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Ohio's Competitive Advantage: Manufacturing Productivity

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By Edward W. Hill

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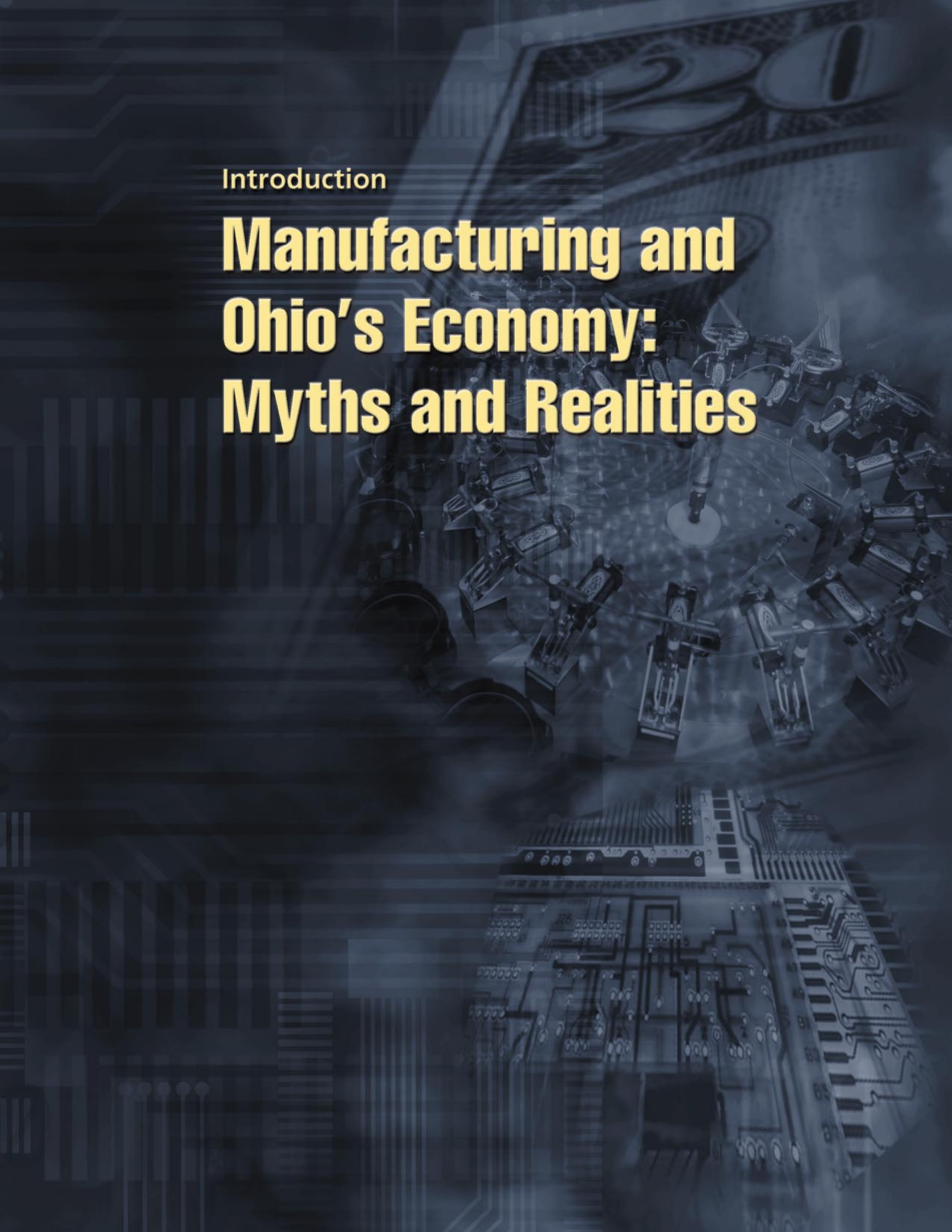

Introduction

Manufacturing and Ohio's Economy: Myths and Realities

MANUFACTURING AND OHIO'S ECONOMY: MYTHS AND REALITIES

Successful economic development is constructed from strength and achievement, not conjured from weakness and entitlement. To sustain the state's economic base, Ohio must have integrated economic and technology policies that build from existing areas of economic strength and reward competitive achievement. The demonstrated strength of this state's economy is manufacturing, and manufacturing's greatest achievement has been implementing a stream of process innovations and capital deepening, resulting in steady improvements in productivity.

Investing in economic strength means that Ohio's manufacturers need to continue applying process innovations to their production activities; building on achievement means working with the public sector (including higher education) to stimulate product innovation and to encourage capital formation that will enhance productivity. At the same time, the production and distribution functions of the overall manufacturing production process serve as an economic link between the strong economic core of the state, which is located along the suburban exit ramps of the state's highway system, and its lagging areas. The foundation of Ohio's economy is manufacturing productivity, which is at the heart of income and wealth building in the state of Ohio.

The recipe for economic success in a competitive global economy is composed from a fragile set of ingredients. At the root of economic success are products that sell well and profitably in the marketplace. The route to profits can be viewed from both sides of a business' ledger book. Revenues from sales sit on the revenue side of the ledger book, with growth in revenue being driven by growth in product demand. The fastest growth rates usually come from product innovations; these are new goods or services. The second route to profitability flows through the expense side of the ledger—squeezing higher earnings from existing sales. Firms achieve these savings through cost containment and investing in process innovations that increase a firm's total productivity. The generation of incomes and wealth in Ohio is contingent, therefore, upon the ways firms innovate new products and increase the profitability of existing products by deploying process innovations.

The role of the public sector in the state's economic development is to put together a tax structure that encourages capital formation and productivity growth on one hand, and provides the resource base that fuels a world-class, competitive economy on the other. Those resources consist of the state's workforce and infrastructure (transportation, utilities, telecommunications, and living environment), all provided at a competitive tax cost. What hurts Ohio's efforts at development is a series of myths about the role of manufacturing in the state's economy that distort the popular perception of Ohio's economic realities.

This chapter has three major sections. In the following section and the subsequent chapters, five myths about the role of manufacturing in Ohio's economy are refuted. The second section of this chapter demonstrates the central role that manufacturing plays in the state's economy and the gains in productivity realized by Ohio's business community. The third section outlines ways in which public policy can enhance the competitive position of Ohio's economy through a series of short-, medium-, and long-term public investment strategies that enhance the state's technology base through its manufacturing sector.

The demonstrated strength of this state's economy is manufacturing, and manufacturing's greatest achievement has been implementing a stream of process innovations and capital deepening, resulting in steady improvements in productivity.

MYTHS, REALITIES, AND SIGNIFICANCE

Public policy and discussions in the media about economic outcomes in the state are captured by four statistics: employment and population growth, Ohio's share of US economic output, and per capita income. On the surface, the story appears to be one of stagnation at best and relative decline at worse, but understanding the entire story of Ohio's economic strengths, competitive advantages, and strategic weaknesses requires deeper digging. If the economic fundamentals on which our current and future incomes rest are not understood, then policy makers can fall prey to questionable economic nostrums and waste public investments.

There are five myths that need to be cleared away so that a true vision about the economic future of the state can be established. The myth that productivity growth lags in Ohio due to its reliance on manufacturing is tackled in the first chapter. The myth that income growth is depressed throughout the state due to its manufacturing base is taken apart in the second chapter. The myths that Ohio is not a high technology state and not participating in the "new" economy are the subject of the third chapter. Finally, the myth that the business tax burden is the same for all sectors of Ohio's economy is refuted in the fourth and final chapter.

The productivity difference between the average manufacturing and non-manufacturing worker was $23,594 in 1977; in 1998 the productivity gap grew to $31,690 per job [in real, inflation-adjusted, dollars].

Myth: Ohio is a state where productivity growth is lagging because of its historical reliance on manufacturing.

Reality: Ohio has experienced growth in productivity, but it is largely confined to the manufacturing sector of the economy. In 1977 productivity as measured by Gross State Product per job was $47,203 in the non-manufacturing sector of Ohio's economy compared to $70,798 in the manufacturing sector.[1] By 1998 non-manufacturing productivity had declined to $46,742 per job while manufacturing productivity rose to $78,432. The productivity difference between the average manufacturing and non-manufacturing worker was $23,594 in 1977; in 1998 the productivity gap grew to $31,690 per job. However, the manufacturing productivity advantage Ohio has over the rest of the nation is narrowing. Where Ohio had a productivity advantage over the average US manufacturing worker of $7,500 in 1977, Ohio's productivity advantage fell to $3,600 per worker in 1998. These facts are demonstrated in the next section of this chapter and in the first chapter.

