THE RURAL-URBAN GAP IN MANUFACTURING PRODUCTIVITY AND WAGES: EFFECTS OF INDUSTRY MIX AND REGION

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Abstract

This study analyzes urban and rural values of value added per worker and production worker wages tabulated from unpublished 1992 Census of Manufactures data. A decomposition of regional averages separates out effects of regional industry mix from within-industry differentials over a rural-urban continuum and for metro and nonmetro portions of census regions. Industry mix accounts for about half of the rural-urban gap in both productivity and wages. The within-industry differentials in both productivity and wages increase with urbanization. The size of the nonmetro gap in productivity and wages varies across regions. Comparison of actual 1991-93 employment growth with regional wage and productivity differentials shows that low wages are strongly associated with job growth.

Keywords: Rural Manufacturing, Shift-Share, Labor Productivity, Wages

*Economist, Rural Economy Division, Economic Research Service. This research was done while the author was a research associate at the U.S. Census Bureau's Center for Economic Studies using data supplied by the Census Bureau. All information removed from the Census Bureau was checked to ensure nondisclosure of

information about individual firms or plants. The views and conclusions reported here do not necessarily reflect those of the Census Bureau. Gerald Schluter and Andy Bernat provided helpful comments on an earlier draft.

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Introduction

Information about wage and productivity differentials between rural and urban locations is important to assess the prospects for rural economic development and to improve our understanding of regional differences in earnings. However, little information is currently available. Regional differences in wages are sometimes available, but a complete analysis must consider wages and productivity together (Fogarty and Garofalo, 1978; Moomaw, 1983). Studies have consistently found that variables associated with labor cost are one of the most important factors influencing of firm location (Blair and Premus, 1987).

Comparisons of average wages and productivity across regions can be misleading, because they partly reflect differences in the structure, or mix, of industries in rural and urban regions (Norcliffe, 1977). Consistent with product cycle theory, or "filtering down," mature labor-intensive industries are more likely to choose rural locations because they are more sensitive to labor costs, have less need of skilled labor and access to innovations (Barkley, 1995; Campbell, 1995; Miller, 1989; Markusen, 1985). Consequently, rural regions have an industry mix

that is more heavily weighted toward low-wage and low-productivity labor-intensive industries, such as textiles, apparel, leather, lumber and wood products. Better regional comparisons of the relative productivity and wages of workers in similar industries can be produced by controlling for the industry mix effect.

This study estimates the magnitude of wage and productivity differentials between rural and urban manufacturing workers. Manufacturing now forms the economic base of many rural communities, and nearly all net growth in manufacturing jobs has been in rural areas during recent years (Bernat, 1994). Average wages and value-added per worker computed from unpublished 1992 Census of Manufactures data provide more detail than is available from published sources, which do not report rural averages. A shift-share method employed by Norcliffe and Mitchell (1977) and Ledebur and Moomaw (1983) is used to decompose rural and urban wages and output per worker into an industry mix effect and a residual component that represents the within-industry regional differential. By removing the industry mix effect, the within-industry differential can give us a better idea of how wages and productivity in similar industries compare across regions. Further homogeneity is achieved by analyzing production worker and nonproduction worker earnings separately. I also compare regional job growth with wage and productivity differentials to

determine whether jobs are currently moving toward low-wage or high-productivity regions.

Decomposition of Regional Averages

Ledebur and Moomaw (1983), Norcliffe (1977), and Norcliffe and Mitchell (1977) developed a shift-share method to analyze regional differences in productivity. While shift-share is normally used for isolating the various factors associated with changes in income and employment (Curtis, 1972), the technique is adapted here to decompose regional averages at a single point in time. I am interested in comparing the average productivity or wage, $V._j$, for various regions, where j represents sets of regions specified below. The regional average can be apportioned into an industry mix component and a residual component that represents the relative productivity/wage of establishments in the region compared with those in the same industry in other regions. I begin by summing establishment values within each industry and region to obtain V_{ij}, the average value for industry I in region j. There are N industries and R regions, for a total of NR values of V_{ij}. I then compute means by region and industry, where V.. is the national average (1 mean), $V._j$ is the average for region j (R means), $V_i.$ is the national average for industry i (one for each of N industries). I also compute NR shares, t_{ij}, the employment share of industry i within region j, where $\mathrm{E}_i\ t_{ij} = 1$. This study performs shift-share analysis for two

sets of regions: Beale codes (R=10), and metro-nonmetro portions of census regions (R=18). The level of industry detail used for the shift-share analysis is the three-digit SIC code--roughly 180 industries.

