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THE COMPETITIVENESS OF RURAL COUNTY MANUFACTURING DURING A PERIOD OF DOLLAR APPRECIATION

*Dan M. Bechter and Christine Chmura**

Some observers contend that manufacturing activity in rural areas has been affected more adversely than in urban areas by foreign competition. For example, in 1988 Steven A. Waldhorn [7] testified that

> A. . .growing rural-urban split seems to be taking place. The source of this divergence is twofold. First, rural areas tend to be at a competitive disadvantage because of their industry mix and structure. They also tend to be dependent on just a few industries; these industries also happen to be the ones most affected by increasing foreign competition. Lower-cost foreign locations are attracting some basic U.S.manufacturing operations. . .at the expense of rural economies.

Others have made specific reference to the concentrations of such manufacturing in the Southeast:

> Rural manufacturing has been especially subject to foreign competition in recent years. . .For example, the textile industry in. . .the rural Southeast has seen a rise in textile imports from Pacific Basin countries that has replaced a significant share of domestic production. (Henry, Drabenstott, and Gibson [5])

Moreover, the press has supported the notion that rural areas have been especially hard hit by overseas competition:

> The story that unfolded last week in this rural Virginia community of 10,000 was depressingly familiar: An aging textile mill, hit hard by foreign competition and environmental problems, closed its doors, throwing hundreds out of work and plunging the town into turmoil. (Gladness [4])

The economies of some rural areas have been devastated by closing of key manufacturing plants. Even if plant closings were distributed randomly among rural and urban areas, however, some rural areas (as well as some urban areas) would suffer greatly because of

*Drs. Dan M. Bechter and Christine Chmura are vice president and associate economist, respectively, Federal Reserve Bank of Richmond.

their company town character. But commentators on hardships in rural manufacturing seem to be saying that reductions in manufacturing activity have been more common in rural than urban areas, either because of the types of manufacturers found in rural areas or because of changes in the relative attractiveness of rural and urban areas to manufacturers.

Little empirical support is found in the literature for the claim that rural areas on average suffered disproportionately from foreign competition. But two studies indicate that manufacturing employment in nonmetropolitan areas fared as well or better than in metropolitan areas. In their study of the Tennessee Valley that covered the period from 1979 to 1985, Robert W. Gilmer and Allan G. Pulsipher [3] conclude:

> The data show a strong recovery in manufacturing by all of the Valley compared to the United States and, surprisingly, a stronger performance by the region's nonmetro areas than metro areas.

Similarly, in their paper that covered the period 1980 to 1985, William H. Branson and James P. Love [1] conclude that in five southern states:

> Changes in manufacturing employment attributable to increases in the foreign exchange value of the dollar were not significantly different between metropolitan and nonmetropolitan areas. . .

Nonmetropolitan areas are not necessarily rural, however, so these findings leave open the question of whether manufacturing in rural areas was harder hit than in urban areas by foreign competition. Using data for all 50 states, Branson and Love [1] find some evidence that rural areas may have been hurt more: ". . .the more rural the state, the more sensitive manufacturing employment in the state is to foreign trade."

Findings are reported on whether manufacturing employment in rural counties generally and in southeastern rural counties in particular was affected more adversely than manufacturing employment in urban counties by foreign competition. The approach is indirect: analysis covers the period 1980 to 1985, during which time foreign competition intensified at least partly because of the rising foreign exchange value of the dollar. Other factors also affected manufacturing activity over this period.

The principal findings are that in the Southeast as well as in the rest of the country, the greatest percentage losses in manufacturing employment over this period did not occur in the most rural counties, but in counties central to large metropolitan areas. In the Southeast,

manufacturing in counties with urban populations of less than 20,000--which can be considered rural--also suffered relatively high average percentage losses in employment, while the hardest hit elsewhere in the United States tended to be counties with urban populations between 20,000 and 50,000. In the Southeast, suburban counties along the Baltimore-Washington-Richmond-Norfolk corridor posted especially rapid growth from 1980 to 1985. In the Southeast as well as the U.S., the rural vs. urban differences in industrial mix likely did not contribute much on average to differences in their manufacturing employment experiences. Simulated responses of manufacturing employment to dollar appreciation from 1980 to 1985 did not differ appreciably from rural to urban counties, which indicates that there was no reason to expect that the rising dollar during that period should have caused manufacturing employment to decline more in rural than in urban areas.

County Data

Manufacturing employment data, in total and by industry for each U.S. county as compiled by the U.S. Department of Commerce for the years 1980, 1982, and 1985 are used. To define the rural or urban character of counties, a classification system created by the Economic Research Service of the U.S. Department of Agriculture was employed. This system classifies counties into ten categories or Beale codes based on population density and proximity to metropolitan areas. Table 1 gives the definitions of these Beale codes and their shares of all U.S. counties and U.S. manufacturing employment. The higher the integer value of the Beale code (also called the rural-urban continuum code), the more rural the county. Following the precedent of a General Accounting Office study, Beale code counties 6, 7, 8, and 9 are defined as rural areas (see footnote to Table 1).

As with most data on the private sector, these county data on employment are not available to the public when fewer than three firms are represented at any level of aggregation (in order to protect the confidentiality of information on individual businesses). For individual manufacturing industries, such as textiles and electrical machinery, incomplete reports for counties are a problem. Omitted data are common for all classes of counties, but especially for the completely rural counties that, as Table 1 shows, do not account for a large share of manufacturing employment. This question of nondisclosure bias is addressed in Appendix A. Fortunately, total manufacturing employment is reported for all but a few counties.

Methods and Findings

This section summarizes the empirical inquiry. The first step was to see if rough calculations with the data supported *a priori* assertions that rural counties generally and southeastern rural counties in particular suffered greater losses in manufacturing employment than did urban counties during the first half of the 1980s. Finding some evidence in support of this contention, an attempt was made through successive refinements to try to isolate the effects of industry mix and the exchange rate on manufacturing employment by type of county.

