Working Paper 88-3

FIFTH DISTRICT INDEXES OF MANUFACTURING OUTPUT

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The absence of timely data on regional manufacturing output makes it difficult to determine what is happening in the manufacturing sector in a particular area. Data comparable to the monthly indexes of U.S. manufacturing output are not generally available for individual states or for specific regions of the country. Although annual surveys of manufacturers provide measures of output by state and industry, these data are published after a lag of more than a year. For example, data on state manufacturing output in 1986 are not yet available. Analysts of regional business conditions therefore need an indicator of current manufacturing output.

Here we present this Reserve Bank's new monthly indexes of manufacturing output for the Fifth Federal Reserve District, its individual states, and three of its major industries--textiles, chemicals, and electric equipment. To introduce these new indexes, we use charts that track regional manufacturing output over the period 1979-1987. Of special historical interest is the 1978-1982 period when two recessions occurred but the Bureau of the Census did not conduct its annual survey of manufacturers. Of current interest is the recent performance of the region's manufacturers.

HIGHLIGHTS

Output in the District's manufacturing sector rose 5.7 percent in 1987. North Carolina posted the largest gain, followed by South Carolina, Virginia, and Maryland, in that order. Manufacturing output in West Virginia declined in 1987. Among the District industries, output in the tobacco industry grew the fastest in 1987 (See Appendix Table A-1). Other industries posting strong increases in output in

the District in 1987 included printing and publishing, electric and electronic equipment, and transportation equipment.

During the recessions of the early 1980s, manufacturing output did not decline as much in the Fifth District as in the nation. Manufacturing in some District states, however, fared better than in others during this period. Manufacturing output in West Virginia declined sharply in both the recessions of 1980 and 1981-1982. Among the District states, output declined the least in North Carolina during the 1980 recession and actually rose in Virginia during the 1981-1982 national recession.

Because of the District's stronger performance in the early part of this decade, its manufacturing output grew by a larger percentage than the nation's over the entire 8-year period of the 1980s. However, District and U.S. manufacturing output grew by virtually equal percentages over the course of the current economic expansion from late 1982 through 1987. The District's growth was slower than the nation's during the first half of this expansion, but faster than the nation's during the second half. Within the District from early 1985 through the end of 1987, manufacturing output grew the fastest in the Carolinas.

PATTERNS OF GROWTH IN MANUFACTURING OUTPUT

We calculated regional monthly indexes of manufacturing output by using monthly data on employment and electricity consumption to interpolate between annual measures of output.[1] Employment data alone

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[1]The technical appendix gives details of the methodology used in calculating monthly indexes of regional manufacturing output.

do not provide adequate information to measure changes in manufacturing output. For example, from the end of 1982 to the end of 1987, manufacturing employment in the District rose only a few percentage points, while manufacturing output rose over 30 percent. Chart 1 compares the paths of manufacturing output and employment in the District.

Indexes of Total Manufacturing Output:
Fifth District and Fifth District States

During the past eight years, U.S. industries grew at different rates for several reasons, including their exposure to import competition, their sensitivity to the business cycle, and their pace of technological change. Thus, the pattern of growth in the combined output of all manufacturing industries in any particular geographic area was closely related to the mix, or structure, of industries in that area, to the ways that mix was changing, and to other factors favorable or unfavorable to growth in manufacturing generally.

In this section, we examine the patterns of growth in manufacturing output in the District and the District states,[2] comparing these patterns to the national one. The analysis focuses on differences in industrial structures which we believe explain much of the variations in the regional growth rates of manufacturing output. Of course, differences in growth patterns could have been due to other factors, including (1) more narrowly defined differences in industrial structure, (2) locational advantages or disadvantages associated with manufacturing activity in particular regions, (3) intraindustry

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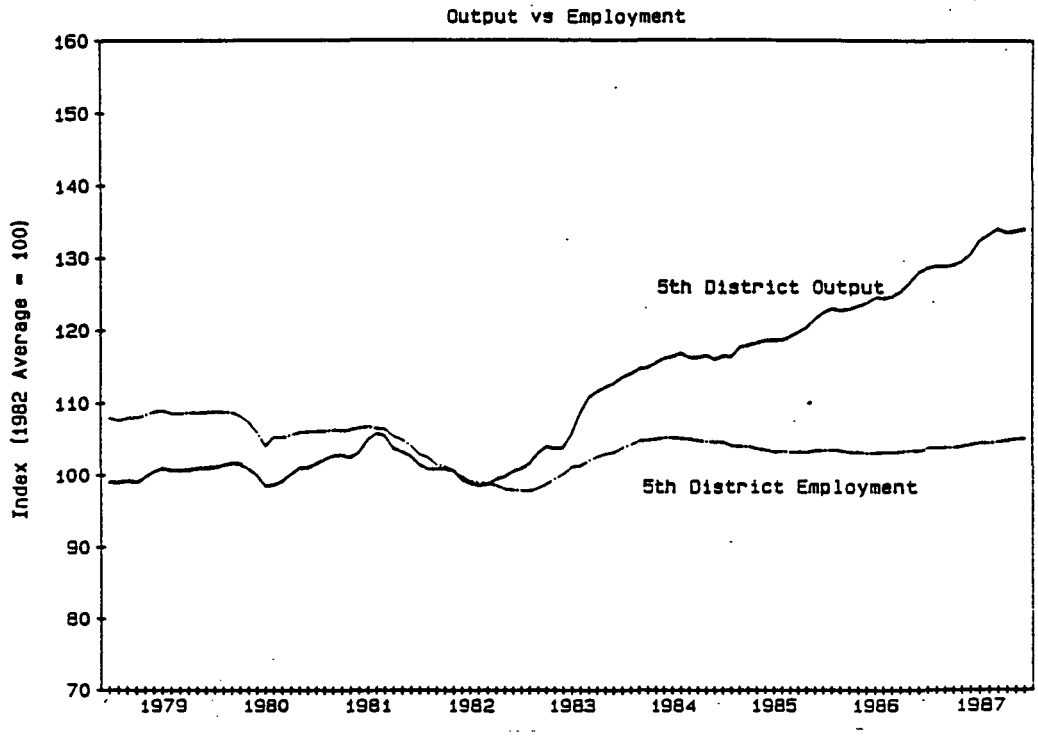
[2]Data limitations required combining the manufacturing outputs of Maryland and the District of Columbia.

Chart 1


5th District Manufacturing Activity
Output vs Employment
Index (1982 Average = 100)
160
150
140
130
120
110
100
90
80
70
1979
1980
1981
1982
1983
1984
1985
1986
1987
5th District Output
5th District Employment

differences in management, labor, etc., that are coincidentally captured by regional boundaries, and (4) differences in regional and national index construction and measurement.[3] We do not here explore the possible influences of these other factors on differences in regional output growth.