Significance: Ohio's manufacturing sector has sustained prosperity over the past decade by making consistent investments in process innovations that have resulted in productivity gains due to the product mix and capital intensity of production. Income growth in any economy is pegged to increases in productivity. Productivity increases come from process and product innovations; both increase the value produced per hour worked, but do so in very different ways. Process innovations are investments and changes in management and work practices that lower the production cost of existing products. These innovations are very important for products that are in the mature phase of the product cycle.[2] Product innovations increase the value of work by introducing new products into the marketplace, which trigger the beginning of the product cycle and where the most rapid gains in value are experienced.

[1] All dollars are expressed in 1999 inflation-adjusted (real) dollars.

[2] The product cycle is a conceptualization of the life span of products, not of industries. The level of sales, value added, or employment over time measures the life of a product. All are variables related to the product's profitability. The length of time a product spends in each stage of the product life cycle depends on market conditions and consumer acceptance. The cycle is extremely short for consumer nondurable goods (such as fashion items) and longer for industrial durable goods. The first two stages of the cycle are where the productivity rewards of product innovation are reaped and where an engineering culture dominates the firm. The first stage of the cycle is the period of product incubation. This is the time when production activities are dominated by research and development, firms in the industry are most likely losing money, and the industry will exist in a small number of locations largely determined by where the founding entrepreneurs live. The second stage is the take-off, or commercialization, stage of the product's life. Here the product establishes itself with a customer base. It goes through rapid engineering and product evolutionary changes and firms husband their capital by engaging in what has become known as networked production—the substantial use of suppliers for subcomponents, subassemblies and, at times, contract production of the entire unit. This is the time when one region (or at most a very few regions) arises to become the dominant location for the industry. The dominance comes from two factors that are not available in other locations: a specialized pool of technical labor and knowledge and a specialized group of suppliers. This is also the point where the industry realizes its fastest growth rates. The third stage of the product cycle is that of a mature product where process innovations dominate the industry's investments. This stage tends to be the longest lasting and it is where process innovations, cost containment, business strategy, and business culture dominates the behavior of firms. Barriers to entry by new firms exist based on brand name or the size of the investment

Myth: Ohio's per capita income is below the national average.

Reality: This statement is correct in the aggregate but wrong in the details. Ohio's per capita income has been below the national average since 1979. However, most of the lost ground has come from rural Ohio and its smaller metropolitan areas (the rest is located in the residences of the inner-cities of Ohio's three largest cities). Per capita incomes in the state's economic core, the metropolitan areas of Cincinnati, Cleveland-Akron, and Columbus, remain above the national average and are above or near the per capita income of the average of their peer metropolitan areas.

Significance: Ohio's job growth and most of its economic advances have taken place in the suburbs of its larger metropolitan areas, leaving the rest of Ohio and its central cities lagging. It is important to know where the drag on incomes is occurring so that linking strategies that tie the weaker performing portions of the state to its economic core can be designed, and to allow the state to make productivity-enhancing investments in those parts of the state that are lagging. The performance of labor markets in different portions of the state is the subject of the second chapter.

Myth: Ohio is a state lacking in high technology workplaces.

Reality: If a high technology industry is one that uses unusually large proportions of technology-oriented labor, then Ohio's major metropolitan areas are near the average for all large metropolitan areas in the nation. The US Bureau of Labor Statistics divides technology industries into two groups: moderately intense users of technologically oriented labor and very intense users of technologically oriented labor. Ohio is home to an unusually large number of moderately technology-intense manufacturing industries; it is not the location for many very technologically intense industries, with the exception of the basic chemicals industry.

Significance: The significance of this finding is coupled with the productivity findings. Ohio is a state that is above average in terms of the number of people employed in industries that are moderately intense users of technologically sophisticated labor. The vast majority of these industries are manufacturing industries. Ohio's technology base is a manu-

Ohio is a state that is above average in terms of the number of people employed in industries that are moderately intense users of technologically sophisticated labor. The vast majority of these industries are manufacturing industries.

required to enter the market. At this stage of the product cycle, the industry will be structured in one of two ways. It could be highly competitive with it being easy for companies to enter and exit the product market and production techniques and product specifications being very stable. In this case, firms in the industry will be extremely cost-sensitive and will locate their production platforms in lower labor cost areas and closer to customers. If the industry has few competitors and can extract relatively high prices, the industry will remain in its original location for an extended period of time until slowing growth affects rates of return. Firms in the industry will also become more vertically integrated, eliminating suppliers. Once slowing growth affects rates of return and stock prices, then the industry will locate routine parts of the production process in lower-cost production platforms and firms in the industry will become vulnerable to takeovers from other firms or conglomerates. In the last stage of the product life cycle, the product's position in the marketplace withers. Offering a new value proposition for customers can revitalize products. The product could incorporate new features, quality characteristics (including technologies), applications, or price.

The structure of business taxation in Ohio hurts capital formation, which in turn holds back increases in productivity, which ends up hurting income growth in the state.

facturing base. Recognition of this fact is required to build meaningful partnerships between the state's competitive industrial base and its research and development infrastructure, especially its public higher educational institutions. This finding is discussed later in this chapter and it is the subject of the third chapter.

Myth: Ohio is a state that has not participated in the "new economy."

Reality: Ohio is the place where new information and computer technologies are applied to the real world of goods and services production, resulting in important innovations in production processes. Ohio is not a state where fundamental technologies—especially information technologies—are shaped.

Significance: A major source of process innovation over the past decade has been the introduction and application of information technologies (IT) in manufacturing workplaces. These technologies are both an opportunity and a threat to the state's manufacturing base. Opportunities lie in two areas. First, information technologies extend the reach of firms and divisions that are headquartered in Ohio, allowing them to optimize their business locations throughout the globe. Under this locational arrangement, the highest value added activities of the production process are retained in-state. The second opportunity lies in the application of information technologies to manufacturing processes. Ohio has a large stock of knowledge in factory automation and machine tooling. This is a promising area for the development of IT product development for export. IT does pose a threat to employers in the state that produce generic products. IT will globalize competition for these products, intensifying price competition. This is a subject that is picked up in the third chapter.

Myth: The tax burden is similar for all industries in Ohio.

Reality: The structure of business taxation in Ohio hurts capital formation, which in turn holds back increases in productivity, which ends up hurting income growth in the state. In 1998 manufacturing paid $4.42 per $1,000 of Gross State Product (GSP) through the Tangible Personal Property and Corporate Franchise Taxes. The wholesale trade sector is taxed at $3.45 per $1,000. These effective tax rates compare with $1.63 per $1,000 of GSP for services and $1.42 for finance, insurance, and real estate (FIRE). The Tangible Personal Property and Corporate Franchise Taxes in Ohio distort the state's competitive advantage in both manufacturing and distribution. The Tangible Personal Property Tax also discourages firms from making productivity-enhancing investments by investing in capital. These are exactly the actions required to increase productivity and raise incomes in the state. Additionally, these taxes are costly and difficult for both the private sector and the state to administer.

Significance: Manufacturing is at the heart of the state's competitive advantage, and the investments Ohio's manufacturers have made in their production processes are the backbone of the state's increases in productivity. The business tax structure works against the very investments that are required to increase incomes in the state, forming a perverse state industrial policy that should be changed. At the same time, the average business tax burden is competitive with surrounding states and the business community recognizes that it needs to support the public educational system financially because it benefits from the products of that system. This argues for a new system of business taxation that is structured to encourage capital formation and capital deepening, resulting in enhanced worker productivity in both the near and long terms. A flat tax paid by business on the wages and salaries of employees is proposed as a replacement for the current Tangible Personal Property and Corporate Franchise Taxes. This proposal is discussed later in this chapter and in the fourth chapter.

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The misperceptions embodied in the five myths are dangerous because they influence how state and local governments make their economic development policies and investments. There is terrible confusion about the impact of the "new economy" on wealth creation and income generation in the nation and, in turn, in Ohio. There is a general sense among policy makers that the state lost out on the information revolution and that the "new economy" has left the state behind. It has frequently been asserted that the state does not contain a "high technology" economy, and that if the state does not do something quickly it will miss out on the next wave of innovation. These are all false perceptions that inhibit our ability to think clearly about the future and invest in ways that benefit the state's residents. Public policies that are built on assertions, wishful thinking, and development fads are no substitutes for those based on data, analysis, and market realities.

MANUFACTURING AND OHIO'S ECONOMY

The data are clear: productivity gains in Ohio and, through increases in productivity, boosts in income are based on manufacturing. Manufacturers in Ohio are aggressively applying technology to their production processes and supply chains, making Ohio a major user of technologically sophisticated labor. (If by high technology we mean the use of technology and technology workers, then Ohio is a high technology state.) This is not the conventional perception about work in Ohio. However, it is a result of more than a decade of investing in information technologies and changing management practices in production processes and is a reflection of Ohio's industrial base of highly engineered materials and machinery. The owner of a Cleveland-area plating operation stated what he considered to be his firm's advantage in the business: "new machines in old buildings."

Fifty-five percent of Ohio's jobs are directly or indirectly dependent on the manufacturing sector of the economy… A second measure of the centrality of manufacturing [is that]… manufacturing's share of Ohio's GSP is nearly 58 percent greater than it is in the remainder of the nation.