Percent Changes in Total Manufacturing Employment by County Type

Initially the percentage changes in total manufacturing employment by Beale code were calculated over the period 1980 to 1985. This period was divided into two subperiods, 1980 to 1982 and 1982 to 1985, to account for reversals in direction in oil prices and the business cycle.

Table 2a shows that contrary to the hypothesis of greater losses in rural manufacturing employment, the two completely rural county classes (Beale codes 8 and 9) experienced increased manufacturing employment for 1980 to 1985. Also, total manufacturing employment declined only slightly over this period in rural counties with urban populations of less than 20,000 (Beale codes 6 and 7). The county classes that experienced the largest losses in manufacturing jobs were those central to large metropolitan areas (Beale code 0) and those with urban populations between 20,000 and 50,000 that were not adjacent to metropolitan areas (Beale code 5).[1]

Changes in manufacturing employment over the two subperiods provide an expected contrast. During the 1980 to 1982 subperiod when energy prices rose and the economy suffered two recessions, manufacturing employment declined in all county classes. During the 1982 to 1985 subperiod when energy prices fell and the economy expanded, however, manufacturing employment rose in all county classes except one, despite continued dollar appreciation.

To summarize, data on total manufacturing employment by type of county do not support the hypothesis that more manufacturing jobs were lost in rural counties than in urban counties during the 1980 to 1985 period of rapid dollar appreciation. The four most rural county classes did sustain slightly greater losses in jobs during the 1980 to

[1] The results of tests for significance in the differences in the numbers in Tables 2a through 6b in this article are included in a working paper available from the authors.

1982 subperiod. But this loss evidently was due to the greater sensitivity of rural county manufacturing to the business cycle or to oil prices, as is evidenced in the more rapid rates of job growth in these counties during the 1982 to 1985 subperiod. The two classes of counties that appear from Table 2a to have been at a relative disadvantage from 1980 to 1985 were the counties represented by Beale codes 0 and 5.[2]

The manufacturing employment experience of counties in a group of southeastern states[3] was compared with counties in all other states. The figures in Table 2b confirm that even in the Southeast where manufacturing in rural areas is relatively more common than in the rest of the country, the greatest concentration of manufacturing jobs is in metropolitan areas (Beale codes 0-3).

The changes in total employment from 1980 to 1985 reveal some particularly strong differences among southeastern counties. In the Southeast even more than in the rest of the country, the counties central to large metropolitan areas experienced the greatest percentage losses in jobs.[4] Counties in the class represented by Beale code 5 had the next to the greatest losses, and the percentage loss was greater in the Southeast. The greatest gain, however, was registered by the fringe counties within the large southeastern metropolitan areas. These fringe counties are all located within the Baltimore-Norfolk corridor or crescent that has grown rapidly in the last decade. As is clear from

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[2]These figures do not negate the argument that in particular industries, the more rural counties may have sustained greater relative losses in employment than did the more urban counties. If this argument is true, however, the figures on total manufacturing employment indicate that the rural counties gained relatively more employment in other industries than did the urban counties (changes in manufacturing employment due to the entry and exit of industries are included in these calculations).

[3]The southeastern states used in this study are those in the Fifth Federal Reserve District: Maryland, North Carolina, South Carolina, Virginia, West Virginia, and the District of Columbia.

[4]Considered central to the three large metropolitan areas (Beale code 0) in the Fifth District are: Baltimore (city); Norfolk, Chesapeake, and Portsmouth; and the District of Columbia. The large 1980 to 1985 decline in manufacturing employment in this combined group of five jurisdictions was primarily due to the loss of 15,000 manufacturing jobs in Baltimore--a decline of 23 percent from 70,000 manufacturing workers in 1980 (Norfolk and Washington experienced smaller percentage losses from much smaller numbers of manufacturing workers). An analysis of changes in industry mix showed that the Baltimore industries that retrenched the most over this period were some of the heavy industries found to be among those industries most adversely affected by the high foreign exchange value of the dollar (see Appendix B).

Table 2b, these Southeastern crescent counties are not representative of the average county in this category in the rest of the country.

A comparison of the numbers in Table 2b lends some support to the argument that manufacturing employment in rural southeastern counties suffered greater declines than in other rural U.S. counties during this period. Individually, only one of four rural county classes (Beale codes 6-9) in the Southeast outperformed its counterpart in the rest of the country. As a group, the southeastern rural counties lost 4.4 percent of their manufacturing jobs from 1980 to 1985. This percentage loss was larger than the 0.4 percent loss experienced by rural counties in the rest of the country and larger also than the 2.9 percent lost by southeastern urban counties. It was smaller, however, than the 6.2 percent loss of manufacturing jobs in urban areas in the rest of the country.

Data for the two subperiods (Table 2b) indicate that southeastern rural manufacturers were somewhat less sensitive than their counterparts in the rest of the country to swings in the business cycle. The percentage declines in manufacturing employment in rural counties during the 1980 to 1982 recession period were similar in the Southeast to those in the rest of the country. In the 1982 to 1985 expansion period, however, three of four county classes in the Southeast posted smaller percentage increases than their counterparts elsewhere in the country. It does not appear, however, that manufacturing employment in southeastern rural counties was held back disproportionately by the rising dollar during the second subperiod. Total manufacturing employment in rural southeastern counties rose faster than the national average from 1982 to 1985.

Distributions of Percentage Changes in Manufacturing Employment by County Type

Totals can hide a great deal of internal variation. Thus, although total manufacturing employment in rural counties fared as well or better than in metropolitan counties during the first half of the 1980s, the average rural county may have suffered greater relative losses. To check this possibility, measures of central tendency and dispersion were calculated for the distributions of percentage changes in manufacturing employment by class of county for 1980 to 1982, 1982 to 1985, and 1980 to 1985.