Fifth District. Output indexes are useful measures for comparing patterns and rates of growth, but they do not permit comparisons of amounts of output. In 1985, the latest year for which comprehensive data are available, manufacturers located in the Fifth Federal Reserve District produced 9.4 percent of U.S. manufacturing output (Table I). Among the states in the Fifth District, North Carolina accounted for largest amount of this production.[4]

Table I. Manufacturing Output, 1985

	Output (Millions of Dollars)	Percent of Fifth District	Percent of United States
United States	999,065.8	---	100.0
Fifth District	93,731.5	100.0	9.4
Maryland/D.C.	13,129.4	14.0	1.3
North Carolina	39,142.6	41.8	3.9
South Carolina	14,636.3	15.6	1.5
Virginia	22,075.0	23.6	2.2
West Virginia	4,748.0	5.1	0.5

Over the period reviewed here, manufacturing output in the Fifth District grew along a path similar to that traced by manufacturing output in the nation (Chart 2). However, the District experienced

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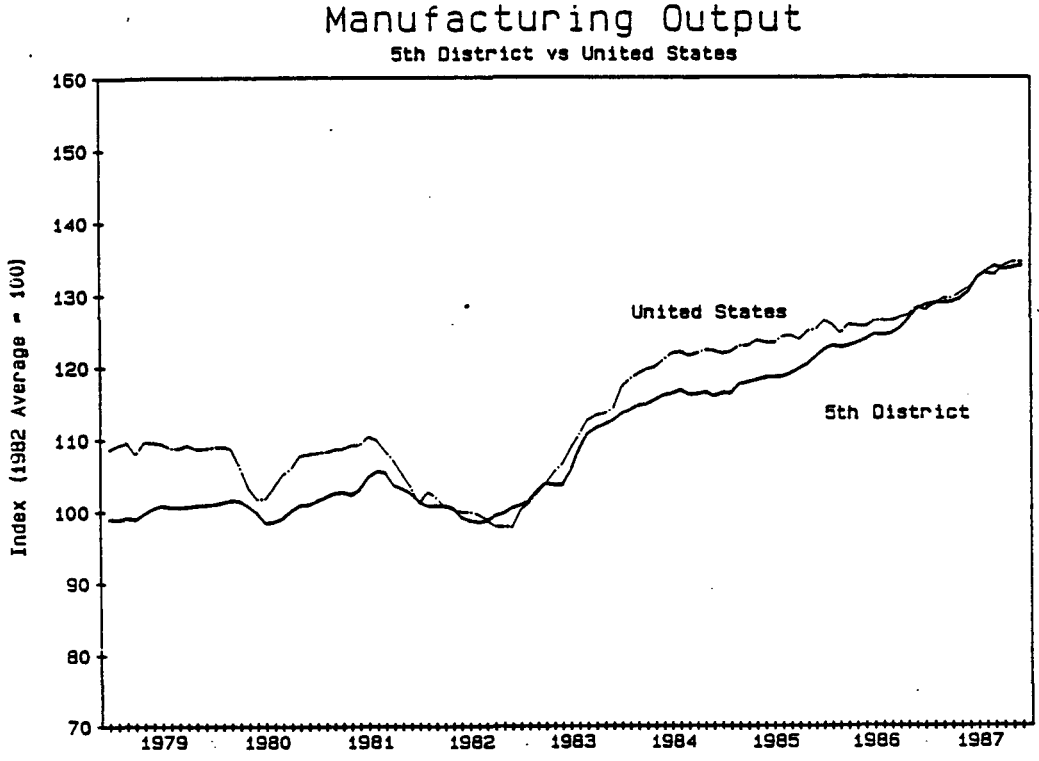
[3]The U.S. Index of Manufacturing Output is based on calculations somewhat different from those we used to construct these regional indexes. For an explanation of the construction of the U.S. Manufacturing Output Index, see Board of Governors of the Federal Reserve System (1986).

[4]Data on industry output by state are published by the U.S. Department of Commerce, Annual Survey of U.S. Manufacturers.

Chart 2


Manufacturing Output
5th District vs United States
Index (1982 Average = 100)
160
150
140
130
120
110
100
90
80
70
1979
1980
1981
1982
1983
1984
1985
1986
1987
United States
5th District

proportionately smaller declines in output during the two recessions early in the current decade (Table II). Moreover, manufacturing output in the District grew slower than in the nation during the first two years of the expansion and has grown faster than its national counterpart since the beginning of 1985.

The marginally smaller contractions in manufacturing output in the District as compared to the nation in the early 1980s probably stemmed from the smaller proportion of industries producing durable goods in the District.

Table II: Manufacturing Output: Growth Over Selected Periods
(Annual Percent Changes)

	Recession Periods		Expansion Periods*	
	Jan 1980 - Jul 1980	Jul 1981 - Nov 1982	Nov 1982 - Feb 1985	Feb 1985 - Dec 1987
United States	-12.7	-8.6	10.3	3.6
Fifth District	- 5.2	-3.6	7.1	5.1
Maryland/D.C.	- 4.9	-5.0	5.9	2.3
North Carolina	- 2.4	-2.3	8.8	7.2
South Carolina	- 6.0	-3.4	5.9	7.2
Virginia	- 6.3	1.6	5.3	4.7
West Virginia	-16.8	-16.1	5.3	-3.7

*The uninterrupted expansion was divided at the month when the foreign exchange value of the dollar reached its peak.

In 1980, for example, producers of durable goods accounted for only 43 percent of District manufacturing output, as compared with 59 percent of U.S. manufacturing output. In the two recessions early in this decade as in other recessions, the output of durable goods declined more than the output of nondurable goods (Table III).

Table III: Declines in U.S. Manufacturing Output in Two Recessions
(Annual Percent Changes)

	1980/1 to 1980/7	1981/7 to 1982/11
Total Manufacturing	- 12.7	- 8.6
Durable Goods	- 15.0	- 11.8
Nondurable Goods	- 9.1	- 4.1

Also evident from Chart 2 are differences between the District and the nation in the timing of the recessions and recoveries. In the months preceding the national recession which began in January of 1980, manufacturing output in the nation was declining but manufacturing output in the District was still rising. There were only negligible differences in the timing of the troughs of regional and national manufacturing output in 1980 and subsequent peaks in 1981.[5] However, following its decline from mid-1981 to mid-1982, District output began expanding before U.S. output. The District's earlier rise in manufacturing output was, again, probably due to its less cyclically sensitive mix of industries.

The relative stability of District manufacturing output also seems to explain the differences in the trends of output over the current expansion. From 1982 to 1985, output in the nation increased faster than in the District, perhaps because durable goods production tends to increase faster than nondurable goods production at the onset of a recovery. Over the course of the two years ending with December 1987, manufacturing output accelerated somewhat from its 1984-1985 pace, although its growth was still slower than early in the expansion. In these two recent years, District output outpaced national growth.[6]

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[5]Likewise, the value added data from the Annual Survey of Manufacturers (ASM) are considered effective in July of that year. Consequently, the value-added data from the ASM are set equal to the constructed manufacturing output values in July of the benchmark years.

[6]The difference in the District and national growth patterns in manufacturing output over the current expansion may also reflect a