Following Ledebur and Moomaw, I use simple algebra to decompose the regional average, $V._j$, using two identities. By definition, $V._j$ is the sum of industry averages in the region weighted by their shares, t_{ij}:

$$V._j = \sum_{i=1}^{N} t_{ij} V_{ij} .$$

The decomposition of $V._j$ is derived by adding and subtracting equivalent terms on the right-hand side of equation (1),[1]

$$V._j = V.. + \sum_{i=1}^{N} t_{ij}(V_i. - V..) + \sum_{i=1}^{N} t_{ij}(V_{ij} - V_i.).$$

The regional average has three components. The national average, V.., is the first component. The second is the region's

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[1]Note that $\sum_{i=1}^{N} t_{ij} V.. = V..$, *since* $\sum_{i=1}^{N} t_{ij} = 1$. Add and subtract equivalent terms:
$V._j = \mathrm{E}_i\, t_{ij} V_{ij} + V.. - \mathrm{E}_i\, t_{ij} V.. + \mathrm{E}_i\, t_{ij} V_i. - \mathrm{E}_i\, t_{ij} V_i.$ Rearranging this equation results in equation 2.

industry mix component. The term (V_i. - V..) is the difference between the average productivity/wage in industry i and overall average, V.. These differences are summed using the region's employment shares for each industry as weights. The industry mix component will be negative if a region has a large share of employment in industries with low productivity/wages, (where V_i.- V..<0), and it will be positive for a region with employment concentrated in high-productivity/wage industries.

The third component of (4) is a residual that I will call the within-industry component. This term evaluates the productivity/wage of each industry in region j relative to the national average for that industry. When industry i's productivity/wage is relatively low in region j, the term (V_{ij} - V_i.) is negative. These within-industry relative productivity differences are summed across industries in the region, weighted by industry employment shares in region j. The within-industry component is negative when industries in region j systematically have relatively low productivity/wages compared to the national average for their industry, and positive when region j's industries tend to have productivity or wages exceeding the national average. Note that if region j's industry mix is equal to the national industry mix, the industry mix term is zero.[2]

[2]To see this, recognize that $G_i t_{ij} V_i$. = V.. if the shares t_{ij} are equal to the national shares, t_i., used to compute V.. Also, recall that $G_i t_{ij}$ V..=V.., since $G_i t_{ij}$=1. Then $G_i t_{ij} V_i$. - $G_i t_{ij}$V.. =

The within-industry component goes to zero when $V_{ij} = V_i.$ for each industry in region j. When both the industry mix and within-industry components are zero, the regional average, $V._j$, equals the national average, V..

Finally, the shift-share equation is converted to percentage form. Dividing through by V.. and multiplying by 100 results in an index for each region:

$$Ix_j = 100 + (Industry\ Mix\ Component_j) + (Within\text{–}Industry\ Componen$$

The index will equal 100 when the regional average equals the national average. The industry mix and within-industry components are reported as percentages of the national average, V.. An industry mix component greater than 0 indicates that the region has attracted industries with relatively high productivity/wages. This is usually an indicator of the capital intensity of the local industries. A within-industry component greater than 0 indicates that the productivity/wages of plants in the region tends to be higher than plants in the same industry located elsewhere.

Data

This study employs unpublished data from the 1992 Census of Manufactures to analyze production worker hourly wages and value added per worker. Wages are computed by dividing total

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0.

production worker wages by production worker hours. Census value added is the gross margin between receipts and the value of materials purchased (Israilevich and Testa). Conceptually, value added equals the factor payments to labor and capital, but the census measure includes the value of purchased services as well. The census value added overstates the production occurring at the establishment for those that utilize services obtained outside the plant. Ciccone and Hall argue that the census value added measure is biased toward showing higher productivity in cities, since urban firms are expected to use more services. Meanwhile, Israilevich and Testa argue that census data understate production in urban areas because the census measure assigns value added to locations where actual production activities take place, while no value is assigned to locations of auxiliary activities (which are largely in urban areas). In multiunit firms, the census value-added per worker measure may be overstated for rural branch plants if they utilize technical and administrative functions performed by workers at urban headquarters, while single-unit plants provide these in the plant.[3] However, the census value added data are the only source that allows comprehensive detailed analysis across both industry and geographic dimensions. Since the two alleged biases are in

[3]The appendix of this study shows that nonproduction workers, which include sales, administrative, clerical, and technical personnel, are highly concentrated in urban locations.

opposite directions, they may offset one another in aggregate analysis.[4]

The analysis was performed separately for the earnings of both production and nonproduction workers, but in the interest of brevity I present only production worker wage results. Nonproduction worker results are placed in an appendix for the interested reader. When considering a location for a manufacturing plant, the cost or quality of production workers at a particular location is generally an important consideration, while management and technical personnel (nonproduction workers) are often recruited from other locations. The reader should keep in mind that the value added per worker results are based on all workers, while the wage results are based only on production workers.