Table 3a reports the mean, median, and standard deviation of percentage changes in manufacturing employment by Beale code. The average changes are similar to the changes in the totals reported in Table 2a. From 1980 to 1985 for example, county classes represented by Beale codes 0 and 5 had the greatest mean and median losses in

manufacturing employment, just as was the case for total employment. But there are some differences.

The mean and median percentage changes (Table 3a) differ from the changes in the totals (Table 2a) in ways that paint a somewhat rosier picture for the counties in metropolitan areas when compared with those outside. For example, although total manufacturing employment in the fringe counties of large metropolitan areas did not change from 1980 to 1985, the mean and median percentage increases for these counties were 4.5 percent and 4.0 percent, respectively. In contrast, for rural county class 9, the gain of 2.7 percent in total manufacturing employment compares to an average loss of about -1.8 percent; similar differences in the same direction characterize rural county classes 6 and 7. Even with this somewhat different picture, however, Table 3a does not provide support for the hypothesis that the more rural counties experienced greater dislocations in manufacturing from 1980 to 1985.

A look at Figures 1 and 2 is instructive. These frequency distributions indicate that the completely rural counties were more likely to experience large changes. This greater frequency in the tails of the distribution was expected even before calculating the standard deviations reported in Table 3a, where the 48.1 percentage point figure for Beale code 9 contrasts sharply with the significantly smaller ones for the other Beale codes. Moreover, the second and third most rural county classes (Beale codes 7 and 8) and counties central to large metropolitan areas also had wider distributions in their percentage changes in manufacturing employment. The larger incidence of big decreases in employment in rural counties may explain (but not necessarily justify, because there were some big increases) why some observers have claimed that rural counties experienced greater relative losses in manufacturing employment over this period.

To assure an adequate sample size of southeastern counties in each rural or metropolitan class, county classes were combined to calculate mean percentage changes in manufacturing employment. Beale code pair 0 and 1 thus represents all counties in large (over 1 million population) metropolitan areas; 2 and 3, other metropolitan areas; 4 and 5, nonmetropolitan counties with larger urban (over 20,000) populations; 6 and 7, rural counties with smaller (under 20,000) populations; and 8 and 9, the completely rural counties.

The results shown in Table 3b are similar to those in Table 2b, as they provide some support for the view that rural southeastern counties suffered greater losses in manufacturing employment than metropolitan southeastern counties. From 1980 to 1985, the median change drops from a strong +11.3 percent in large southeastern metropolitan area counties to -3.7 percent in the smaller metropolitan counties, and further to -4.4 percent and -8.5 percent, respectively, in the

southeastern nonmetropolitan counties with larger and smaller urban populations. This association of poorer performance with the more rural southeastern counties fails at the rural extreme, however. The median loss in the completely rural southeastern counties was only 1.4 percent. It fails also in the rest of the country, where from 1980 to 1985 the greatest median loss (-7.5 percent) in manufacturing employment was sustained by the county classes (4 and 5) right in the middle of the rural/urban continuum.

Effects of Industry Mix

Up to this point, actual percentage changes in manufacturing employment by Beale code have been reported. The findings provide weak support to the view that rural manufacturing sustained greater losses in employment than urban manufacturing in the Southeast and virtually no support for the same contention regarding the rest of the nation. Some observers, however, claim that rural counties experienced greater losses because rural counties have the kinds of manufacturing industries that are particularly sensitive to foreign competition. For example,

> Rural areas have relied on manufacturing to a greater degree than metropolitan areas. The typical manufacturing-dominant rural community has tended to be dependent on the traditional, mass production segments of industry that pay less, require fewer skills, and have fared poorly against foreign competition. (Pizzano [6])

In order to check how the differences in the mix of manufacturing industries may have affected changes in employment, it is assumed that each county's employment in each two digit manufacturing industry changed by the same percentage as that industry's employment changed in the nation as a whole. In those cases where part or all of a county's manufacturing employment was not disclosed at the two digit Standard Industrial Classification (SIC) level, it is assumed that the undistributed employment changed by the same percentage as total manufacturing employment in the nation.[5] After calculating an expected employment change for each county, the resultant distributions of hypothetical percentage changes in manufacturing employment for each county class then were calculated by Beale code.

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[5]This assumption biases the results--especially for the rural counties--toward the national average percentage change in manufacturing employment.

The means of these distributions are compared with actual changes in Table 4a.

The hypothetical changes provide a rough measure of whether the relative performances by Beale code were influenced by industry mix.[6] Over the period 1980 to 1985, for example, Table 4a shows that based on their mix of industries, the more rural counties in Beale codes 6 through 9 may have been expected to show smaller average losses in manufacturing employment than counties in other Beale classes. Counties in Beale code classes 2, 3, and 4 may have been expected to show larger losses because of their industry mixes. On the basis of these results, one would conclude that in the nation as a whole, the kinds of manufacturing industries located in rural areas on average did not put their home counties at a relative disadvantage to foreign competition.

The Table 4a hypothetical changes for the periods 1980 to 1982 and 1982 to 1985 suggest, as did the actual changes reported earlier in this paper, that rural manufacturing was more sensitive than urban manufacturing to the business cycle and to the swing in energy prices and less sensitive to the foreign exchange value of the dollar, which appreciated throughout the period. Over the 1980 to 1982 subperiod, the hypothetical mean percentage changes in manufacturing employment by county class indicate that the two completely rural county classes were somewhat disadvantaged by their industry mixes as compared to the most metropolitan of the county classes. During the 1982 to 1985 subperiod, however, the industry mixes of the five more rural counties--at least hypothetically--were relatively advantageous compared to those of the more metropolitan counties.

