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Impacts of Foreign Trade, Automation, and Comparative Advantage on Manufacturing Employment Changes, 1975-80

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ABSTRACT

A modified shift-share analysis for 1975-80 indicated that (1) 122,000 total net manufacturing jobs were lost to foreign trade; (2) automation accounted for about 1.8 million job losses; (3) apparel, leather, and motor vehicle industries lost many jobs to foreign trade; (4) the Great Lakes region lost many jobs to the South Atlantic, Southwest, and Far West regions; and (5) gains in nonmetropolitan areas were mainly in low-growth industries.

Keywords: Manufacturing, employment, foreign trade, automation, shift-share, location, regional analysis.

SUMMARY

A modified shift-share analysis was used to identify the distribution of manufacturing employment changes by sources and for subnational areas in 1975-80.

Overall, national manufacturing employment grew 11.2 percent. This net change consisted of a 21.8-percent growth in the domestic economy offset by a .7-percent decline because of foreign trade and a 9.9-percent decline resulting from changes in automation.

Foreign trade impacts and relationships to U.S. investment abroad varied by industry. Both the chemical industry and the transportation equipment industry, excluding motor vehicles, gained many jobs from foreign trade. The apparel, leather, and motor vehicles industry lost many jobs to foreign trade. Industry groups which gained from foreign trade may have benefited from U.S. investment abroad. The motor vehicle industry's job losses to foreign trade could be directly related to U.S. investment abroad, unlike job losses in apparel and leather industries.

Within the United States, the Middle Atlantic and East North Central census divisions lost 808,000 jobs to other parts of the Nation. Major gaining regions were the South Atlantic, West South Central, and Pacific census divisions. Nonmetropolitan areas attracted mainly low-growth industries.

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INTRODUCTION

This report uses a modified shift-share analysis to identify the source of manufacturing employment changes and the spatial distribution of these changes for States, metropolitan-nonmetropolitan areas, and census divisions. Examination of these trends, their sources, and spatial distribution provides additional information for analyzing current discussions regarding trade deficits, industrial policy, and the service versus goods economy.

Current Debates

The strong dollar and the recovering U.S. economy, among other factors, are creating an increasing foreign trade deficit. Also, prospects appear to be increasing trade deficits, especially in manufactures, and deficits with more countries [2, 3].[1/] However, the New York Stock Exchange's recent study, in contrast, concludes that U.S. manufacturing overall has not lost international competitiveness but concedes problems exist in autos, steel, and textiles.

Many economists are questioning the New York Stock Exchange study's findings [22]. Such questioning often leads to requests for trade and industrial policies to rescue U.S. manufacturing. Business Week, as early as 1980, called for the "The Reindustrialization of America." Causes of the manufacturing decline, according to Business Week, include incoherent government policy, short-term corporate strategies, inflation, failure to invest in long-term productivity, lack of entrepreneurship, and a sluggish system of collective bargaining [26]. Bluestone and Harrison in The Deindustrialization of America emphasize the role of managerial capitalism and unproductive speculation in this decline [5]. Suggested industrial policies range from do-nothing through Business Week's call for a new social consensus involving business, labor, government, minorities, and public-interest groups to Bluestone and Harrison's movement towards a radical industrial policy of economic democracy. A variety of possible policy approaches are being debated [24].

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1/ Underscored numbers in brackets refer to the list of references at the end of this report.

The strongest hypothesis against the need for an industrial policy possibly arises from the advocates of the service economy. Reminiscent of the "sector" theory of growth, these advocates see the demise of manufacturing as a natural and healthy evolution of the economy towards trades and services. These tertiary industries will replace the economic base of manufacturing [19]. Ronald Shelp in Beyond Industrialization views trade deficits and loss of domestic manufactures as the natural and needed outcome of becoming a service economy [27].

On the other hand, many see the retail trade and service economy with its low wage scales as a denial of the American society founded upon a well-established middle class [29]. Even the acknowledged revival of the New England area with high-tech and service industries has not escaped an increasing disparity of incomes [23].

Current debates on trade deficits, industrial policy, and goods versus service economy portend problems for the Nation as a whole and for all sectors of America [21]. Agriculture and rural communities also have a stake in these debates. Questions in debate are: What will be the effects of trade policies or trade restrictions on agriculture? What will be the effects on rural communities if more manufacturing plants disappear from the American scene? What will be the effects on small and part-time farmers if off-farm manufacturing jobs are lost to imports? About 700 nonmetropolitan counties are heavily dependent upon farming for their economic base; about 670 nonmetropolitan counties are also heavily dependent upon manufacturing for personal incomes [4].

Objectives

This report provides information:

1. Assessing the performance of manufacturing groups in terms of national economic growth, foreign trade, and automation;
2. Relating foreign trade impacts to direct investment abroad by U.S. firms;
3. Identifying effects of these national trends on States and other subnational areas; and
4. Identifying movements of industries within the United States.

Industry performance is measured by the growth or decline in total employment in 1975-80. The employment data are for 2-digit Standard Industrial Classification groups, except that motor vehicles (SIC 371) are analyzed separately from the transportation group [7]. These data represent the average monthly employment in 1975 and 1980 and closely coincide with the business cycle troughs of March 1975 and July 1980. Capacity use in manufacturing averages 72.9 percent in 1975 and 79.1 percent in 1980 according to the Federal Reserve Board, and 77 percent in 1975 and 77.5 percent in 1980 according to the Bureau of Economic Analysis [6]. This coincidence of time periods mitigates cyclical effects; however, the Nation's economy has also experienced secular, trend growth during the period 1975-80.

A modified shift-share analysis is used to factor employment change into causal components. First, national employment change by industry is factored into changes associated with (1) domestic use of an industry's product, (2) net foreign trade, and (3) automation measured by labor use per dollar of

product. These national industry components are then proportioned to States and other subnational areas relative to the areas' shares of industry employment in 1975. Then, the shifts of industry employment within the Nation adjusted for the above proportions are calculated. These shifts are often associated with areas' relative comparative advantages. Appendix A presents relevant formulae and assumptions.

