

Socio-Economic Review of Appalachia

Appalachian Competitiveness in a Global Economy: Industrial Exports and Exporter Establishments

Rodney A. Erickson, Samuel X. Lowe
The Pennsylvania State University
David J. Hayward
University of Auckland, New Zealand

Abstract: Much public debate and current policy initiatives of federal and state governments revolve around questions of export performance and the prospects of future growth or decline in various industries and the places in which these producers are located. The purpose of this research was to analyze the export growth performance of Appalachian manufacturing industries and the destination patterns of export flows. Published and unpublished U.S. Bureau of the Census data on industrial exports by place of production were used to estimate export shipments and employment for the 399-county Appalachian Region for each of the years 1983-91 by 2-digit SIC. An extended and dynamic version of shift-share analysis was used to determine the shares of Appalachian industrial growth attributable to various national, industry, and regional growth effects further decomposed into export, import, and domestic demand components. By combining data on the place of production of manufactured exports with data on the origin and destination of export goods movements, the authors were able to develop reliable estimates of the flows of Appalachian exports to various world regions and more than a hundred country destinations for the years 1987 and 1991. The analysis indicates that Appalachian exporters fared well over the 1983 to 1991 period in comparison with the national economy. Only about 15 percent of Appalachia's total increase in manufacturing shipments over the 1983-91 period was attributable to increased production for exports. Nearly 85 percent of Appalachian exports in both 1987 and 1991 was destined for Canada, Europe, and Asia. Manufacturing establishments producing advanced technology merchandise have been identified in recent national studies as having significantly higher export propensities than non-advanced technology plants. Overall, the prospects for future exports growth in Appalachia appear to be promising. Despite a lower proportion of advanced technology producers in the region than in the nation, recent past export performance has been good, largely in response to national export growth trends.

Acknowledgments: This report was prepared for the Appalachian Regional Commission through a subcontract with the Regional Research Institute, West Virginia University. This research relied extensively on the use of manufacturing establishment microdata from the Longitudinal Research Database at the Center for Economic Studies (CES) of the U.S. Bureau of the Census. David Ryan and Brad Jensen, both of CES, have provided valuable assistance with computing and insights into the nature of the microdata, respectively. The authors are responsible for any errors or omissions in the analysis. The interpretations and opinions expressed in this paper are those of the authors and do not necessarily reflect official positions of the Appalachian Regional Commission, the U.S. Bureau of the Census, or our respective academic institutions.

I. INTRODUCTION

Foreign trade between the United States and other nations represents a component of the U.S. economy whose importance has been increasing substantially in recent years. In 1973, U.S. merchandise exports were valued at nearly \$70 billion or equivalent to 4.2 percent of GNP. By 1993, exports had increased to \$461 billion or 7.3 percent of GNP, representing a real increase of 270 percent over the two-decade period.¹ Nearly 80 percent of merchandise exports consist of manufactured products; most of the remainder is agricultural and mineral commodities. Thus, industrial production remains very much a centerpiece in the battle of U.S. companies for global market share.²

Despite the unprecedented increase in the value of merchandise exports, the U.S. economy has experienced stubbornly high trade deficits since the 1980s. Competition from imports in industries such as motor vehicles, machinery, and electronics, along with large quantities of imported petroleum, have usually been blamed for the deficits, although there is indirect evidence from trade data suggesting that the U.S. trade deficit stems more from an inability to export than easy penetration from imports (Hanink 1987).

By the early 1980s, the U.S. trade woes had sparked wide-ranging discussions regarding the competitiveness of U.S. producers and the role of public policies in "managing" the institutional context of international trade and foreign investment. The Reagan, Bush, and Clinton Administrations each espoused free trade ideology while seeking what they regarded as a "level playing field" in bilateral and multilateral trade negotiations. These efforts culminated in the recently-revamped General Agreement on Tariffs and Trade (GATT) and the implementation of the North American Free Trade Agreement (NAFTA) between the U.S., Canada, and Mexico, promoted largely on the strength of arguments revolving around the potential for enhanced export markets for U.S. producers. These institutional developments notwithstanding, the U.S. continues to experience great difficulty in significantly reducing its annual trade deficits.

As a result of this restructuring in international trade regimes, competition and the quest for enhanced competitiveness became the watchwords and thrust of U.S. efforts to stave off import penetration in domestic markets and increase market share in foreign countries. U.S. companies have restructured, downsized, merged, and adopted new technologies--at no small human and capital costs--the outcome of which has been the achievement of substantial productivity gains and improved ability to compete in both domestic and foreign markets. Simultaneously, federal agencies, along with many nonprofit trade associations, launched a wide array of market promotion, tax incentive, and financial assistance programs to enhance the ability of U.S. producers to compete better in export markets. Similarly, the states and regions such as

¹These figures were derived from national income and product accounts and price deflators published by the U.S. Bureau of Economic Analysis in various issues of the *Survey of Current Business*.

²Although "services" as defined in the U.S. national income and product accounts constitute almost 30 percent of total U.S. exports, the bulk of this category consists of travel expenditures and transportation fares of foreign visitors to the U.S., royalties and license fees accruing to U.S. companies, and direct defense expenditures overseas. Business services exports, such as contracting and consulting services, advertising, insurance, and communications, represent a rapidly growing, but still relatively small, share of total "services" exports in the U.S. accounts.

Appalachia embarked on a myriad of programs to enhance the competitive position of their indigenous companies, open new markets for export business, assist small and midsize firms to export, and reduce the perceived threat of import competition within their respective boundaries.

The public policy focus on exporting has been bolstered substantially by a growing number of research studies that have found a positive association between foreign exports and state manufacturing or aggregate economic growth. Early studies by Manrique (1985) and Coughlin and Cartwright (1987a) using regression analysis demonstrated that exports were a significant independent variable in accounting statistically for past variations in state economic growth while controlling for other traditional explanatory factors.³ Subsequent research has provided additional support for the role of exports (Webster et al. 1990), although Erickson (1989) and Markusen et al. (1991) have stressed the importance of competitiveness in domestic markets and challenged some of the usual assumptions of causality between exports and state economic growth. An underlying focus on competitiveness, whether explicit or implicit, has been a central feature of attempts to uncover the relationship between exports and state economic growth.

Yet, competitiveness remains an ambiguous and elusive concept that can be reflected in a myriad of ways, and imprecisely at best. For an individual company or establishment, the increase in output, expansion of market share in both domestic and foreign markets, profitability on sales, and return on capital assets are all traditional indicators of business competitiveness. At the scale of the state or region, global competitiveness is a much more elusive concept, typically reflected in such indicators as growth in output and foreign sales in relation to the aggregate performance of establishments nationally or in relation to other states or regions.

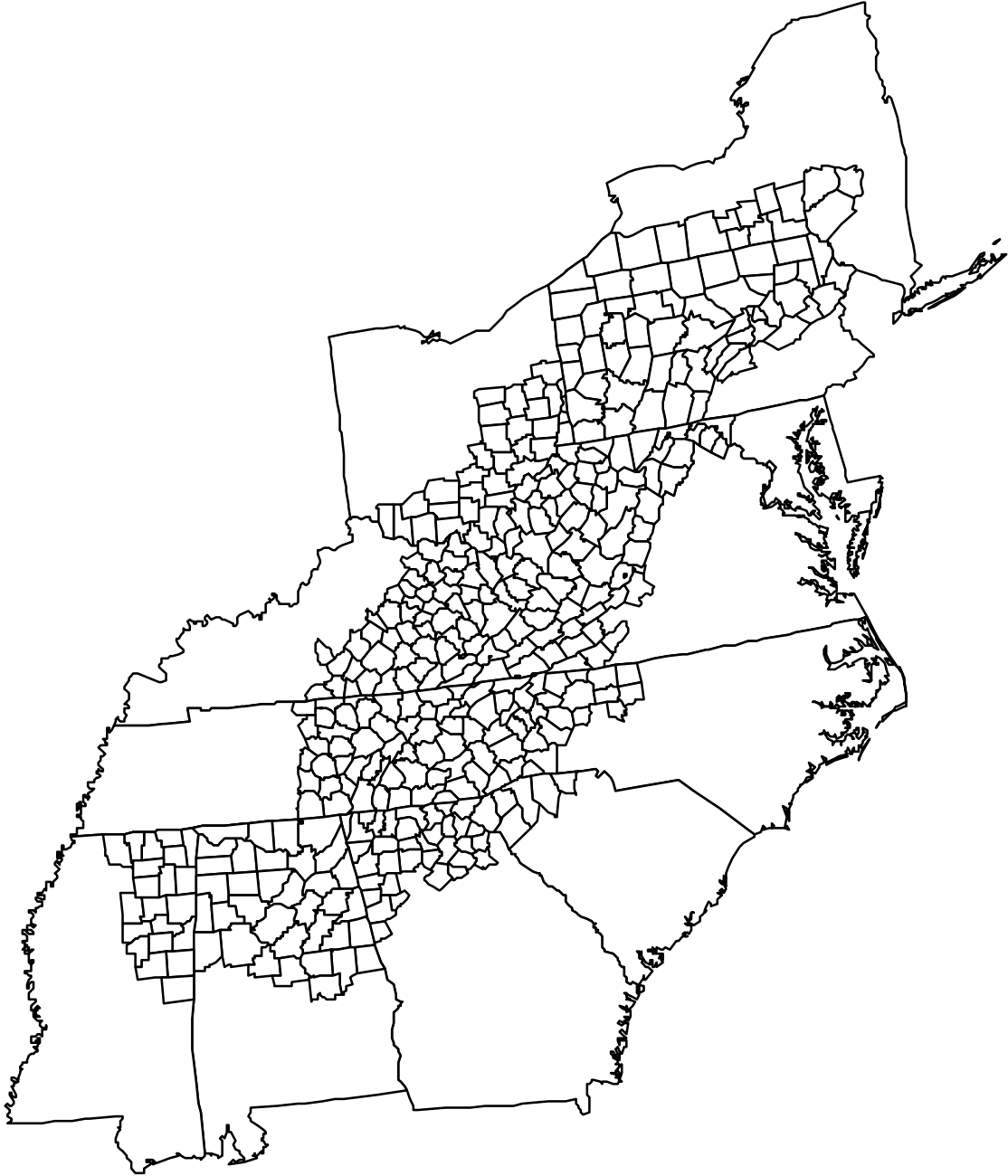
The purpose of our research is to shed light on certain aspects of the competitiveness of Appalachian producers in the global economy as reflected in the nature and dynamics of industrial exports from the Appalachian Region (Figure 1).⁴ We begin by laying out the features of data on exports from individual states and the assumptions and methods we have used to estimate the value of export shipments and the associated export employment from the Appalachian Region. This information is used to assess the growth in manufacturing exports in Appalachia relative to the rest of the nation and the non-ARC portion of the constituent states. Our analysis is limited to manufacturing although, as noted above, this sector accounts for nearly 80 percent of all merchandise exports nationally.⁵ We have also derived estimates of the shares of Appalachian

³Coughlin and Cartwright (1987a) estimated a model for each of the 50 states in separate regression equations, focusing on the slope of the parameter relating real exports to nonagricultural employment. The model generally performed well, with R^2 values exceeding 0.70 for over 80 percent of the states. The parameter estimates for real exports were of the anticipated (positive) sign and significant at the 0.10 level or better for all but three of the states. The average short-run elasticity measuring the response of nonagricultural employment to a change in real exports was 0.21, indicating that a one percent increase in real exports would cause a 0.21 percent change in state employment.

⁴In this analysis, our geographic definition of Appalachia is the 399-county area comprising the Appalachian Regional Commission (ARC).

⁵Problems encountered in assigning nonmanufactured merchandise exports to a place of production are identified in the following section of the report. No reliable state or substate data on business services exports are available.

FIGURE 1
The Appalachian Region



export shipments that are destined for particular foreign countries by combining information on place of exports production and the origin and destination of export shipments.

Within this framework of export information, we undertake an analysis of Appalachian industrial exports growth over the 1983-91 period using an extended and dynamic version of shift-share analysis that incorporates international trade effects. This approach permits us to isolate the contributions of several export and import components to overall economic change in the Appalachian Region, and to observe the relative contributions of these components in Appalachia and other areas including the non-Appalachian portions of ARC-constituent states.

Following the shift-share analysis, we turn our attention to developing a better understanding of Appalachian competitiveness in the global economy by analyzing detailed microdata on exporter and nonexporter manufacturing establishments within the Appalachian Region. These confidential establishment data, drawn from the Longitudinal Research Database of the U.S. Bureau of the Census, provide a unique opportunity to explore aspects of the features of Appalachian manufacturers that lead to a better understanding of the relative export competitiveness of Appalachian producers. The paper concludes with a brief assessment of the prospects for growth of Appalachian exports in the years ahead.