The difference between the actual and hypothetical percentage change provides a rough estimate of the influence of factors other than industry mix on changes in manufacturing employment by Beale code. These differences, shown also in Table 4a, include some relatively large values. For example, based on their industry mix, the fringe counties within large metropolitan areas (Beale code 1) might have been expected to suffer an average loss in manufacturing employment of 4.9 percent from 1980 to 1985. They posted an average gain of 4.5 percent, a difference of 9.4 percent. One can infer that this large difference probably was due to factors other than the types of industries located in these counties. Similarly, the large positive

[6]The measure must be considered rough because each two digit SIC code manufacturing industry includes a wide variation of specialized types of manufacturing. For example, textile mills making carpets and textile mills making cloth are likely to experience different effects from the business cycle, oil price shocks, and dollar appreciation.

difference for Beale code 8 counties and the large negative differences for Beale code 0 and 5 counties indicate that the actual performances of these county classes are well outside what would be expected based on industry mix alone.

In the Southeast, the hypothetical means in Table 4b show that for 1980 to 1985, counties within large metropolitan areas (Beale codes 0 and 1) had industrial mixes that were, on average, least likely to suffer from the dollar, oil, and cyclical shocks of 1980 to 1985. In second-best position, as far as industrial mix was concerned, were the completely rural counties (Beale codes 8 and 9). The distribution of industries among the other three county classes results in little difference in the mean losses in manufacturing employment expected for them. Even in the Southeast, therefore, it would not appear that the type of industries found in rural areas were those that suffered, on average, greater losses in manufacturing employment from 1980 to 1985.

The positive numbers in the difference column in Table 4b show that from 1980 to 1985 the large metropolitan and the completely rural counties in the Southeast did substantially better than expected on the basis of their industry mixes. The standout performance of the large southeastern metropolitan counties is especially noteworthy. The largest negative number in the difference column is associated with rural counties with small urban populations (Beale codes 6 and 7). These counties suffered the greatest mean percentage losses in manufacturing employment (-11.1 percent); about half of this percentage loss in employment appears attributable to industry mix.

Also of interest are comparisons of the industry-adjusted relative performances of southeastern counties to counties in the rest of the country. For 1980 to 1985, one can infer from the hypothetical mean percentage changes of Table 4b that the only southeastern counties with a more favorable industry mix than their counterparts in the rest of the country were the large metropolitan area counties. Yet the southeastern counties outperformed counties in the rest of the country in three of the five county-class pairs, including the pair composed of the completely rural counties. The decidedly poorer performance of small urban counties in the Southeast as compared to their counterparts in the rest of the country was apparently partly, but not mostly, a consequence of difference in industry mix.

Dollar-Induced Changes in Manufacturing Employment by Type of County

There is no clear evidence in support of the view that rural county manufacturing employment suffered more than that in metropolitan counties from the rise in the foreign exchange value of the dollar from

1980 to 1985. This paper elected to see if this could be expected to be the case. Everything was held constant except industry mix, and changes were simulated in each county's manufacturing employment, given the county's industry mix, the dollar appreciation that occurred, and industry-specific measures of exchange rate elasticities. Two sets of projections were made: one based on employment elasticities calculated from a single real exchange rate (National Bureau of Economic Research, Inc. [3]) and the other based on production elasticities calculated from industry-specific real exchange rates (Cox and Hill [2]).

The results of the set of projections based on a single real exchange rate index are shown in Table 5a. These estimates indicate that an in-period simulation, in which everything is held constant except the dollar, yields simulated percentage losses in manufacturing employment that are smaller for the five most rural counties than for the five least rural counties. In other words, if in every county every industry is assumed to respond to dollar appreciation according to the employment elasticity estimated for that industry nationally, then the industry mixes of rural counties were, during the period under review, on average slightly more insulated than metropolitan counties from changes in the real exchange rate.[7]

Among counties in the five southeastern states, those in large metropolitan areas (Table 5b) produced the smallest mean simulated losses in manufacturing employment from 1980 to 1982, 1982 to 1985, and 1980 to 1985. The completely rural counties were a close second; the differences among Beale code pairs in the Southeast were small. The types of manufacturers and their sensitivities to a real exchange rate index produced mean simulated losses for counties in the Southeast that were smaller than in the rest of the country. In the case of counties in large metropolitan areas (Beale code pair 0 and 1), the simulated loss in the Southeast from 1980 to 1985 (-5.4 percent) is over two percentage points lower than in the rest of the country (-7.8 percent). This result suggests that the stronger actual performance of these southeastern counties, reported in Table 3b, may have been due at least partly to their industry mix.

The results of the projections based on Cox and Hill findings are shown in Table 6a. These simulations use both industry-specific real

[7]The simulation included counties with 80 percent or more of their manufacturing employment assigned to specific industries (i.e., the simulation excluded counties with over 20 percent of their manufacturing employment undisclosed to protect confidentiality). The noninclusion of some counties undoubtedly has introduced some bias into the results, but for reasons given in Appendix A, the bias is not of any consequence.

exchange rates as well as industry-specific elasticities.[8] As in the previous simulation, these estimates indicate that an in-period simulation holding everything constant except dollar appreciation yields mean percentage losses in manufacturing employment that are slightly smaller for rural than for metropolitan area counties.

When counties are combined in Beale code pairs and separated to compare those in five southeastern states with those in the rest of the country, the simulations produced small differences in expected response to dollar appreciation. In contrast to the previous simulation reported in Table 5b, this simulation, reported in Table 6b, generated much smaller differences in projected sensitivities to exchange rate movements. In particular, in this simulation the counties in the large southeastern metropolitan areas do not have as much an advantage in industry mix over their counterparts in the rest of the country. As in the previous simulation, the projected performances of manufacturing employment in rural counties is not notably different from that in metropolitan counties.

Summary

Some observers argue that employment in rural areas was affected more adversely than employment in urban areas by the rapid appreciation of the foreign exchange value of the dollar between 1980 and 1985. Changes in total manufacturing employment, however, provide no evidence that rural areas in the whole nation suffered greater employment losses than urban areas during this period. In the Southeast, however, rural counties lost more employment than urban counties during this period.