The Importance of Manufacturing

There are two ways of gauging Ohio's economic dependence on manufacturing: measuring the job impact of spending in the manufacturing sector and by examining the fraction of the state's Gross State Product (GSP) that originates in the manufacturing sector and comparing that to the rest of the nation.[3] The Ohio Department of Development's Office of Strategic Research estimated that 55 percent of Ohio's jobs are directly or indirectly dependent on the manufacturing sector of the economy.[4] There are three pathways through which the manufacturing sector affects the state's economy. The first is through the direct flow of spending that occurs when customers order products from the manufacturing sector. The second round of spending occurs when manufacturing firms place orders for intermediate goods that are used to complete their orders. The third and most pervasive flow of spending takes place when workers in manufacturing companies and workers in the companies that supply the manufacturing sector spend their incomes in the economy.

A second measure of the centrality of manufacturing to Ohio's economy is the fact that, in 1998, manufacturing accounted for 25.3 percent of GSP compared to 16 percent in the rest of the nation.[5] In other words, manufacturing's share of Ohio's GSP is nearly 58 percent greater than it is in the remainder of the nation. This relationship is graphed in Figure 1.[6] The ratio of manufacturing's share of Ohio's GSP to its share in the rest of the nation from 1977 to 1998 is plotted. Manufacturing's share of GSP is at all times 50 percent greater than the national share, peaking at nearly 65 percent greater in 1985.

Both pieces of data, the total number of jobs dependent on manufacturing and the disproportionate size of the state's economic activity that is generated by the manufacturing sector, deliver the same message: the state of Ohio has a comparative advantage in manufacturing. Manufacturing is an economic strength that has been validated in the market. The state must build on it. Ohio's economic development policies, including tax and higher education policies, should recognize the connection between a firm's products, the value of those products, and where that value is generated.

Development policy needs to work with the portion of the production process that is located

[3] Gross State Product (GSP) is the state's equivalent to Gross National Product (GNP) at the national level. This is the sum of the value of all goods and services produced in the economy without subtracting the value of capital depreciation.

[4] The estimate was derived in September 2000 using the Implan input-output model.

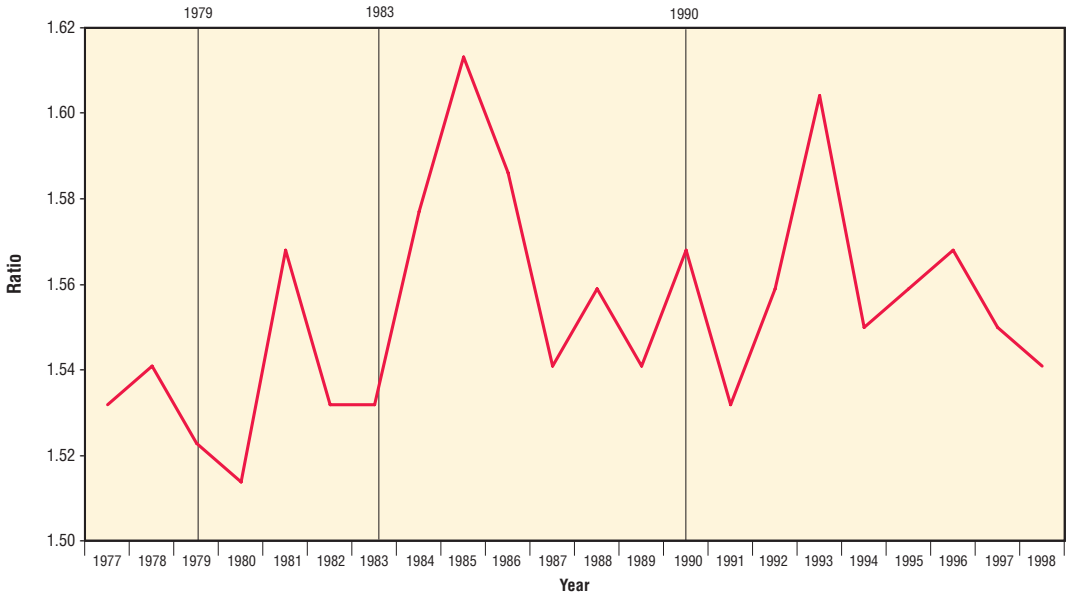
[5] The comparison is not made to manufacturing's national share of GSP, but to the share in the nation less Ohio (the rest of the nation). This is done because the remainder of the nation is being used as the comparison, or control, group. Including Ohio in the comparison group data would constitute double counting.

[6] The data used in Figure 1 are available in the data appendix that is part of the web site constructed for this book: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>.

Figure 1

Ohio Is Much More Dependent on Manufacturing Than the Nation

Ratio: Manufacturing's Share of GSP in Ohio to the US



in Ohio and tailor its tax code and other public investments accordingly.[7] Each of these parts of the production process generates value added, with the smallest return to capital and portion of value added increasingly coming from physical production. More value added is being generated by those parts of the manufacturing firm that used to be counted as "overhead"—product design and deployment; sales, marketing, and service; and management. One strategy that Ohio's firms are pursuing is being taken from the electronics and athletic footwear industries where the "brand name" company (i.e., the "manufacturer") devotes its capital to design, marketing, and distribution while contracting out or procuring the physical

[7] All businesses produce goods and services and have production processes. The production process can be split into five components that can either take place in the same location for a single-establishment firm or in different facilities around the globe for a firm with multiple locations:

1. Management;
2. Research, design, and product deployment;
3. Production or product procurement;
4. Sales, marketing, and service; and
5. Product distribution or logistics.

Cluster-based economic development strategies focus on the product and the supplier network that supports the product. However, there is an implicit assumption that either all parts of the production process take place in a single location, or that each of the firm's locations contains all parts of the production process. Neither is correct. The interaction of the industry that the product belongs to and the portion of the production process that is being sited determines business location decisions. If a company is to be successful, each of these five parts of the production process needs to contribute to the value of firm. Manufacturing is more than physical production, or the actual making of a physical product. Manufacturing is a chain of business activities that can take place anywhere in the globe with very different supply chains being at work for different parts of the production process. For example, the reporters of *IndustryWeek* discovered either two or three separate just-in-time (JIT) vendor systems at work in Southeast Michigan working with different parts of the automobile industry. There was a traditional JIT system at work supplying sub-assemblies to the auto plants. There was a separate system of contractors working with the product design and purchasing departments at the headquarters of General Motors, Ford, and Chrysler. One JIT system fed the production platforms; a second system serviced the headquarters functions; a third worked with the product development and design engineers on new product design and deployment.

Incomes are directly tied to productivity, and income gains are tied to gains in productivity.

production of the product. (The danger to this strategy is that the firm loses contact with process improvements that take place in the plant and can lose control over its product and technology, as happened with the US television industry.) The lines between manufacturers and wholesalers are blurring (where the major distinction between the two is that a wholesaler does not design the product and a manufacturer often completes the design).

Productivity: Manufacturing Dominates

Incomes are directly tied to productivity, and income gains are tied to gains in productivity. The single most dramatic depiction of the role manufacturing has in driving productivity in the state is depicted in Figure 2.[8] This is a graph of the difference in the real (inflation-adjusted) Gross State Product (GSP) generated by each manufacturing worker and each non-manufacturing worker over time. The top (red) line is a graph of real average GSP generated by each manufacturing worker in the state; the bottom (blue) line is the real average GSP generated by each non-manufacturing worker in the state. The gap between the two lines was $23,594 in 1977 and $31,690 in 1998. While non-manufacturing productivity has improved a bit during the mid-1990s, it does not come close to matching the more than $6,000 per worker gain made in the manufacturing sector since 1991.

The productivity results graphed in Figure 2 point out an important economic development lesson to be learned: productivity growth is much more important than job growth (especially in times when labor markets are very tight), because productivity growth supports real income gains. The traditional barometer of the state's economic health has been the number of jobs created or the change in the number of jobs over time. Now the climate has changed due to the slowdown in population growth and migration. Public policy makers need to look beyond simple employment figures and examine economic outcomes: opportunity, income, and wealth—leaving issues of income redistribution to the tax and welfare systems. In this context, slowing employment growth in specific sectors of the economy may be a sign of economic vitality as long as there is growth in productivity, which, coupled with product innovation, is the source of real income growth.