County data were summed to 3-digit industry totals for each of the larger regions used in the analysis: Beale codes and metro-nonmetro portions of census divisions. The 1993 Beale codes shown in table 1 are a rural-urban continuum that classifies all U.S. counties into 10 groups based on degree of

[4]Wages and productivity should be closely related, since higher productivity will lead to higher wages. The close correspondence I find in this study between productivity and wage measures suggests that the census value-added measure may not be so bad.

urbanization (Butler, 1990). Counties were first broken down on the basis of whether they are part of a standard metropolitan statistical area (SMSA). Metro counties were grouped into three categories based on the size of the metropolitan area where they are located, with an additional category for counties on the fringe of the largest metro areas. Nonmetro areas were classified into three classes of urbanization based on the amount of population that lives in urban places (towns or cities) in the county. The classes are 10,000 or more (urbanized), 2,500-9,999 (less urbanized), and under 2,500 (completely rural). These three classes were then split into two groups each, depending on whether they are adjacent to a metro area or not. Most research uses metro-nonmetro as the definition of rural-urban, but the Beale codes provide a more detailed measure of degree of urbanization for U.S. counties. The initial shift-share analysis treats each Beale code as a region. Subsequent analysis focuses on regional differences in rural-urban productivity and wages by performing the decomposition analysis for metro and nonmetro portions of the nine census divisions.

Decomposition Results

By Beale Code

Table 2 shows the labor shares and decomposition results for the Beale code rural-urban continuum. The share of production worker hours in each Beale code is shown to evaluate the relative

importance of each class of counties in the national averages. The two classes representing large and medium-sized metro areas account for over 60 percent of production activity. Metro areas of all sizes account for nearly three-fourths of all production worker hours.[5]

The index values in table 2 suggest a wide rural-urban differential in both wages and productivity. Wages are 28 percent below the national average in the most-rural counties and 8 percent above the average in the most-urbanized counties. However, the decomposition shows that this "raw" differential of 36 percent between the most-rural and most-urban places is narrowed to about 18 percent after controlling for industry mix. Industry mix reinforces within-industry differentials and accounts for about half of rural-urban differences in productivity and wages. After removing the industry mix component, a rural-urban gradient in productivity and wages is still apparent, but it is less steep. The within-industry components show a narrower differential of 14 percent in both productivity and wages for the most-rural counties. The within-

[5]The heavy weight given to metro regions explains why only one or two regions have values above the national average in many of the analyses that follow. Note also that, as pointed out by Israilevich and Testa, the actual contribution of urban areas to manufacturing output is even greater than their share of production worker hours, since an even greater share of nonproduction workers is in urban areas.

industry component for core metro counties is 5 percent for wages and 4 percent for value added per worker. The other three metro types and nonmetro urbanized adjacent counties are similar--each has small within-industry differentials. Nonmetro counties with lower degrees of urbanization have larger negative within-industry components in both productivity and wages. Nonmetro counties that are adjacent to a metro area have higher productivity and wages than nonadjacent counties with the same degree of urbanization. The differential is generally 2 to 4 percentage points, but is higher for the nonmetro urbanized productivity components (7 percentage points).

Industry mix components also generally increase with urbanization. More urbanized counties tend to attract manufacturing establishments from industries with relatively high productivity and wages. The pattern is clear for wages. The industry-mix wage component falls from +3 percent for core metro counties to -14 percent for rural nonadjacent counties. For productivity, the industry mix components generally fall as counties become more rural, but there are some exceptions. The industry-mix productivity component is highest for medium metro counties, while core metro counties have an industry-mix component of 0. Another exception is the positive industry mix component for urbanized nonadjacent counties.