Observers also claim that some rural counties were affected more adversely by the 1980 to 1985 increase in the dollar because labor intensive industries are more common in rural areas, and those industries are more susceptible to foreign competition. To the contrary, however, this paper finds that when industry experience is used to project employment growth, the rural areas performed better on average than the urban areas. Finally, simulations based on alternative estimates of real exchange rates and industry-specific exchange rate elasticities did not support the view that the more rural counties, because of the exchange rate effect on their types of industries, should have suffered greater losses in manufacturing employment when the dollar was rising from 1980 to 1985.

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[8]The Cox-Hill elasticities are output elasticities, so a constant ratio of output to labor implicitly is assumed.

This study provides a preliminary analysis of the relationship between the rural character of a county and the effect of a rapid dollar appreciation on the employment in that county. Additional studies are necessary to provide more conclusive evidence on the effect of exchange rate changes on rural vs. urban counties. An area of further study to pursue is whether the differences in employment changes between rural areas in the Southeast and the rest of the country are caused by differences in the mix of manufacturing industries.

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Table 1
Rural-Urban Continuum (Beale Code) County Classification System

Beale Code, Population, and County Metropolitan Area (MA) Location	Percent of Counties	Percent of Manufacturing Employment
0 Central to MAs of over 1 million	2.0	30.0
1 Fringe of MAs of over 1 million	6.3	15.7
2 In MAs of 250,000 to 1 million	10.4	24.1
3 In MAs of less than 250,000	7.1	8.7
4 Urban 20,000 or more, adjacent to MA	5.1	5.1
5 Urban 20,000 or more, not adjacent to MA	5.1	2.9
6 Urban less than 20,000, adjacent to MA*	18.7	5.9
7 Urban less than 20,000, not adjacent to MA*	25.4	6.0
8 Completely rural, adjacent to a MA*	6.5	0.6
9 Completely rural, not adjacent to a MA*	13.5	1.0

Addenda: Total number of U.S. counties represented in 1985 = 2,691.
Total manufacturing employment represented in 1985 = 19,174,317

Notes: Metropolitan status was determined by the U.S. Office of Management and Budget, June 1983, based on the results of the 1980 census. Metropolitan areas must have at least 50,000 population, a criterion that further defines Beale codes 3, 4, and 5. A completely rural (Beale codes 8 and 9) county has no town in it with over 5,000 population. A county adjacent to a metropolitan area must have an adjacent physical boundary and at least 2 percent of its employed labor force must commute to metropolitan central counties

*Counties in these four classes are considered rural by the U.S. General Accounting Office in their study *Rural Development: Federal Programs That Focus on Rural America and its Economic Development* (January 1989)

Table 2a
Percentage Change in Total Manufacturing Employment by Urban/Rural Character (Beale Code) of Counties

Beale Code	1980 to 1982	1982 to 1985	1980 to 1985
0	-8.0	-1.3	-9.2
1	-6.1	6.4	-0.0
2	-7.2	2.2	-5.2
3	-7.6	2.1	-5.7
4	-7.8	2.5	-5.5
5	-9.6	1.8	-8.0
6	-7.9	6.5	-1.9
7	-7.7	6.9	-1.3
8	-7.8	9.5	1.0
9	-6.9	10.3	2.7
United States	-7.5	2.4	-5.3

Table 2b
Percentage Change in Total Manufacturing Employment in Counties
in Southeast States and Other States by Beale Code

Beale Code	Percent of Manufacturing Jobs in 1985		Percent Change in Manufacturing Employment					
			1980-1982		1982-1985		1980-1985	
	Southeast (1)	Other States (2)	Southeast (3)	Other States (4)	Southeast (5)	Other States (6)	Southeast (7)	Other States (8)
0	4.6	32.8	-12.9	-7.9	-4.2	-1.3	-16.5	-9.1
1	10.5	16.3	-1.0	-6.4	12.1	6.0	11.0	-0.8
2	32.3	23.2	-4.7	-7.6	2.5	2.2	-2.3	-5.6
3	14.3	8.1	-8.0	-7.5	1.6	2.2	-6.5	-5.5
4	7.5	4.9	-6.3	-8.0	5.2	2.1	-1.4	-6.1
5	5.0	2.7	-8.2	-10.0	-1.5	2.6	-9.5	-7.7
6	13.7	5.0	-8.6	-7.6	3.2	7.6	-5.7	-0.6
7	8.5	5.7	-7.1	-7.8	3.8	7.4	-3.5	-0.9
8	1.2	0.6	-7.2	-7.9	10.1	9.3	2.1	0.7
9	2.4	0.8	-7.4	-6.7	4.9	12.2	-2.8	4.7
All	100.0	100.0	-6.4	-7.6	3.3	2.3	-3.3	-5.5

Table 3a
Means, Medians, and Standard Deviations in Percentage Change in Manufacturing Employment Among Counties

Beale Code	Mean	Median	Standard Deviation
		1980 to 1982	
0	-8.0	-8.2	8.0
1	-3.9	-5.3	18.9
2	-7.4	-5.9	12.6
3	-6.2	-6.4	11.9
4	-7.3	-8.8	16.5
5	-10.1	-10.4	11.7
6	-9.1	-8.6	17.2
7	-8.4	-7.8	23.4
8	-6.1	-6.9	29.6
9	-9.0	-8.2	30.0
		1982 to 1985	
0	0.2	-0.2	12.0
1	8.4	7.9	22.1
2	3.4	3.7	17.2
3	0.9	3.3	18.5
4	1.4	1.9	17.3
5	1.5	1.0	18.5
6	5.2	5.7	25.3
7	2.6	4.2	27.5
8	8.4	7.3	34.9
9	7.2	7.5	42.6
		1980 to 1985	
0	-7.7	-9.7	18.0
1	4.5	4.0	31.1
2	-4.0	-3.3	22.8
3	-5.3	-3.9	24.4
4	-6.0	-6.6	23.6
5	-8.6	-7.5	18.8
6	-3.9	-4.2	29.1
7	-5.8	-2.9	35.3
8	2.3	0.0	39.1
9	-1.8	-1.6	48.1