NATIONAL TRENDS

In 1975-80, manufacturing employment increased by 2.055 million workers for an 11.2-percent gain. High-growth industries with employment growth of 20 or more percent included rubber and plastic products, nonelectrical machinery, electric and electronic products, transportation except motor vehicles, and instruments. Moderate growth industries with employment growth rates between 10 and 20 percent included wood products, furniture, printing and publishing, and fabricated metals. All other industry groups grew less than 10 percent with tobacco, textile mills, and leather products showing actual declines (table 1).

Growth Components

Overall, the 2-million national increase in manufacturing jobs resulted from a net addition of almost 4 million jobs from domestic economic growth offset by net losses of 1.8 million jobs because of automation and net losses of only 122,000 jobs as a result of deteriorating trade balances (table 1). There would have been 21.8 percent more jobs in manufacturing because of domestic economic growth in product use except for a .7-percent decline attributable to foreign trade and a 9.9-percent decline occasioned by changes in labor use. In 1975-80, automation accounted for most job losses; foreign trade impacts overall were minimal. Net foreign exports of manufactured goods were $12.3 billion in 1975 and $11.0 billion in 1980 adjusted for inflation [17, 18].

Economic performance regarding changes in foreign trade varied considerably among the 2-digit SIC industry groups. Major losers were the apparel industry with a 5.4-percent loss of 67,381 jobs, leather products with an 11.6-percent loss of 28,438 jobs, and motor vehicles with a 9.3-percent loss of 73,394 jobs. Somewhat ominous was the 1-percent loss of 17,708 jobs in the electric and electronics industry; however, this industry did experience a 46.5-gain in employment from domestic consumption and reduced its labor use by 21.2 percent, a possible signal of increasing labor productivity. Major gainers from foreign trade were the chemical industry with a 4.6-percent gain of 46,665 jobs and the transportation equipment industry, other than motor vehicles, with a 3.5-percent gain of 31,753 jobs. The chemical industry also had an 18.5-percent decline in jobs from automation. More modest gains from foreign trade, 1.2-percent growth each, benefited the food products industry with 19,276 jobs and the nonelectrical machinery group with 24,222 jobs.

Declines in labor use per shipment values, adjusted for inflation, likely mirror trends towards automation and increasing labor productivity. Besides the declines already mentioned for chemical products and the electric and electronics industry, sizable changes also occurred for several other industry groups. Employment declined 18.5 percent for a loss of 160,999 jobs in textile mills whose rush to automation has been widely reported; textile mills were able to hold their own in foreign trade in 1975-80. The furniture and fixtures group declined 20.1 percent for a loss of 83,988 jobs from automation; this group registered a 34.1-percent gain from domestic markets and foreign trade impacts were modest. Automation also affected the food products, apparel, and nonelectrical machinery industries.

Foreign Investment

The role of multinationals, or more broadly, the role of U.S. investment abroad, has been both criticized and encouraged. Bluestone and Harrison criticize the exporting of jobs through foreign investment by American corporations [5]. On the other hand, overseas investment by American companies is one way to expand markets for both domestic and foreign production [26]. Debate regarding the role of multinationals in the trade deficit continues and generalizations are likely erroneous. Data regarding overseas investment were obtained from a periodic survey conducted by the U.S. Department of Commerce [8] and were compared with the foreign trade component of employment change and U.S. domestic investment [14, 15]. Overseas investment in an industry was not necessarily held by domestic corporations in the same industry.

Industry groups which gained from foreign trade may have benefited from U.S. investment abroad (table 2). Investment abroad was quite different for the two industry groups benefiting most from foreign trade. The chemical products industry gained 46,665 jobs from foreign trade, while U.S. overseas investments were about 20 percent the size of domestic capacity as measured by assets and employment. In

Table 1
Components of manufacturing employment change, 1975-80, United States

SIC code[1/]	Manufacturing industry	Employment change		Employees			Percentage of 1975 employment		
				Domestic consumption	Net foreign trade	Automation	Domestic consumption	Net foreign trade	Automation
		Thousand	Percent[2/]	Number			Percent		
20	Food products	49	3.0	206802	19276	-177079	12.5	1.2	-10.7
21	Tobacco products	-5	-6.8	-9000	2107	1892	-12.3	2.9	2.6
22	Textile mills	-17	-2.0	139173	4826	-160999	16.0	.6	-18.5
23	Apparel, Other textiles	25	2.0	251289	-67381	-158909	20.2	-5.4	-12.8
24	Lumber and wood products	74	11.9	98888	-662	-24226	15.9	-.1	-3.9
25	Furniture and fixtures	50	12.0	142070	-8083	-83988	34.1	-1.9	-20.1
26	Paper products	49	7.6	135468	-1879	-84589	21.1	-.3	-13.2
27	Printing and publishing	176	16.3	278809	1879	-104688	25.8	.2	-9.7
28	Chemical products	91	8.9	233180	46665	-188845	22.8	4.6	-18.5
29	Petroleum and coal products	12	6.3	11773	5849	-5621	6.2	3.1	-3.0
30	Rubber and plastic products	127	21.1	126569	-1262	1693	21.1	-.2	.3
31	Leather products	-9	-3.7	10425	-28438	9013	4.2	-11.6	3.7
32	Stone, clay, glass	38	6.0	36024	-4888	6864	5.7	-.8	1.1
33	Primary metals	11	1.0	82621	-9050	-62571	7.2	-.8	-5.5
34	Fabricated metals	162	11.1	164833	-12277	9445	11.3	-.8	.6
35	Nonelectrical machinery	436	21.1	596337	24222	-184560	28.9	1.2	-9.0
36	Electric and electronics	413	24.3	790606	-17708	-359899	46.5	-1.0	-21.2
371	Motor vehicles and equipment	8	1.0	99102	-73394	-17709	12.6	-9.3	-2.3
372-9	Transportation except motor vehicles	192	21.0	281278	31753	-121031	30.8	3.5	-13.2
38	Instruments	159	29.0	179022	1154	-21176	32.7	.2	-3.9
39	Miscellaneous	14	3.4	138833	-35098	-89736	33.7	-8.5	-21.8
	Total	2055	11.2	3994105	-122387	-1816718	21.8	-.7	-9.9

[1/] Standard Industrial Classication

[2/] Percent of 1975 employment

contrast, the transportation group, excluding motor vehicles, gained 31,753 jobs from foreign trade, while U.S. investment abroad was minimal. The nonelectrical machinery group gained 24,222 jobs from foreign trade, while U.S. investments abroad were about one-third the size of domestic assets and about one-tenth the number of U.S. employees.