II. EXPORTS DATA AND METHODS OF ESTIMATION FOR THE APPALACHIAN REGION

The principal sources for state foreign export data are the Industry Division (ID) and the Foreign Trade Division (FTD) of the U.S. Bureau of the Census. Each data set has its own particular strengths and limitations (Farrell and Radspieler 1989). The Industry Division compiles export data for states based upon the location of production of exported manufactured goods. These annual data have been published over the past three decades with some missing years, and there is typically a 2-3 year time lag in obtaining these exports data. Although these data represent the best estimates available of export production by state, the data cover only the manufacturing sector and provide no information on the destination of exports. The state exports data compiled by the Foreign Trade Division are based on the state in which the merchandise begins its export journey; this geographic location may be different than the state where production occurred. The Bureau of the Census has made these FTD data available on an annual and quarterly basis since 1987 with only a few months time lag.

In this analysis, we have used the state exports data of the Industry Division to analyze export shipments and employment in the Appalachian Region, because these data are clearly the most reliable estimates of exports by state of production. Although this choice limits our analysis to manufacturing industry, this sector, as noted above, accounts for nearly 80 percent of all merchandise trade. We have also merged the Industry Division production data with the Foreign Trade Division movements data to permit us to derive reliable estimates of the foreign destinations of Appalachian exports. A more detailed discussion of each of these data sources provides a suitable background for an appreciation of the utility and legitimacy of this approach.

The state export data compiled by the Industry Division of the Bureau of the Census are based on the value of shipments destined for export markets (sold directly or through brokers) as

reported by manufacturing establishments in the *Census of Manufactures* (CM) or the *Annual Survey of Manufactures* (ASM). The CM provides a complete reporting of establishments on a five-year cycle; intervening years are covered in the ASM using a sample panel of establishments. The ASM panel covers about 1/6 of the number of establishments included in the Census; however, the ASM focuses its surveys on larger plants, so it typically accounts for a very high proportion of the total value of shipments in the U.S. Export employment is derived from the share of exports in the total value of an establishment's shipments. In addition, indirect exports (those goods and services required as intermediate inputs in the production of direct exports) are estimated for individual states by the U.S. Bureau of Economic Analysis using an input-output modeling procedure with allocations of indirect requirements to the various states.⁶

The CM and ASM are the sources of the microdata on individual manufacturing establishments that comprise the Longitudinal Research Database (LRD) of the Bureau of the Census. The LRD consists of extensive data on the organizational and operating characteristics of manufacturing establishments. Data on the export value of shipments for individual establishments are also included for LRD plants. More detailed information on the specific features of the LRD are provided in a subsequent section that examines the characteristics of Appalachian exporters.

The value of direct export shipments from the 399-county Appalachian Region were derived by summing the export shipments for West Virginia and those for the Appalachian counties in each of the 12 remaining ARC states. These estimates were made for each state and its individual 2-digit Standard Industrial Classification (SIC) codes by splitting the LRD records from the 1987 CM into those plants with the appropriate state and ARC or non-ARC county geocodes.⁷ Then, exports for each of the ARC states by 2-digit SIC code were multiplied by the share of exports produced in the ARC portions as determined from the LRD records. This procedure permitted us to derive an estimate of direct exports by industry sector for the ARC and non-ARC portion of each constituent state. These individual ARC-areas of the states were then summed across states to derive total exports from the Appalachian Region by 2-digit SIC code. The proportional allocation of exports (on a 2-digit SIC basis) between ARC and non-ARC portions of the respective states for 1987 was also used to split the exports for the years 1983-1986 and 1988-1991. Although we recognize that these procedures invariably introduce some error into the ARC and non-ARC estimates, particularly for years more distant from 1987, we believe the estimates provide a reliable indication of the value of export shipments from the Appalachian Region using the best feasible methods that time, resources, and Census disclosure regulations permit.

The Foreign Trade Division export data are based on the U.S. Customs Service declarations of domestic exporter firms. These data, commonly called the "MISER exports data," are taken from the shippers' export declarations (SED) of U.S. companies' shipments to foreign

⁶Estimates of direct exports are widely considered to be more reliable than indirect exports; only direct exports are considered in our analysis of Appalachian exporting.

⁷The 1987 CM was used for this purpose because it represents the full set of establishments and the only such census taken during the 1983-91 period of our analysis. The 1987 CM is also the mid-point year between 1983 and 1991. The ASM is not a geographically-stratified sample and, as such, may introduce considerable error if used to allocate export production into the ARC and non-ARC portions of states.

buyers.⁸ These value of shipments export data are available for combinations of state, foreign destinations, and two-digit SIC codes. At the national level, the data are considered to be highly reliable for individual SIC categories; the data are also very reliable for (first) foreign destination, although no account can be made of U.S. exports to foreign transshipment points that are then re-exported to other, ultimate destinations. Serious problems arise with these data, however, if they are used to assign exports to their source states of production in the U.S. The declaration form completed by the exporter asks for the origin of the shipment (i.e., the state in which the goods begin their export journey), but a significant problem exists when goods are produced in one state, perhaps processed further in another, and packaged or otherwise brokered at the port which may be in a third state. The pattern of state exports in this data set is inherently biased toward those states with major ports. This problem is particularly acute in the case of relatively undifferentiated commodity exports such as cereal grains, coal, or timber, and effectively precludes the state or regional analysis of nonmanufactured export commodities.⁹ Thus, while the FTD data are a rich source of information on export flows and are reliable with respect to SICs and destinations, they are inherently flawed for tracking exports from individual states.

Our estimates of the foreign (first) destinations of Appalachian exports are based on a methodology previously developed and utilized by the authors (Erickson and Hayward 1991; Hayward 1992 and 1995; Hayward and Erickson 1995). Basically, the Foreign Trade Division data on origin and destination of manufactured exports by state and 2-digit SIC code are used to allocate Industry Division manufacturing exports production data by state and 2-digit SIC code to the respective countries of first destination; the critical (and defensible) assumption is that the destination distribution by industry and state accurately reflects the geographic distribution of the manufactures that are actually produced for export in a given state.¹⁰ The combination of the merged CM/ASM and MISER data results in a matrix of export flows by industry and state to

⁸An algorithm was developed at the Massachusetts Institute for Social and Economic Research (MISER) to allocate those exports for which either SIC code or origin of shipment information is missing from the SED. MISER has continued to provide these adjusted data under contract to the U.S. Bureau of the Census, and the "MISER exports data" are those provided to public users in the National Trade Data Bank of the Department of Commerce.

⁹Agricultural exports shipments data compiled by the Foreign Trade Division is allocated to states based on point of consolidation of shipments. Thus, states such as Louisiana, which handle much of the Great Plains and Upper Midwest grain trade, are credited with a majority of the field crop exports when, in reality, they produce very little of those commodities. Examples of the distortions revealed in using these data on an unadjusted basis may be found in a recent report by the U. S. Department of Commerce, International Trade Administration (1992) on patterns of state trade with Mexico from 1987-91. A paper by Risha (1991) compares exports data based on origin of movement and place of production and finds considerable variance among sectors at the 2-digit SIC level for individual states.

¹⁰A prototype of an Exporter Data Base (EDB) has been developed at the Bureau of the Census using 1987 data. The EDB could eventually provide more accurate state and even substate export and import data and the characteristics of establishments and firms engaged in trade through its linkage of the shipper's export declaration to Census' individual establishment records.

each of more than a hundred foreign destinations.¹¹

III. EXPORTS OF APPALACHIAN MANUFACTURES

Manufacturing exports in the U.S. experienced significant growth over the 1983-91 period (Table 1). In 1983, total industrial export shipments (based on f.o.b. value at plant site of production) equaled \$142.3 billion.

By 1991, the total of these shipments had risen to \$314.1 billion, an increase of 121 percent in current dollars and an increase of 95 percent in constant dollars (using an implicit price deflator for exports in U.S. gross domestic product). This significant rate of growth in the value of manufacturing export shipments was paralleled by a sizeable increase in direct export employment. Nationally, direct manufacturing export employment expanded from 1.13 million jobs in 1983 to 1.70 million in 1991, a substantial increase of 50.4 percent, given the overall decline that occurred nationally in total manufacturing employment over the 1983-91 period.

Data on direct export employment reveals only a partial picture of its relative importance to the national economy. Estimates produced by the U.S. Bureau of Economic Analysis for 1991 using input/output domestic requirements tables indicate that indirect employment created by interindustry linkages of exporters added nearly 4.40 million additional supporting jobs to the 1.70 million jobs created in the production of direct exports. Thus, the total contribution of exports to total national civilian employment was 5.1 percent (U.S. Bureau of the Census 1994).

The contribution to total exports and the growth pattern of manufacturing export shipments was widely divergent among the various 2-digit SIC codes that comprise the U.S. manufacturing sector (Table 1).¹² The most significant industrial exporting sectors (representing 5.0 percent or more of total value of shipments) in both years include Food and Kindred Products, Chemicals and Allied Products, Fabricated Metal Products, Machinery and Computer Equipment, Electronic and Other Electrical Equipment, Transportation Equipment, and Instruments. Absolute growth over the 1983-91 period was most pronounced in the Food and Kindred Products, Chemicals, Primary Metals, Machinery and Computer Equipment, Electronics and Other Electrical Equipment, Transportation Equipment, and Instruments sectors, with increases ranging from \$6.8 billion to \$44.0 billion, the largest occurring in the Transportation Equipment, Electronics, and Machinery and Computer Equipment sectors (Table 1).

¹¹The CM/ASM data are based on f.o.b. (freight on board) values and the FT/MISER data are based on f.a.s. (free alongside ship) values, the latter including shipping and insurance costs. In this report, the FT/MISER data were converted to f.o.b. values based on conversion factors supplied by the U.S. Bureau of the Census. It should also be noted here that the FT/MISER data are the source for several Bureau of the Census publications including the *Location of Exports* series; published state or regional totals in our analysis are based on the place of production data and, aside from the f.a.s./f.o.b. differences, will not directly match those totals based on shippers' declarations, such as FT/MISER data.

¹²Some minor reclassification of products occurred during the 1983-91 interval that may have a very slight effect on the value of 2-digit SIC export shipments in individual industry sectors.

SIC Industry	1983 Exports (millions\$)	Percentage of Nation's Total MFG Exports	1991 Exports (millions\$)	Percentage of Nation's Total MFG Exports
20 Food & Kindred Products	\$10,471.4	7.4	\$17,627.8	5.6
21 Tobacco Products	2,213.3	1.6	4,720.4	1.5
22 Textile Mill Products	1,762.1	1.2	4,171.8	1.3
23 Apparel	886.9	0.6	3,566.6	1.1
24 Lumber & Wood Products	2,451.6	1.7	6,240.1	2.0
25 Furniture & Fixtures	464.4	0.3	1,393.7	0.4
26 Paper & Allied Products	3,572.3	2.5	7,982.4	2.5
27 Printing & Publishing	1,278.5	0.9	3,072.6	1.0
28 Chemicals	17,400.3	12.2	38,615.1	12.3
29 Petroleum Refining	4,771.1	3.4	5,724.6	1.8
30 Rubber & Plastics	2,359.6	1.7	6,780.7	2.2
31 Leather Products	456.2	0.3	1,511.6	0.5
32 Stone, Clay & Glass	1,555.5	1.1	3,009.4	1.0
33 Primary Metals	3,712.9	2.6	10,511.3	3.3
34 Fabricated Metals	6,031.7	4.2	9,898.6	3.2
35 Machinery & Computer Equipment	29,040.4	20.4	53,919.1	17.2
36 Electronic & Other Electrical Equipment	15,841.5	11.1	39,472.4	12.6
37 Transportation Equipment	28,187.0	19.8	72,223.4	23.0
38 Instruments	7,810.3	5.5	19,747.8	6.3
39 Miscellaneous	2,040.4	1.4	3,946.5	1.3
TOTAL	\$142,307.3	100.	\$314,135.9	100.

SOURCE: U.S. Bureau of the Census, *Annual Survey of Manufactures*, 1983, "Origin of Exports of Manufactured Products;" and *Annual Survey of Manufactures*, "Exports from Manufacturing Establishments: 1990 and 1991." Table reproduced from Erickson et al. (1995).

Table 1: Manufacturing Direct Export Shipments in the U.S.
by Industry, 1983 and 1991 (in current dollars)

Only five 2-digit SIC code sectors exported ten percent or more of their value of shipments in 1983: Tobacco Products, Machinery and Computer Equipment, Electronics and Other Electrical Equipment, Transportation Equipment, and Instruments. By 1991, eight 2-digit sectors exported ten percent or more of their value of shipments; the previous five sectors were joined by Chemicals, Leather Products, and Miscellaneous Manufacturing. All of the 2-digit SIC manufacturing industries increased their shares of shipments exported over the 1983-91 period, with particularly large gains in share occurring in the Leather Products, Machinery and Computer Equipment, Electronics, and Transportation Equipment sectors.