By Metro-Nonmetro Region

Table 3 shows labor shares and regional decomposition results for metro and nonmetro portions of the nine census divisions. The regional shares of production labor show that production is concentrated in metro areas, particularly in the East North Central, Pacific, Mid-Atlantic, and South Atlantic regions. Nonmetro production labor is concentrated in southern regions and the East and West North Central regions.

Index values indicate that nonmetro value added per worker and wages are systematically lower than metro values. Index values show that metro areas in each region except New England have value added per worker above the national average.[6] All nonmetro regions fall below the U.S. average. Nonmetro wages tend to be lower than metro wages, but one nonmetro region--the Pacific--has wages above the national average and three metro regions have wages slightly below the national average. Again, wide differences among regions are apparent. Wage and productivity indexes range from as low as 77 to as high as 118. Removing the industry mix effect narrows the differentials, but

[6]The Israilevich and Testa criticism may explain the low value-added in the metro New England region, since many corporate headquarters and research and development units are located in this region. Ledebur and Moomaw and Peterson and Muller also found low productivity in New England. The metro Mid-Atlantic and Pacific regions have high concentrations of nonproduction workers, so their productivity may also be biased downward.

there is still substantial variation among regions.

Within-industry components show that nonmetro portions of regions tend to have lower wages and productivity, but the magnitude of the gap varies from region to region. Nonmetro productivity is only 2 percent below the national average in the East North Central region, compared with 19 percent in the nonmetro Mountain region. The within-industry wage component for nonmetro regions is as high as -4 to -5 percent in New England, Mid-Atlantic, and East North Central, and is as low as -11 to -12 percent in the West North Central, East South Central, and West South Central regions. The nonmetro Pacific region has a puzzling +10 percent within-industry wage component. Inspection of the data showed that the high averages in this region are due to very high wages in nonmetro Washington state. Wages in other nonmetro Pacific region states were more in line with those in other nonmetro regions.

Most metro regions have positive within-industry components. However, four metro regions have negative within-industry wage components of -4 to -5 percent regions--South Atlantic, East and West South Central and the Mountain region. The highest within-industry productivity component is in the metro West South Central region, but the within-industry wage component in that region is -4. The high output per worker in the metro West South Central region is probably due to the importance of the capital-intensive petroleum industry in that region. The highest within-

industry wage component is in the metro East North Central region. This reflects the concentration of unionized skilled workers in what is often considered the nation's traditional "manufacturing belt."

Industry mix tends to favor metro regions, making a positive contribution to average productivity in five metro regions and a negative contribution in seven nonmetro regions. Industry mix wage components also tend to be positive in metro regions and negative in nonmetro regions. The largest negative industry mix components for both productivity and wages are in the nonmetro South Atlantic and East South Central regions. It is interesting to note, however, that this concentration of low-productivity industry in the South is not observed in the metro portions of the southern regions. In fact, the metro West South Central, East South Central, and South Atlantic have the largest positive industry mix productivity components. These results agree with anecdotal evidence in the popular press that the "New South" economic phenomenon is largely confined to urban areas, resulting in a widening rural-urban gap in the South.

Productivity, Wages and Employment Growth

Are the differentials reported in the previous section useful as indicators of the attractiveness of manufacturing locations? Is manufacturing activity shifting toward regions with low wages and/or high productivity? In this section, I

address these questions by comparing within-industry productivity and wage differentials across regions with patterns of manufacturing employment growth from 1991 to 1993, a period that brackets the year of the data, 1992, and follows the recovery from the 1990-91 recession. Regional manufacturing employment measures were constructed from unpublished county-level Bureau of Economic Analysis data.

It is difficult to identify the separate effects of productivity and wage differentials, since the two are closely related. Similarity of regional patterns of wages and productivity is implied by profit-maximization. For example, if productivity were equal in all regions, while a substantial wage differential existed, firms would have strong incentive to move to low-wage regions. However, the within-industry differentials indicate that productivity is lower in rural regions, which would tend to offset the attraction of lower rural wages. For Beale codes, wage and productivity differentials are very closely associated, with a partial correlation coefficient of .96. The within-industry productivity and wage components for metro-nonmetro portions of regions display a weaker, but still positive, relationship, with a partial correlation coefficient of .62.