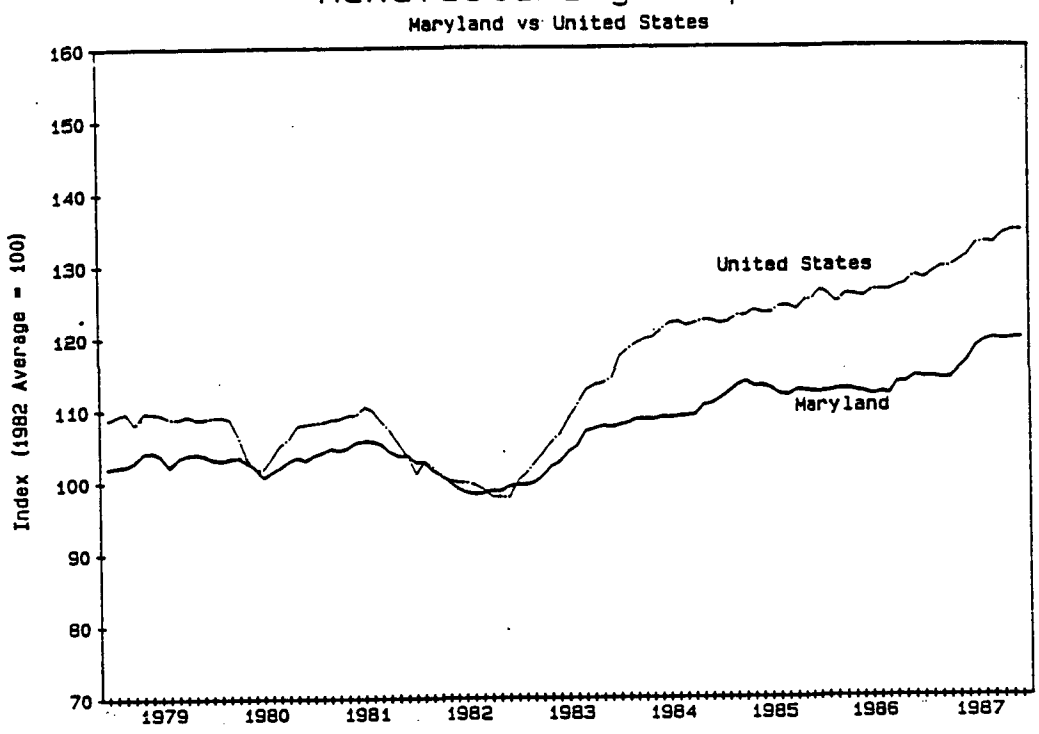
(Footnote Continued)

Maryland/D.C. Manufacturing output in Maryland and the District of Columbia declined less than that of the nation in percentage terms during the 1980 and 1982 recessions, but increased less during the 1982-1987 period of expansion (Table II and Chart 3). That difference is largely due to different types of industries in Maryland versus the nation. The proportions of durable and nondurable industries in Maryland and in the nation were similar over the period under study, but the more narrowly defined kinds of industries within these categories and their shifts in relative importance over time were different (See Appendix Table A-2). Growth in the electric equipment industry figured importantly in these period differentials. From 1979 through 1982 the output of Maryland's electric equipment industry grew at an annual average rate of 19.5 percent, compared to the nation's average annual gain in that industry of 10.3 percent. During the years 1983 through 1985, however, when the nation's manufacturing output grew faster than Maryland's, the output of electric equipment grew faster in the United States.

Estimates of Maryland manufacturing output for the period July 1985 through November 1987 suggest that Maryland producers did not benefit at first from the decline in the foreign exchange value of the dollar that began in February 1985. From the autumn of 1986 through the end of 1987, however, manufacturing output in Maryland has kept pace with that of the nation.

(Footnote Continued)
greater sensitivity in the District to the foreign exchange value of the dollar. Textile and electric equipment manufacturing have relatively high concentrations in the District, and both of these industries have experienced large swings in net exports.

Chart 3


Manufacturing Output
Maryland vs United States
Index (1982 Average = 100)
160
150
140
130
120
110
100
90
80
70
1979
1980
1981
1982
1983
1984
1985
1986
1987
United States
Maryland

North Carolina. Manufacturing output in North Carolina suffered smaller declines than in the nation during the 1980 and 1982 recessions (Table II and Chart 4), and outpaced the rate of growth of manufacturing output in the nation over the five years ending with 1987. The industrial structure of North Carolina appears to have been responsible for that state's relative stability and stronger growth in manufacturing output.

North Carolina manufacturing industries are much more concentrated in nondurable goods production, where output growth was more rapid nationwide since mid-1984. Also, the North Carolina manufacturing sector includes a large proportion of industry groups that posted increases that exceeded national averages in output from 1985 through 1987. Specifically, about one-fourth of North Carolina's manufacturing output over this period was produced by two industries, textiles and chemicals, whose annual gains in output of 5.2 percent and 7.1 percent, respectively, outpaced the 3.9 percent increase for all manufacturing.

South Carolina. The pattern of change in manufacturing output in South Carolina was similar to that of the nation during the early 1980s, but differed sharply from the national pattern after mid-1984 (Chart 5). Manufacturing output in the state throughout this period was strongly influenced by its concentration of textile mills, which produced over 20 percent of the state's total manufacturing output in 1985. The textile industry has been as cyclical as many durable goods industries. Moreover, it has proven to be vulnerable to foreign competition. When the dollar was high and rising in 1984 and 1985, the domestic producers of textiles suffered from an increase in imported textiles. Consequently, the output of textile mills in South

Chart 4

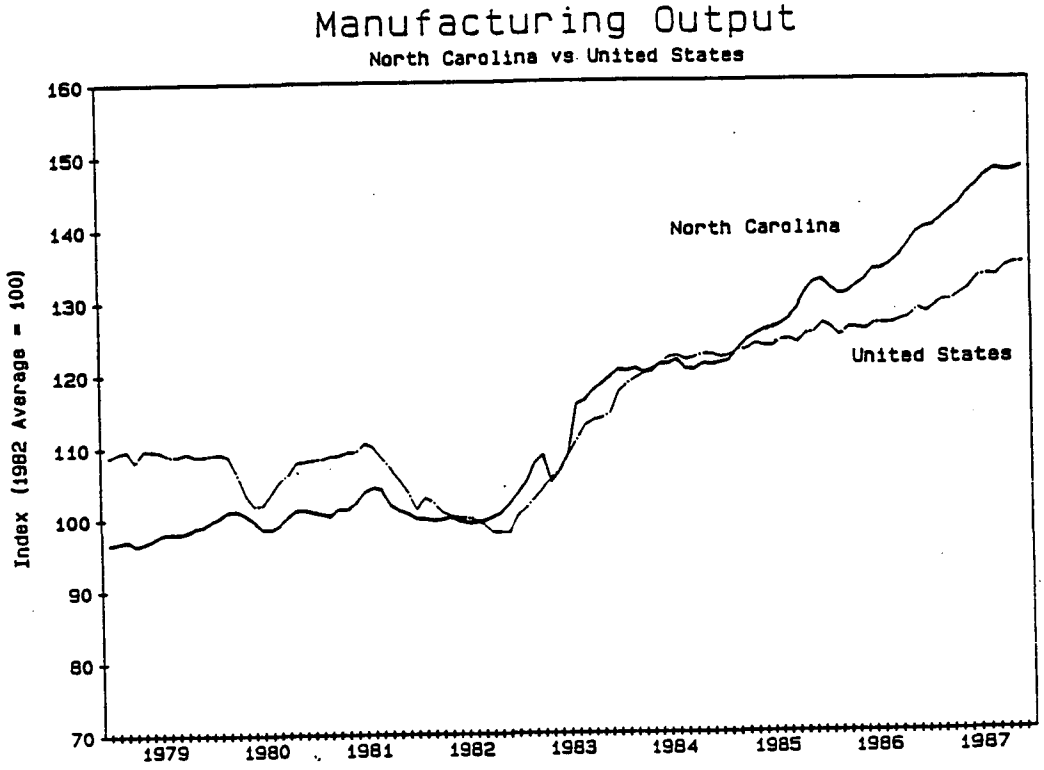
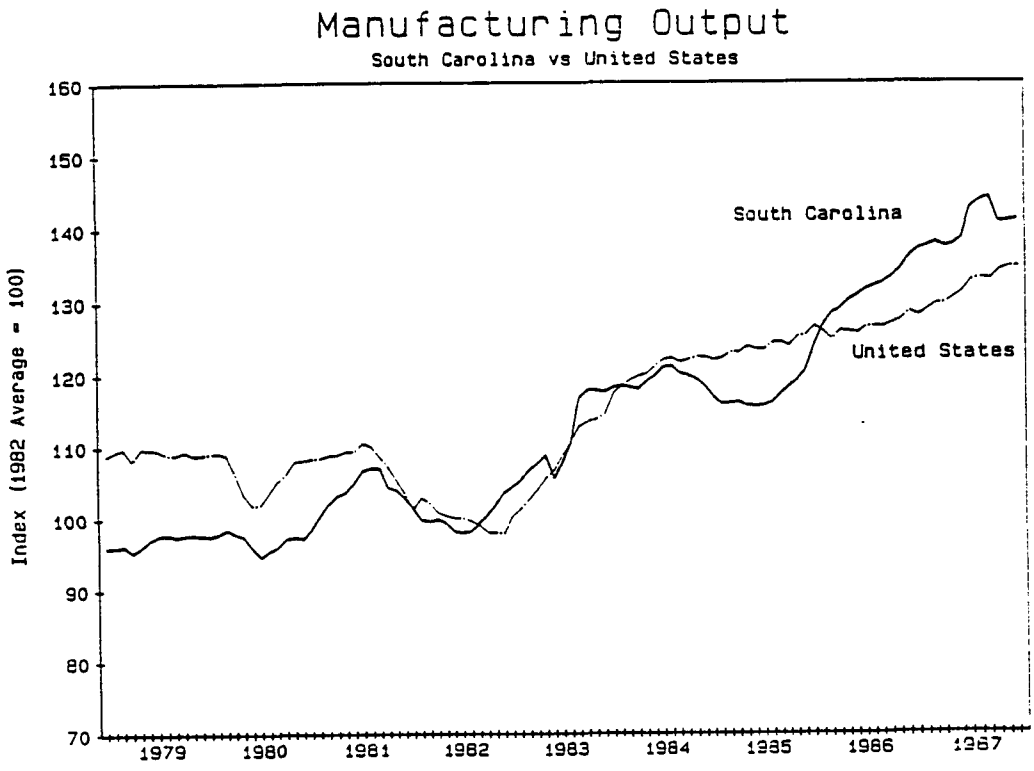