Our estimates of industrial export shipments for the Appalachian Region in 1983 and 1991 indicate that this region fared rather well in comparison to national norms. Manufacturing direct exports increased from \$9.6 billion in 1983 to \$20.7 billion in 1991, a current dollar increase of 116 percent, and only very slightly less than the national growth of 121 percent (Table 2). The

relative contributions of various industry sectors to total exports in Appalachia, however, were quite different than for the nation as a whole. Appalachia's export industry structure is heavily dominated by the Chemicals and the Machinery and Computer Equipment sectors, each accounting for about one-fifth of total industrial exports from Appalachia. Other sectors that are well-represented in Appalachia compared to the national distribution of exports include Tobacco Products, Textiles, and Primary Metals. Absolute growth during the 1983-91 period was particularly strong among the Chemicals, Primary Metals, Machinery and Computer Equipment, Electronics, and Transportation Equipment sectors, with lesser but significant increases in the Tobacco Products, Textiles, Apparel, Lumber and Wood Products, Paper and Allied Products, and Rubber and Plastics sectors.

SIC Industry	1983 Exports (millions\$)	Percentage of Region's Total MFG Exports	1991 Exports (millions\$)	Percentage of Region's Total MFG Exports
20 Food & Kindred Products	\$432.7	4.5	\$508.8	2.5
21 Tobacco Products	625.5	6.5	1,008.9	4.9
22 Textile Mill Products	522.6	5.5	1,265.3	6.1
23 Apparel	132.6	1.4	462.6	2.2
24 Lumber & Wood Products	167.3	1.7	544.3	2.6
25 Furniture & Fixtures	92.4	1.0	215.1	1.0
26 Paper & Allied Products	124.4	1.3	334.2	1.6
27 Printing & Publishing	20.9	0.2	76.4	0.4
28 Chemicals	1,983.7	20.7	3,932.4	19.0
29 Petroleum Refining	79.5	0.8	61.0	0.3
30 Rubber & Plastics	297.8	3.1	652.0	3.1
31 Leather Products	43.5	0.5	195.1	0.9
32 Stone, Clay & Glass	225.6	2.4	452.2	2.2
33 Primary Metals	488.8	5.1	1,736.5	8.4
34 Fabricated Metals	488.7	5.1	428.9	2.1
35 Machinery & Computer Equipment	1,838.9	19.2	3,779.7	18.3
36 Electronic & Other Electrical Equipment	1,005.5	10.5	2,551.9	12.3
37 Transportation Equipment	565.0	5.9	1,579.5	7.6
38 Instruments	379.6	4.0	745.2	3.6
39 Miscellaneous	71.8	0.7	169.3	0.8
TOTAL	\$9,586.8	100.	\$20,699.0	100.

SOURCE: Authors' estimates based on unpublished data from the U.S. Bureau of the Census and from the *Annual Survey of Manufactures*, 1983 and 1991.

Table 2: Manufacturing Direct Export Shipments from Appalachia by Industry, 1983 and 1991 (in current dollars)

The data in Table 3 compare Appalachia's value of direct export shipments in 1983 and 1991 with the values for the non-Appalachian portions of the surrounding states. Exports from Appalachia exceeded exports from the remaining portions of any single Appalachian state,

although exports from the non-Appalachian portions of Ohio and New York are nearly as great as total exports from Appalachia. Appalachia exported 5.8 percent of its total manufacturing shipments in 1983 and 8.7 percent in 1991. These shares compare favorably with the non-Appalachian portions of ARC states; six of the 12 surrounding state residuals exported a higher share of their output in 1983, while eight of the state residuals exceeded Appalachia in 1991 (Table 3).

Region	1983		1991	
	Direct Exports (millions\$)	Percentage of Total Shipments	Direct Exports (millions\$)	Percentage of Total Shipments
APPALACHIA	\$9,586.8	5.8	\$20,669.0	8.7
Rest of Alabama	940.9	7.7	2,049.8	12.0
Rest of Georgia	1,839.5	4.8	5,169.4	8.5
Rest of Kentucky	1,476.3	5.5	4,787.3	11.2
Rest of Maryland	939.3	4.5	2,592.8	8.7
Rest of Mississippi	1,064.1	6.9	2,227.1	10.5
Rest of New York	7,451.5	6.4	14,493.8	9.9
Rest of North Carolina	3,520.4	6.4	8,322.5	9.2
Rest of Ohio	7,271.4	6.3	18,751.6	11.3
Rest of Pennsylvania	3,302.0	5.2	6,493.5	7.9
Rest of South Carolina	1,151.6	5.8	3,336.4	10.7
Rest of Tennessee	1,337.5	5.5	2,821.8	7.4
Rest of Virginia	2,465.8	6.6	5,648.8	9.9
TOTAL U.S.	\$142,307.3	6.9	\$314,135.9	11.1

SOURCE: Authors' estimates based on unpublished data from the U.S. Bureau of the Census and from the *Annual Survey of Manufactures*, 1983 and 1991.

Table 3: Manufacturing Direct Export Shipments by Region, 1983 and 1991
(in current dollars)

With respect to export employment as a share of total manufacturing employment, the patterns closely mirror those reflected in the shipments data for both 1983 and 1991 (Table 4). The national share of export employment in manufacturing was 6.0 percent in 1983, somewhat lower than the 6.9 percent national share of direct exports in total manufacturing shipments. Similarly, direct export employment represented 9.4 percent of total manufacturing employment in 1991, while direct exports represented 11.1 percent of total shipments. These differences are also consistent with comparisons of employment and shipments data for 1977 and 1986 in which it has been noted that manufacturing value of shipments per employee in export activities is typically higher than in nonexport production (Erickson 1989).

This pattern of higher export shares in value of shipments relative to employment holds across the Appalachian Region as well. Manufacturing direct export employment in Appalachia accounted for 4.4 percent of the region's total manufacturing employment in 1983, significantly

smaller than Appalachian exporters 5.8 percent share of total manufacturing shipments (Table 3). Similarly, export employment accounted for 6.9 percent of total Appalachian manufacturing employment in 1991, again significantly lower than the 8.7 percent share of total value of shipments accounted for by exporters (Table 3). Although exports as a share of both total shipments and total employment was lower in Appalachia than the U.S. as a whole in both years, the gap was not large, and Appalachian exporters are generally keeping pace with the rest of the nation in terms of both employment and value of shipments.

Manufacturing export employment in the Appalachian Region grew substantially during the study period, rising from 80,500 in 1983 to 122,700 in 1991 (Table 4). This growth occurred at the same time total manufacturing employment in the region was falling slightly from 1,823,000 to 1,784,000 jobs. The 52.5 percent growth in Appalachia's export employment from 1983 to 1991 was actually slightly higher than the U.S. growth of 50.4 percent recorded during the same time frame. Absolute growth in Appalachian manufacturing export employment was most pronounced in the Electronic and Other Electrical Equipment, Machinery and Computer Equipment, Transportation Equipment, Textile Mill Products, Primary Metals, Apparel, and Chemicals industries, with lesser gains in the Lumber and Wood Products, Rubber and Plastics, and Instruments industries. Only the Fabricated Metal Products industry experienced an absolute decline in export employment, although two other sectors (Tobacco Products and Petroleum Refining) experienced no change (Table 4).

SIC Industry	1983 Export Employment (000's)	Percentage of Region's Total MFG Employment	1991 Export Employment (000's)	Percentage of Region's Total MFG Employment
20 Food & Kindred Products	1.8	2.2	2.4	2.0
21 Tobacco Products	1.4	1.7	1.4	1.1
22 Textile Mill Products	5.5	6.8	9.4	7.7
23 Apparel	1.6	2.0	5.3	4.3
24 Lumber & Wood Products	1.5	1.9	4.3	3.5
25 Furniture & Fixtures	1.7	2.1	2.8	2.3
26 Paper & Allied Products	0.7	0.9	1.4	1.1
27 Printing & Publishing	0.3	0.4	0.7	0.6
28 Chemicals	10.4	12.9	14.0	11.4
29 Petroleum Refining	0.2	0.2	0.2	0.2
30 Rubber & Plastics	2.5	3.1	4.9	4.0
31 Leather Products	0.7	0.9	1.7	1.4
32 Stone, Clay & Glass	2.4	3.0	3.1	2.5
33 Primary Metals	3.7	4.6	7.5	6.1
34 Fabricated Metals	5.9	7.3	4.3	3.5
35 Machinery & Computer Equipment	19.0	23.6	23.9	19.5
36 Electronic & Other Electrical Equipment	11.1	14.4	18.3	14.9
37 Transportation Equipment	4.4	5.5	8.9	7.3
38 Instruments	4.9	6.1	6.8	5.5
39 Miscellaneous	0.8	1.0	1.5	1.2
TOTAL	80.5	100.	122.8	100.

SOURCE: Authors' estimates based on unpublished data from the U.S. Bureau of the Census and from the *Annual Survey of Manufactures*, 1983 and 1991.

Table 4: Manufacturing Direct Export Employment in Appalachia by Sector, 1983 and 1991

IV. FOREIGN DESTINATIONS OF APPALACHIAN EXPORTS

The merged ID/FTD data sets were used to estimate foreign (first destination) flows of industrial exports from the Appalachian Region for the years 1987 and 1991. Destination data of exports are provided both by world region (Table 5) and by leading individual countries (Table 6).

Destination	1987 Export Shipments (millions\$)	Percentage of Total Exports	1991 Export Shipments (millions\$)	Percentage of Total Exports
Asia	\$3,193.7	25.4	\$6,371.5	30.8
Europe	3,658.7	29.1	5,864.1	28.3
Other North America*	3,605.8	28.7	5,149.2	24.9
Central America/Caribbean	781.0	6.2	1,536.5	7.4
South America	682.1	5.4	941.8	4.6
Australasia/Oceania	331.1	2.6	423.3	2.0
Africa	316.0	2.5	410.4	2.0
TOTAL	\$12,568.5	100.	\$20,696.9	100.

*Canada accounts for more than 99 percent of the Other North America category.

SOURCE: Estimates compiled by the authors based upon data from the *Census of Manufacturers* 1987, the *Annual Survey of Manufactures* 1991, and the State Exporter Database of the Massachusetts Institute for Social and Economic Research.

Table 5: Foreign Destinations of Appalachian Industrial Exports, 1987 and 1991
(by major world region in current \$)

The data indicate that Asia, Europe, and Other North America (essentially Canada) dominate the industrial export flows destinations from Appalachia. In both 1987 and 1991, these three world regions accounted for 83 percent or more of total export shipments, and increased their overall share slightly between 1987 and 1991 (Table 5). The Central America/Caribbean and South America regions are secondary destinations that together account for most of the rest of Appalachian export shipments. The share of the Asia region has increased most notably, at the expense of each of the remaining regions except Central America/Caribbean.

The general pattern of destinations of Appalachian exports to various world regions closely mirrors the U.S. national pattern. In 1987, for example, 27.3 percent, 28.0 percent, and 26.5 percent of total U.S. manufacturing exports had destinations in the Other North America, Europe, and Asia regions, respectively, little different from those for the Appalachian Region (Table 5). Indeed, there is no statistically significant difference between the shares of Appalachian and U.S. exports destined for the seven world regions identified in Table 5.

Among those countries that are the most frequent destinations of Appalachian exports, Canada obviously dominates, although its relative share fell between 1987 and 1991 (Table 6). The proportion of Appalachian exports destined for Canada in 1987 was very similar to the share

for the nation as a whole. Canada dominates the destinations for Appalachian exports across a broad spectrum of industry sectors; in 1991, it was the leading destination for all but three 2-digit SIC sectors including Tobacco Products (SIC 21), Petroleum Refining and Related Industries (SIC 29), and Leather and Leather Products (SIC 31).

Destination	1991 Export Shipments (millions\$)	Percentage of Total Exports	1987 Export Shipments (millions\$)	Percentage of Total Exports
Canada	\$5,149.2	24.9	\$3,605.8	28.7
Japan	2,038.0	9.8	1,082.0	8.6
United Kingdom	1,033.2	5.0	627.1	5.0
F.R. Germany	1,022.1	4.9	698.4	5.6
Mexico	966.1	4.7	366.2	2.9
South Korea	862.6	4.2	347.4	2.8
Netherlands	764.7	3.7	437.7	3.5
Belgium	754.9	3.6	521.7	4.2
France	610.7	3.0	347.2	2.8
Hong Kong	548.2	2.6	210.6	1.7
Taiwan	499.2	2.4	283.5	2.3
Saudia Arabia	497.0	2.4	248.8	2.0
Italy	379.4	1.8	256.0	2.0
Australia	360.9	1.7	284.5	2.3
P.R. China	340.2	1.6	220.7	1.8
Singapore	322.3	1.6	164.8	1.3
Brazil	322.2	1.6	247.1	2.0
Spain	239.5	1.2	177.8	1.4
Israel	225.7	1.1	129.8	1.0
United Arab Emirates	217.1	1.0	66.9	0.5
Other Countries	3,543.7	17.1	2,224.5	17.9
TOTAL	\$20,696.9	100.	\$12,568.5	100.

SOURCE: Estimates compiled by the authors based upon data from the *Census of Manufacturers* 1987, the *Annual Survey of Manufactures* 1991, and the State Exporter Database of the Massachusetts Institute for Social and Economic Research.