In the early 1990's, manufacturing employment fell in urban places (where wages and productivity are high), and grew in more rural places (where wages and productivity are low). Table 4

shows that core metro areas lost over 400,000 manufacturing jobs (5 percent) and medium metro areas lost a further 26,000 (0.6 percent). All other county types gained manufacturing jobs, including a gain of nearly 128,000 jobs in nonmetro counties. The bulk of the job gain was in less urbanized nonmetro counties, which gained 90,000 jobs. Completely rural areas posted job gains that were small in magnitude, but large in percent terms (4-5 percent). Data by region also show strong manufacturing job growth in nonmetro portions of regions and decline in metro portions. It seems clear that urban productivity advantages did not attract manufacturing employment over the 1991-93 period. The job growth in more rural parts of the United States suggests that manufacturers were attracted by the lower wages in those areas, despite their lower productivity.

Figure 1 plots manufacturing job growth rates against within-industry wage differentials for each of the ten Beale codes. A clear negative association between job growth and wage level is apparent, as low-wage (rural) regions added manufacturing jobs at a faster rate than high-wage (urban) regions. Figure 2 shows a weaker, but still negative, relationship between job growth and wages for metro-nonmetro portions of census regions. Nonmetro regions tend to have negative wage differentials and positive employment growth, while the opposite is true for most metro regions. Of the four metro regions that had negative wage differentials, two showed little

change in employment and the other two were the only metro regions to show significant job growth. The New England and Mid-Atlantic were the only nonmetro regions showing significant negative job growth. The negative relationship between wages and job growth is more apparent if the nonmetro Pacific and metro East North Central regions are excluded. These two regions had unusually large positive wage differentials of 9 and 10 percent, respectively, and showed little change in employment. The other 16 regions show a clear negative relationship between job growth and wages.

Since the wage and productivity differentials are closely related, the relationship between job growth and productivity also is negative. Regions with relatively high value added per worker lost manufacturing jobs, apparently due to their high wage structure. This suggests that wages (or some characteristic that is correlated with wages) are the dominant feature that attracted manufacturing industry to regions during the 1991-93 period.

Conclusion

Rural manufacturing establishments pay their workers considerably less than their urban counterparts. After adjusting for the mix of industries, production worker wages in the most-rural areas tend to be 14 percent below the national average for workers in the same industry. In nonmetro parts of the South Central and West North Central regions, wages are 11-12 percent

lower than the national average. These wage differentials suggest substantial cost savings for firms relocating to these regions from high-wage urban locations where wages are 5 percent above the average. However, the cost savings would be offset by lower value added per worker, which is also 14 percent below the average in the most-rural areas. Low-wage rural and southern regions gained manufacturing jobs during the early 1990's, indicating that manufacturing firms sought locations with low wages, but the gains were small in comparison to the losses in large urban areas.

This study did not directly investigate the source of productivity and wage differentials between rural and urban areas. Does higher urban productivity, due to agglomeration economies or other reasons, lead to higher urban wages? Or, must urban residents be paid higher wages to compensate for urban disamenities and higher costs of living, resulting in higher urban productivity? These two questions pose a “chicken-and-egg” dilemma, i.e., “Which came first, higher urban productivity or higher urban wages?” It is difficult to address these questions of causation in the cross-sectional comparisons performed here.

While rural workers earn considerably less than urban workers in the same industry, about half of the difference between urban and rural wages is due to the rural industry mix, heavily weighted toward low-wage/low-productivity industries. This is consistent with the product cycle or “filtering down”

theories of manufacturing location, and provides further evidence that the rural competitive advantage is currently in low-wage industry. However, this also implies that nonmetro areas are vulnerable to competition from overseas locations where wages are even lower. This points to the third option in the manufacturing location decision--overseas locations. The prospects for rural areas in their competition with foreign locations for manufacturing jobs are mixed. Some shifting of manufacturing jobs from urban to rural areas has occurred in recent years, but rural areas have only gained a fraction of the urban jobs lost to foreign competition and downsizing. In particular, many labor-intensive manufacturing operations have moved overseas. The apparel industry, perhaps the most labor-intensive manufacturing industry in the United States and a large rural employer, has generally declined in the face of low-wage foreign competition. On the other hand, the North American Free Trade Agreement (NAFTA) has, so far, failed to produce the dramatic southward exodus of jobs to Mexico envisioned by NAFTA's opponents. Some anecdotal evidence suggests that the shift of jobs to Mexico following NAFTA was less than expected because the higher productivity of U.S. workers offsets the cost of their higher wages relative to Mexican workers. Although rural workers appear to be less productive than urban workers, they likely are more productive than workers in low-wage nations of Asia and Latin America. This reinforces the point that wages and worker

productivity cannot be considered in isolation from one another when analyzing manufacturing location.