Ohio Has a Technologically Intense Economy

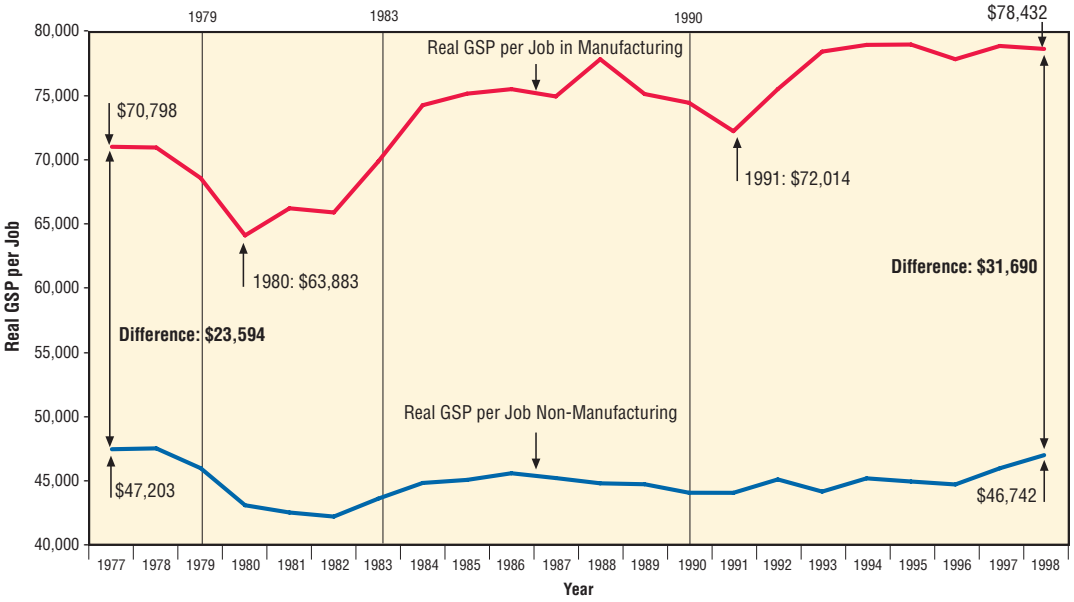
A byproduct of manufacturing's productivity-enhancing process investments is a demand for a technologically sophisticated workforce. Ohio has a technology-intense industrial base compared to the nation as a whole. A bit more than 10 percent of the nation's private sector jobs are in industries defined as technologically intense by the US Bureau of Labor Statistics; the figure for Ohio is 11.7 percent.[9] However, the state does not do equally well in all catego-

[8] The data used in Figure 1 are available in the data appendix that is part of the web site constructed for this book: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>.

[9] These data are presented in Chapter 3.

Figure 2

Productivity per Job in Ohio's Manufacturing and Non-Manufacturing Sectors



While non-manufacturing productivity has improved a bit during the mid-1990s, it does not come close to matching the more than $6,000 per worker gain made in the manufacturing sector since 1991.

ries of technology employment: Ohio specializes in moderately technologically intense manufacturing industries. More than one-half million of Ohio's non-governmental jobs are in industries that are intense users of technologically oriented labor. Nearly two-thirds, or 330,000, of Ohio's employment in this group of technologically intense industries is in the moderately intense manufacturing sector; this is nearly twice the national percentage. Correspondingly, Ohio has about half the nation's proportion of manufacturing jobs that are in industries that are very intense users of technologically oriented labor. These 65,000 jobs are 12 percent of total employment in Ohio's technology sector. As far as the technology-intense services sector is concerned, 14 percent of Ohio's technology employment are in moderately intense technology services, and a bit less than 12 percent are in very intense technology services.

The proportion of workers in technologically intense occupations (as opposed to workers in technologically intense industries, which is the subject of the dataset referred to in the previous paragraph and in Chapter 3) in Ohio's six major metropolitan areas is near that of the average of the 101 largest metropolitan areas (Table 1).[10] Seven percent of the workforce is the average share of technology workers in non-healthcare related, private sector employment in 1997 across the nation's 101 largest metropolitan areas. The percentage for Dayton

[10] This approach to defining the technology base of the workforce was undertaken by Kurt Usowski, an economist at the US Department of Housing and Urban Development (HUD). Usowski estimated the number of technology workers employed in all private sector industries, with the exception of healthcare services. These estimates were produced for all metropolitan areas that are part of the State of the Cities Data System (SOCDS). The SOCDS covers the 101 metropolitan areas that contain the 100 largest central cities in the nation and the 14 largest central cities in those states that have no central city among the 100 largest. This is the reason why state estimates are not available and estimates are restricted to the six largest metropolitan areas in Ohio. Usowski examined all 12,781 occupational titles in the *1996 Dictionary of Occupational Titles.* These were aggregated to match the 498 non-

Table 1

Are Ohio's Metropolitan Areas and Central Cities Locations of Technology Intense Employment?

1997 Private Sector Employment

Metropolitan Area	Technology-Intensive Share of Private Employment: Metro Area	Technology-Intensive Share of Private Employment: Central City
Ohio's Metro Areas		
Akron	6.1%	5.1%
Cincinnati	6.6%	6.8%
Cleveland	6.9%	6.8%
Columbus	6.0%	5.9%
Dayton	7.4%	7.2%
Toledo	6.4%	5.9%
Technology Reputation		
Atlanta	6.5%	6.9%
Austin	9.5%	9.5%
Boston NECMA	8.6%	8.0%
Minneapolis-St. Paul	7.0%	7.0%
Portland, Oregon	7.0%	6.8%
San Antonio	6.1%	6.1%
San Francisco CMSA	8.9%	8.1%
Oakland PMSA	7.4%	5.8%
San Francisco PMSA	7.0%	6.9%
San Jose PMSA	12.3%	11.0%

Metropolitan Area	Technology-Intensive Share of Private Employment: Metro Area	Technology-Intensive Share of Private Employment: Central City
Comparison Metropolitan Areas		
All Areas Total	**7.0%**	**6.9%**
Baltimore	6.8%	6.8%
Buffalo	6.4%	6.0%
Charlotte	6.5%	7.0%
Chicago	7.3%	7.3%
Detroit	6.4%	6.4%
Grand Rapids	6.7%	6.8%
Hartford	7.2%	7.0%
Indianapolis	6.1%	6.0%
Louisville	6.1%	5.9%
Milwaukee	7.7%	7.7%
Philadelphia	7.5%	7.6%
Pittsburgh	6.8%	7.6%
Providence	6.7%	7.7%
Rochester	8.9%	11.0%
St. Louis	6.7%	7.5%
Wilmington, DE	6.1%	5.2%

Source: US Department of Housing and Urban Development, State of the Cities Data System, from a special extract of *County Business Patterns*, 1997 by the US Census Bureau.

is 7.4 percent, Cleveland is 6.9 percent, Cincinnati is 6.6 percent, Toledo is 6.4 percent, Akron is 6.1 percent, and Columbus is six percent. The same pattern is evident for the central cities of these same metropolitan areas. The average in the universe of metropolitan areas is 6.9 percent. Dayton is above the average, Cleveland and Cincinnati are just below the average, and Columbus and Toledo are a percentage point below the national average. (One possible cause for Columbus' low share is that a major employer, The Ohio State University, is a public sector employer.)

Table 1 lists two sets of comparison metropolitan areas and their central cities. The first comparison group is a set of metropolitan areas that have achieved a popular reputation as being technology hotbeds. The San Jose, Austin, and Boston metropolitan areas are the only areas on the list with much higher shares of private sector technology workers than Dayton, Cincinnati, and Cleveland. The second comparison group of metropolitan areas is located in the Northeast or Midwest. Rochester, Milwaukee, Philadelphia, Chicago, and Hartford have higher proportions of technology workers than do the Ohio metropolitan areas.

government occupations in the Bureau of Labor Statistic's Occupation-Industry Employment Matrix. The job titles within the aggregated occupations were examined, and if more than 50 percent of the job titles had a substantial technological knowledge component, that occupation was defined as being a technologically intensive occupation. The occupation side of the matrix was matched to the industry dimension and the technological portion of industry employment was estimated. Usowski assumed that industries in each metropolitan area in the SOCDS had the same occupational structure of employment as the nation. Usowski excluded the healthcare industry, even though it is technologically intensive, because most healthcare is consumed locally. (Usowski's techniques capture biotechnology and pharmaceutical employment because those industries exist outside the healthcare industry.) The data are from a special extract of *County Business Patterns* provided to HUD by the US Census Bureau: <http://socds.huduser.org/CBPSE/CBPSE_Home.htm>.

There are three points to be made about the comparison groups of metropolitan areas. The first is that having a high proportion of technology jobs in a city or metropolitan area does not ensure high rates of employment growth—Hartford, Rochester, Milwaukee, and Philadelphia provide testimony to this fact. Second, spillovers are limited. A metropolitan area that is located next to another metropolitan area that has a large share of technology workers does not ensure a similar employment structure. Here Austin and San Antonio, Boston and Providence, San Jose and San Francisco, Philadelphia and Wilmington, and Rochester and Buffalo provide the evidence. The third point is the same as that made with the dataset used in Chapter 3: a technologically deep workforce can occur in places that do not specialize in the electronics, bio-pharmaceuticals, or information technologies. Rochester, Chicago, and Hartford all have industrial specializations outside of the popular "high tech" core.