Manufacturing Output
North Carolina vs United States
Index (1982 Average = 100)
160
150
140
130
120
110
100
90
80
70
1979
1980
1981
1982
1983
1984
1985
1986
1987
North Carolina
United States

Chart 5


Manufacturing Output
South Carolina vs United States
Index (1982 Average = 100)
160
150
140
130
120
110
100
90
80
70
1979
1980
1981
1982
1983
1984
1985
1986
1987
South Carolina
United States

Carolina dropped sharply between August of 1984 and August of 1985, pulling down total manufacturing output. Then, when the foreign exchange value of the dollar began to fall, the textile industry rebounded and total manufacturing output in South Carolina turned upward.

The attractiveness of the state to new manufacturers in many other industries also helped boost South Carolina's manufacturing output in the past two years. In 1987, for example, the South Carolina Development Board reported that capital investment announced by new and expanding companies in the state recorded the largest increase in 22 years. More than half of the capital investment was in the manufacturing sector.

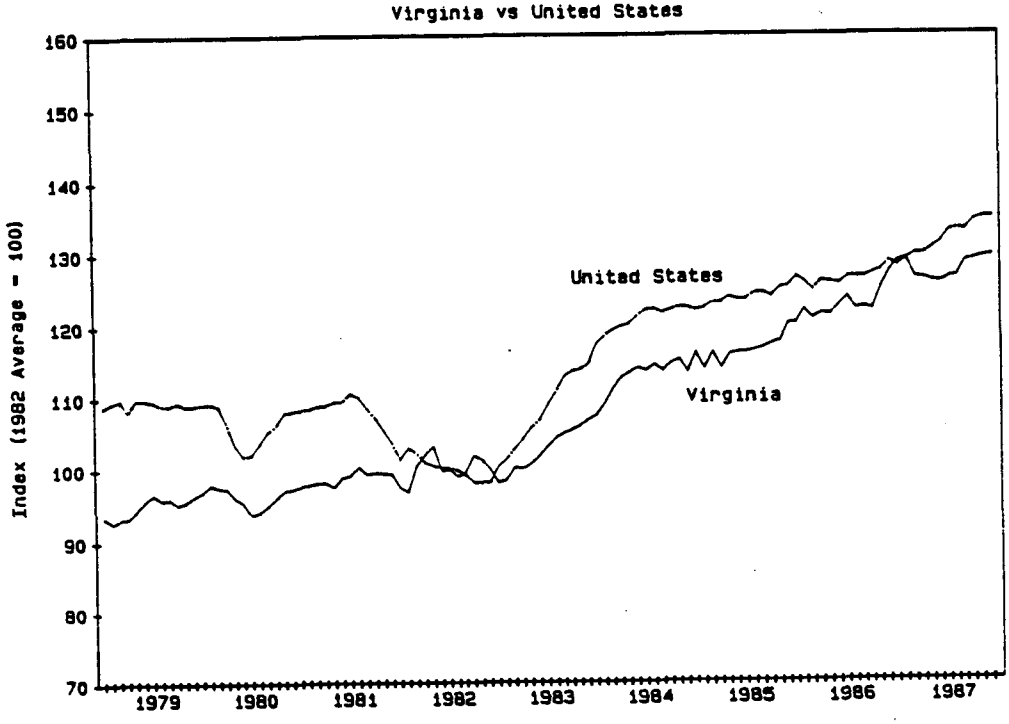
Virginia. Manufacturing output in Virginia held up fairly well during the last nine years (Chart 6). In fact, during the recession of 1982, manufacturing output in Virginia rose 1.6 percent, in contrast to the decline in manufacturing output in the country. The relative stability of Virginia manufacturing output during this period was probably because almost three-fifths of the state's output was composed of the less cyclically sensitive nondurable goods. Also, Virginia economic activity, including manufacturing, was strongly influenced by federal government spending, which added stability to the state's growth rate.

The relative stability of Virginia output has also been apparent during the current expansion. During the first two years of the expansion, manufacturing output in Virginia rose more slowly than it did in the nation--at an annual rate of 5.3 percent in Virginia, compared to 10.9 percent in the nation. In the last two years,

Chart 6

Manufacturing Output

Virginia vs United States



however, Virginia's growth in manufacturing output was greater than the nation's.

The behavior of Virginia's manufacturing output since 1982 might also suggest that the state's industrial structure is somewhat more sensitive than the nation's industrial structure to changes in the foreign exchange rate. From 1982 to 1985 when the foreign exchange value of the dollar was rising, manufacturing output in Virginia rose more slowly than it did in the nation. And during the more recent period when the foreign exchange value of the dollar was falling, manufacturing output in Virginia grew faster than in the nation.