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Table 1. The Beale code rural-urban continuum and basic manufacturing statistics, 1992

Beale Code		Manufacturing employment	Value Added per worker	Hourly wage[1]
		1,000	*1,000 dollars*	*dollars*
Metro Counties:				
Core Metro	Central counties of a metro area with population 1 million or more	8,042	81.0	12.88
Fringe Metro	Fringe counties of a metro area of population 1 million or more	546	78.9	11.82
Medium Metro	Metro ares of population 250,000 - 1 million	4,243	82.2	12.42
Small Metro	Metro areas of population under 250,000	1,072	80.3	11.76
Nonmetro Counties:				
Urbanized	Largest urban place has population 20,000 or more			
Adjacent to metro		890	74.1	11.36
Not Adjacent		420	73.5	10.88
Less Urbanized	Largest urban place has population 2,500-19,999			
Adjacent to metro		1,311	66.5	10.01
Not Adjacent		982	61.3	9.55
Completely Rural	Largest urban place has population under 2,500			
Adjacent to metro		137	56.8	8.99
Not Adjacent		169	56.2	8.62

[1] Production workers only.

Source: Butler (1990); Analysis of unpublished U.S. Bureau of the Census, 1992 Census of Manufactures.

Table 2. Decomposition analysis of value added per worker and production worker wages by Beale code, 1992

Beale Code	Share of Production Labor[1]	Labor Productivity[2]			Production Worker Wages		
		Index	Industry Mix	Within-Industry	Index	Industry Mix	Within-Industry
	percent	*percent*					*percent*
Metro							
Core	38.7	104	0	4	108	3	5
Fringe	3.3	101	2	-1	99	1	-2
Medium	23.5	105	6	-1	104	2	2
Small	8.8	103	4	-1	99	1	-2
Nonmetro							
Urbanized adjacent[3]	5.6	95	-4	-1	95	-3	-2
Urbanized nonadjacent	2.7	94	2	-8	91	-3	-6
Less Urbanized adjacent[3]	8.7	85	-8	-7	84	-7	-9
Less Urbanized nonadjacent	6.6	79	-10	-11	80	-9	-11
Rural adjacent[3]	0.9	73	-16	-11	75	-15	-10
Rural nonadjacent	1.1	72	-14	-14	72	-14	-14

Note: Table shows regional average productivity/wage relative to national average. Index = 100 + Industry Mix Component + Within-Industry Component.

[1]Share of national production worker hours. [2]Value added per worker. [3]Adjacent to metro area.

Source: Analysis of unpublished 1992 Census of Manufactures data.

Table 3. Regional decomposition analysis of metro-nonmetro value added per worker and production worker wages by region, 1992

Beale Code	Share of Production Labor[1]	Labor Productivity[2]			Production Worker Wages		
		Index	Industry Mix	Within-Industry	Index	Industry Mix	Within-Industry
	percent	*percent*					*percent*
Metro							
New England	4.7	95	-3	-2	107	2	6
Mid-Atlantic	11.4	102	-1	3	103	-2	5
East North Central	17.8	102	-2	5	118	9	9
West North Central	4.4	105	0	5	108	4	4
South Atlantic	11.4	107	7	0	94	-3	-4
East South Central	4.1	106	9	-3	99	4	-5
West South Central	6.4	118	10	8	101	5	-4
Mountain	2.5	104	5	-1	99	3	-4
Pacific	11.7	101	2	-1	102	0	2
Nonmetro							
New England	1.0	81	-7	-12	96	0	-4
Mid-Atlantic	1.4	86	-6	-8	91	-4	-5
East North Central	5.2	95	-2	-2	97	2	-5
West North Central	3.1	93	-3	-4	83	-6	-11
South Atlantic	6.2	77	-13	-10	77	-15	-8
East South Central	4.8	77	-14	-9	77	-12	-11
West South Central	2.3	90	-1	-9	82	-6	-12
Mountain	0.8	90	8	-19	90	-3	-7
Pacific	1.0	95	1	-6	103	-7	10

Note: Table shows regional average productivity/wage relative to national average. Index = 100 + Industry Mix Component + Within-Industry Component.