The existing base of moderately intense technology manufacturing industries constitutes the state's technology base… The critical variable for economic success is not technology, it is products that are competitive.

There are three implications for Ohio public policy drawn from Table 1 and Chapter 3. The first is that the proportion of jobs in Ohio and its larger metropolitan areas that are technologically sophisticated is at, or a bit above, the national average. Demand for technology workers exists and needs to be accommodated within the state. Second, the existing base of moderately intense technology manufacturing industries constitutes the state's technology base. Third, technology by and of itself does not create wealth, incomes, or job growth. The critical variable for economic success is not technology: it is products that are competitive.

PUBLIC POLICY OPTIONS

The State of Ohio needs to consider a four-part approach to its economic development and technology public policies. These are:

1. In the near term, or short run, continue workforce development programs that are targeted at the existing or incumbent workforce.
2. Over the medium term, five to 15 years into the future, nurture a strong industry-educational partnership that focuses on process and product innovations in manufacturing.
3. In the long-term, improve the basic science and research infrastructure of the state to reflect the strengths of the university community and respond to national science policy.
4. Fundamentally change the business taxation policy to provide incentives for capital formation and deepening and encourage new business formation by replacing the Tangible Personal Property and Corporate Franchise Taxes with a flat tax paid by business on wage and salary payments.

The share of the nation's economy located in Ohio is less important to its residents than is the productivity of Ohio's establishments and the income that productivity generates for them. To protect the state's existing competitive advantage, and to build upon it, Ohio's manufacturing leadership needs to form a strong forward-looking partnership with the higher educa-

The share of the nation's economy located in Ohio is less important to its residents than is the productivity of Ohio's establishments and the income that productivity generates for them.

tional establishment to foster product innovation and to continue improving productivity. A private-public partnership needs to be developed that strengthens the elements of industrial innovation that relate to the parts of Ohio's economic base where there is a clearly demonstrated competitive advantage: product design; materials development; materials shaping and forming (no matter if the material in question is a metal, polymer, ceramic, or composite); paints, coatings, and adhesives; and portable energy production and storage (engines, turbines, and batteries). At the same time, Ohio is one of the world-class centers of high value added production and the application of manufacturing process innovations. The state needs to ensure that it remains a leader in factory automation and manufacturing integration through both supply and customer chains.

Ohio's educational establishment cannot succeed in developing an industrial policy on its own; it needs the partnership and investment of the state's industrialists. The partnership should focus on three time periods, each with a distinct set of outcomes: near term, intermediate term (five to 15 years out), and long term (more than 15 years). Each set of outcomes should specifically address industrial specializations where the state currently has a competitive advantage. The largest, risk-adjusted economic rewards come from investing and building on existing areas of strength and then moving toward correcting weakness. Additionally, most economic innovations relate to existing strengths.

The value of economic benefits to any program of investment is always sensitive to the timing of costs and rewards. The largest returns are realized in the short run, and returns become more speculative as the time horizon of the investment lengthens. In Ohio, the largest rewards will come from solving existing workforce shortages and from investing in education and training of the incumbent workforce, coupled with applying existing technological advances to production processes. Over the intermediate term, the focus should be on product and fundamental process innovations that are directly tied to the state's economic base. This is the branch of state development policy that too often is ignored because it lies outside of the traditional purview of economic development departments and public educational institutions; yet efforts in this area are most likely to have the greatest long-term impact on the state's economy. Finally, over the long term, the state should enhance its basic research capacity to investigate new areas of science and be in a position to bring federal research and development funds back home after its taxpayers have sent them to Washington.

A critical public policy change that should be made to both encourage capital formation and increase productivity is to change the system of business taxation. The current system of business taxation in Ohio treats businesses that make similar contributions to Gross State Product differently, violating the public finance principle of horizontal equity. The tax code also provides disincentives to invest in capital, hurting productivity growth and putting those

portions of the state's economy in which it has natural and historical competitive advantages at a disadvantage. Additionally, the Tangible Personal Property, Corporate Franchise, and business profit component of the Municipal Income Tax are difficult and expensive for both business and government to administer. Trends in the Tangible Personal Property Tax and the Corporate Franchise Tax, and to some extent the local taxation of business profits under the Municipal Income Tax, leave the State of Ohio with a conundrum. These taxes are major sources of revenue, and abolishing them in a tax environment where business' share of the tax burden has been dropping is problematic. The Tangible Personal Property Tax is a major funding source for public education; abolishing the tax at a time when the business community is leading arguments that the development of the state's economy will falter unless the product of those school systems is improved increases the difficulty of removing the tax. Yet the state's Supreme Court has ruled that school finance needs to become less reliant on local property tax sources. These facts argue for abolishing the Tangible Personal Property and Corporate Franchise Taxes and substituting a new source of business taxation in their place. The solution is to gradually move to a broader-based system of business taxation.

Business taxation in the state should be horizontally equitable, encourage productivity, be both stable over the business cycle and revenue elastic, be economically neutral in terms of capital and labor resources used in the production process (which may come into conflict with the goal of encouraging productivity), and be responsive to the mandates of the state Supreme Court. A final criterion is that the tax be administratively easy to assess, pay, and collect. A candidate replacement tax is a statewide, non-abatable flat tax paid by for-profit employers on wage and salary payments. The first component is a 0.86 percent flat tax on business wage and salary payments to replace the Tangible Personal Property Tax. The second component is a 0.52 percent flat tax on business wage and salary payments to replace the Corporate Franchise Tax, for a combined tax rate of 1.38 percent. If the state were to enact a 1.50 percent flat tax on earnings, it could also abolish the business profits component of the Municipal Income Tax and have a revenue cushion that could be applied toward a reduction in the State Personal Income Tax, which has been picking up an increasing share of the state's tax burden. The exact estimates are explained in Chapter 4.

MANUFACTURING: OHIO'S CONNECTIVE TISSUE

Manufacturing is the connective tissue of the state's economy. This is true in two ways. The first is in terms of the distribution of employment and the second connection is in locations of different parts of the manufacturing production process. The key to increasing incomes in all parts of Ohio is to ensure that the products made in manufacturing production platforms remain competitive, which means vigorously pursuing public policies that enhance productivity—investing in both labor and capital.

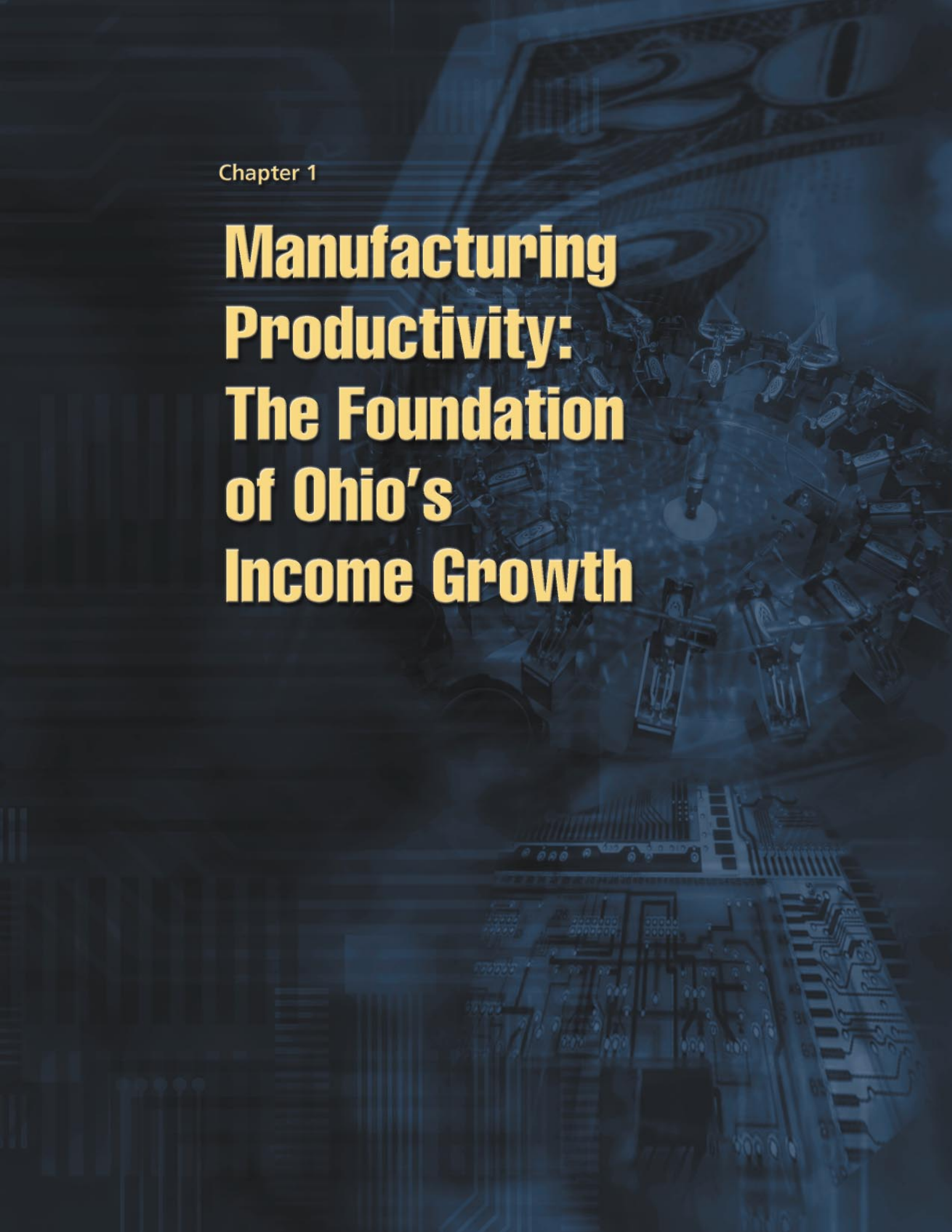
The parts of Ohio that are not closely connected to the state's major metropolitan areas are dependent on those places that are to generate new firms and employment opportunities. Rural and exurban locations in particular are dependent on the production and distribution portions of the manufacturing production process. Ohio's rural counties are extremely dependent on manufacturing employment.[11] Most of this employment is in production or distribution activities and its stability is highly dependent on their employers investing in their products to maintain high value added. Manufacturing is not an exclusively rural industry in Ohio. The largest concentrations of manufacturing employment are in the state's large urban counties. These counties contain business locations in all five parts of the manufacturing production process.[12]