Table 6: Twenty Leading Destinations of Appalachian Industrial Exports, 1991
(arranged by 1991 current \$ volume with 1987 comparisons)

Japan represents the destination accounting for the second largest volume of export shipments from Appalachia, and one that expanded notably from 1987 to 1991, although Japan as a destination still represents only about 2/5 of the dollar value of shipments to Canada. Japan is dominant as an export destination in two industry sectors, Tobacco Products and Leather and Leather Products, and is also strongly represented in the Food and Kindred Products, Lumber and Wood Products, Chemicals, Rubber and Plastics, Stone/Clay/Glass, and Electronics industries.

The United Kingdom, Germany, and Mexico each were the destination for about 5 percent of Appalachian exports in 1991. The United Kingdom is a particularly prominent destination for Appalachian exports in the Textile Mill Products, Printing and Publishing, Machinery and Computer Equipment, and Instruments sectors, while Germany stands out as a destination for Lumber and Wood Products, Furniture, Paper Products, Leather Products, Stone/Clay/Glass, Transportation Equipment, and Instruments industries. Mexico experienced the largest gain in share of any country over the 1987-1991 period, and by 1991, was most prominently represented as a destination for exports in the Food and Kindred Products, Paper Products, Rubber and Plastics Products, Stone/Clay/Glass, Primary Metals, Electronics and Other Electrical Equipment, and Transportation Equipment industries. The current economic turmoil in Mexico could thus be expected to have some (at least) temporary impact on the growth of Appalachian exports to that Latin American country, although the overall impact on the Appalachian economy is probably very small.

Among other nations that are leading destinations for Appalachian industrial exports, several Asian nations (along with Japan) also accounted for rising shares of export shipment destinations (Table 6). South Korea experienced a substantial increase in shipments of Appalachian exports, as did Hong Kong; Singapore experienced a much smaller increase, while only a marginal gain in share was experienced in Taiwan. South Korean purchases of Appalachian exports were most notably concentrated in the Primary Metals, Fabricated Metals, Machinery and Computer Equipment, and Chemicals industries. Other Asian nations exhibited a broadly variable pattern of destinations that did not prove to represent large concentrations in any individual sectors.

V. SHIFT-SHARE ANALYSIS OF GROWTH IN APPALACHIAN INDUSTRIAL EXPORTS

Although the previous analysis provides some useful benchmarks of manufacturing export levels and growth in Appalachia and the U.S., it is limited by its comparison of two discrete points in time. Furthermore, Appalachian export performance is not placed in the context of aggregate industrial growth, nor is an assessment made of the extent to which Appalachia benefits from national export growth trends, the fortune (or misfortune) of having industries the demand for whose products is growing (or declining), or the extent to which factors indigenous to the regional economy itself affect industrial export performance. Therefore, a method of disaggregating this regional economic performance known as "extended and dynamic shift-share analysis" is used to accomplish this task.

The basic shift-share technique has been used in regional analysis for more than 30 years to decompose regional economic change into national, industrial, and regional components. Although the technique has been criticized by some scholars (Stilwell 1970; Richardson 1978) as lacking in theoretical content--a charge that has been increasingly challenged in recent years (Fothergill and Gudgin 1979; Casler 1989)--shift-share remains one of the most widely used methods of state and regional economic analysis.

Three basic components comprise the traditional shift-share model. In the first instance, the region will experience growth (or decline) simply as the result of national economic

performance, and this component is known as the *national shift*. In addition, regional economies are host to a variety of industry sectors, each of which experience different growth (or decline) effects over time; thus, each region's particular mix of industries with their respective growth rates produces a pattern of growth (or decline) that reflects these different industry growth rates and structural mixes. This second effect is known as the *industrial shift* (or mix) effect. The third component is the *regional shift* which reflects the share of economic growth attributable to the region's unique competitive position.¹³

Taken together, these three components of traditional shift-share analysis comprise the *total shift*, which is the aggregate change in some measure of regional industrial growth, typically total value of shipments, value added, or employment. Changes in employment and production are closely linked in most instances. Because the use of employment as a measure would require data on productivity and add additional complexity to the extended shift-share model utilized below, we present our analysis in terms of change in value of manufacturing shipments.¹⁴

In the traditional shift-share model, total shift is represented in the following equation (using Hayward's [1992] notation): where Q_r is net output change in region r , i represents industry

$$Q_r = \sum_i Q_{ri0}(q) + \sum_i Q_{ri0}(q_i - q) + \sum_i Q_{ri0}(q_{ri} - q_i) \quad (1)$$

sectors, 0 represents the initial time period, and q is output growth over the relevant time interval. The output growth rates are defined as follows:

$$q = \frac{(Q_t - Q_0)}{Q_0} \quad (2)$$

where t represents some time period later than the initial one.

The three components of traditional shift-share are identified algebraically in Equation 1. The national shift component appears first on the right hand side of the equation, and is the product of the region's output in the initial time period and the national growth rate, summed across all industry sectors. The industrial shift component appears second in the equation and is the product of regional industrial output in the initial period and the difference between the national growth rate and specific industry sector growth rates, summed across all industry sectors.

¹³A further disaggregation of traditional shift-share analysis components was accomplished by Arcelus (1984) in which the regional shift was decomposed further by separating it into a regional shift and a differential shift. The former is based on regional and national growth rate differentials across industries and the latter is based on the difference of the differences between (1) regional growth rates for industries and the aggregate regional growth rate, and (2) the national growth rate for individual industries and the aggregate national growth rate. Although this component would be a useful addition in traditional shift-share analysis, the Arcelus Method would add unnecessary complexity to the extended version of shift-share analysis incorporating exports and imports that is used in our analysis.

¹⁴Data on value added in industrial exports are not available. However, the correlation between value added and value of shipments is very high across industry sectors.

The regional (or competitive) shift appears as the third component in Equation 1, and is the product of the region's initial output and the difference between the industrial sectors' (aggregate) growth rate and the sectors' growth rate in the particular region, summed across all sectors.

Markusen et al. (1991) developed an important extension to the basic model that incorporates international trade. These authors decomposed the national and industrial shifts into export, import, and domestic demand components where domestic demand is defined as total output minus exports plus imports.¹⁵ The inclusion of export, import, and domestic demand components in the national and industry shifts yields a total of six components. The national export shift component, the national import shift component, and the domestic demand shift component are the shares of total growth attributable to national export growth, national import growth, and national domestic demand growth, respectively. The industrial export shift component, the industrial import shift component, and the industrial domestic demand shift component represent the shares of growth attributable to the export, import, and domestic demand growth rates of different industry sectors, respectively, as represented in the region's economy. These components are identified as the first six elements in Figure 2. A seventh component in the Markusen model is the traditional regional/competitive shift that is identical to the traditional model.

An important extension to the Markusen model has been added by Hayward (1992) who further decomposed the regional/competitive shift. Because regional exports data are available, Hayward decomposed the regional/ competitive shift into a regional export shift component (the seventh element in Figure 2) and a regional residual that incorporates both the domestic demand and import components.¹⁶ The regional export shift component is especially important in our analysis because it accounts for the share of the region's industrial growth that is attributable to the unique competitive factors that affect a region's export trade. The final component, the regional residual (identified as the eighth element in Figure 2) accounts for the share of industrial growth attributable to a region's unique competitive position with respect to domestic demand and imports; this residual is not further disaggregated because actual regional imports data are not available. A measure of regions' imports was derived by allocating total U.S. imports in proportion to the states' shares of industrial output by sector and, as such, only reflect the industrial output patterns of the regions. Thus, imports are assumed to compete with a region's producers purely in relation to that region's share of production (as measured in total value of shipments) by industry sector.

¹⁵A fourth component, the productivity shift (which is typically negative), is used by Markusen et al. (1991) to adjust for productivity changes over time as they affect employment. This productivity component is not used in our analysis inasmuch as regional economic change is calculated from the perspective of changes in output measured as value of manufacturing shipments.

¹⁶State imports data were made available by the U.S. Bureau of the Census in the FT990 publication, *Highlights of U.S. Export and Import Trade*, for a very brief period during the late 1980s; unfortunately, these state imports data were neither empirically accurate nor conceptually meaningful. In the FT990, imports were allocated to states based on the address of the consignee on the U.S. Customs declaration, which created a heavy bias toward those states with concentrations of corporate headquarters rather than the states in which the goods actually entered the domestic market (Radspieler and Mehl 1991). In our analysis, imports at the state level are estimated as the share of production by state in each import industry category, based on the more relevant premise that those states where imports come into competition with domestic production are the critical places to which imports should be assigned.

FIGURE 2
Extended Shift-Share Model with International Trade Effects

National Export Shift	$NX = \sum_i Q_{ri0} \left[\frac{X_0}{Q_0} x \right]$
National Import Shift	$NM = -\sum_i Q_{ri0} \left[\frac{M_0}{Q_0} m \right]$
National Domestic Demand Shift	$ND = \sum_i Q_{ri0} \left[\frac{D_0}{Q_0} d \right]$
Industrial Export Shift	$IX = \sum_i Q_{ri0} \left[\left(\frac{X_{i0}}{Q_{i0}} x_i \right) - \left(\frac{X_0}{Q_0} x \right) \right]$
Industrial Import Shift	$IM = -\sum_i Q_{ri0} \left[\left(\frac{M_{i0}}{Q_{i0}} m_i \right) - \left(\frac{M_0}{Q_0} m \right) \right]$
Industrial Domestic Demand Shift	$ID = \sum_i Q_{ri0} \left[\left(\frac{D_{i0}}{Q_{i0}} d_i \right) - \left(\frac{D_0}{Q_0} d \right) \right]$
Regional Export Shift	$RX = \sum_i Q_{ri0} \left[\left(\frac{X_{ri0}}{Q_{ri0}} x_{ri} \right) - \left(\frac{X_{i0}}{Q_{i0}} x_i \right) \right]$
Regional Residual Shift	$RR = \sum_i [Q_{ri0} (q_{ri} - q_i) - RX]$

where:

- Q_{ri0} is the total value of shipments in region r , industry i , in period 0
- Q_{i0} is the total value of shipments in industry i , in period 0
- Q_0 is the total value of U.S. shipments in the initial period
- q is the national growth rate of total value of shipments
- X_{ri0} is the value of exports in region r , industry i , in period 0
- X_{i0} is the value of exports in industry i , in period 0
- X_0 is the value of exports in the U.S. in the initial period
- x is the national growth rate of export shipments
- M_{i0} is the value of U.S. imports in industry i in period 0
- M_0 is the total value of U.S. imports in the initial period
- m is the national growth rate of imports
- D_{i0} is the total value of U.S. domestic demand in industry i in period 0
- D_0 is the total value of U.S. domestic demand in the initial period, and
- d is the national growth rate of domestic demand

The dynamic element to shift-share analysis has been added by Barff and Knight (1988). Whereas the traditional shift-share model calculates shifts based on only the values of the beginning and ending years, the dynamic version recalculates growth rates every incremental year in the period of analysis, thereby allowing growth rates and industrial mixes to vary annually over the time period of analysis. The dynamic model, although requiring considerably more computational steps, is widely regarded as a substantial improvement over the traditional comparative static method for determining the values of the various shift-share components.

VI. COMPONENTS OF INDUSTRIAL CHANGE IN APPALACHIA AND SURROUNDING STATES

The results of the extended and dynamic shift-share analysis based on value of shipments changes over the 1983-91 period are presented in Tables 7 and 8. The former table lists five shift components, those based on domestic demand and imports as well as the regional residual shift (or the combination of the regional competitive effect and imports). The latter table lists the three export shift components, a total export shift which is the net of the three export shift components, and the absolute value of the total shift. The various component shifts are given in percentage terms to make relative comparisons among components and across regions from a common base;¹⁷ however, it should be noted that the regions listed (Appalachian state residuals) whose industrial bases are small may have relatively large percentage changes reflected in some of their shifts. Therefore, it is necessary to make comparisons across regions on individual component shifts, across shift components of the same region, and in the context of the size of the total shift that is evidenced. As Table 8 indicates, there are substantial size differences among the regional economies in terms of the absolute change in manufacturing shipments from 1983-91 (the total shift column).

One of the most notable features of the shift-share information provided in Tables 7 and 8 is the relatively large role played by the national domestic demand shift across all regions in accounting for industrial shipments change. In Appalachia, the national domestic demand shift accounts for 87.4 percent of the total shift from 1983 to 1991. This large contribution to regional industrial growth is typical, i.e., for the most part, individual regions respond to the same aggregate economic conditions characterizing the national economy, particularly with respect to national domestic demand. The relative importance of this component serves to re-emphasize the key role of national economic growth and the domestic market in influencing regional growth, a point increasingly made by regional economic researchers who have analyzed the contribution of exports to regional economic growth (Erickson 1989; Markusen et al. 1991).