Relationships between employment change due to foreign trade and U.S. investment abroad were quite mixed for those industries which lost large numbers of jobs because of foreign trade (table 2). The motor vehicle industry lost 73,394 jobs to foreign trade. This was directly related to U.S. investment abroad. Overseas investment represented 45 percent of domestic assets and foreign jobs almost 30 percent of U.S. employment in the industry. Foreign wage levels were only 60 percent of U.S. wage levels. The automobile industry has been criticized both for its high wage levels and its failure to rapidly move into the small car market with a high-quality product [1, 24]. In contrast, major job losses in apparel and leather products occurred with minimal overseas investment by U.S. companies. Job losses in domestic apparel and leather industries could not be attributed to foreign investment by U.S. companies. In the electric and electronics industry, which lost 17,708 jobs to foreign trade, overseas investment was about one-fifth the size of domestic assets, and foreign wage levels were 77 percent that of U.S. workers. Since 1980, several nationally known companies in electronics have announced plans for overseas production.

Blanket generalizations are not warranted. Each industry's performance needs to be analyzed separately. In several industries, U.S. investment abroad appeared to benefit domestic production. However, in a few sectors, American companies have apparently and deliberately exported jobs; and several industrial sectors have lost jobs to foreign competitors.

STATE IMPACTS

All but five States indicated at least some employment growth in manufacturing in 1975-80 (table 3). Illinois and Pennsylvania endured major declines in manufacturing employment. Other States with total decreases were West Virginia, Ohio, and North Dakota.

Foreign trade impacts were most severe in the Great Lakes region. The East North Central census division lost 53,844 jobs to changes in foreign trade with Michigan accounting for 30,279 of these jobs. The Middle Atlantic census division lost 28,514 jobs. A recent study by SRI International estimated that this Great Lakes area lost 4 percent of its jobs to foreign trade in 1972-83 [28]. Other census divisions with sizable job losses to foreign trade included New England, except Connecticut, with 11,505 jobs, the East South Central with 11,781 jobs,and the South Atlantic with 7,968 jobs. Manufacturing in the Old South region has also become vulnerable to foreign trade. For the remainder of the Nation, west of the Mississippi River, Missouri evidenced 5,457 job losses because of foreign trade effects.

Not only has the Great Lakes region lost jobs to foreign competitors but also to domestic competitors. Regional shifts amounted to 808,000 jobs out of the Middle Atlantic and East North Central divisions to other parts of the Nation (table 3). These shifts, measured by the differentials between State and national growth rates, indicated this old industrial belt of American manufacturing was losing its share of national manufacturing employment. Outward shifts occurred for high-, moderate-, and low-growth industries. Outside the Great Lakes region, Iowa and Mississippi also lost many jobs in high-growth industries to other areas of the Nation. Assuming the economic rationality of businesses' location decisions, these employment shifts reflected the relative comparative advantages of various areas for manufactures.

Who gained from the shift of manufacturing? Major beneficiaries of this domestic shift of industry were largely in the Sunbelt region. California, Arizona, Colorado, Oklahoma, Texas, the Carolinas, Florida, and Georgia posted major employment gains from domestic shifts of high-, moderate-, and low-growth industries. Much of Georgia's growth was in low-growth industries. Several States outside the Sunbelt region were able to increase their shares of high-growth industries: Massachusetts, New Hampshire, Minnesota, Washington, and Oregon.

Table 2
Employment change, net foreign trade, 1975-80, and foreign investment, 1977, United States

SIC code[1]	Manufacturing industry	1975-80 Employment change, net foreign trade		U.S. direct investment abroad, 1977					
				Dollars		Employment		Annual Wages	
				Foreign investment	Ratio U.S. depreciable assets[2]	Foreign employees[3]	Ratio U.S. employees[4]	Foreign employees	Ratio U.S. production workers[5]
		Number	Percent	Million	Percent	Number	Percent	Number	Percent
20	Food products	19276	1.2	5571	14.5	171428	11.3	8136	74.3
21	Tobacco products	2107	2.9	937	52.4	17551	29.0	8173	72.2
22	Textile mills	4826	.6	752	5.1	21552	2.5	7633	94.1
23	Apparel, other textiles	-67381	-5.4	505	12.3	35247	2.6	5005	79.8
24	Lumber and wood products	-662	-.1	531	4.3	16634	2.4	11457	117.6
25	Furniture and fixtures	-8083	-1.9	175	4.5	7188	1.5	9018	108.4
26	Paper products	-1879	-.3	2770	8.8	56784	9.0	11793	90.7
27	Printing and publishing	1879	.2	408	2.7	12822	1.2	9773	83.5
28	Chemical products	46665	4.6	11864	18.2	187858	21.3	11013	80.4
29	Petroleum and coal products	5849	3.1	8026	31.2	29648	20.2	18005	103.1
30	Rubber and plastic products	-1262	-.2	2533	15.8	74009	10.3	9464	91.3
31	Leather products	-28438	-11.6	53	5.4	4626	1.9	5283	79.4
32	Stone, clay, glass	-4888	-.8	1625	8.1	40794	6.6	10181	85.5
33	Primary metals	-9050	-.8	1754	3.0	25295	2.3	10622	66.9
34	Fabricated metals	-12277	-.8	2872	11.1	67925	4.4	11113	91.8
35	Nonelectrical machinery	24222	1.2	11223	31.1	248343	11.9	13788	106.5
36	Electric and electronics	-17708	-1.0	5494	23.0	242741	14.1	8400	77.3
371	Motor vehicles and equipment	-73394	-9.3	9032	45.2	256174	29.2	10597	60.8
372-9	Transportation except motor vehicles	31753	3.5	289	2.4	8089	.9	14459	105.5
38	Instruments	1154	.2	2608	31.0	82081	14.7	10831	100.5
39	Miscellaneous	-35098	-8.5	1025	24.1	36313	8.2	7550	93.1
	Total	-122387	-.7	70047	16.0	1643100	8.9	10606	92.4

1/ Standard Industrial Classification

2/ Ratio of U.S. direct investment abroad to U.S. domestic depreciable assets (gross book value), expressed as percent.