Increases in rural per capita income appear to be linked to direct spillovers from the metropolitan core of the state. The future of lagging areas that are not near the core depends on making those places viable production and distribution platforms for businesses that are expanding in the state; those expansions are most likely to be connected with manufacturing operations. However, capturing these expansions is more likely if the state already houses the headquarters location of either the corporation or division making the investment.

The chapters that follow pursue these themes in greater depth. The first chapter documents the sources of productivity growth in the state. The second looks at what is behind the relative decrease in Ohio's per capita income over the past two decades, while reminding the reader that in absolute, inflation-adjusted terms, per capita incomes have increased significantly during that same time period. The third chapter documents the fact that Ohio is a technology-intense state and that the technology base is firmly rooted in the manufacturing sector. The final chapter shows how the business tax code in the state provides a disincentive for Ohio's employers to invest in productivity-enhancing capital and explores the corporate flat tax on earnings as a substitute business tax.

[11] See Appendix Table 3, posted on the web site created for this book: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>. This table displays the rank order of Ohio's counties according to their share of employment in the manufacturing sector in 1998. The counties with at least 25 percent of employment in manufacturing were (from high to low): Shelby, Union, Williams, Pike, Fulton, Monroe, Holmes, Auglaize, Huron, Wyandot, Sandusky, Defiance, Van Wert, Crawford, Trumbull, Jackson, Miami, Hancock, Wayne, Coshocton, and Ashland counties.

[12] Ohio's counties are ranked according to their number of manufacturing employees in Appendix Table 4 that is located on the web site. The counties with more than 25,000 manufacturing workers are: Cuyahoga (138,000), Hamilton (98,000), Franklin (67,000), Montgomery (65,000), Summit (53,000), Stark (46,000), Lucas (37,000), Trumbull (34,000), Lake (29,000), and Lorain (29,000).



Chapter 1

Manufacturing Productivity: The Foundation of Ohio's Income Growth

MANUFACTURING PRODUCTIVITY: THE FOUNDATION OF OHIO'S INCOME GROWTH

There is a broad misperception about manufacturing's role in Ohio's economy. It is frequently asserted that the importance of manufacturing to Ohio's economy has lessened in the shadow of the dramatic declines experienced in the manufacturing sector from 1972 to 1983. The facts tell a different story, a story that is repeated time and again in Ohio's economic data—real gains coupled with relative declines. The truth is:

- The inflation-adjusted increase in manufacturing's contribution to Gross State Product (GSP) from 1982 to 1998 was $15.2 billion (this is a 21 percent increase).[1]
- Ohio's share of national GSP from manufactured products declined by only 0.47 percentage points. This is an average decline in market share of 0.3 percentage points per year.
- Manufacturing has been the most important source of productivity growth in Ohio's economy over the past 25 years.
  - Manufacturing productivity increased by 19.4 percent from 1982 to 1998. Non-manufacturing productivity increased by 12.6 percent over the same time period.
  - In 1977 the difference between manufacturing GSP per worker—a measure of productivity—and non-manufacturing GSP per worker was $23,594. In other words, the average manufacturing worker produced $23,594 more in GSP than did that worker's non-manufacturing counterpart.
  - That difference peaked in 1993 at $34,326. In 1998 the difference was $31,690.
- Ohio's manufacturers produced 50 percent more GSP than expected based on the sector's share of employment.

Ohio is a state that applies technology and where production process innovations have dominated corporate investments for the past decade and a half. While this may not be as glamor-

[1] GSP is the state equivalent to national Gross Domestic Product (GDP).

ous as the new developments and rapid growth experienced in Silicon Valley, Austin, or metropolitan Boston, it is no less innovative and has resulted in productivity improvements that support incomes throughout the state. Because of these investments and process innovations, manufacturing productivity is the state's economic competitive advantage.

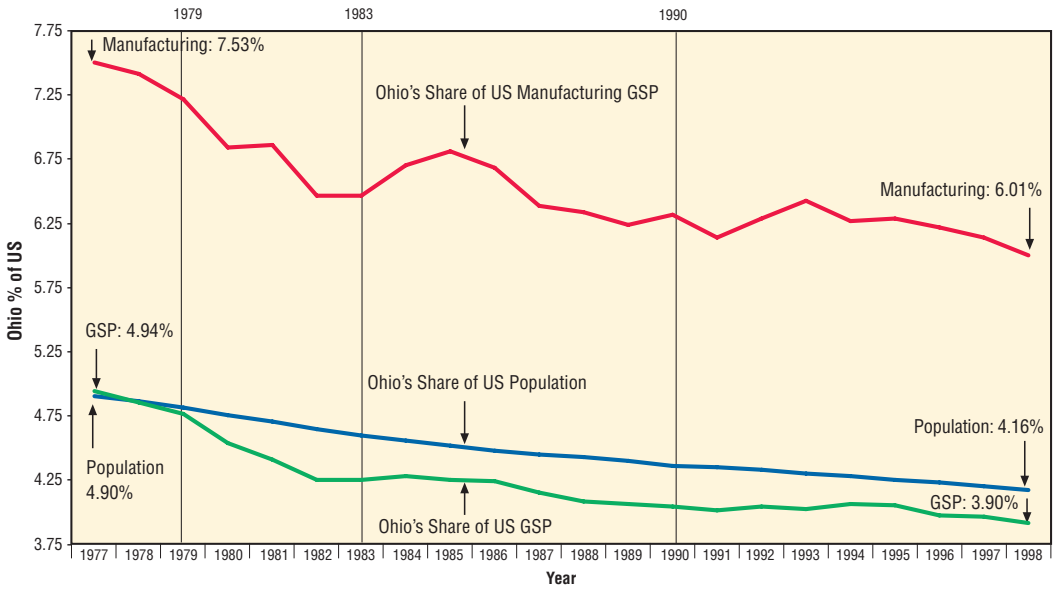
The decline in Ohio's national market share of manufactured products was accompanied by a 21 percent increase in the real (inflation-adjusted) value of manufacturing production from 1982 to 1998. This increase was worth $15.2 billion in 1999 inflation-adjusted dollars.

HOW THE WRONG CONCLUSION WAS REACHED

The 21-year period from 1977 to 1998 encompassed the largest economic restructuring Ohio has experienced since the Great Depression. The state experienced a 0.74 percentage point erosion in its share of US population, a 1.04 percentage point decline in its share of national product, and a 1.5 percentage point drop in its share of the national value of manufacturing products (Figure 1-1).[2] However, the decline in Ohio's national market share of manufactured products was accompanied by a 21 percent increase in the real (inflation-adjusted) value of manufacturing production from 1982 to 1998. This increase was worth $15.2 billion in 1999 inflation-adjusted dollars. In sum: absolute gain coupled with relative decline.

Figure 1-1

Relative Decline: Ohio's Recent Share of US Gross Product, Population, and Value of Manufactured Products Has Declined—But Not Drastically



[2] The vertical lines in Figure 1 denote years when major changes in the economy took place: 1979 marks the beginning of the 1979 recession, 1983 was the year the economy hit bottom, and 1990 is the year a milder recession began. GSP data are from the US Bureau of Economic Analysis: <http://www.bea.doc.gov/bea/regional/gsp/>. Population data are from the Regional Economic Information System of the Bureau of Economic Analysis, obtained from the interactive data library maintained by the Fisher Library, University of Virginia: <http://fisher.lib.virginia.edu/reis/county.html>. The data for each of the figures are available on the web site developed for this book and are listed as Appendix Tables: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>.