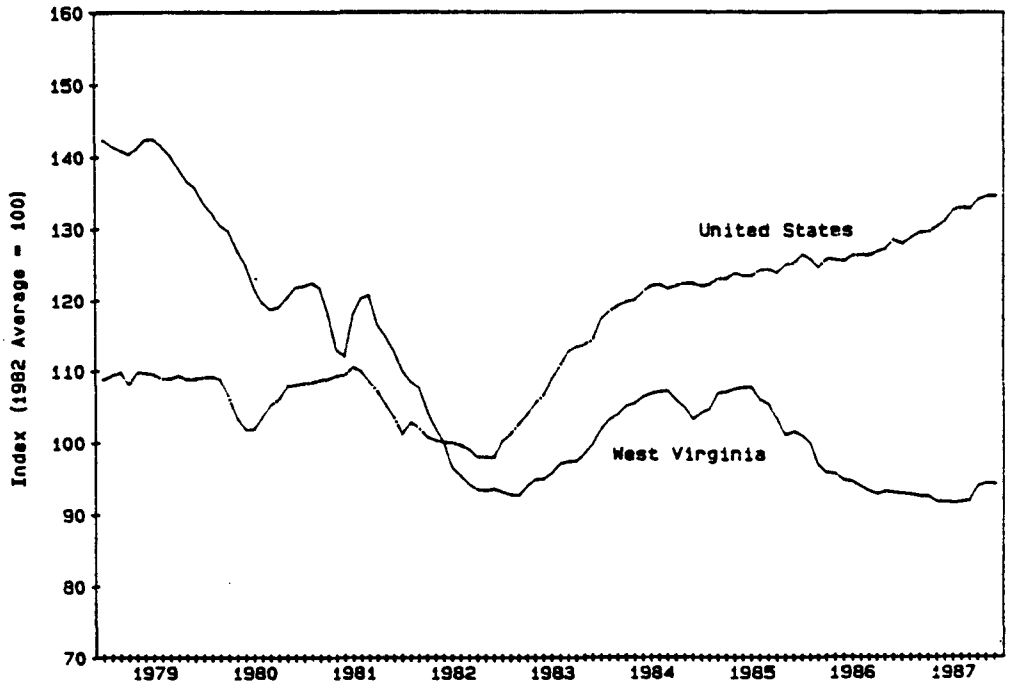
West Virginia. The West Virginia pattern of growth in manufacturing output contrasts more sharply than other District states' to the national pattern (Chart 7). Manufacturing output in West Virginia declined steadily and dramatically from 1979 through 1982, when the state experienced severe drops in manufacturing activity during the two recessions. The sensitivity of West Virginia to economic contractions was largely due to its dependence on three highly cyclical industries: the chemical industry; the primary metals industry; and the stone, clay, and glass industry. These three industries were responsible for over half of the manufacturing output in West Virginia, and all three suffered sharp downturns nationally in the recessions of 1980 and 1982.

West Virginia's manufacturing output did recover somewhat during the early part of the expansion that began in late 1982. Most of the gains in 1983 and early 1984 were in the durable goods sector. However, plant closings and layoffs in 1984 ended the short-lived recovery in West Virginia manufacturing. Output leveled off late that year, then weakened further through 1986.

Chart 7

Manufacturing Output

West Virginia vs United States



West Virginia's close ties to coal mining help explain the decline in manufacturing output in the early 1980s and its subsequent poor recovery. Employment in coal mining declined sharply during the period covered by this study. Largely because of out-migration attributable to high unemployment rates in the coal fields, and the lack of alternative employment elsewhere in the state, West Virginia's population fell. Over the first five years of the 1980s, the population in West Virginia declined almost one percent, while it rose 6.3 percent in the nation. During the eight years ending with the fourth quarter of 1987, real income in West Virginia declined 3.4 percent. The state's shrinking population and real income might have contributed to the decline in manufacturing output by reducing demand for manufactured goods, such as food items, targeted for local markets.

The manufacturing outlook for West Virginia may be improving. The state's producers finished 1987 with output on the rise.

INDUSTRY OUTPUT INDEXES

This section reviews the 1980's production patterns of the textile, chemical, and electric equipment industries. Each of these three industries produced over 10 percent of total manufacturing output in the District, and the three industries combined accounted for an about 35 percent of the region's manufacturing output in 1987.

Textiles

The U.S. textile industry is more heavily concentrated in the Fifth District than in any other Federal Reserve District. In 1986,

for example, five out of every 10 textile workers in the nation were employed at mills located within the District.

The textile industry produced more than 10 percent of total District manufacturing output during the 1980s, and even larger shares of the manufacturing output of the Carolinas. In 1985, for example, the textile industry in North Carolina accounted for about 14 percent of that state's manufacturing output, and in South Carolina, about 20 percent. In that year, the two Carolinas were responsible for 88 percent of total District textile output, and Virginia accounted for almost all of the rest (Table IV).

Table IV: Textile Production in Fifth District States
(Percent of District Total)

	1978	1985
Maryland/D.C.	0.3	0.7
North Carolina	55.7	56.3
South Carolina	32.6	31.0
Virginia	11.2	11.8
West Virginia	0.2	0.2

The U.S. textile industry went through some radical adjustments in the past 10 years. During the late 1970s and up to mid-1982, both employment and output in the industry declined. After about a year of recovery in 1983, the textile industry suffered another decline in 1984. During these periods of contraction, the textile industry experienced a wringing-out process as hundreds of inefficient mills were closed for good. Many of the surviving textile manufacturers invested in highly productive machinery and manufacturing processes. Despite plant closings, total productive capacity in the industry has been fairly constant since 1980. For the most part, therefore, changes in production over the period under review reflect changes in capacity utilization. At the end of 1987, textile mills were operating at close to their maximum capacities.

Chart 8 shows that output for the textile industry in the Fifth District generally followed a path similar to that of textile output in the nation. However, the District's output of textiles declined proportionally less than the nation's during the two recessions early in this decade, and proportionately more during the industry slump of 1984. From late 1984 to the end of 1987, District textile output grew less rapidly than U.S. textile output. At the end of 1987, District textile output was 11.0 percent above its July 1982 level, but still 2.2 percent below its March 1984 peak. In contrast, U.S. textile output was 34.4 percent above its July 1982 level, and 9.3 percent above its level of March 1984.

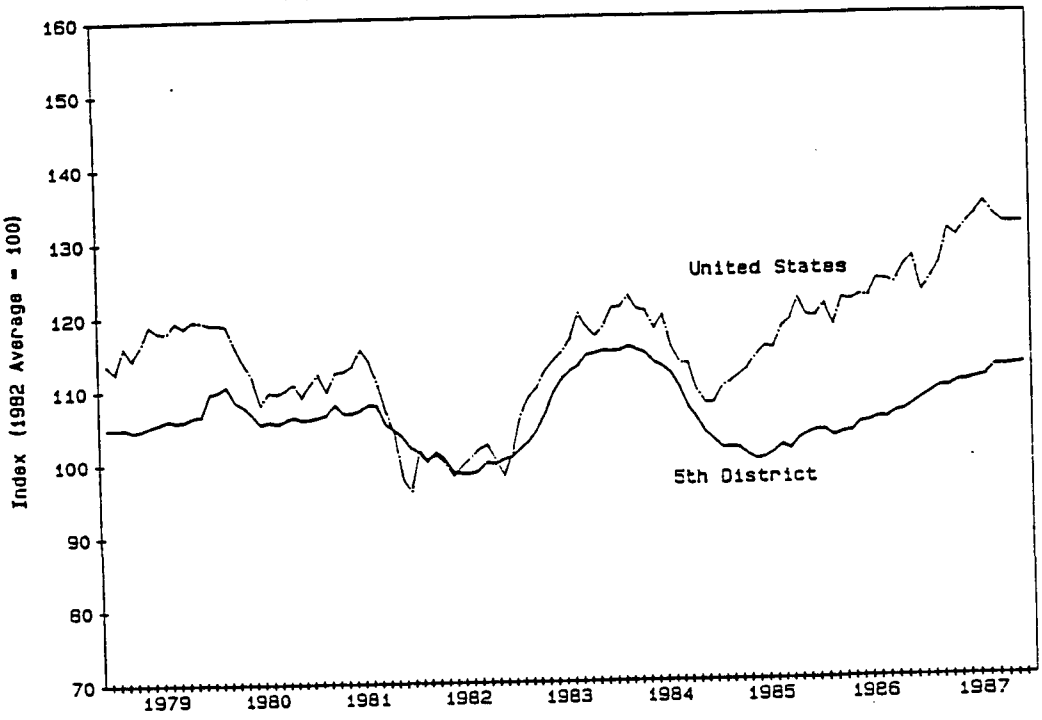
In addition to differences in growth rates, differences in the timing of national and District swings in textile output are apparent from Chart 8. The most obvious is the earlier upturn in national textile production in 1985. Somewhat less obvious from the chart are the "delayed" District downturns, as compared to the nation's, in 1980, 1981, and 1984.