Regarding the remainder of the nonexport shifts, several patterns and interregional differences are apparent in Table 7. The national import shift is negative in Appalachia and all other regions (which it must be by definition). Most regions have values in a relatively limited range; this national import shift distribution is partly a result of the assignment pattern of imports to regions based simply on their shares of output in the respective sectors. The industrial shifts in

¹⁷Because the shift-share analysis is used here to provide cross-state comparisons and the results are reported as components' percentages of total shift, it is not necessary to change the state export shipments data to real (or inflation-adjusted) values using a constant-dollar exports deflator.

Appalachia and the other regions are typically smaller than the national shifts. The Appalachian Region industrial domestic demand and industrial import shifts are minuscule, at -0.8 and 0.4 percent, respectively. The major exceptions to the relatively small percentages in the industrial domestic demand shift are the Rest of Mississippi and the Rest of Pennsylvania with substantial negative shifts (the effects of an unfavorable industrial structure from a growth perspective) and the Rest of New York with a substantial positive shift. The regional residual shifts are overwhelmingly positive; only the Rest of New York has a negative shift. Again, all of the regional residual shifts are considerably smaller than the national domestic demand shifts. In short, it would be very difficult for a region to produce a competitive effect that is strong enough to overshadow the general conditions in the national economy that provide the aggregate driver for a region's economy.

Region	Percentage of Total Shift				
	National Domestic Demand Shift	National Import Shift	Industrial Domestic Demand Shift	Industrial Import Shift	Regional Residual Shift
APPALACHIA	87.4	-18.8	-0.8	0.4	16.6
Rest of Alabama	95.6	-20.6	-1.8	1.4	2.8
Rest of Georgia	63.2	-13.6	5.4	-0.3	33.3
Rest of Kentucky	64.7	-13.9	7.6	-1.1	20.8
Rest of Maryland	91.8	-19.8	2.8	-0.5	8.8
Rest of Mississippi	101.5	-21.9	-58.6	6.8	52.3
Rest of New York	146.0	-31.4	50.9	-15.6	-74.3
Rest of North Carolina	59.1	-12.7	2.3	-0.8	38.6
Rest of Ohio	86.8	-18.7	-3.8	-1.2	13.7
Rest of Pennsylvania	132.5	-28.5	-26.8	1.9	1.7
Rest of South Carolina	67.1	-14.5	5.3	0.6	18.9
Rest of Tennessee	69.0	-14.9	-0.4	-1.6	34.1
Rest of Virginia	73.5	-15.8	3.5	2.7	21.3

SOURCE: Data from U.S. Bureau of the Census, *Annual Survey of Manufactures*, 1983-86 and 1988-91, and *Census of Manufactures*, 1987; authors' calculations.

Table 7: Dynamic Shift-Share Analysis by Region, 1983-91: Non-Export Components

Turning to the export shifts (Table 8), the total export shift (which represents the net effect of the three component export shifts) accounts for 15.2 percent of the total shift in Appalachia. This percentage in Appalachia is higher than the non-Appalachian portions of four of the surrounding states, but lower than eight others. This positive total export shift pattern parallels (and is mainly driven by) the national export shift--the fact that regional export successes typically followed the general pattern of national export growth over the 1983-91 period (the national export shift was positive for all regions). For Appalachia, the industrial export shift is negative, but relatively small, the result of an industrial structure that has a below-average proportion of high export growth industries. For the residuals of the Appalachian states, the industrial export shifts are highly variable, with a mix of both positive and negative effects, although most fall within a rather limited range of percentage contribution to total shift.

Region	Percentage of Total Shift				
	Regional Export Shift	National Export Shift	Industrial Export Shift	Total Export Shift*	Total Shift (millions\$)
APPALACHIA	-1.8	19.1	-2.1	15.2	\$73,016.2
Rest of Alabama	6.7	20.9	-5.0	22.6	4,902.7
Rest of Georgia	-1.4	13.8	-0.4	12.0	23,098.7
Rest of Kentucky	4.9	14.2	2.9	21.9	15,983.5
Rest of Maryland	-3.0	20.1	-0.2	16.9	8,755.0
Rest of Mississippi	3.2	22.2	-5.6	19.8	5,798.0
Rest of New York	-9.9	31.9	2.4	24.4	30,548.9
Rest of North Carolina	1.2	12.9	-0.6	13.5	35,790.0
Rest of Ohio	2.5	19.0	1.8	23.2	51,099.1
Rest of Pennsylvania	-4.6	29.0	-5.1	19.3	18,557.0
Rest of South Carolina	9.5	14.7	-6.1	22.6	11,370.3
Rest of Tennessee	0.0	15.1	-1.3	13.8	13,583.9
Rest of Virginia	-1.5	16.1	0.3	14.8	19,659.2

*Total export shift is the sum of the national, industry, and regional export shift.

SOURCE: Data from U.S. Bureau of the Census, *Annual Survey of Manufactures*, 1983-86 and 1988-91, and *Census of Manufactures*, 1987; authors' calculations.

Table 8: Dynamic Shift-Share Analysis by Region, 1983-91: Export Components

The regional export shift is a component in which we have particular interest (Table 8), for it is the export growth (or decline) effect that can be attributed to a region's unique competitive position with respect to exports after all other export, import, and domestic demand effects at the national, regional, and industry level have been isolated. In Appalachia, the regional export shift is -1.8 percent and much smaller than the regional residual shift--again emphasizing the importance of production for the domestic market in terms of overall contribution to the region's economy. Regional export shifts (in percentage terms) range from approximately +10 percent to -10 percent across all the residual portions of the Appalachian states, distributed evenly among positive and negative contributions.

Thus, the picture of Appalachia that emerges from the dynamic and extended shift-share analysis is one of substantial export shipments growth over the 1983-91 period, and one in which export performance has been only slightly less robust than the rest of the nation and the residual of the states comprising the Appalachian Region. Export growth following trends in the national economy accounts for all of the Appalachian exports growth, while industry and regional export shift effects are small and negative. If Appalachia had a more "export favorable" industrial structure and was more competitive in the region with respect to exporting, the growth in exports shipments could have been greater. We now turn our attention to the characteristics of individual Appalachian exporter establishments to try to understand better some of the underlying structural dimensions that help to account for Appalachia's relative export performance.

VII. APPALACHIAN EXPORTER ESTABLISHMENTS: A STRUCTURAL PERSPECTIVE

Research concerning the structural dimensions of exporting has been accomplished at both the meso (regional) and micro (establishment) scales.¹⁸ Both provide useful perspectives from which to draw elements of structural characteristics that influence the export performance of production units and the areas in which they are located.

At the meso scale, Coughlin and Cartwright (1987b) completed a cross-state analysis of export performance using data for 1980. The analysis was based in the theory of comparative advantage for exporting among states, utilizing a basic Heckscher-Olin approach wherein the revealed comparative advantage of states was a reflection of their respective factor endowments. Estimation results using regression analysis (generalized least squares) indicated that both physical and human capital endowments were very significant explanatory variables of states' manufacturing direct export levels.¹⁹ Differences in factor endowments, in and of themselves, accounted for the bulk of the variation across states in the magnitude of export shipments.²⁰

Other researchers have noted the concentrations of industries with high levels of capital, both physical and human, in certain states, and the apparent relationship to higher state export performance (Gillespie 1982; Fieleke 1986). Erickson and Hayward (1992), using unpublished state by 3-digit SIC manufacturing data from the 1986 ASM, demonstrated that interstate variations in relative export performance are closely related to differences in the industrial structures of the states. Those states whose industrial portfolios included sectors characterized nationally by strong export performances were obviously better positioned to be successful exporters. The authors found that the relative export efficiency of industries (defined as the state's share of exports of an industry relative to its share of total shipments for all industries) was significantly related to the capital intensity of the various industry sectors in 39 of the 48 contiguous states. The parameters from these regressions were subsequently related in a second-stage regression analysis to physical and human capital endowments across the various states, and shown to be significant explanatory variables.

At the micro scale, the issue of what kinds of establishments are more likely to be engaged in exporting has also been a topic of considerable research interest.²¹ The factors generally believed to be associated with export initiation or performance include elements of the structure and organization of the firm, the nature of both domestic and foreign markets, decisionmaker characteristics, and the noneconomic environment of the decisionmaker. Our focus here is on those structural and organizational dimensions of manufacturers that affect export propensity.

¹⁸We consider research on exporting at the national level to be macro-scale inquiry.

¹⁹Coughlin and Cartwright (1987b) also estimated their model in relative rather than absolute terms; the results were very similar.

²⁰The Coughlin-Cartwright model was reestimated by Erickson et al. (1995) using 1986 data with very similar regression results.

²¹An extensive review of this literature may be found in Chapter 2 of Erickson et al. (1995).

Previous research using the Census manufacturing microdata (LRD) supports the proposition that larger manufacturing establishments are more likely to engage in exporting than smaller plants (Bernard and Jensen 1993, 1994, 1995; Erickson et al. 1995). This finding is consistent with the macro perspective of "new international trade theory" that emphasizes the role of scale economies in accounting for patterns of international trade, and scale economies are obviously related closely to the size of producer units (Krugman 1979; 1980). Exporters typically pay higher wages, salaries, and benefits, are more productive in terms of output per worker, and are more capital intensive producers, all consistent with meso scale findings regarding the effects of physical and human capital endowments on export performance (Bernard and Jensen 1993, 1994, 1995; Erickson et al. 1995).

The structural features of the industry sectors themselves are also important dimensions to exporting at the micro scale. Establishments in such sectors as chemicals, electronics, machinery, and transportation equipment demonstrate consistently higher involvement in foreign markets. More importantly, however, establishments producing advanced technology products within these sectors are far more likely to be exporters or to initiate exporting than non-advanced technology producers. Similarly, relatively more resources are devoted to nonproduction types of activities in exporter establishments, activities such as research and development, sales, accounting, and logistics (Erickson et al. 1995).

Finally, exporter manufacturing establishments have a higher probability of being units in multiplant enterprises than nonexporters. As McConnell (1979) and others have suggested, units of multiplant enterprises are more likely (1) to have access to greater sources of information concerning foreign markets, (2) to have more company resources regarding foreign transactions such as brokerage and other elements of international transactions, (3) to have lower costs of raising capital, and (4) to have greater capacities to take risks, absorb losses, and wait longer for suitable financial returns. Such multiplant enterprises are also more likely to have a stronger base of operations in domestic markets, from which Erickson (1989), Markusen et al. (1991), and others have argued that successful foreign exporting springs.

VIII. ESTABLISHMENT MICRODATA DESCRIPTION

As noted above, the Longitudinal Research Database (LRD) is an extremely large collection of microdata on individual manufacturing establishments compiled from information gathered in the *Census of Manufactures* (CM) and the *Annual Survey of Manufactures* (ASM) (McGuckin and Pascoe 1988). The LRD currently contains information from 16 ASMs (1973-76; 1978-81; 1983-86; and 1988-91) and six CMs (1963, 1967, 1972, 1977, 1982, and 1987). The ASM panel establishments can also be identified in each of the CM years.

The *establishment* is the basic unit of data gathering in both the CM and the ASM. The CM is meant to be a true census of activity of manufacturing establishments in the U.S., although not all establishments are currently surveyed. Following the 1963 CM, small companies have been exempted from reporting; instead, records from other federal agencies, as well as industry averages drawn from those CM establishments surveyed, are used to create "administrative records" for these small companies not surveyed. There are approximately 120-145 thousand such administrative records of establishments in a CM year. These administrative records

typically account for no more than 1-2 percent of total manufacturing activity in the nation (McGuckin and Pascoe 1988, p. 32).²²

The LRD is a rich source of information on the operating and organizational characteristics of manufacturing establishments including labor, materials, and capital inputs; value of shipments and output; export shipments; locations (including state, metropolitan area, and place codes); and legal form of organization. Each establishment has a permanent identification number and location that follows it over time, and a company code that permits the individual plant to be linked to its multi-plant parent company, if appropriate.

Table 9 provides a selected list of variables from the LRD that we have used in analyzing Appalachian exporter establishments. A description of each of the variables is provided in Appendix A at the end of this report. We focus on the establishment as the unit of analysis for one principal reason: the characteristics of exporting relevant to establishments are likely to be lost under the umbrella of an entire multiplant enterprise, which typically produces a wide variety of products with different production methods and capital and labor combinations, and with different mixes of domestic and foreign market orientation.

Identification Number
Derived Industry Code
Total Value of Shipments
Value of Direct Export Shipments
State Code
County Code
Value Added
Total Employment
Production Workers
Total Wages and Salaries
Production Worker Wages
Supplemental Labor Costs
New Building Expenditures
New Machinery Expenditures
Used Building Expenditures
Used Machinery Expenditures
End-of-Year Building Assets
End-of-Year Machinery Assets
SOURCE: Longitudinal Research Database, U.S. Bureau of the Census, Center for Economic Studies.