Ohio's share of the nation's economy has indeed slipped from 4.9 percent of the value of production in 1977 as measured by Gross State Product (GSP) to 3.9 percent of national GSP in 1998. Over this same time period, the state's share of population declined, but not by as much. In 1977 the state accounted for 4.9 percent of the total population of the US; in 1998 it was a bit less than 4.2 percent. The state's share of the value of manufactured products also dropped over this time period. In 1977 Ohio accounted for 7.5 percent of US GSP in manufacturing; that declined to six percent in 1998.

The drop in Ohio's manufacturing market share took place in two distinct time periods. The first was from the early 1970s until 1982, when large numbers of manufacturing facilities closed in the state, often accompanied by the movement of headquarters or the loss of headquarters through mergers. This was a period of absolute decline. The state's manufacturing market share then recovered in the mid-1980s as the firms that survived began to aggressively recapitalize. Once the recovery became fully engaged, Ohio began to lose market share again as new products and capacity were added in other states. This pattern of decline during a recession, followed by a sharp recovery, terminating in gradual erosion in market share at the end of a business cycle growth phase, was also exhibited in the 1990s.

Manufacturing work of all kinds—management as well as production employment—has declined drastically as a share of total number of jobs in the state of Ohio since 1969 (Fig-

Figure 1-2

Manufacturing Is a Declining Share of Ohio's Jobs

Manufacturing Jobs as a Percentage of All Jobs in Ohio: 1969 to 1998

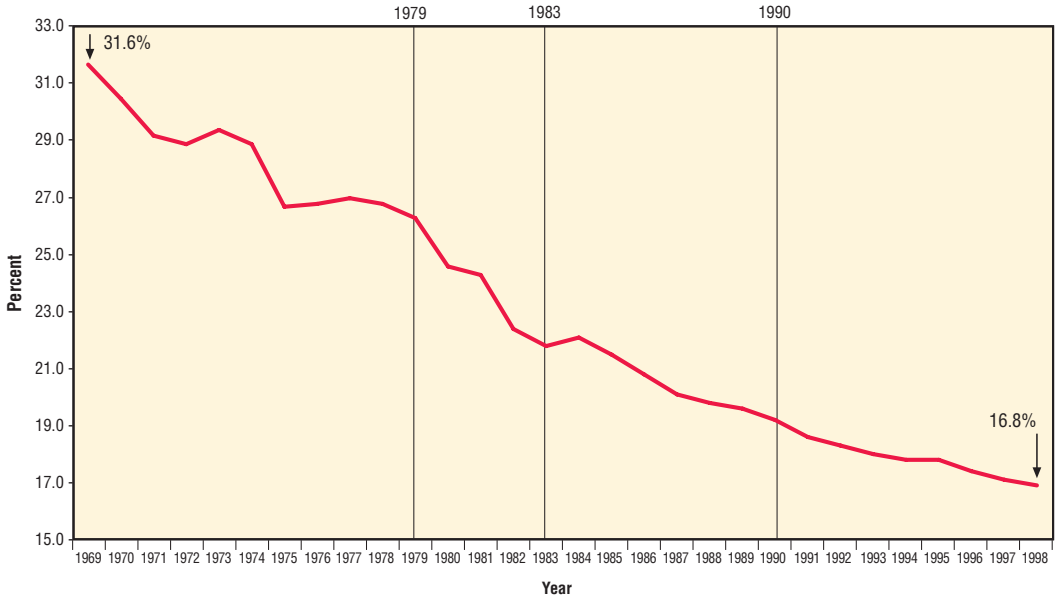
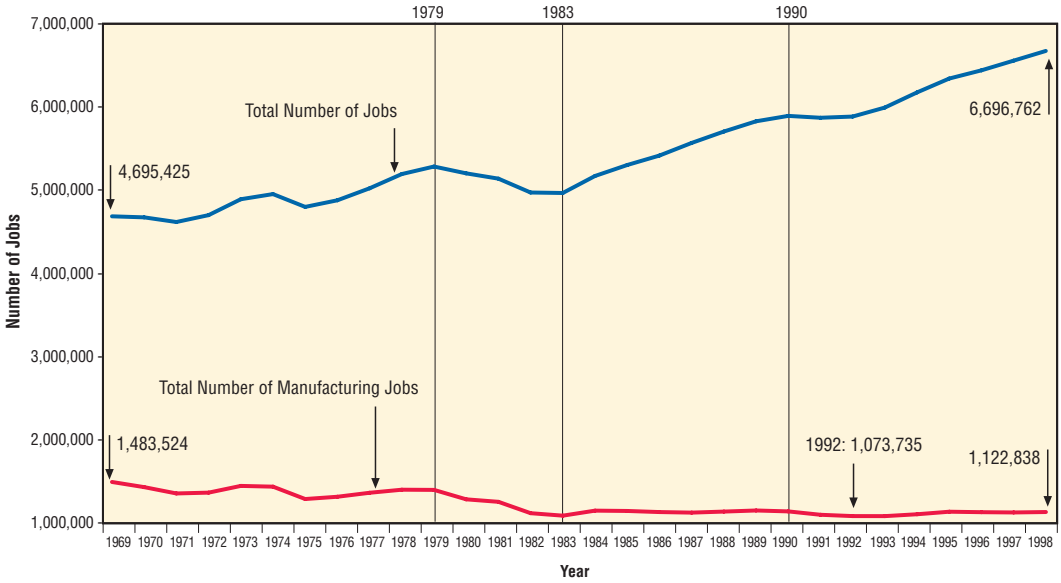


Figure 1-3

The Number of Manufacturing Jobs in Ohio Stabilized in 1983

Composition of Jobs in Ohio from 1969 to 1998



[Manufacturing's] percentage decline in the state's job base hides a surprising fact: the total number of manufacturing jobs in the state has barely budged since 1983.

ure 1-2).[3] In that year, manufacturing accounted for 31.6 percent of the state's employment. By 1998, manufacturing's share of employment had declined to 16.8 percent. Looking only at this steady decline in employment share produces a greatly distorted picture of the role of manufacturing in the state's economy.

The percentage decline in the share of manufacturing in the state's job base hides a surprising fact: the total number of manufacturing jobs in the state has barely budged since 1983 (Figure 1-3). In 1969 there were 1,484,000 manufacturing jobs in the state. This number declined steadily, bottoming out in 1983 at 1,079,000 jobs. A gradual recovery in manufacturing employment began in 1984. After the minor recession of 1992, when the number of manufacturing positions dropped to 1,073,000, manufacturing employment climbed once again—reaching 1,122,000 positions in 1998 in Ohio (out of a total of 6,697,000 positions).[4] (The total number of manufacturing jobs will almost assuredly shrink as the economy slows in 2001.) Why has the percentage share of manufacturing employment declined over the past decade and a half? The decline is not due to the loss of manufacturing jobs, it is due to employment growth in the other sectors of the economy.

[3] All employment data are from the Regional Economic Information System, Bureau of Economic Analysis: <http://fisher.lib.virginia.edu/reis/county.html>.

[4] The total number of jobs in the state in 1999 was approximately one million positions greater than the total number of employed people. The difference is attributable to moonlighters—those who hold a full-time job and part-time employment—and those who hold multiple part-time positions.

THE VALUE OF OHIO'S MANUFACTURED PRODUCTS: ABSOLUTE GAIN

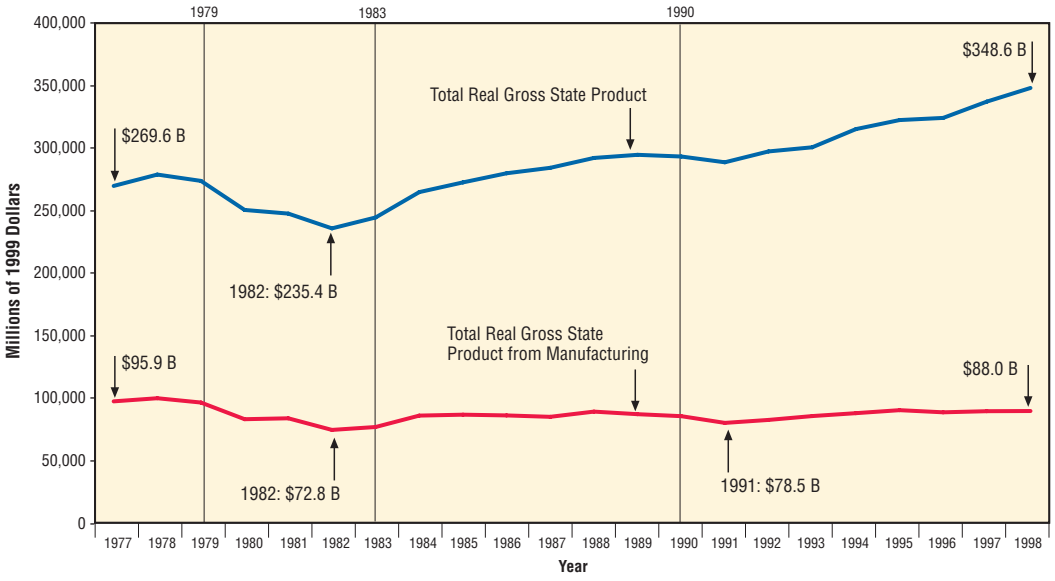
Manufacturing's contribution to Ohio's Gross State Product in 1977 was $95.9 billion in 1999 dollars (Figure 1-4).[5] Over two decades, Ohio experienced a 24.3 percent decrease in manufacturing employment, but only an 8.1 percent decrease in the real value of manufacturing GSP. Despite much public concern about the decline in manufacturing, its contribution to the state's economy in 1998 was $88 billion. Manufacturing GSP dropped to a low of $72.8 billion in 1982 and was $78.5 billion in 1991, the bottom of the mild 1990 recession. These data are not restricted to the value of manufactured production (the physical product produced). It is for the total value that is added to manufactured products by any corporate activity that takes place within the borders of the state. Manufacturing in Ohio is much more than production, it is also marketing, management, and distribution.