3/ Share of foreign affiliates' employment represented by U.S. direct investment abroad in foreign affilates' total assets.

4/ Ratio of foreign employment supported by U.S. direct investment abroad to total domestic employment, expressed as percent.

5/ Ratio of average wage rates of all foreign employees to average wage rates for U.S. production workers, expressed as percent.

In 1975-80, the relative shifts of industry from the Great Lakes region to selected portions of the Sunbelt region were substantial. Such domestic shifts of industry, compounded by foreign trade deficits, have undoubtedly not eased sectional strife nor the calls for federal policies, programs, and the mitigation of nation wide tax reforms [21].

RURAL IMPACTS

A recent study by the U.S. Department of Agriculture classified the Nation's nonmetropolitan counties into six economic types based on dominant sectors and counties exhibiting persistent poverty [4]. Based on 1979 data, manufacturing dependent counties comprised 27.8 percent of all nonmetropolitan counties and contained 39 percent of the nonmetropolitan population (figure 1). Most of these counties were in the Southeast with another sizable portion in the North

Table 3
Components of manufacturing employment changes, 1975-80

Census division and State	Employment change 1/	State shares of national growth			Regional shifts among states		
		Domestic consumption	Net foreign trade	Automation	High-growth industry 2/	Moderate-growth industry 3/	Low-growth industry 4/
				Number			
New England							
CT	57848	96654	943	-37852	-2669	-876	1648
MA	96075	146047	-5735	-60670	21286	-5362	509
ME	17456	17084	-2140	-7765	4822	224	5230
NH	31966	19775	-1474	-7424	15467	3191	2430
RI	15798	27923	-2926	-14323	255	648	4221
VT	11327	10946	-173	-4626	817	3131	1233
Middle Atlantic							
NJ	33133	172823	-1439	-83627	-24729	-5468	-24427
NY	31364	341718	-16368	-151149	-68062	-24393	-50383
PA	-7261	271974	-10707	-126372	-67880	-21418	-52858
East North Central							
IL	-21987	286357	-3545	-117876	-106834	-33678	-46410
IN	19257	144465	-6126	-60277	-34666	-10603	-13536
MI	24889	172432	-30279	-60447	-3659	-17407	-35751
OH	-1951	259534	-9471	-96810	-94160	-21435	-39609
WI	51688	111883	-4423	-45137	-9001	1646	-3279
West North Central							
IA	14838	53278	-49	-22738	-14741	-1293	383
KS	28122	37077	840	-15358	2964	-631	3230
MN	60883	70710	-734	-28682	14643	7553	-2607
MO	36827	88243	-5457	-38945	-3240	-2090	-1684
ND	-638	3552	71	-1570	-2693	122	-120
NE	11873	18222	-89	-8352	1088	-489	1492
SD	6380	3809	-64	-1757	3054	148	1190
South Atlantic							
DC	136	3783	40	-1549	-708	-1386	-43
DE	3951	13376	720	-8392	-726	167	-1195
FL	114231	76384	-378	-35760	45043	19587	9356
GA	82328	82415	-3586	-52547	7895	11487	36665
MD	8094	47768	-1401	-22607	853	-654	-15865
NC	114100	139990	-2592	-97511	23602	14487	35724
SC	52377	67323	-599	-47795	15610	3767	14072
VA	44253	76951	-288	-43340	-3808	6179	8558
WV	-2296	20129	116	-10308	-2422	-1530	-8281
East South Central							
AL	38067	59526	-2421	-33458	3708	4462	6251
KY	18594	53364	-2229	-24720	-6646	-2720	1545
MS	19490	46782	-1873	-22803	-13142	2932	7593
TN	42290	95427	-5258	-49398	3533	-5674	3659
West South Central							
AR	30522	38237	-2136	-17212	3359	-1303	9576
LA	28133	36499	1636	-19082	6163	-624	3542
OK	41283	30853	-627	-12132	13260	1208	8721
TX	238033	171934	-194	-77411	76674	24069	42961

Table 3
Components of manufacturing employment changes, 1975-80--continued

Census division and State	Employment change 1/	State shares of national growth: Domestic consumption	State shares of national growth: Net foreign trade	State shares of national growth: Automation	Regional shifts among states: High-growth industry 2/	Regional shifts among states: Moderate-growth industry 3/	Regional shifts among states: Low-growth industry 4/
			Number				
Mountain							
AZ	55402	26717	-242	-11327	24444	6733	9076
CO	43839	29292	-385	-11680	17228	4807	4577
ID	5700	8046	190	-3932	2285	-1254	366
MT	1166	3461	17	-1511	-80	-91	-632
NM	5775	6414	-418	-3162	2017	495	429
NV	7221	2690	-71	-1253	2509	1501	1844
UT	20114	13845	-205	-6164	8435	2095	2108
WY	1301	1245	64	-533	318	322	-115
Pacific							
AK	4671	1529	47	-849	270	323	3351
CA	422806	394801	-2341	-170118	98141	48571	53752
HI	32	3852	-103	-2379	-37	-170	-1131
OR	31740	34868	-226	-12964	10977	-6515	5600
WA	63760	52097	1699	-23064	29181	-3189	7036
United States	2055000	3994105	-122387	-1816718	0	0	0

1/ Totals may not exactly add because of rounding.

2/ Includes SIC 30, 35, 36, 372-379, 38.

3/ Includes SIC 24, 25, 27, 34.

4/ Includes SIC 20, 21, 22, 23, 26, 28, 29, 31, 32, 33, 371, 39.

Central division. These manufacturing counties were subject to recessions, foreign competition, and U.S. overseas investment. Their manufacturing base was often concentrated in low-wage manufacturing [4].

Approximately 27 percent of the Nation's net gain in manufacturing employment occurred in nonmetropolitan areas with almost 60 percent of that in the southern census divisions (table 4). Job losses to foreign trade and to automation also occurred mainly in the South Atlantic, East South Central, and Great Lakes regions. However, nonmetropolitan losses in the Great Lakes region were considerably less than the region's metropolitan counties. Both the Old South and the Great Lakes regions confronted employment problems occasioned by foreign trade and automation.