Table 9: Subset of LRD Variables Used in Appalachian Exporter Analysis

²²The administrative records have been included in the version of the LRD that we have used in this analysis. Because these "administrative record plants" (which have five or fewer employees) were not actually surveyed, there is obviously no information on their export activity. However, our previous research has shown that the export involvement of these very small administrative record plants is negligible (Erickson et al., 1995). Thus, the inclusion of administrative records understates the share of establishments engaged in exporting while the exclusion overstates the share. Bernard and Jensen (1993, 1994, 1995) have found, in an excluded LRD file, that nearly 18 percent of all plants have some exports; our included file indicates that about 8 percent are exporters. The actual figure undoubtedly lies somewhere between these bounds. Within the group of exporters, there is obviously no effect that results from inclusion or exclusion of administrative records.

IX. STRUCTURAL CHARACTERISTICS OF APPALACHIAN EXPORTERS

The results of data analysis for Appalachian and non-ARC manufacturing establishments presented in Table 10 provide evidence of the significant differences in the structural and organizational dimensions of exporter and nonexporter establishments.²³ The differences in the means are statistically significant for all variables at the .01 level based on t-tests, except for the ratio of nonproduction workers to total employment.

Variable	Appalachia			Rest of the U.S.		
	Exporter		Nonexporter	Exporter		Nonexporter
Total Employment	280	***	46	249	***	33
Total Value of Shipments (\$000)	42,262	***	4,151	44,181	***	3,493
Wages and Salaries Per Employee	22,507	***	16,092	24,619	***	18,810
Prod'n Worker Wages Per Prod'n Worker	19,865	***	13,694	20,764	***	15,724
Benefits Per Employee	5,577	***	3,203	5,746	***	3,631
Ratio of Nonproduction Workers to Total Empl	0.27		0.26	0.36		0.37
Value Added Per Employee	64,222	***	42,120	73,981	***	43,885
Plant and Equipment Assets Per Employee	57,887	***	29,235	53,410	***	28,901
Capital Expenditures Per Employee	5,299	***	2,504	4,998	***	2,563
Percent of Estab's in Multiplant Firms	72.1		23.0	59.7		18.3
Exports as a Percentage of Total Shipments	0.077		---	0.102		---
Number of Estab's	2,339		25,865	26,537		314,151
Percentage of Estab's in Group	8.3		91.7	7.8		92.2
***Means are significantly different at the .01 level.						
SOURCE: Longitudinal Research Database, 1987 CM Files, U.S. Bureau of the Census, Center for Economic Studies						

Table 10: Exporter and Nonexporter Means Comparisons, 1987 Appalachian Region and Rest of the U.S. (All Establishments)

²³We have focused our analysis on the 1987 CM data in the LRD in order to reflect the results of the larger Census (the ASM sample is not geographically drawn, as noted above). However, our analysis using the 1987, 1988, 1989, and 1990 ASM data indicates a remarkable degree of structural stability in establishment exporting behavior, and we are confident that the information derived from the 1987 CM is broadly reflective of current exporter structures.

Appalachian exporter establishments are several times larger than nonexporters in terms of employment, the former averaging 280 employees and the latter 46 employees (Table 10). Similarly, the average value of shipments among exporter establishments is ten times greater than that for nonexporters. Exporters pay significantly higher wages and salaries per employee, have higher average production worker wages, and have significantly higher benefits costs per employee. Appalachian exporter establishments are more productive than nonexporter establishments; value added per employee is over 50 percent higher among exporter establishments (Table 10). In addition, plant and equipment capital assets per employee are higher among exporters, as are current year (new and used) capital expenditures per employee.

With respect to organizational structure, the percentage of Appalachian exporter establishments in multiplant companies (72.1 percent) is notably higher than the percentage of nonexporters in multiplant firms (23 percent) (Table 10). This finding provides support for the small-sample results of McConnell (1979) and other researchers who have argued that large, multi-unit organizations have significantly greater capacity to export than smaller, single-plant companies.

The comparison between Appalachian exporters and exporters in the rest of the nation is equally interesting (Table 10). Data indicate that Appalachian exporters are more likely to be lower wage establishments and branch plants than the rest of the nation. Wages, salaries, and benefits are consistently lower in Appalachia, productivity among exporters is somewhat lower, and the proportion of nonproduction workers to total employment is significantly lower. Higher proportions of nonproduction workers are typically found where more of the work force is engaged in management, research and development, sales, and logistics. Average plant size in Appalachia is somewhat larger, and capital asset intensity and current year capital expenditures are very similar to non-Appalachian areas. Although a slightly larger proportion of Appalachian plants exports, a lower proportion of total shipments is destined for foreign export, and a greater share of plants, both among exporters and nonexporters, is branch plants in Appalachia.

X. SECTORAL DIFFERENCES

The results of analysis of the LRD files indicate that the percentage of plants exporting and the share of total shipments exported by 2-digit SIC industry in Appalachia is similar to the pattern that exists in non-Appalachian areas (Table 11). In both regions, nondurable manufacturers such as Food Products, Textiles, Apparel, Furniture, and Printing and Publishing tended to export less of their value of shipments than durables manufacturers. Lumber and Wood Products, Chemicals, Leather Products, Machinery and Computer Equipment, Electronics, and Transportation Equipment were leading exporters by share of shipments in both regions. Appalachian plants have higher proportions of plants exporting than the Rest of the U.S. in Textiles, Furniture, Chemicals, Rubber and Plastics, Leather Products, Stone, Clay, and Glass, Primary Metals, Fabricated Metals, Electronics, and Transportation Equipment. However, the share of export shipments from Appalachian plants exceeds the Rest of the U.S. only in Chemicals, Petroleum Refining, and Instruments.

A comparison of Appalachian exporter and nonexporter plants by 2-digit SIC group is provided in Appendix B. A summary of the comparison means for the same variables displayed in

Table 12 indicates that most industry sectors reflect significant differences between exporter and nonexporter plants. Only SIC 29, Petroleum Refining, consistently breaks from the normal pattern. In terms of specific variables, a higher ratio of nonproduction workers to total employees holds for nearly half of the plants, even though the difference is not statistically significant for the aggregate of Appalachian exporters. Although current capital expenditures per worker was higher for exporters in all but one sector (SIC 32), the differences were statistically significant in only four of the sectors.

SIC Industry Sector	Appalachia			Rest of the U.S.	
	Number of Export Plants	Percentage of Plants Exporting	Percentage of Shipments Exported	Percentage of Plants Exporting	Percentage of Shipments Exported
20 Food Products	58	4.3	3.7	8.2	5.1
21 Tobacco Products	D*	D	D	D	D
22 Textiles	145	11.9	3.3	9.4	4.6
23 Apparel	44	2.3	3.8	2.6	5.7
24 Lumber & Wood	135	3.0	12.8	3.3	13.9
25 Furniture	69	6.0	2.2	3.7	2.4
26 Paper	55	13.4	2.8	13.6	9.4
27 Printing	51	1.5	1.8	1.7	3.6
28 Chemicals	195	24.1	12.1	18.7	11.8
29 Petroleum	13	5.7	7.8	10.8	2.7
30 Rubber & Plastics	156	20.3	5.9	18.8	6.7
31 Leather	23	16.7	9.6	7.7	11.8
32 Stone, Clay, Etc.	143	8.6	6.4	4.7	7.2
33 Primary Metals	134	21.3	2.9	16.6	4.3
34 Fabricated Metals	298	12.4	5.4	9.2	7.7
35 Mach. & Computers	377	12.6	13.4	12.5	13.8
36 Electronics	200	26.6	9.4	21.8	11.6
37 Transportation	94	16.3	9.6	12.5	13.1
38 Instruments	103	22.2	12.4	22.7	7.3
39 Miscellaneous	35	4.4	7.4	5.8	7.3

*D indicates that the value cannot be disclosed due to confidentiality restrictions.

SOURCE: Longitudinal Research Database, 1987 CM File, U.S. Bureau of the Census, Center for Economic Studies; *1987 Census of Manufactures*, "Exports from Manufacturing Establishments," U.S. Bureau of the Census.

Table 11: Exporter Establishments as a Percentage of All Establishments and Percentage of Shipments Exported: Appalachia and the Rest of the U.S., 1987

The more detailed sectoral breakdowns provided in Appendix B indicate many interesting differences among the various 2-digit industry groupings. Not surprisingly, the largest exporter plants produce Transportation Equipment and Primary Metals; the average employment of these plants is nearly ten times that of plants in the Lumber and Wood Products sector. The highest salary, wage, and benefit levels among exporter establishments occur in the Paper, Chemicals, Petroleum Refining, Primary Metals, Transportation Equipment, and Instruments sectors. In the

same pattern as all plants, export establishments pay the lowest wages in Textiles, Apparel, Lumber and Wood Products, Furniture, and Leather Products. Productivity in terms of value added per employee is highest in the Food Products, Chemicals, and Petroleum Refining sectors, and capital intensity also characterizes these plants in the Appalachian export sector.

Variable	SIC GROUP																		
	20	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Total Employment	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y
Total Value of Shipments (\$000)	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Wages and Salaries Per Employee	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Prod'n Worker Wages Per Prod'n Worker	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Benefits Per Employee	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ratio of Nonproduction Workers to Total Empl		Y	Y	Y						Y			Y	Y	Y		Y		Y
Value Added Per Employee	Y	Y	Y	Y	Y	Y	Y			Y		Y		Y	Y	Y	Y	Y	Y
Plant and Equipment Assets Per Employee	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y		Y	Y
Capital Expenditures Per Employee	Y		Y											Y					Y

*Statistically significant at the .05 level using a Cochran t-test with unequal variances.

Table 12: Significantly Greater (Y)* Mean Attributes for Appalachian Exporters, 1987
(by 2-digit SIC)

The analysis of exporter and nonexporter differences at the 2-digit SIC level provides some interesting intersectoral comparisons of the extent to which various industries correspond to the general findings; however, there is increasing evidence that producers of advanced technology products are major contributors to U.S. exports and the positive trade balance that exists for these types of products (Doms and McGuckin 1992). Researchers at the U.S. Bureau of the Census have identified products by 5-digit SIC codes that represent advanced technology products

(Abbott et al. 1989).²⁴ We have examined the export orientation of 52 4-digit SIC codes of which these advanced technology industries are a part (Table 13). The extent to which establishments producing in these sectors are associated with a higher propensity to export is a matter of considerable interest in assessing the future prospects for export development in Appalachia.

The cross-classification of establishments by exporter and technology status in Appalachia and the Rest of the U.S. is presented in Table 14. These data indicate that advanced technology plants are far more likely to be exporters than non-advanced technology plants. About 21 percent of advanced technology plants in both Appalachia and the Rest of the U.S. were exporters in 1987; only about 7 percent of non-advanced technology plants were exporters in either Appalachia or in the rest of the nation. Advanced technology exporter plants are larger, on average, than non-advanced technology exporters. Advanced technology exporters are not only larger in size on average than non-advanced technology exporters, they are higher wage plants with a much higher ratio of nonproduction to production workers that export a significantly larger proportion of their shipments as opposed to non-advanced technology plants. Elsewhere, we have shown in a national study of export propensity using logit regression analysis that manufacturing establishments belonging to an advanced technology sector have the highest likelihood of being an exporter among all variables considered for a specific year during the 1987-1990 period (Erickson et al. 1995).²⁵ Thus, the advanced technology dimension appears to be critically important to export sector development.

Because of the Appalachian Region's substantial role as a branch plant economy, advanced technology establishments are not nearly as well represented in Appalachia as in the rest of the nation. Only 4.9 percent of the nonexporter establishments in Appalachia are advanced technology plants, while 14.2 percent of the exporters are advanced technology goods producers. In contrast, 6.8 percent of nonexporter establishments and 20.8 percent of exporters in the rest of the nation fall under the advanced technology industry category as defined above.

XI. SUMMARY ASSESSMENT OF APPALACHIA'S COMPETITIVENESS IN THE GLOBAL ECONOMY

By historic standards, U.S. companies have performed well in expanding foreign sales of manufactured goods over the past two decades. Nonetheless, competition from imports in domestic markets has increased even faster and, despite a rather steadily falling dollar, the nation

²⁴The Bureau of the Census' definition of Advanced Technology Products is focused on ten fields including biotechnology, life sciences, opto-electronics, computers and telecommunications, electronics, computer integrated manufacturing, materials design, aerospace, weapons, and nuclear materials and equipment (a complete listing of the products is given in Abbott et al. (1989), Appendix B. The list of Advanced Technology Products was developed from special reports on technology in *Fortune* magazine, CorpTech's *High Technology Classification System*, and a 1987 report on the status of emerging technologies for former Deputy Secretary of Commerce Brown.

²⁵In addition, establishment size, as reflected in either employment or total value of shipments, is also a key explanatory and predictive variable. Taking a sequential year-to-year approach in the analysis, the issue of whether or not a plant has ever exported dominantly predicts the probability of whether or not that establishment exports in subsequent years. Once an establishment has exported, that plant has the highest potential of being an exporter again.

is currently racking up trade deficits that will challenge the previous high of more than \$160 billion in 1987. With little apparent inclination or ability to slow the demand for imports, public policy will undoubtedly continue to focus on enhancing exports. The ability of U.S. manufacturers to export in greater volume is one relevant measure of global competitiveness in the 1990s.

