidence," *Journal of Political Economy* (May-June, 1968).

Carlino, Gerald A. "Increasing Returns to Scale in Metropolitan Manufacturing," *Journal of Regional Science*, 19, 3 (1979): 363-374.

Ferguson, C. E. "Cross-Section Production Functions and the Elasticity of Substitution in American Manufacturing Industry," *Review of Economics and Statistics*, 45 (August 1963): 305-13.

Griliches, Zvi. "Production Functions in Manufacturing: Some Preliminary Results" in the *Theory and Empirical Analysis of Production*, ed. M. Brown (New York: National Bureau of Economic Research, 1967) pp. 275-322.

Moroney, J. R. *The Structure of Production in Manufacturing*, (Chapel Hill: University of North Carolina Press, 1972).

Sveikauskas, L. "The Productivity of Cities," *Quarterly Journal of Economics*, 89 (1975): 393-413.

Yezer, A. M. J. and Goldfarb, R. S., "An Indirect Test of Efficient City Size," *Journal of Urban Economics*, 5 (1978): 46-65.

U.S. Bureau of the Census, *Census of Manufactures, 1972* (Washington, DC: U.S. Government Printing Office, 1975).