Table 3b
Median Percentage Changes in Manufacturing Employment Among Southeastern and Other Counties Classified by Beale Code Pairs

Beale Code	Southeast	Other States
	1980 to 1982	
0+1	-4.9	-6.1
2+3	-5.6	-6.1
4+5	-6.4	-9.9
6+7	-8.9	-8.1
8+9	-7.1	-7.7
	1982 to 1985	
0+1	5.6	6.0
2+3	2.7	3.7
4+5	2.6	1.0
6+7	2.7	5.1
8+9	8.2	7.4
	1980 to 1985	
0+1	11.3	-1.3
2+3	-3.7	-3.6
4+5	-4.4	-7.5
6+7	-8.5	-2.9
8+9	-1.4	-0.7

Table 4a

Actual and Hypothetical* Mean Percentage Changes in Manufacturing Employment Among Counties Classified by Beale Code

Beale Code	Actual	Hypothetical	Difference
		1980 to 1982	
0	-7.9	-7.8	-0.2
1	-3.9	-8.5	4.6
2	-7.4	-8.7	1.3
3	-6.2	-8.5	2.3
4	-7.3	-7.6	0.3
5	-10.1	-8.5	-1.6
6	-9.1	-8.7	-0.4
7	-8.4	-8.6	0.2
8	-6.1	-9.4	3.3
9	-9.0	-9.1	0.1
		1982 to 1985	
0	0.2	3.3	-3.1
1	8.4	3.7	4.7
2	3.4	2.9	0.5
3	0.9	3.2	-2.3
4	1.4	2.5	-1.1
5	1.5	3.9	-2.4
6	5.2	4.3	0.9
7	2.6	4.8	-2.2
8	8.4	6.2	2.2
9	7.2	6.1	1.1
		1980 to 1985	
0	-7.7	-4.7	-3.0
1	4.5	-4.9	9.4
2	-4.0	-5.8	1.8
3	-5.3	-5.3	0.0
4	-6.0	-6.3	0.3
5	-8.6	-4.7	-3.9
6	-3.9	-4.3	0.4
7	-5.8	-3.8	-2.0
8	2.3	-3.2	5.5
9	-1.8	-2.9	1.1

*Hypothetical percentage changes were generated by assuming that a particular industry's manufacturing employment changed in each county by the same percentage as it did in the nation as a whole

Table 4b
Actual and Hypothetical* Mean Percentage Changes in Manufacturing Employment Among Counties Classified by Beale Code Pairs

Beale Code	Actual	Hypothetical	Difference
		Southeastern Counties	
		1980 to 1982	
0+1	-2.6	-7.2	4.6
2+3	-7.3	-9.6	2.3
4+5	-6.8	-8.9	2.1
6+7	-10.5	-9.4	-1.1
8+9	-7.5	-9.1	1.6
		1982 to 1985	
0+1	13.0	6.5	7.5
2+3	-1.1	3.2	-4.3
4+5	0.7	2.5	-1.8
6+7	-0.7	3.3	-4.0
8+9	9.5	5.8	3.7
		1980 to 1985	
0+1	10.4	-2.1	12.1
2+3	-8.3	-6.4	-1.9
4+5	-6.1	-6.5	0.4
6+7	-11.1	-6.1	-5.0
8+9	2.1	-3.3	5.4
		Other Counties	
		1980 to 1982	
0+1	-5.2	-8.5	3.3
2+3	-6.8	-8.4	1.6
4+5	-8.9	-9.3	0.4
6+7	-8.5	-8.6	0.1
8+9	-8.2	-8.3	0.1
		1982 to 1985	
0+1	5.4	3.3	2.1
2+3	3.1	3.0	0.1
4+5	1.5	3.2	-1.7
6+7	4.2	4.8	-0.6
8+9	7.3	6.3	1.0
		1980 to 1985	
0+1	0.2	-5.3	5.5
2+3	-3.8	-5.4	1.6
4+5	-7.4	-5.3	-2.1
6+7	-4.3	-4.8	0.5
8+9	-0.9	-2.9	2.0

*See footnote to Table 4a

Table 5a

Simulated* Mean Percentage Changes in County Manufacturing Employment Due to Dollar Appreciation: U.S. Counties by Beale Code, 1980 to 1985

Beale Code	1980 to 1982	1982 to 1985	1980 to 1985
0	-3.5	-3.2	-7.2
1	-3.7	-3.5	-7.6
2	-3.7	-3.5	-7.4
3	-3.3	-3.4	-7.1
4	-3.8	-3.6	-7.7
5	-3.5	-3.2	-6.6
6	-3.3	-3.2	-6.5
7	-3.3	-3.1	-6.3
8	-3.2	-3.1	-6.3
9	-3.2	-3.1	-6.2

*The real exchange rate and the elasticities used in these simulations were taken from Branson and Love. These simulations included only counties for which at least 80 percent of the manufacturing employment was disclosed (assigned to specific industries)

Table 5b
Simulated Mean Percentage Changes in Manufacturing Employment
Due to Dollar Appreciation:
Southeastern and Other Counties Classified by Beale Code Pairs
(Using Branson and Love Findings)

Beale Code	Southeast	Other States
	1980 to 1982	
0+1	-2.7	-3.8
2+3	-3.3	-3.7
4+5	-3.4	-3.6
6+7	-3.1	-3.3
8+9	-3.0	-3.3
	1982 to 1985	
0+1	-2.5	-3.6
2+3	-3.1	-3.5
4+5	-3.2	-3.4
6+7	-2.9	-3.1
8+9	-2.9	-3.1
	1980 to 1985	
0+1	-5.4	-7.8
2+3	-6.5	-7.5
4+5	-6.5	-7.2
6+7	-5.9	-6.4
8+9	-5.8	-6.3