Our analysis indicates that Appalachian industrial exporters performed well over the 1983-91 period relative to the nation as a whole. Direct export manufacturing shipments from Appalachia increased from \$9.6 billion in 1983 to \$20.7 billion in 1991, an increase of 116 percent in current dollars and 91 percent in real terms. This rate of growth was only slightly lower than the 121 percent and 95 percent current dollar and real growth rates, respectively, for industrial export shipments in the nation as a whole during the same years. Similarly, direct export employment in Appalachia increased from 80,500 to 122,700 during the 1983-91 period; the 52.5 percent growth rate in Appalachia slightly exceeded the U.S. rate of 50.4 percent.

Nonetheless, Appalachia continues to lag somewhat behind the national economy in terms of its share of production shipped for export and in its export share of manufacturing employment. Appalachian plants exported an average of 5.8 percent of their shipments in 1983 and 8.7 percent in 1991, lower than the respective U.S. figures of 6.9 and 11.1 percent for these years. Similarly, direct export employment as a share of total employment in Appalachia was 4.4 percent in 1993 and 6.9 percent in 1991, again lower than the U.S. shares of 6.0 and 9.4 percent in the respective years. Like the U.S. as a whole, the Appalachian Region is characterized by a higher value of shipments per employee in exports than in that produced for the domestic market.

The industrial composition of Appalachia's exports is also different from the nation's export industry mix. Appalachia relies much more heavily on the Chemicals, Tobacco Products, Textiles, and Primary Metals industries for its exports than does the nation as a whole.

In terms of the destinations of exports, the relative shares of Appalachian export flows to other world regions and countries closely mirrors that of the U.S. Canada, Europe, and Asia dominate the flow structure, accounting for nearly 85 percent of all manufacturing export shipments. The Appalachian Region is gaining significantly in its share destined for the Asian market, most notably in export shipments to Japan and South Korea. These gains have been spread over a wide array of industrial sectors. That Appalachian exporters have been able to increase significantly the share of their exports destined for these growing Asian markets over the past decade bodes well for future export development in the region.

Industry SIC Code	Industry Sector Titles
2819	Industrial Inorganic Chemicals, Not Elsewhere Classified (NEC)
2833	Medicinal Chemicals and Botanical Products
2834	Pharmaceutical Preparations
2835	In Vitro and In Vivo Diagnostic Substances
2836	Biological Products, Except Diagnostic Substances
3443	Fabricated Plate Work
3483	Sheet Metal Work
3484	Small Arms
3489	Ordnance and Accessories, NEC
3499	Fabricated Metal Products, NEC
3519	Internal Combustion Engines, NEC
3531	Construction Machinery and Equipment
3541	Machine Tools, Metal Cutting Types
3542	Machine Tools, Metal Forming Types
3548	Electric and Gas Welding and Soldering Equipment
3569	General Industrial Machinery and Equipment, NEC
3571	Electronic Computers
3572	Computer Peripheral Equipment, NEC
3575	Computer Terminals
3577	Computer Peripheral Equipment, NEC
3578	Calculating and Accounting Machines, Except Electronic Computers
3579	Office Machines, NEC
3651	Household Audio and Video Equipment
3652	Phonograph Records and Prerecorded Audio Tapes and Disks
3661	Telephone and Telegraph Apparatus
3663	Radio and Television Broadcasting and Commercial Equipment
3669	Communications Equipment, NEC
3671	Electron Tubes
3674	Semiconductors and Related Devices
3679	Electronic Components, NEC
3695	Magnetic and Optical Recording Media
3699	Electrical Machinery, Equipment, and Supplies, NEC
3721	Aircraft
3724	Aircraft Engines and Engine Parts
3728	Aircraft Parts and Auxiliary Equipment, NEC
3761	Guided Missiles and Space Vehicles
3764	Guided Missile and Space Vehicle Propulsion Units and Parts
3769	Guided Missile and Space Vehicle Parts and Auxiliary Equipment, NEC
3812	Search, Detection, Navigation, Guidance, and Aeronautical Instruments
3822	Automatic Controls for Regulating Environments and Appliances
3823	Industrial Instruments for Process Measurement, Display, and Control
3824	Totalizing Fluid Meters and Counting Devices
3825	Instruments for Measuring and Testing Electricity and Electrical Signals
3826	Laboratory Analytical Instruments
3827	Optical Instruments and Lenses
3829	Measuring and Controlling Devices, NEC
3841	Surgical and Medical Instruments and Apparatus
3842	Orthopedic, Prosthetic, and Surgical Appliances and Supplies
3844	X-Ray Apparatus and Tubes and Related Irradiation Apparatus
3845	Electromedical and Electrotherapeutic Apparatus
3861	Photographic Equipment and Supplies
3944	Games, Toys, and Children's Vehicles, Except Dolls and Bicycles

SOURCE: Abbott et al. (1989), Appendix B, Advanced Technology Exports by Product Type.

Table 13: Advanced Technology Sectors

Technology of Establishment	Appalachia		Rest of the U.S.	
	Exporters	Nonexporters	Exporters	Nonexporters
Non-Advanced (Non-ADV) Technology Plants:				
Percentage of Non-ADV Plants	7.5	92.5	6.7	93.3
Average Employment of Non-ADV Plants	271	46	207	32
Advanced (ADV) Technology Plants:				
Percentage of ADV Plants	20.9	79.1	20.5	79.5
Average Employment of ADV Plants	339	49	412	47

SOURCE: Longitudinal Research Database, 1987 CM File, U.S. Bureau of the Census, Center for Economic Studies.

Table 14: Characteristics of Advanced Technology and Non-Advanced Technology Exporter and Nonexporter Establishments in Appalachia, 1987

Our dynamic and extended shift-share analysis decomposed the Appalachian Region's annual growth of manufacturing shipments over the 1983-91 period into export, import, and domestic demand components of the traditional national, industry, and regional shifts. The net export shift (the sum of the national export, industrial export, and regional export shifts) accounted for more than 15 percent of Appalachia's total growth in industrial shipments over the study period, higher than the non-Appalachian portions of four of the constituent states, but lower than eight others. The negative, but relatively small, industrial export shift in Appalachia is due to a regional industrial structure characterized by a below-average proportion of high export growth industries. The regional export shift, that proportion of the region's growth attributable to the unique competitive factors that affect Appalachia's export trade, was -1.8 percent. Thus, Appalachian export growth was entirely a result of the region simply matching the nation's export growth trends.

Results from the analysis of Census manufacturing establishment microdata indicate that exporter plants in Appalachia, like the Rest of the U.S., are significantly different from nonexporter plants in terms of their structural and organizational attributes. Appalachian exporter plants are larger, pay higher wages and salaries per employee for both production and nonproduction workers, are more productive, are more capital intensive, and are more likely to be plants of a multiplant enterprise than the region's nonexporter plants. In comparison with the Rest of the U.S., the Appalachian Region reflects its orientation to the branch plant economy with relatively lower wages and benefits and a lower ratio of nonproduction workers to total

employees. Appalachian exporter plants also tend to be larger units relative to the Rest of the U.S. average. Although the proportion of shipments exported from Appalachian plants is lower than in the Rest of the U.S., it is noteworthy that a higher percentage of plants in Appalachia has at least some exports. This relatively higher export propensity (or proportion of exporters) among Appalachian plants bodes well for potential future export growth, given that many plants already have some experience with exporting.

Advanced technology plants are far more likely to be exporters than non-advanced technology plants, and the proportion of advanced technology plants that export is nearly identical in Appalachia and the Rest of the U.S. Unfortunately, advanced technology plants represent a significantly lower proportion of all plants in Appalachia than in the Rest of the U.S., further evidence of the branch plant orientation of the Appalachian Region.

In summary, Appalachia has fared well in global competition when one compares the region's export performance with the rest of the nation over the past decade. Appalachian industrial export growth of both shipments and employment has closely paralleled the nation's export expansion, and clearly drawn much of its strength from national export trends. This performance has occurred in the face of a somewhat less favorable export industrial structure and the region's branch plant orientation. Despite the generally positive industrial export performance of Appalachia over the past decade, there is also room for considerable improvement in the Appalachian Region's export performance, as there is for the nation as a whole, amidst the realization that competition with imports in U.S. domestic markets is an equally important facet of global competitiveness.

REFERENCES

- Abbott, T., R. McGuckin, P. Herrick, and L. Norfolk. 1989. Measuring the trade balance in advanced technology products. Discussion Paper CES 89-1. U.S. Bureau of the Census, Center for Economic Studies, Washington, DC.
- Arcelus, F. J. 1984. An extension of shift-share analysis. *Growth and Change* 15:3-8.
- Barff, R., and P. Knight III. 1988. Dynamic shift-share analysis. *Growth and Change* 19:1-10.
- Bernard, A. B., and J. B. Jensen. 1993. U.S. manufacturing exports, jobs, and wages. Working Paper, Center for Economic Studies, U.S. Bureau of the Census, Washington, DC.
- _____. 1994. Exporters, skill upgrading, and the wage gap. Working Paper, Center for Economic Studies, U.S. Bureau of the Census, Washington, DC.
- _____. 1995. Exporters, jobs and wages in U.S. manufacturing: 1976-1987. Working Paper, Center for Economic Studies, U.S. Bureau of the Census, Washington, DC.
- Casler, S. D. 1989. A theoretical context for shift and share analysis. *Regional Studies* 23:43-48.
- Coughlin, C. C., and P. A. Cartwright. 1987a. An examination of state foreign exports and manufacturing employment. *Economic Development Quarterly* 1:257-67.
- _____. 1987b. An examination of state foreign export promotion and manufacturing exports. *Journal of Regional Science* 27:439-49.
- Doms, M. E., and R. H. McGuckin. 1992. Trade in high technology products. *Science and Public Policy* 19:343-46.
- Erickson, R. A. 1989. Export performance and state industrial growth. *Economic Geography* 65:280-92.
- _____. 1993. Trade, economic growth, and state export promotion programs. In R.P. McGowan and E.J. Ottensmeyer (eds.), *Economic Development Strategies for State and Local Governments*. Chicago: Nelson-Hall, pp. 26-40.
- Erickson, R. A., and D. J. Hayward. 1991. The international flows of industrial exports from U.S. regions. *Annals of the Association of American Geographers* 81:371-90.
- _____. 1992. Interstate differences in relative export performance: a test of factor endowments theory. *Geographical Analysis* 23:223-39.
- Erickson, R. A., S. W. Friedman, and S. X. Lowe. 1995. *State Industrial Exports, Export Promotion Programs, and Exporter Targeting*. Final Report to the U.S. Department of Commerce, Economic Development Administration, Technical Assistance and Research Division. Washington, DC.
- Farrell, M. G., and A. Radspieler. 1989. Census Bureau state-by-state foreign trade data: historical perspective; current situation; future outlook. Paper presented to the National Governors' Association, Committee on International Trade and Foreign Relations, Washington DC.
- Fothergill, S., and G. Gudgin. 1979. In defense of shift-share. *Urban Studies* 16:309-19.

- Gillespie, Robert W. 1982. The Midwest region and the international economy. *The Midwest Economy: Issues and Policy*. Edited by R.W. Resek and R.F. Kosobud. Urbana, IL: University of Illinois, 185-211.
- Hanink, D. M. 1987. A comparative analysis of the competitive geographical trade performance of the USA, FRG, and Japan: the markets and marketers hypothesis. *Economic Geography* 63:293-305.
- Hayward, D. J. 1992. *The Impacts of the European Community 1992 on U.S. State Economies*. Unpublished Ph.D. Dissertation, Department of Geography, Pennsylvania State University.
- _____. 1995. *International Trade and Regional Integration: The Impacts of European Integration on the United States*. Boulder, CO: Westview Press.
- Hayward, D. J., and R. A. Erickson. 1995. The North American trade of U.S. states: a comparative analysis of industrial shipments, 1983-91. *International Regional Science Review* 18:1-31.
- Krugman, P. 1979. Increasing returns, monopolistic competition, and international trade. *Journal of International Economics* 9:469-79.
- _____. 1980. Scale economies, product differentiation, and the pattern of trade. *American Economic Review* 70:950-59.
- Manrique, G. C. 1987. Foreign export orientation and regional growth in the U.S. *Growth and Change* 18:1-12.
- Markusen, A. R., H. Noponen, and K. Driessen. 1991. International trade, productivity and regional job growth: a shift-share interpretation. *International Regional Science Review* 14:15-39.
- McConnell, J. E.. 1979. The export decision: an empirical study of firm behavior. *Economic Geography* 55:171-83.
- McGuckin, R. H., and G. A. Pascoe, Jr. 1988. The Longitudinal Research Database: status and research possibilities. *Survey of Current Business* 68(November):30-37.
- Newman, M. 1972. *The Political Economy of Appalachia*. Lexington, MA: D.C. Heath and Company.
- Radspieler, A., and G. Mehl. 1991. The myth of state trade balances. Unpublished manuscript, U.S. Bureau of the Census, Foreign Trade Division.
- Richardson, H. W. 1978. The state of regional economics: a survey. *International Regional Science Review* 3:1-48.
- Risha, M. 1991. A comparison of the "origin of movement" series and the "exports from manufacturing establishments" series. Unpublished paper, U.S. Bureau of the Census, Foreign Trade Administration.
- Stilwell, F. J. B. 1970. Further thoughts on the shift and share approach. *Regional Studies* 4:451-58.