Rural areas, outside the Great Lakes region, continued the trend of attracting low-growth industries relative to metropolitan areas attracting the high-growth industries. Often these low-growth industries have been associated with mature sectors of the economy and with low-wage levels. This imbalance in regional shifts of high-versus low-growth industries was most pronounced in the Old South, especially the South Atlantic division, and in the West North Central division. The Great Lakes region continued to lose domestic jobs to other parts of the Nation as evidenced by negative regional shifts across the board.

The population turnaround of many rural areas during the late sixties and seventies was often spearheaded and financed by the movement of manufacturing into rural areas. Continued dependence on low-growth industries, especially in the Old South, and failure to attract high-growth industry could threaten rural prosperity. Only in the New England and Mountain divisions did rural

areas exhibit as much attraction for high-growth as for low-growth industries. Foreign trade and automation could affect the livelihood of many rural workers in the Old South and Great Lakes regions.

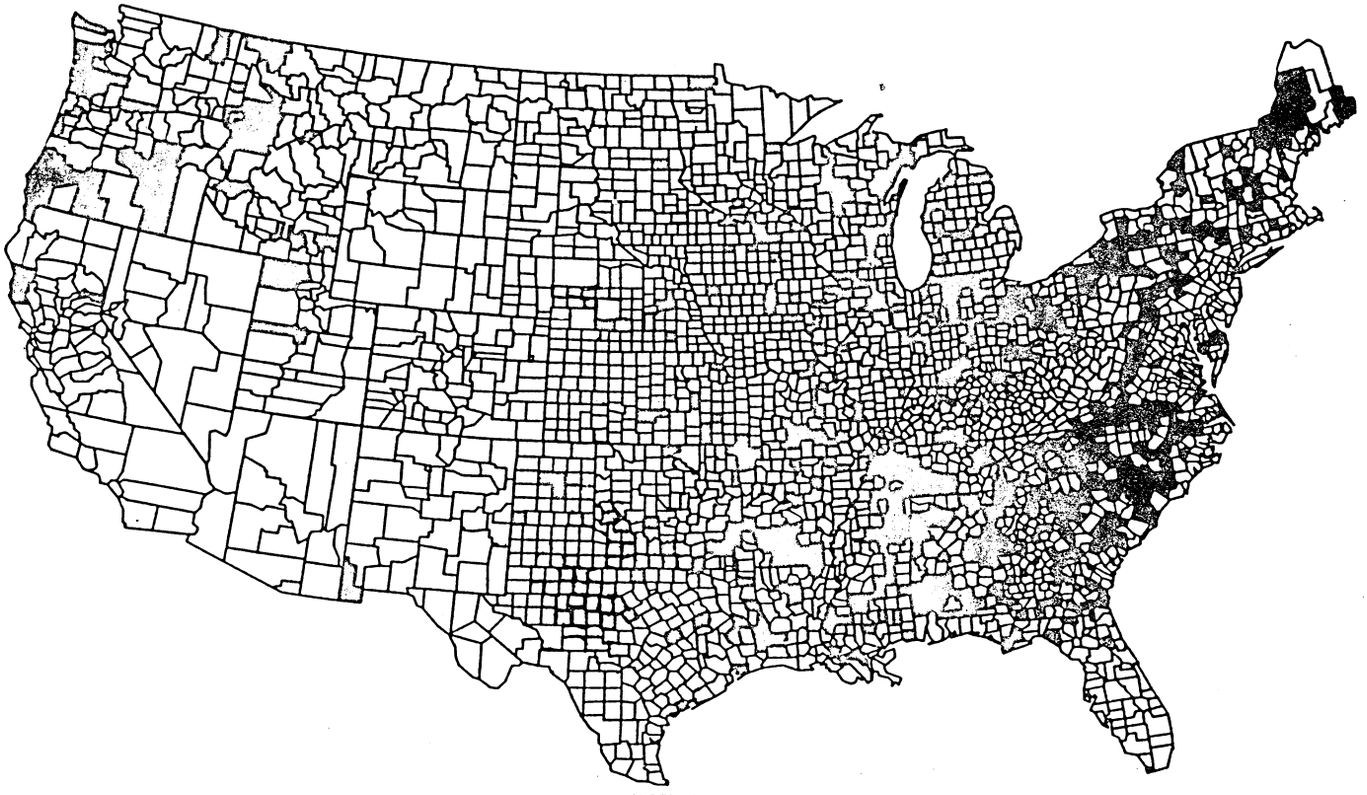
INDUSTRY SHIFTS

Regional shifts of domestic employment occurred mainly in eight industry groups (table 5). Among the high-growth industries, both nonelectrical machinery and the electric and electronics group shifted employment into New England, the South Atlantic, West South Central, and the Mountain and Pacific divisions. These two industry groups evidenced the most shifts of domestic employment among 2-digit SIC groups. In addition, instrument manufactures shifted employment into the Mountain and Pacific divisions. Among moderate-growth industries, printing and fabricated metals shifted employment into the South Atlantic and Pacific divisions. The low-growth industries of apparel, primary metals, and motor vehicles also shifted employment into the South Atlantic division. Primary metals also moved into the West South Central division.

Regional shifts have measured the impacts of underlying comparative advantages of differing regions for industrial production. The South Atlantic and Far West regions have attracted industry because of perceived comparative advantages. Lists of location factors have often included labor wages, productivity, and unionization; energy requirements and costs; regional market growth; transportation costs; amenities; and a host of others.

FIG. 1

MANUFACTURING COUNTIES



Labor and Proprietary Income (LPI) is equal to or greater than 30 percent of county total LPI, 1979.