Table 6a

Simulated Mean Percentage Changes in County Manufacturing Employment Due to Dollar Appreciation: U. S. Counties by Beale Code (Using Cox and Hill Findings)

Beale Code	1980 to 1982	1982 to 1985	1980 to 1985
0	-2.9	-2.6	-5.4
1	-2.7	-2.4	-5.1
2	-2.7	-2.5	-5.2
3	-2.6	-2.3	-4.8
4	-2.5	-2.3	-4.7
5	-2.3	-2.3	-4.5
6	-2.5	-2.5	-4.9
7	-2.4	-2.4	-4.7
8	-2.4	-2.6	-4.9
9	-2.5	-2.6	-5.0

Table 6b
Simulated Mean Percentage Changes in Manufacturing Employment
Due to Dollar Appreciation:
Southeastern and Other Counties Classified by Beale Code Pairs
(Using Cox and Hill Findings)

Beale Code	Southeast	Other States
	1980 to 1982	
0+1	-2.5	-2.8
2+3	-2.5	-2.7
4+5	-2.5	-2.4
6+7	-2.4	-2.4
8+9	-2.4	-2.5
	1982 to 1985	
0+1	-2.2	-2.5
2+3	-2.5	-2.5
4+5	-2.5	-2.3
6+7	-2.5	-2.4
8+9	-2.6	-2.6
	1980 to 1985	
0+1	-4.6	-5.2
2+3	-4.9	-5.1
4+5	-4.9	-4.6
6+7	-4.8	-4.8
8+9	-4.9	-5.0

Appendix A

Two sources of bias are introduced when data are not available. The first source is the bias associated with excluding observations from the sample when data on these observations are not known. The second source is associated with using proxies for unavailable data for observations included in the sample.

Both sources of bias are present in the calculations. In the current sample, any county that did not disclose employing industries for at least 80 percent of its manufacturing employment was excluded. For counties included in the sample, it was assumed the undisclosed percent of manufacturing employment behaved in accordance with the national average for manufacturing.

As one would expect, the 80 percent disclosure rule results in omitting more rural than metropolitan counties from the simulations. It could be argued, therefore, that the omitted rural counties, because of their lack of diversity, were the ones that suffered the most economic shock during the 1980 to 1985 period. If this is so, the mean percentage losses in manufacturing employment reported here for rural counties understate the true means. But there is reason to believe that it is not so: one also must take into account the kinds of industries in the omitted counties. If, as is commonly believed, the industries more common to rural areas are generally the lighter industries that weathered the shocks of the early 1980s well, omitting these counties from the simulations does not bias the findings unduly.

The second source of bias arises from assuming that the undisclosed portion of an included county's manufacturing employment behaves as the national average for manufacturing. This bias pushes the mean simulated change in manufacturing employment toward the national average. As in the case of bias due to omitted counties, this bias probably works to underestimate the simulated percentage losses in employment in metropolitan area counties and to overstate them in rural counties.

An indication of the direction of bias due to excluding counties can be gleaned from economic statistics disclosed by both included and excluded counties. For example, if excluded counties experienced larger changes in manufacturing employment, these changes should appear in larger changes in total employment, personal income, etc. Table A1 provides comparisons of mean percentage changes in per capita personal income. None of the differences between included and excluded nonmetropolitan counties are large enough to justify worry about bias in county classes 4 through 9. Although the differences are fairly large for metropolitan area counties, the implied amount of bias is

small because so few of these counties were excluded from the calculations.

Table A1

Percentage Change in Per Capita Personal Income, 1981 to 1984
Counties Included in Sample vs. Counties Excluded from Sample
by Beale Code

Beale Code	In	Out	Difference
0	18.0	none	n.a.
1	25.6	27.5	-1.9
2	20.8	26.3	-5.5
3	18.0	21.0	-3.0
4	18.9	18.1	0.8
5	16.4	17.1	-0.7
6	21.0	20.8	0.2
7	18.6	19.0	-0.4
8	24.0	23.4	0.6
9	21.8	21.1	0.7

Appendix B

Branson and Love use a quarterly time series on four independent variables--a real exchange rate, a measure of energy prices, the unemployment rate, and a time (trend) variable--to estimate elasticities of U.S. employment by industry. This paper uses their estimates of these industry exchange rate elasticities with their real exchange rate to project percentage changes in manufacturing employment by county type. The Branson and Love real exchange rate index and their estimates of industry elasticities are summarized in Table B1.

The elasticity estimates of Branson and Love lead them to conclude:

> The exchange rate has its greatest impact on primary metal industries (SIC 33), nonelectrical machinery (35), fabricated metal industries (34), and miscellaneous manufacturing (35), with somewhat smaller, but important, effects on textiles and apparel (22, 23), petroleum and coal products (29), leather and leather goods (31), stone, clay, and glass products (32), transportation equipment (37), and instruments and related products (38).

Cox and Hill use industry-specific real exchange rates, measures of domestic and foreign trade exposure, estimates of elasticities of substitution from the Michigan model of world production and trade, and the assumption of unitary price elasticities to derive their estimates of the sensitivities of the output of U.S. industries to exchange rate movements. This paper uses their estimates of these industry exchange rate elasticities with their real exchange rates by industry to project percentage changes in manufacturing employment by county type. The Cox and Hill figures used are summarized in the tables below.

The Cox and Hill estimates show real exchange rate appreciation for individual industries over the 1980 to 1985 period ranged from a low of just over 20 percent for lumber and wood products (SIC 24) to a high of about 42 percent for tobacco manufacturers, while the absolute values of their estimates of the sensitivities (elasticities) of industries to exchange rate movements varied from a low of 0.041 for printing and publishing (27) to a high of 0.403 for miscellaneous manufacturing (39). The total effect of dollar appreciation is given by the product of the amount of appreciation and the estimated elasticity.