The differences between the United States and District patterns of textile output over the period probably were due partly to the difference in the types of textiles produced. For example, over the period under review only about 2 percent of the textiles manufactured in the District were carpets and rugs, compared to 9 percent in the nation. The demand for carpets and rugs is closely tied to the demands for new homes and new cars. These demands usually shrink in economic contractions and expand during periods of economic growth.

Also important was the District concentration in synthetic fiber products. Over the period reviewed, about 25 percent of District

Chart 8

Textile Industry Output



textile output came from synthetic fiber weaving mills versus about 15 percent in the rest of the nation. This relative District emphasis on manmade fibers worked to the advantage of the region's textile manufacturers in the early 1980s when demand for synthetic textile products rose sharply, but to their relative disadvantage in more recent years when demand shifted back to natural fibers.[7]

Chemicals

The Fifth District produced an estimated 13 percent of the nation's chemical and allied products in 1985. North Carolina accounted for the highest percentage of the District's total (Table V). The chemical industry's proportion of all manufacturing output in the District and in the nation increased only slightly from 1979 to 1985, but in West Virginia the chemical industry's share of that state's manufacturing output rose from 30.8 percent in 1979 to 38.7 percent in 1985.

The output of chemical products in the Fifth District generally followed the same pattern as in the nation (Chart 9). District chemical production, however, declined proportionately less than in the country as a whole in 1979-80, and then declined proportionately more in 1981-82. Following the trough of the recession in late 1982, District chemical output rose rapidly through most of 1983, outpacing growth in U.S. chemical output. From October 1983 through December 1987, however, District growth in chemical output was slower than that of the nation.

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[7]Kent M. Barker, "Textiles," in 1987 U.S. Industrial Output, U.S. Department of Commerce/International Trade Administration, pp. 41-43.

Chart 9

Chemicals Industry Output

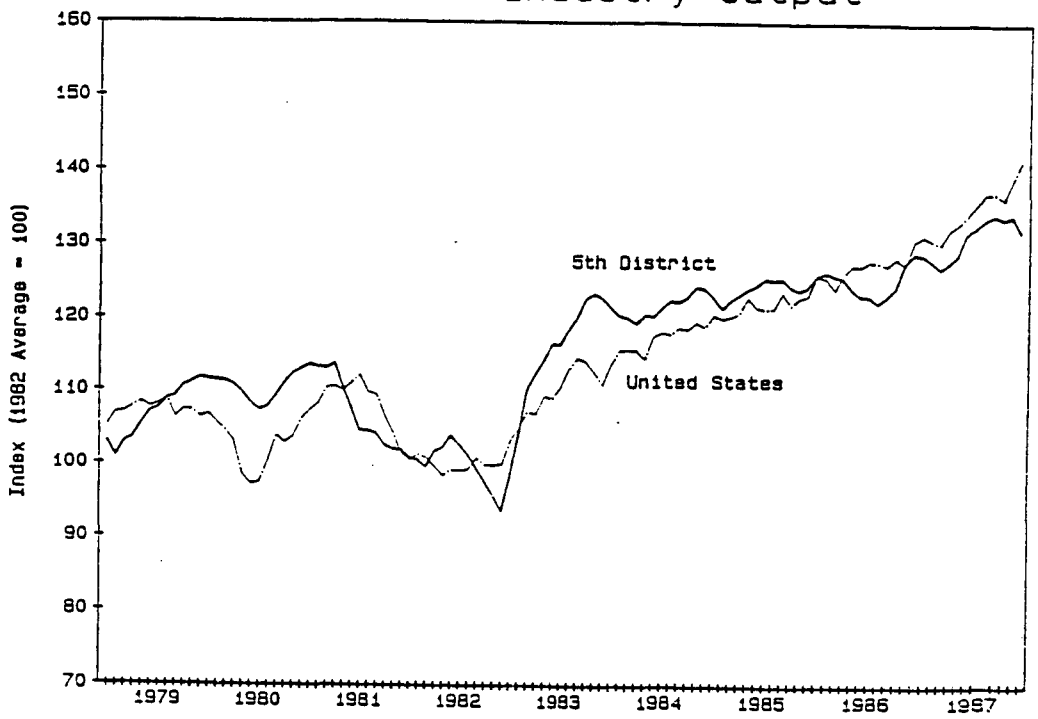

Table V: Chemical Production in Fifth District States
(Percent of District Total)

	1978	1985
Maryland/D.C.	9.5	9.0
North Carolina	26.1	35.3
South Carolina	22.4	21.6
Virginia	22.9	20.2
West Virginia	19.1	13.9

Differences in the timing of District and U.S. declines and recoveries in chemical industry output are also apparent from Chart 9. The nation's chemical producers began reducing production much earlier than the District's in 1979-80, but the District producers reduced output earlier than in the nation in 1981. Also, it appears that in the recession of 1982, the chemical industry in the country as a whole started to recover earlier than in the District.

The differences between the District and the nation in their growth patterns for chemical industry output reflect their different types of products. Consider three chemical groups: drugs; cleaning preparations and cosmetics; and synthetic and plastic materials (Table VI). The trends and cycles in output of these three groups over the review period have diverged and affected comparisons of the District with the nation.

The relatively greater concentrations in the nation versus the District in drugs and in cleaning preparations and cosmetics helped stabilize total chemical industry output nationally during the early 1980s, and helped industry output to grow nationally thereafter. Output in the drug industry grew over the entire period under review. To a somewhat lesser extent, output in the cleaning preparations and

cosmetics group also contributed to greater stability and growth nationally.[8]

Table VI: Percentages of Industries Within the Chemical and Allied Products Industrial Category, Fifth District and United States, 1982

	Fifth District	United States
Drugs	17	22
Cleaning Preparations and Cosmetics	11	20
Synthetic and Plastic Materials	27	12

The wider fluctuations in the District chemical industry from 1981 through 1983 were at least partly due to the District's higher concentration in the production of synthetic and plastic materials. During 1981-82, exports of petrochemicals, of which synthetic and plastic materials are a part, fell sharply for several reasons, including shrinking world demand and the imposition of antidumping duties.[9] In 1983, exports of these products rose rapidly until leveling off in 1984-85 because of the high foreign exchange value of the dollar. In 1986-87, a falling dollar and lower oil prices helped stimulate world demand for synthetic and plastic materials.

Electric Equipment

Electric and electronic equipment manufacturers in the Fifth District produced nearly 10 percent of the nation's output for that industry in 1985. North Carolina was the largest District producer (Table VII).

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[8]Leo McIntyre, "Cleaning Preparations, and Cosmetics," in 1985 Industrial Output, U.S. Department of Commerce, Bureau of Industrial Economics, p. 16-5.

[9]Philip Lewis, "Chemicals and Allied Products," in 1982 Industrial Output, U.S. Department of Commerce, Bureau of Industrial Economics, pp. 97-102.

The electric equipment industry grew rapidly in both the District and the nation over the 1979 to 1987 review period (Chart 10). Output in the industry rose at an average annual rate of 7.7 percent in the District and 4.0 percent in the nation in those eight years. From 1979 to 1985, the electric equipment industry's share of total manufacturing output in the District rose from about 7.5 percent to 12.5 percent. The electric equipment industry comprised 19.0 percent of manufacturing in Maryland in 1985 and nearly 12.0 percent each in North Carolina and Virginia.