Table 4
Components of manufacturing employment changes, 1975-80

Census division and metro status	Employment change	Regional Shares of national growth			Regional shifts		
		Domestic consumption	Net foreign trade	Automation	High-growth industry	Moderate-growth industry	Low-growth industry
		Number					
New England							
Metro	187362	278268	-8919	-115439	32953	-5818	6317
Nonmetro	43108	40162	-2585	-17221	7026	6773	8954
Middle Atlantic							
Metro	39838	701161	-24977	-322734	-146054	-48752	-118805
Nonmetro	17398	85354	-3537	-38414	-14616	-2526	-8864
East North Central							
Metro	21538	763510	-45933	-296086	-195851	-78660	-125442
Nonmetro	50358	211161	-7911	-84462	-52470	-2817	-13143
West North Central							
Metro	94007	183645	-1616	-77219	5252	-3858	-12197
Nonmetro	64278	91245	-3865	-40185	-4176	7178	14080
South Atlantic							
Metro	238139	294497	258	-161892	60393	26973	17910
Nonmetro	179035	233621	-8225	-157917	24946	25530	61081
East South Central							
Metro	45490	110485	-1992	-53582	-3589	-4581	-1251
Nonmetro	72951	144614	-9790	-76796	-8957	3580	20299
West South Central							
Metro	253612	206298	1398	-91876	79776	16385	41632
Nonmetro	84359	71225	-2719	-33961	19680	6966	23168
Mountain							
Metro	116198	66952	-929	-28100	49598	14133	14543
Nonmetro	24320	24758	-120	-11460	7557	475	3110
Pacific							
Metro	491874	452413	-1043	-194880	131483	49281	54619
Nonmetro	31135	34734	119	-14494	7049	-10262	13989

We briefly studied the relationships between regional employment shifts and production workers' wages and contributions to profit. In this case, profit includes both capital returns and overhead salaries of administrative employees. Productivity of production workers is measured by the dollars contributed to profit per each dollar of wages. Similar measures have been used by Miller [25]. Significant inverse correlations existed between production workers' average wages in 1977 and State shifts of domestic employment for only seven industry groups, with the highest correlation being that for motor vehicles. However, only two of these seven industry groups also exhibited significant positive correlations between production workers' profitability and regional shifts; namely, nonelectrical machinery and primary metals.

Three hypotheses are warranted. First, location factors other than production workers' wages and profitability are more important for explaining regional shifts. If not, then second, location decisions are economically irrational. And third, several industry sectors are victims of "money illusion"; that is, their executives take into account money wage levels but not real productivity.

CONCLUSIONS

Since 1980, the ending date for this analyses, foreign trade deficits have grown alarmingly so that now a $100-billion trade gap is in prospect [2]. Moreover, capital spending has increased dramatically but not for new plant capacity. Rather capital spending is mainly for new equipment, automation [1]. Both trade gaps and automation do not augur well for future employment gains in manufacturing. Dependence of rural areas on low-growth industries and the shifting of remaining domestic employment towards the South Atlantic and Far West regions may well leave many parts of the country with vacant plants and ranks of underemployed and jobless people.

Debates and their resolutions regarding trade deficits, industrial policy, and the service versus goods economy need to be addressed. A great variety of options are presented ranging from laissez-faire to centralized planning [24]. A conscious choice and sufficiently lengthy period of experimentation are warranted. Probably, the worst choices are ad hoc interventions during crises which often guarantee nothing but damaging repercussions elsewhere in the Nation's economy. Valid questions are: Can the Nation survive with rich and poor regions? Can the Nation survive without a sizable middle-class citizenry [21, 29]?

If economists are to furnish information for policy decisionmakers, we crucially need data more currently published, data publicly released for disaggregated economic sectors for at least State areas, and data which more closely describe individual economic sectors [24]. Information for policy decisions is impossible in a data vacuum and can be misleading with meaningless data.

Table 5
Regional shifts of manufacturing employment, 1975-80

SIC code	Manufacturing industry	Census divisions: New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	Correlation with labor: Profits 1/	Wages 2/
		Number									Percent	
High-Growth Industries												
30	Rubber and plastic products	-9050	-1152	-26288	613	16572	-558	9028	338	10497	.10	-.25
35	Nonelectrical machinery	25986	-51986	-108886	3476	26163	2024	51517	19059	32647	.35*	-.43*
36	Electric and electronics	15612	-62698	-88722	-5307	28892	1488	36171	16105	58459	.22	-.22
372-9	Transportation except motor vehicles	5033	-13221	-1541	-1780	4375	-14742	5825	5553	10498	-.06	-.17
38	Instruments	2399	-31613	-22883	4074	9335	-759	-3085	16100	26432	-.05	-.14
Moderate-growth industries												
24	Lumber and wood products	1651	-69	-1993	265	9494	1733	1197	-859	-11420	.17	-.41*
25	Furniture and fixtures	-2412	-5468	-7799	839	8886	-1709	-3625	2221	9068	.09	-.09
27	Printing and publishing	-2500	-21333	-29949	3403	13037	2927	9261	6886	18268	-.18	-.33*
34	Fabricated metals	4216	-24407	-41737	-1186	21085	-3952	16518	6360	23103	.27	-.44*
Low-growth industries												
20	Food products	-1357	-19430	-18345	-2535	9026	3263	10007	1574	17797	-.16	-.30*
22	Textile mills	225	-15234	-2815	-401	17856	-197	-1291	446	1410	.05	-.06
23	Apparel, other textiles	-1870	-31407	-9600	-1911	20921	8285	1917	-267	13933	-.06	-.13
26	Paper products	-501	-5467	-5725	-343	5018	1902	3072	1243	802	.27	.03
28	Chemical products	-1340	-13261	-2854	3979	-6405	-1729	12113	2962	6535	.22	.06
29	Petroleum and coal products	-9	-657	-4324	703	804	876	230	490	1887	.10	.15
31	Leather products	3579	-5052	-3370	1614	1482	-3099	1456	1096	2294	.08	-.16
32	Stone, clay, glass	1913	-12020	-14063	-923	2293	-194	10432	6957	5604	.36*	-.14
33	Primary metals	8505	-23951	-27913	4707	11066	3003	15993	2829	5760	.34*	-.42*
371	Motor vehicles and equipment	2419	9259	-43187	-3098	13314	5951	7715	1791	5837	.27	-.62*
39	Miscellaneous	3690	-10030	-6313	98	1773	2408	3150	-1469	6691	.12	-.24

1/ Labor profits equals (value added minus production workers' wages)/production workers' wages in 1977. The number of observations varies by industry and equals the number of States with published data in the 1977 Census of Manufacturers. An "*" indicates the correlation coefficient is significantly different from zero at the 5 percent level.

2/ Labor wage equals (total production workers' wages/total number production workers) in 1977. The number of observations varies by industry and equals the number of States with published data in the 1977 Census of Manufacturers. An "*" indicates the correlation coefficient is significantly different from zero at the 5 percent level.