Cox and Hill conclude:

> The industries found to be the most sensitive to exchange rate movements are miscellaneous manufacturing (including

jewelry, toys, and sporting equipment), leather and leather products, transportation equipment, and apparel. These industries are highly exposed to trade, either through exports or imports, and their products are highly substitutable for foreign products within the same product group. Industries such as printing and publishing, food processing, textiles, and tobacco manufacturing are considered relatively insensitive to the exchange rate movements, primarily because of low trade exposure.

The table below shows some clear differences between the findings of Cox and Hill and those of Branson and Love. In particular, Branson and Love estimate that U.S. primary metals industries were the hardest hit by dollar appreciation, while Cox and Hill find primary metals industries suffered relatively less than many other manufacturing sectors. Cox and Hill, on the other hand, estimate that U.S. apparel industries were among the hardest hit and textile industries among the least hard hit, while Branson and Love find apparel industries less sensitive than textile industries to the exchange rate, and both significantly less than several other industries.

Table B1
Branson and Love Exchange Rate Statistics

Real Exchange Rate Index		
1980 = 100	1982 = 125	1985 = 155

Employment Elasticities by Industry (All Manufacturing = -0.164)

SIC	Elasticity
20	-.095
21	-.114
22	-.150
23	-.099
24	-.081
25	.044
26	-.044
27	.113
28	-.167
29	-.293
30	-.133
31	-.211
32	-.235
33	-.629
34	-.311
35	-.433
36	.032
37	-.262
38	-.208
39	-.301

Table B2
Cox and Hill Exchange Rate Statistics
Index of Real Exchange Rate
(1980 = 100)

SIC	1982	1985	Elasticity
20	116.6	138.6	-.062
21	128.0	151.7	-.079
22	120.0	142.5	-.070
23	116.1	141.4	-.328
24	108.2	122.7	-.134
25	115.2	131.3	-.167
26	110.5	123.9	-.109
27	114.5	132.0	-.041
28	120.7	143.3	-.216
29	111.3	134.5	-.101
30	116.0	132.0	-.163
31	113.3	138.9	-.365
32	118.9	135.9	-.127
33	115.5	137.9	-.144
34	114.9	129.5	-.155
35	120.1	138.2	-.190
36	117.6	129.7	-.254
37	115.4	127.3	-.357
38	121.7	138.6	-.258
39	116.6	134.8	-.403

Table B3
The Impact of the High Foreign Exchange Value of the Dollar on U.S. Manufacturing Industries, 1980 to 1985
(Industries Listed in Descending Order of Estimated Damage)

Cox and Hill	Branson and Love
Miscellaneous manufacturing	Primary metals
Leather goods	
Apparel	
	Nonelectrical machinery
Transportation equipment	Fabricated metal products
Instruments	Miscellaneous manufacturing
Chemicals	Petroleum and coal products
	Transportation equipment
Electrical equipment	Stone, clay, and glass
Nonelectrical machinery	Leather goods
	Instruments
Primary metals	Chemicals
Furniture and fixtures	Textile products
Rubber and plastics	Rubber and plastics
Fabricated metals	Tobacco products
Stone, clay, and glass	Apparel
Tobacco products	Food and kindred products
Petroleum and coal products	Lumber and wood products
Lumber and wood products	Paper products
Textile products	
Paper products	
Food and kindred products	Electrical equipment
	Furniture and fixtures
Printing and publishing	Printing and publishing

Figure 1
Distribution of Percentage Changes in Manufacturing Employment
for Beale Codes 0, 1, 2, 8, and 9
1980 to 1985

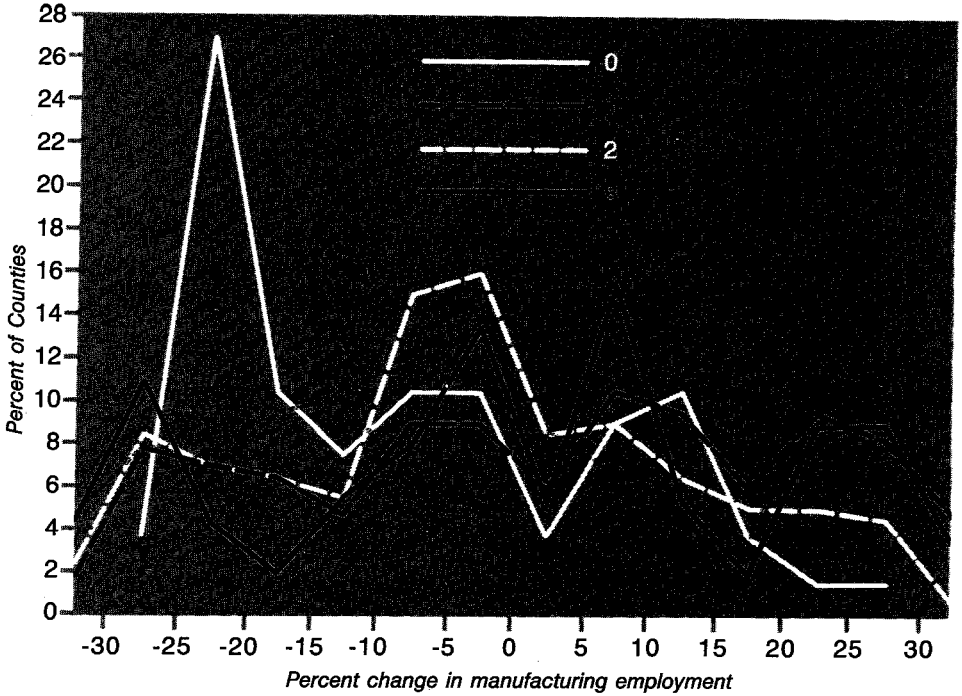

Figure 2
Distribution of Percentage Changes in Manufacturing Employment
for Beale Codes 3, 4, 5, 6, and 7
1980 to 1985