The national and District growth patterns in the output of the electric equipment industry were quite similar until the middle of 1984. District output grew somewhat faster than national output from 1979 through 1982, but experienced much the same in the way of contractions in growth during the recessions of 1980 and 1981-82. The divergence in District and national growth rates in the electric equipment industry began in the autumn of 1984, when the industry's output growth in the nation fell while that of the District continued to rise.

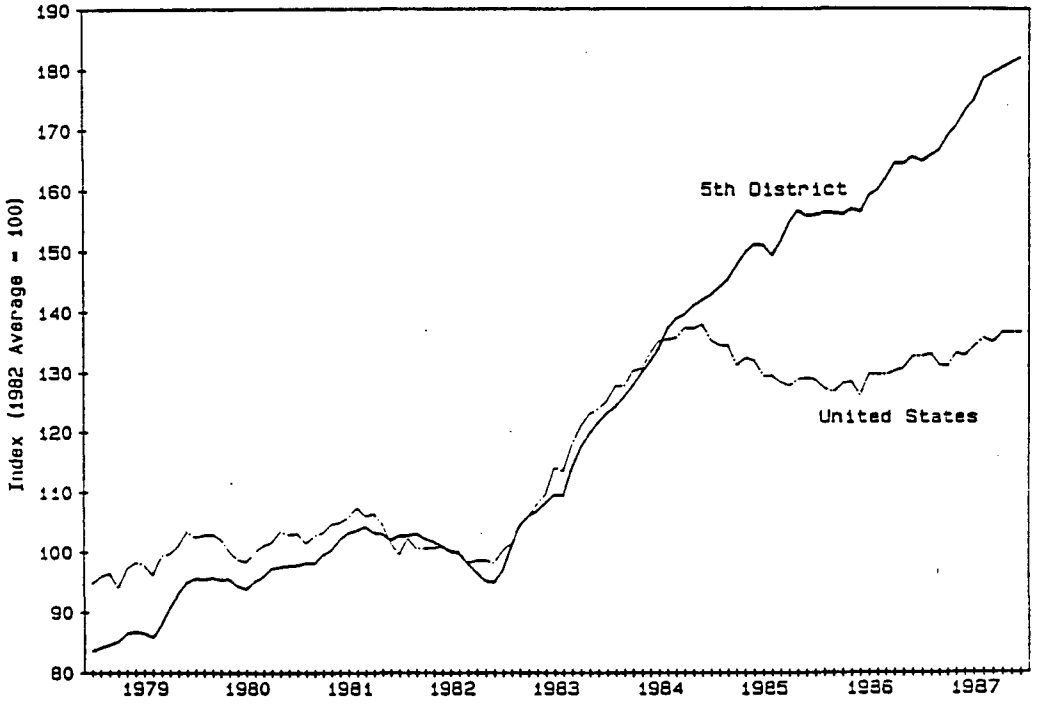
Table VII: Electric Equipment Production in Fifth District States
(Percent of District Total)

	1978	1985
Maryland/D.C.	22.9	23.4
North Carolina	37.4	42.6
South Carolina	11.4	9.1
Virginia	24.0	23.6
West Virginia	4.3	1.3

The explanation for the more rapid District growth in the output of electric equipment lies in its lesser concentration in the production of electronic components and its greater concentration in communications equipment. The national decline in electronic equipment output from mid-1984 to mid-1986 was due largely to a

Chart 10

Electric Equipment Industry Output



decrease in the output of electronic components. A consolidation of U.S. producers of electronic components occurred in 1985 because of intense foreign competition. The District felt the effects of this competition somewhat less than the nation because manufacturers of electronic components comprised only 19 percent of the District's output for the electric equipment industry as compared with the nation's 25 percent.

The relatively faster growth in electric equipment output in the District compared to the nation was also due to the District's relatively greater concentration in the production of communications equipment. About 40 percent of the District's electric equipment production over this period was communications equipment, compared to about 33 percent in the nation. Demand for products in this group grew rapidly in the 1980s for two major reasons. First, a large proportion of output was associated with the growth in federal government defense expenditures. Second, the continued introduction of new products stimulated demand.

What is true for the electric equipment industry seems to replicate the general patterns discussed in the rest of the article; namely, there appear to be differences in the patterns of production in specific states and industries. The information presented in this article does not exhaust the findings that one can acquire from these indexes. We hope that researchers will be encouraged to extract more insights from our data.

Table A-1

GROWTH IN FIFTH DISTRICT INDUSTRIES

(Annual Average Percent Change)

	Recession Periods		Expansion	Entire Period	
	Jan. 1980-Jul. 1980	Jul. 1981-Nov. 1982	Nov. 1982-Dec. 1987	Jan. 1979-Dec. 1987	1987
Food	0.4	-0.1	4.2	3.8	3.2
Tobacco	3.6	-8.9	-0.7	0.9	14.6
Textile	-7.5	-5.4	2.4	0.8	4.5
Apparel	4.9	-4.5	3.2	1.3	4.1
Wood Products	-3.8	-6.6	7.1	4.2	4.3
Furniture	-16.4	-10.8	4.3	-0.6	3.7
Paper Products	-3.4	-2.0	4.4	2.2	-9.0
Printing & Publishing	0.2	-2.7	8.0	4.6	10.6
Chemicals	-7.4	-6.5	6.5	2.8	2.7
Rubber Products	7.5	-2.8	6.6	6.2	-3.5
Stone, Clay & Glass	-8.2	-6.2	4.7	1.4	-2.7
Primary Metals	-15.7	-25.9	-0.4	-5.1	8.3
Fabricated Metals	-18.5	-6.3	5.2	0.7	6.5
Nonelectrical Machinery	-0.0	-4.1	17.4	9.3	5.1
Electric Equipment	-3.9	-6.0	13.6	9.1	11.4
Transportation Equipment	-12.4	-7.0	9.1	2.8	11.9
Instruments	12.4	-8.9	6.2	2.2	0.0

Table A-2

OUTPUT AS A PERCENT OF TOTAL MANUFACTURING

(Selected Industries)