- U.S. Bureau of the Census. 1994. *Exports from Manufacturing Establishments: 1990 and 1991*. Washington, DC: Bureau of the Census.
- U.S. Department of Commerce, International Trade Administration. 1992. *U.S. Exports to Mexico: A State-By-State Overview, 1987-1991*. Washington, DC: International Trade Administration.
- Webster, E., E. J. Mathis, and C. E. Zech. 1990. The case for state-level export promotion assistance: a comparison of foreign and domestic export employment multipliers. *Economic Development Quarterly* 4:203-10.

APPENDIX A

Brief Descriptions of LRD Variables Used in Analysis

Identification Number:

An establishment's Identification Number is a ten-digit number assigned by the Bureau of the Census. This number provides information on the organizational status and company affiliation of the plant.

Derived Industry Code:

The four-digit SIC code for the manufacturing industry in which the establishment should be classified on the basis of its recorded shipments (or production) values for the current year.

Total Value of Shipments:

The total value of shipments is the sum of product values; receipts from contract work performed for others; sales of products bought and resold without further processing; and miscellaneous receipts for installation and repair work, sales of scrap, etc.

State Code:

The Federal Information Processing Standards (FIPS) code for each state.

Metropolitan Statistical Area Code:

A four-digit code assigned to MSA's in alphabetic sequence.

Value Added:

The first step in the calculation of value added is the conversion of the value of shipments to value of production by adding the end of year inventory of finished goods and work in process and subtracting the beginning of year inventories. The costs of materials (including materials, supplies, fuel, electric energy, cost of resales, and cost of contract work) are then subtracted from this value of production to obtain value added.

Total Employment:

Total Employment records the sum of the average number of production workers for the mid-month payroll periods of March, May, August, and November and the number of nonproduction personnel employed during the pay period including the 12th of March.

Production Workers:

Production workers are employees (up through the working foreman level) engaged in fabricating, processing, assembling, inspecting, receiving, packing, warehousing, shipping, maintenance, repair, janitorial and watchman services, product development, auxiliary production for plant's own use (e.g., powerplant), recordkeeping, and other services closely associated with these production operations at the establishment. Supervisory employees above the working foreman level and proprietors and partners are excluded from this category.

Total Wages and Salaries:

The gross earnings paid in the calendar year to employees at the establishment prior to such deductions as employees' social security contributions, withholding taxes, group insurance premiums, union dues, and savings bonds. Included in gross earnings are all forms of compensation such as salaries, wages, commissions, dismissal pay, paid bonuses, vacation and sick leave pay, and the cash equivalent of compensation paid in kind. Payments to officers of the establishment, proprietors, or partners, are excluded.

Production Worker Wages:

Salaries and wages paid to production workers during the year.

Supplemental Labor Costs:

Legally required supplemental labor costs including Federal Old Age and Survivors' Insurance; unemployment compensation; and workers compensation, and voluntary supplemental labor costs including such contributions as insurance premiums; pension plans; and stock purchase plans.

New Building Expenditures:

All new construction and other land improvements costs, including major alterations, capitalized repairs, and improvements of buildings and sites.

New Machinery Expenditures:

Total capital expenditures during the year for new production machinery and equipment and other new machinery and equipment including replacements as well as additions to capacity.

Used Building Expenditures:

The purchase price of all used buildings and other structures purchased during the year.

Used Machinery Expenditures:

The purchase price of used machinery and equipment acquired from others during the year.

End-of-Year Building Assets:

Equipment that is an integral part of the building or structure; land on which the structure sits is excluded, except for the capitalized site improvements, which are included.

End-of-Year Machinery Assets:

All production machinery, transportation equipment; office equipment and machines, computers, furniture and fixtures for offices, cafeterias, and warehouse equipment.

Primary Industry Specialization Ratio

The ratio of the primary industry output to the total output of the establishment.

Source: U.S. Bureau of the Census, Center for Economic Studies, *Longitudinal Research Database Technical Documentation Manual*, 1992.

APPENDIX B: Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 20		SIC 22			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	351	***	67	395	***	138
Total Value of Shipments (\$000)	81,502	***	11,160	49,239	***	13,988
Wages and Salaries Per Employee	20,417	***	15,402	17,844	***	15,084
Prod'n Worker Wages Per Prod'n Worker	17,976	***	13,486	15,555	***	12,943
Benefits Per Employee	5,082	***	3,529	3,454	***	2,732
Ratio of Nonproduction Workers to Total Empl	0.23	***	0.34	0.18	***	0.15
Value Added Per Employee	104,171	***	52,070	47,424	***	36,824
Plant and Equipment Assets Per Employee	91,179	***	39,800	38,770	***	29,751
Capital Expenditures Per Employee	5,084	***	3,196	3,420		3,037
Number of Establishments	58		1,291	145		1,077

***Means are significantly different at the .01 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 23		SIC 24			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	215	***	107	63	***	16
Total Value of Shipments (\$000)	20,140	***	4,243	5,925	***	1,364
Wages and Salaries Per Employee	14,688	***	10,621	15,734	***	12,671
Prod'n Worker Wages Per Prod'n Worker	12,025	***	9,179	14,507	***	11,153
Benefits Per Employee	2,929	***	1,962	3,748	***	2,814
Ratio of Nonproduction Workers to Total Empl	0.22	***	0.12	0.18	***	0.12
Value Added Per Employee	36,765	***	22,100	43,719	***	28,705
Plant and Equipment Assets Per Employee	12,267	***	5,832	45,399	***	26,475
Capital Expenditures Per Employee	1,531	***	600	4,715		2,590
Number of Establishments	44		1,787	135		4,375

***Means are significantly different at the .01 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 25		SIC 26			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	333	***	66	431	***	83
Total Value of Shipments (\$000)	24,000	***	4,159	86,434	***	12,614
Wages and Salaries Per Employee	16,817	***	13,098	25,968	***	18,843
Prod'n Worker Wages Per Prod'n Worker	14,880	***	11,312	23,754	***	16,505
Benefits Per Employee	3,456	***	2,471	5,508	***	4,065
Ratio of Nonproduction Workers to Total Empl	0.17	***	0.15	0.25	***	0.24
Value Added Per Employee	40,042	***	28,225	77,226	***	46,032
Plant and Equipment Assets Per Employee	21,067	***	11,949	116,274	***	41,851
Capital Expenditures Per Employee	2,533	***	1,236	7,781		4,801
Number of Establishments	69		1,078	55		356

***Means are significantly different at the .01 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 27		SIC 28			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	108	***	22	308	***	29
Total Value of Shipments (\$000)	14,558	***	1,592	77,083	***	6,110
Wages and Salaries Per Employee	20,215	***	14,636	28,384	***	22,111
Prod'n Worker Wages Per Prod'n Worker	18,140	***	13,131	25,054	***	18,847
Benefits Per Employee	4,370	***	2,681	6,517	***	4,839
Ratio of Nonproduction Workers to Total Empl	0.41		0.39	0.36		0.39
Value Added Per Employee	70,559	***	35,634	130,335		278,996
Plant and Equipment Assets Per Employee	41,409	***	19,766	144,893		153,460
Capital Expenditures Per Employee	3,716		1,980	20,476		6,007
Number of Establishments	51		3,247	195		613

***Means are significantly different at the .01 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 29		SIC 30			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	127	**	26	251	***	68
Total Value of Shipments (\$000)	43,667		16,860	33,967	***	6,464
Wages and Salaries Per Employee	25,160		24,766	21,457	***	17,451
Prod'n Worker Wages Per Prod'n Worker	24,880		22,163	18,566	***	14,875
Benefits Per Employee	5,912		5,808	5,349	***	4,089
Ratio of Nonproduction Workers to Total Empl	0.32		0.28	0.25	***	0.20
Value Added Per Employee	134,700		109,647	62,803	***	44,887
Plant and Equipment Assets Per Employee	163,461		137,959	54,782	***	36,903
Capital Expenditures Per Employee	9,345		8,201	4,507		4,177
	-----		-----			
Number of Establishments	13		216	156		613
***Means are significantly different at the .01 level.						
**Means are significantly different at the .05 level.						

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 31		SIC 32	
	Exporter	Nonexporter	Exporter	Nonexporter
Total Employment	158	90	216	29
Total Value of Shipments (\$000)	16,165	** 5,017	23,897	*** 2,700
Wages and Salaries Per Employee	15,404	*** 11,911	23,710	*** 17,933
Prod'n Worker Wages Per Prod'n Worker	14,029	*** 9,994	22,082	*** 16,275
Benefits Per Employee	3,507	*** 2,459	6,608	*** 3,858
Ratio of Nonproduction Workers to Total Empl	0.13	0.15	0.22	0.23
Value Added Per Employee	31,728	25,801	61,330	*** 46,277
Plant and Equipment Assets Per Employee	17,704	** 8,969	68,523	*** 47,436
Capital Expenditures Per Employee	820	590	3,491	3,545
Number of Establishments	23	115	143	1,511

***Means are significantly different at the .01 level.
**Means are significantly different at the .05 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 33		SIC 34			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	519	***	100	177	***	32
Total Value of Shipments (\$000)	97,956	***	18,776	19,300	***	3,237
Wages and Salaries Per Employee	27,535	***	20,570	23,141	***	18,074
Prod'n Worker Wages Per Prod'n Worker	25,408	***	18,496	20,527	***	15,621
Benefits Per Employee	9,319	***	5,805	5,894	***	4,114
Ratio of Nonproduction Workers to Total Empl	0.25	***	0.21	0.28	***	0.24
Value Added Per Employee	62,920		56,030	56,701	***	63,462
Plant and Equipment Assets Per Employee	97,948	***	57,439	40,021	***	25,532
Capital Expenditures Per Employee	5,624		3,167	3,486	***	2,278
Number of Establishments	134		496	298		2,104

***Means are significantly different at the .01 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 35		SIC 36			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	198	***	24	371	***	98
Total Value of Shipments (\$000)	22,864	***	2,052	42,118	***	11,030
Wages and Salaries Per Employee	23,694	***	19,560	21,068	***	18,779
Prod'n Worker Wages Per Prod'n Worker	21,033	***	17,159	17,468	***	15,430
Benefits Per Employee	5,722	***	3,914	5,324	***	4,346
Ratio of Nonproduction Workers to Total Empl	0.32	***	0.25	0.30		0.29
Value Added Per Employee	56,212	***	38,992	53,932	**	47,983
Plant and Equipment Assets Per Employee	43,328	***	24,733	40,303	**	29,410
Capital Expenditures Per Employee	3,411	***	2,354	3,642		3,458
Number of Establishments	377		2,616	200		553

*** Means are significantly different at the .01 level.
** Means are significantly different at the .05 level.

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 37		SIC 38			
	Exporter	Nonexporter	Exporter	Nonexporter		
Total Employment	515	***	47	340	***	35
Total Value of Shipments (\$000)	76,462	***	4,593	40,928	***	3,083
Wages and Salaries Per Employee	24,905	***	17,908	24,857	***	19,031
Prod'n Worker Wages Per Prod'n Worker	22,210	***	15,440	19,665	***	14,945
Benefits Per Employee	6,760	***	4,033	5,572	***	3,988
Ratio of Nonproduction Workers to Total Empl	0.26	***	0.21	0.38		0.35
Value Added Per Employee	65,316	***	39,759	63,234	***	48,816
Plant and Equipment Assets Per Employee	46,441		34,473	33,628	***	20,057
Capital Expenditures Per Employee	3,949		3,136	4,524	***	1,785
	-----		-----			
Number of Establishments	94		482	103		361
***Means are significantly different at the .01 level.						

APPENDIX B (continued): Exporter and Nonexporter Means Comparisons for Appalachia, 1987
(by 2-digit Manufacturing SIC)

Variable	SIC 39	
	Exporter	Nonexporter
Total Employment	175	23
Total Value of Shipments (\$000)	19,313	1,521
Wages and Salaries Per Employee	18,348	13,726
Prod'n Worker Wages Per Prod'n Worker	15,151	10,999
Benefits Per Employee	4,293	2,528
Ratio of Nonproduction Workers to Total Empl	0.27	0.24
Value Added Per Employee	50,856	32,095
Plant and Equipment Assets Per Employee	25,198	14,121
Capital Expenditures Per Employee	2,604	1,639

Number of Establishments	35	752

***Means are significantly different at the .01 level.
SOURCE: Longitudinal Research Database, 1987 CM File, U.S. Bureau of the Census, Center for Economic Studies.