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APPENDIX A--METHOD

Shift-share analysis has been widely used as a descriptive technique for analyzing components of employment change even though its usefulness for predicting future employment changes has been seriously questioned. In its customary use, subnational area employment change is factored first into two components, regional share or proportion, and second, regional shift. The first term depends on national industry-growth rates and the second on the differential between area and national industry-growth rates. Often, the regional share component is further factored into overall national growth and specific industry-mix components; however, this factoring has recently been criticized as a needless complication for analyzing regional comparative advantages [30].

In the modification used in this report's analysis, the regional share component is divided into three subcomponents reflecting: national growth in domestic usage of an industry's product, changes in net foreign trade, and changes in automation. As a result, for example, a State's change in employment in an industry depends on its proportionate share of national product consumption, its share of foreign trade, its share of changes in automation, and its regional shift, that is, for each industry group:

$$(1)\quad E_{t8} - E_{t7} = D + F + A + R$$

$$(2)\quad D = (E_{u7}/S_{u7})\cdot((S_{u8} - X_{u8} + I_{u8})-(S_{u7} - X_{u7} + I_{u7}))\cdot(E_{t7}/E_{u7})$$

$$(3)\quad F = (E_{u7}/S_{u7})\cdot((X_{u8} - I_{u8})-(X_{u7} - I_{u7}))\cdot(E_{t7}/E_{u7})$$

$$(4)\quad A = ((E_{u8}/S_{u8})-(E_{u7}/S_{u7}))\cdot S_{u8}\cdot(E_{t7}/E_{u7})$$

$$(5)\quad R = ((E_{t8}/E_{t7}) - (E_{u8}/E_{u7}))\cdot E_{t7}$$

where

A = employment change from automation as measured by labor use per dollar of an industry's output;
D = employment change from domestic consumption of an industry's product, no matter its origin;
E = employment;
F = employment change from net foreign trade of an industry's product;
I = imports of an industry's product;
R = regional shift of employment in an industry within the Nation;
S = total value of shipments for an industry, including the net change in year-end inventories;
X = exports of an industry's output;
t = subscripts for State or other subnational area,
u = subscript for the Nation;
7 = subscript for 1975; and
8 = subscript for 1980.

All 1980 prices are adjusted to 1975 levels using appropriate producer price indices. Data sources include [7] for employment, [9, 10] for producer price indices, [11, 16] for industry shipments, [17, 18] for exports and imports. Import values include costs, insurance, and freight to the port of entry, and noncomparable imports not produced in the United States. Export values include price, freight, and insurance at the port of exit. Shipment values are f.o.b. (free on board) plant.

In equation 2, the second factor measures the change in domestic use of an industry's product no matter its origin; the first factor transforms this product change into employment based on the employee-output relation existing in 1975. Equation 3 performs similarly for the change in net foreign trade. In equation 4, the first factor measures the change in the employee-output relation in 1975-80; this change factor is then multiplied by the total shipment value in 1980. Consequently, "D" measures employment change caused by changes in domestic use of a product; "F" measures employment change caused by changes in net foreign trade; and "A" measures employment changes caused by changes in automation or labor usage. Only the first-round, direct effects of foreign trade and automation are identified in this analysis. Indirect and induced effects (a la an input-output model) are subsumed within the domestic growth category. The third factor in equations 2, 3, and 4 distributes national changes among States based on their proportions of national employment in 1975. Equation 5 is the traditional measure of shifts in employment.

A major limitation of this study concerns the use of data at a highly aggregated 2-digit SIC code level. Ideally, data for 3-digit and even 4-digit SIC code levels would be more accurately factored into components of employment change. However, disclosure rules prohibit public release of much detailed data for subnational areas. Consequently, study results are subject to errors due to changes in the composition of products within the 2-digit industry graoup. Appendix B presents more detail regarding actual employment change.

In addition, changes in vertical plant integration within a 2-digit industry can affect comparisons of shipment values between two time periods and, consequently, study results. Shift-share models were investigated using shipments as noted above and also using value-added measurements which are not affected by vertical integration. The two models yield substantially different values for domestic growth and automation changes and somewhat different values for foreign trade effects; regional shifts are not affected. In general, absolute values for domestic growth and automation are greater using value-added measures than shipment values. Greater differences in automation based on value-added are offset by greater differences in domestic use based on value-added. Note that summation to total national employment change requires such compensation.

This study uses shipment measures instead of value-added for the following reasons. First, as noted in Appendix table A, automation changes are lower using shipments than value-added for 13 of the 21 industry sectors studied. Five industry groups exhibit different directions for changes in labor use. Using shipments yields decreases in labor (except for tobacco products), which more accurately depict manufacturing trends toward automation. For example, in the motor vehicles industry, the shipment base indicates a decline in employment of about 17,700, whereas the value-added base indicates an increase of 20,000 employees. Second, shipments more closely correspond with physica production than value-added, which is a residual concept greatly affected by increasing costs of materials and declining profit margins. For example, in the chemical industry, shipments per employee increased 17 percent whereas value-added per employee increased only 5.8 percent. The resultant job loss of 188,845 employees measured by shipments may still be more accurate than the smaller job loss of 64,408 employees measured by value-added. Third, foreign value-added for imports is not readily available; our comparisons adjust import shipments by the U.S. ratios of value-added to shipments. Fourth, the short-time span of 5 years and the period's correspondence with similar points

in the business cycle mitigate problems of industrial composition within broad industry groupings and changes in vertical integration within plant establishments.