	YEAR	U.S.	DISTRICT	MD/DC	NC	SC	VA	WV
All Nondurable	1985	42.6	58.0	41.4	61.4	65.3	58.3	52.8
	1978	41.1	57.2	37.1	63.7	67.5	57.8	40.8*
Food & Kindred	1985	10.4	8.0	13.4	7.0	4.9	9.6	4.1
	1978	9.6	7.6	14.1	5.6	3.7	11.3	3.5
Tobacco	1985	1.2	9.4	NA	15.6	NA	12.5	NA
	1978	0.7	5.7	NA	11.6	NA	6.4	NA
Textile	1985	2.1	10.2	0.5	13.7	20.1	5.1	0.5
	1978	2.6	15.1	0.3	22.3	28.5	7.7	0.3
Apparel	1985	2.8	3.7	2.7	3.8	4.9	3.7	1.3
	1978	3.2	4.6	3.1	5.0	6.4	4.8	1.9
Paper Products	1985	4.0	4.1	4.6	2.8	7.0	4.7	1.2
	1978	3.7	3.9	4.0	3.3	5.2	5.1	0.8
Printing & Publishing	1985	7.3	4.3	8.4	2.4	2.6	6.5	4.1
	1978	5.4	4.0	6.9	3.4	1.8	5.0	2.5
Chemical & Allied Products	1985	9.5	14.1	9.1	11.9	19.5	12.0	38.7
	1978	9.4	13.0	8.1	9.1	16.9	13.7	30.8
Rubber Products	1985	3.6	4.1	2.7	4.1	6.4	4.2	0.9
	1978	3.2	3.0	NA	3.4	4.8	3.8	NA
All Durable	1985	57.4	42.0	58.6	38.6	34.7	41.7	47.2
	1978	58.9	42.8	62.9	36.3	32.5	42.2	59.2*
Furniture	1985	1.6	3.4	0.7	5.7	1.1	3.2	0.4
	1978	1.5	4.0	0.7	7.5	0.7	4.1	NA
Stone, Clay, & Glass	1985	2.5	2.9	2.7	2.1	4.1	2.5	8.2
	1978	3.4	3.7	3.7	2.5	3.9	2.7	11.3
Primary Metals	1985	3.8	2.8	4.6	1.4	2.0	1.4	18.2
	1978	6.7	5.2	12.4	1.5	1.6	2.7	23.8
Fabricated Metals	1985	6.9	3.8	4.9	2.9	4.8	3.6	6.1
	1978	7.7	5.0	4.3	5.5	4.8	4.0	6.7
Nonelectrical Machinery	1985	11.0	6.5	7.8	7.0	7.9	4.3	4.2
	1978	12.0	6.4	9.8	5.6	8.5	4.6	3.8
Electric Equipment	1985	11.0	11.4	19.0	11.6	6.6	11.5	2.8
	1978	8.7	7.5	11.3	7.5	5.0	8.3	4.0
Transportation Equipment	1985	12.1	4.5	5.5	2.5	2.1	9.7	1.3
	1978	11.1	4.2	7.5	1.9	0.6	9.3	2.9

NA — Value-added data were not available. Generally, they are withheld by the Bureau of Census to avoid disclosing figures for individual companies.

* The proportion of nondurable goods is probably understated and the proportion of durable goods overstated because data for the rubber industry were not released in 1978 but were released in 1985.

Source: U.S. Department of Commerce, Bureau of Census, *Annual Survey of Manufacturers*, Statistics for Industry Groups and Industries, 1978-1979 and 1985.

TECHNICAL APPENDIX: CONSTRUCTING A MANFUACTURING OUTPUT INDEX

Manufacturing output, V (nominal value added by manufacturers), is assumed to be produced according to a linear homogenous production function in which labor (L) and capital (K) are the only variable inputs, and the industry is perfectly competitive. Under these assumptions (given a technology), the total value of output is allocated to the two variable factors:

$$(1)\quad V = (P^L \times L) + (P^K \times K),$$

where P^L and P^K are the respective prices of labor and capital. Dividing through by V in (1) yields:

$$(2)\quad 1 = (P^L \times L) / V + (P^K \times K) / V,$$

where the first term on the right of (2) is labor's share of output, and the second term is capital's share.

Estimating the price and quantity of capital is always difficult. We avoid the need for these measurements, however, by rewriting equation (1) as:

$$(3)\quad V = (P^L \times L) / V \times (V / L) \times L + (P^K \times K) / V \times (V / K) \times K,$$

and substituting into (3) from (2) for capital's share:

$$(4)\quad V^* = (P^L \times L)/ V \times (V^* / L) \times L + (1 - (P^L \times L) / V) \times (V^* / K) \times K,$$

where V^*, real value added, is V divided by D, the deflator. (See Table A-3 for data sources.)

To simplify the notation, equation (4) is rewritten as

$$(5)\quad V^*_{y,m} = (S^L_y \times R^L_y \times L_{y,m}) + ((1 - S^L_y) \times R^K_y \times K_{y,m}),$$

where the subscripts "y" and "m" denote the year (e.g., 1982) or month (e.g., November), respectively, and

(5.1) $S^L_y = (P^L \times L_y) / V_y$, labor share, survey year y,

(5.2) $R^L_y = V^*_y/L_y$, real-output-to-labor ratio, survey year y,

(5.3) $R^K_y = V^*_y/K_y$, real-output-to-capital ratio, survey year y.

If factor shares and average productivities (output/factor ratios) were constant, $V^*_{y,m}$ would change only with monthly changes in capital and labor usage. But of course, factor shares and average productivities change over time. To take these changes into account, the shares and average productivities calculated in the survey years are considered effective in July of that year,[10] and changes in these variables are spread evenly over the months in between.[11] The interpolations for the factor shares are:

(6) $S^L_{y,m} = S^L_y + [\, j \times (S^L_{y+i} - S^L_y) / 12i]$, and

(7) $S^K_{y,m} = 1 - S^L_{y,m}$

where j = number of months elapsed since July of year y, and
i = number of years between surveys (usually just one year).

The interpolations for the average productivities are:

(8) $R^L_{y,m} = R^L_y \times [\, (R^L_{y+i} / R^L_y)^{1/12i} \,]^j$, and

(9) $R^K_{y,m} = R^K_y \times [\, (R^K_{y+i} / R^K_y)^{1/12i} \,]^j$.

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[10] Likewise, the value added data from the Annual Survey of Manufacturers (ASM) are considered effective in July of that year. Consequently, the value-added data from the ASM are set equal to the constructed manufacturing output values in July of the benchmark years.

[11] The ASM by geographic areas was not performed in 1979, 1980, and 1981. In addition, the ASM for 1986 and 1987 are not yet available. Monthly measures of manufacturing output for 1986 and 1987 were calculated by extrapolating trends in average factor shares and average productivities.

The data have been adjusted and we now have:

$$(10)\quad V^{*} = (S^{L}_{y,m} \times R^{L}_{y,m} \times L_{y,m}) + ((1 - S^{L}_{y,m}) \times R^{K}_{y,m} \times K_{y,m}),$$

where $S^{L}_{y,m}$, $R^{L}_{y,m}$, $S^{K}_{y,m}$, and $R^{K}_{y,m}$ are given by equations (6) through (9). All the data on the right-hand-side are now monthly. Finally, each series for monthly manufacturing output is indexed at 1982 = 100.

TABLE A-3: DEFINITIONS AND SOURCES OF DATA

$P^L_y \times L_y$ = nominal payroll for all employees, data for the years the survey was conducted (1978 and 1982-85) by the Bureau of Census, Annual Survey of Manufactures (ASM).

V_y = nominal value added by manufacturers for the ASM years.

V^* = V / D, real valued added.

D = GNP industry deflators used to convert nominal value added to real value added. The state deflators for manufacturing are the value-added weighted averages of the industry deflators at the 2-digit Standard Industrial Classification (SIC) level. GNP deflator data are from U.S. Department of Commerce, Bureau of Economic Analysis.

$L_{y,m}$ = monthly employment by manufacturing sector and by state from the U.S. Department of Labor, Bureau of Labor Statistics, Tape BLS790.

L_y = manufacturing employees in July of the benchmark years.

S^L_y = $(P^L_y \times L_y)/V_y$, nominal payroll for all manufacturing employees divided by nominal value added for the ASM years, i.e. labor's share.

R^L_y = $((V_y/D) / L_y)$, value added from the ASM, deflated, and divided by total manufacturing employees, i.e. real-output-to-labor ratio.

$K_{y,m}$ = monthly electric power consumption by manufacturing sector and by state. Due to frequent fluctuations in the data, a 3-month moving average is used. Data are compiled by the U.S. Department of Energy for state data and by the Board of Governors of the Federal Reserve System for 2-digit SIC manufacturing data at the District level.

K_y = electric power consumption for industrial customers for the average of May, June, and July of the benchmark years.

R^K_y = $((V_y/D) / K_y)$, value added from the ASM, deflated, and divided by electric power consumption, i.e. real-output-to-capital ratio.

Note: All monthly data were seasonally adjusted using the Bureau of Census X11 procedure.

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