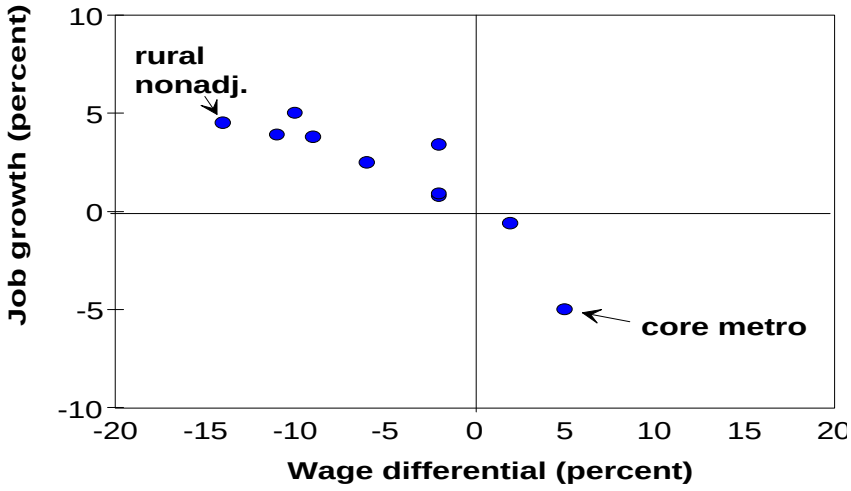
[1]Share of national production worker hours. [2]Value added per worker.
Source: Analysis of unpublished 1992 Census of Manufactures data.

Table 4. Within-industry productivity and wage components and employment growth, 1991-93, by Beale code

Beale code	Within-industry components		Manufacturing employment growth	
	Productivity	Wage	Number	Percent
	percent	*percent*	*1,000*	*percent*
Metro				
Core	4	5	-416.8	-5.0
Fringe	-1	-2	19.1	3.4
Medium	-1	2	-26.1	-0.6
Small	-1	-2	11.8	0.8
Nonmetro				
Urbanized adjacent[3]	-2	-2	8.1	0.9
Urbanized nonadjacent	-8	-6	10.1	2.5
Less Urbanized adjacent[3]	-7	-9	51.6	3.8
Less Urbanized nonadjacent	-11	-11	40.8	3.9
Rural adjacent[3]	-11	-10	7.6	5.0
Rural nonadjacent	-14	-14	8.9	4.5
Metro				
New England	-2	6	-62.3	-6.2
Mid-Atlantic	3	5	-144.6	-6.0
East North Central	5	9	-12.2	-0.4
West North Central	5	4	-11.4	-1.3
South Atlantic	0	-4	-9.1	-0.4
East South Central	-3	-5	16.6	2.3
West South Central	8	-4	5.6	0.4
Mountain	-1	-4	15.0	2.8
Pacific	-1	2	-209.5	-8.2
Nonmetro				
New England	-12	-4	-4.6	-2.8
Mid-Atlantic	-8	-5	-7.7	-3.0
East North Central	-2	-5	34.4	4.2
West North Central	-4	-11	27.6	5.3
South Atlantic	-10	-8	21.6	2.3
East South Central	-9	-11	36.3	5.0
West South Central	-9	-12	13.8	3.6
Mountain	-19	-7	7.3	4.9
Pacific	-6	10	-0.9	-0.5
All	NA	NA	-284.3	-1.5

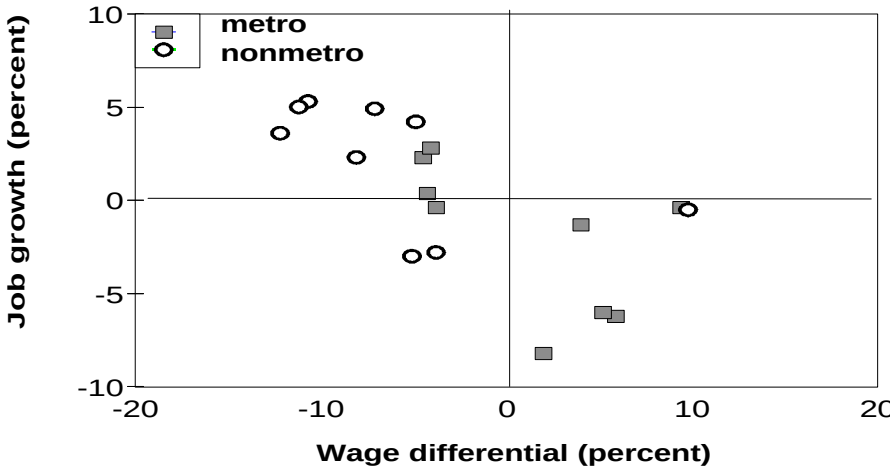
Source: Tables 2, 3 and unpublished Bureau of Economic Analysis employment data.