Appendix table A
Comparison of automation components using shipments and value-added concepts, United States

SIC Code	Manufacturing industry	Employment change from automation		Percent change, 1975-80		Percent value-added of shipment	
		Shipments	Value-added	Value-added per employee	Shipments per employee	1975	1980
		Number		Percent			
20	Food products	-177079	-263554	15.4	10.4	28.0	29.3
21	Tobacco products	1892	-5422	8.0	-2.8	44.6	49.5
22	Textile mills	-160999	-177106	20.8	18.9	39.1	39.8
23	Apparel, other textiles	-158909	-259622	20.5	12.5	47.3	50.6
24	Lumber and wood products	-24226	32951	-4.7	3.5	41.4	38.1
25	Furniture and fixtures	-83988	-83825	18.0	18.0	51.9	51.9
26	Paper products	-84589	-37090	5.4	12.2	43.0	40.4
27	Printing and publishing	-104688	-78358	6.2	8.3	64.7	63.5
28	Chemical products	-188845	-64408	5.8	17.0	49.9	45.1
29	Petroleum and coal products	-5621	30516	-15.2	2.8	15.0	12.4
30	Rubber and plastic products	1693	38912	-5.3	-.2	50.2	47.6
31	Leather products	9013	13603	-5.7	-3.8	50.5	49.5
32	Stone, clay, glass	6864	40595	-6.1	-1.0	54.4	51.6
33	Primary metals	-62571	-25844	2.2	5.4	36.5	35.4
34	Fabricated metals	9445	19860	-1.2	-.6	50.0	49.7
35	Nonelectrical machinery	-184560	-205560	8.2	7.4	53.5	54.0
36	Electric and electronics	-359899	-376941	17.8	17.0	55.3	55.6
371	Motor vehicles and equipment	-17709	20025	-2.5	2.2	30.9	29.5
372-9	Transportation except motor vehicles	-121031	-99782	9.0	10.9	53.7	52.8
38	Instruments	-21176	11559	-1.6	3.0	64.5	61.6
39	Miscellaneous	-89736	-43748	10.3	21.1	54.0	49.2

APPENDIX B--GROWTH INDUSTRIES

Appendix table B provides a more detailed identification of growth industries in 1975-80 based on County Business Patterns data. Note that employment data compares March 1975 and March 1980 employment. Within broad industrial groupings, not all types of manufacturing industries exhibit high-growth rates. For example, only plastic products and hose and belting exhibit growth greater than 20 percent within the 2-digit SIC 30 group. In contrast, the luggage industry has grown 26.8 percent even though the leather products group overall has practically zero growth.

Industrial development groups often develop a list of industries and their companies to target as prospects. Such targeting is based on recent industry trends, anticipation of future growth industries, and matching industry characteristics with community and labor-force occupational characteristics. Appendix table B identifies recent growth industries. Of particular interest are those industries which not only have had high-employment growth but also large increases in the number of establishments.

Appendix table B

Manufacturing establishment and employment changes for 2-digit industry groups and for 3-digit high-employment growth industries, 1975-80, United States

SIC code	Industry 1/	Establishment change	Employment change	
		Number	Thousand	Percent
	All manufacturing	13,440	2,777	15.1
20	Food products	-3,567	64	4.4
21	Tobacco products	-82	-9	-14.3
22	Textile mill products	-391	38	4.7
23	Apparel and other textiles	-571	100	8.4
239	Miscellaneous fabricated textiles	56	40	26.4
24	Lumber and wood products	-225	141	24.9
241	Logging camps and contractors	-311	24	32.6
243	Millwork, plywood, structural members	707	49	32.1
244	Wood containers	579	13	41.8
245	Wood bldgs., mobile homes	99	16	30.5
25	Furniture and fixtures	356	96	24.3
251	Household furniture	181	59	22.7
252	Office furniture	120	15	39.1
254	Partitions and fixtures	87	15	30.0
259	Miscellaneous furniture, fixtures	-48	9	34.2
26	Paper and allied products	319	71	12.1
261	Pulp mills	9	4	27.2
27	Printing and publishing	4,084	178	16.5
272	Periodical	367	17	26.2
274	Miscellaneous publishing	-236	8	23.1
276	Manifold business forms	68	9	22.0
277	Greeting card publishing	-17	6	35.2
278	Blankbooks and bookbinding	35	14	27.0
279	Printing trade services	688	10	21.6
28	Chemicals and allied products	304	85	10.1
29	Petroleum and coal products	165	1	.9
299	Miscellaneous petroleum and coal products	46	2	20.1
30	Rubber and miscellaneous plastics products	2,382	182	30.9
304	Rubber and plastic hose and belting	39	8	26.9
307	Miscellaneous plastic products	2,267	183	55.2
31	Leather and leather products	-219	1	.3
313	Boot and shoe cut stock and findings	-25	2	27.4
316	Luggage	6	4	26.8
32	Stone, clay, glass products	92	56	9.8
323	Products, purchased glass	225	13	41.7
33	Primary metal industries	187	15	1.3
334	Secondary nonferrous metals	39	5	28.5
336	Nonferrous foundries	97	18	24.8
339	Miscellaneous primary metal industries	-94	6	20.0

Appendix table B--continued
Manufacturing establishment and employment changes for 2-digit industry groups and for 3-digit high-employment growth industries, 1975-80, United States

SIC code and industry [1]		Establishment change	Employment change	
		Number	Thousand	Percent
34	Fabricated metal products	2,784	275	19.6
342	Cutlery, hand tools hardware	121	35	24.8
343	Plumbing, heating except electric	360	12	24.2
345	Screw machine products, bolts, and others	82	21	21.4
346	Metal forgings and stampings	434	53	22.8
347	Metal services not elsewhere classified	109	27	34.2
349	Miscellaneous fabricated metals	829	64	26.4
35	Machinery, except electrical	5,624	427	20.6
354	Metal working machinery	1,142	65	21.6
357	Office and computing machines	461	140	57.4
358	Refrigeration and service machinery	332	39	23.4
359	Miscellaneous machinery, except electrical	1,789	72	31.7
36	Electric and electronic equipment	1,694	454	28.8
362	Electrical industrial apparatus	210	38	20.2
364	Electric lighting and wiring equipment	28	33	22.9
366	Communication equipment	254	118	25.9
367	Electronic components and accessories	1,333	191	59.6
369	Miscellaneous electrical equipment and supplies	-82	38	33.1
37	Transportation equipment	105	268	16.9
372	Aircraft and parts	172	136	30.4
375	Motorcycles, bicycles, parts	1	5	29.4
38	Instruments and related products	936	125	24.1
381	Engineering and scientific instruments	123	12	22.4
382	Measuring and controlling devices	424	62	37.4
383	Optical instruments and lenses	36	21	95.8
384	Medical instruments and supplies	350	24	20.9
39	Miscellaneous manufacturers	-996	33	8.1

[1] Only those 3-digit SIC industries are listed which have growth rates greater than or equal to 20.0 percent.

Source: 1975 and 1980 County Business Patterns [12, 13].

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