Figure 1
The relationship between manufacturing job growth and county Beale code, 1992



Source: Analysis of unpublished 1992 Census of Manufactures data

Figure 2
The relationship between manufacturing job growth and wage differential, for metro-nonmetro portions of census divisions, 1992



Source: Analysis of unpublished 1992 Census of Manufactures dat

Appendix: Nonproduction Worker Salaries and Wages

Nonproduction worker salaries are highest in the metro New England, Mid-Atlantic, and Pacific regions. This reflects the concentration of headquarters, research and development, and other technical, legal, and management operations in those regions. This is also consistent with the “spatial division of labor” described by Miller and Hansen. The location of large corporations in the Northeast and West Coast may push up average nonproduction worker salaries in those regions. Large corporations located in those regions likely have higher-salaried executives and larger legal, accounting, and r&d staffs than companies headquartered in other regions. All nonmetro regions have negative industry mix and within-industry wage components. Nonproduction worker salaries range from 21 percent under the national average in the nonmetro East North Central to 24 percent under the national average in the West North Central and Mountain regions. The negative within-industry wage component for nonmetro regions further reflects the location of routine production operations in rural areas. The nonproduction workforce in these areas is likely more heavily composed of clerical and other low-paid personnel than urban establishments.

Product cycle theory suggests a “spatial division of labor” (Barkley, 1995; Hansen, 1979; Miller, 1989), where nonproduction workers are concentrated in urbanized areas and production

workers are relatively concentrated in outlying regions. Nonproduction workers are often used as a proxy for skilled labor, while production workers are usually considered unskilled labor.[7] The regional shares of nonproduction workers and production worker hours shown in table 1 confirm the presence of a spatial division of labor. Only 13.5 percent of nonproduction (skilled) workers are located in nonmetro regions, while more than one-fourth of production worker (unskilled) hours are in nonmetro regions. In eight of nine metro regions the share of nonproduction workers exceeds the share of production worker hours, while the production worker hours share exceeds the nonproduction worker share in all nonmetro regions. Nonproduction workers are concentrated in the metro East North Central (19.0 percent), as is production labor (17.8 percent). This region is the nation's historical "manufacturing belt." The metro Mid-Atlantic and Pacific regions have the second-highest concentration of nonproduction workers (15 percent each) and the greatest imbalance between nonproduction and production labor, as the nonproduction exceeds the production labor share by nearly 4 percentage points in each of these two regions. This reflects the location of headquarters, other management, sales, research

[7]Leamer has criticized the use of production-nonproduction workers as a proxy for skilled-unskilled workers, but the availability of this variable and lack of other information on workforce make this a convenient measure.

and auxiliary functions in the northeast and on the west coast.

Appendix Table. Regional decomposition of nonproduction worker annual salaries, 1992

Region	Employment share	Index	Component: Industry Mix	Component: Within industry
	percent			
Metro				
Core	54.2	107	3	4
Fringe	2.6	93	-3	-4
Medium	22.9	99	0	-1
Small	6.8	88	-4	-7
Nonmetro				
Urbanized adjacent	3.5	87	-6	-8
Urbanized nonadjacent	1.7	80	-8	-13
Less Urbanized adjacent	4.3	82	-8	-10
Less Urbanized nonadjacent	3.1	76	-11	-13
Rural adjacent	0.4	73	-12	-15
Rural nonadjacent	0.5	67	-14	-18
Metro				
New England	6.3	109	1	8
Mid-Atlantic	15.3	108	1	7
East North Central	19.0	104	3	1
West North Central	5.6	99	2	-3
South Atlantic	11.4	98	0	-2
East South Central	3.3	90	-3	-7
West South Central	6.8	97	2	-4
Mountain	3.2	94	0	-6
Pacific	15.4	108	2	6
Nonmetro				
New England	0.7	87	-6	-8
Mid-Atlantic	1.0	85	-5	-10
East North Central	3.1	89	-6	-5
West North Central	1.8	76	-10	-14
South Atlantic	2.7	79	-10	-12
East South Central	2.0	76	-11	-13
West South Central	1.1	77	-8	-15
Mountain	0.6	76	-7	-17
Pacific	0.6	84	-11	-5

Note: Table shows regional average productivity/wage relative to national average. Index = 100 + Industry Mix Component + Within-Industry Component

Source: Analysis of unpublished 1992 Census of Manufacturing data.