The recent gradual growth in the value of manufacturing GSP from 1983 is contrasted with a steady increase in total GSP from a low of $235.4 billion in 1982 to $348.6 billion in 1998. Since 1991, Ohio's total GSP has increased by 20.8 percent in real terms, or an average annual increase of three percent. There is no question that the rate of GSP growth in the manufacturing sector of the economy is slower than it is in the non-manufacturing portion of the economy. Manufacturing GSP increased by 12.2 percent, or 1.7 percent per year on average, from 1991 to 1998. Non-manufacturing grew at twice that rate.

Figure 1-4

Absolute Gain: Manufacturing's Share of GSP Has Increased by $15.2 Billion Since 1982

Ohio's Real GSP and GSP from Manufacturing from 1977 to 1998 in 1999 Real Dollars



[5] All dollar figures used are expressed in 1999 constant (inflation-adjusted) dollars, unless noted in the text. Using real dollars rather than current dollars is required to make comparisons across time.

There is a short version of what has occurred in the manufacturing sector of Ohio's economy over the past two decades. Manufacturing accounts for a declining share of the state's job base. This is coupled with only a slight decline in manufacturing's share of Ohio's Gross State Product (GSP). However, the total real, inflation-adjusted dollar value of GSP that comes from the state's manufacturing sector has increased dramatically since its nadir of 1982. The missing piece of the economic puzzle, and what turns a story of relative decline into one of absolute gain, is manufacturing productivity. While the non-manufacturing portion of the economy is growing faster than manufacturing in terms of gains in GSP, the manufacturing sector remains the leading sector of the state's economy in terms of productivity growth.

Manufacturing has been the single most important source of productivity growth in Ohio's economy over the past 25 years.

THE KEY TO COMPETITIVE ADVANTAGE: PRODUCTIVITY

Investments made by Ohio's manufacturers in their production processes are the backbone of the state's competitive advantage. This is demonstrated by the fact that manufacturing has been the single most important source of productivity growth in Ohio's economy over the past 25 years, as measured by real (inflation-adjusted) Gross State Product per job.

Productivity is a multifaceted concept.[6] People instinctively think of productivity as being directly associated with work effort—which it partially is. However, total productivity is more than that. Total productivity is the value that is added by a firm at its stage of the production process divided by the number of worker hours. This means that at the root of all productivity is the price of the good in question, followed by the process engineering and capital associated with the production activity, the cost of intermediate goods, the efficiency of management, and the efforts of employees. After all, who is a more productive: an employee who cleans a restaurant diligently or a merger and acquisitions lawyer taking cell phone calls setting up a deal on a golf course? The fundamental difference between these two service workers is not the effort expended (the restaurant worker wins on this measure), it is the value of the product that is sold.

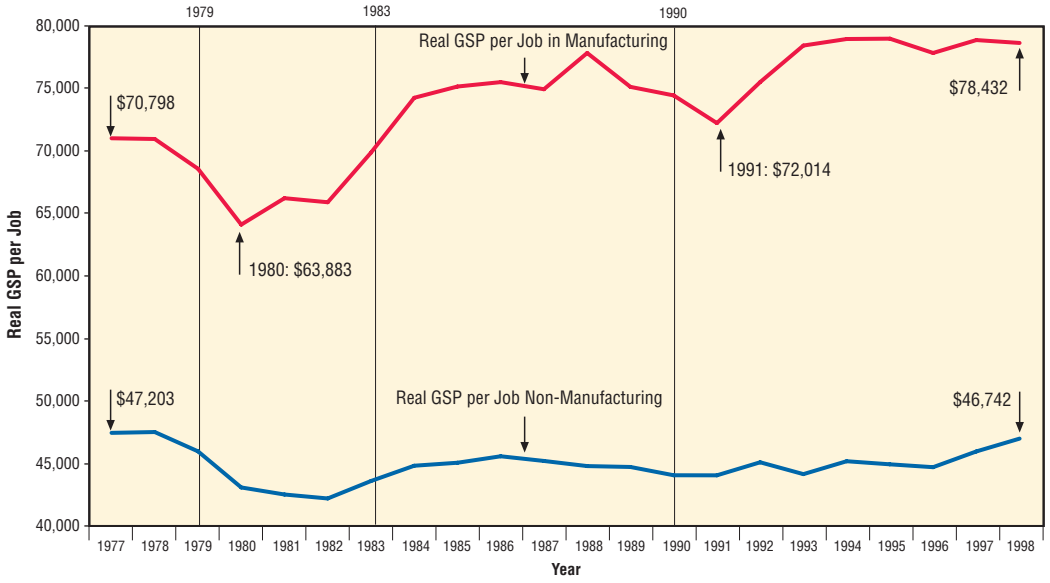
GSP per job for manufacturing and non-manufacturing are graphed in Figure 1-5. Manufacturing has always been more productive than the non-manufacturing portion of the economy because of the value of the products made, the capital and technical intensity of production processes, and the quality of labor and management. Productivity in these two sectors of

[6] Real GSP per job is the best indicator of productivity available at the state level, because it is a close approximation of economists' conceptualization of "value added." It can be argued that the number is influenced by the average number of hours worked in each sector of the economy—in fact, GSP per total number of hours worked and value added per hour worked are superior measures of productivity. Unfortunately, hours worked data are not available at the state level. Another problem is that value added data are only derived from business establishments that are directly involved in the making of a physical product. This means that the data ignore the other portions of the production process that produce value for customers, and they are not available at all for non-manufacturing industries. Therefore, GSP is the best available measure of economic value added.

Figure 1-5

Manufacturing Productivity Dwarfs Productivity in the Non-Manufacturing Sector

GSP per Job, 1977 to 1998, Manufacturing and Non-Manufacturing Sectors in 1999 Real Dollars



Ohio's economy roughly follows the same path, with manufacturing having larger swings. There are two important features to this graphic: the difference in productivity in the two sectors and productivity growth.

The most noticeable difference is the gap in productivity between the two sectors. The gap in productivity between the two sectors is highlighted in Figure 1-6 by plotting the difference in GSP per job. In 1977 the difference between manufacturing GSP per worker and non-manufacturing GSP per worker was $23,594. This means that the average worker employed in manufacturing produced $23,594 more in GSP than did that worker's non-manufacturing counterpart. That difference peaked in 1993 at $34,326. In 1998 the difference was $31,690. Figure 1-6 dramatically demonstrates that productivity and gains in productivity in Ohio have been tied to manufacturing.

The second feature in Figure 1-5 is the dramatic growth in manufacturing productivity from the 1980 low of $63,883 per job to the 1998 figure of $78,432 per job. Contrast this with the decrease in non-manufacturing productivity over the same time period. Productivity declined in both the manufacturing and non-manufacturing sectors of Ohio's economy from 1977 through 1980. After that date the sectors took different paths. Manufacturing productivity turned around in 1980, while non-manufacturing productivity declined for two more years. The difference in performance was compounded by a striking difference in the rate of productivity growth. Growth in manufacturing productivity has been dramatic; non-manufac-

turing's productivity growth has been anemic. While manufacturing productivity is $7,634 higher per worker in 1998 than it was in 1977, non-manufacturing productivity is $461 per worker lower.

Growth in manufacturing productivity has been dramatic; non-manufacturing's productivity growth has been anemic… In 1998 the difference was $31,690 [per job].

Another way of measuring the productivity difference between manufacturing and non-manufacturing jobs is to look at the ratio of manufacturing's share of Ohio's GSP to its share of jobs. The ratio peaked at 1.56 in 1993; it was 1.51 in 1998. In other words, manufacturing produced 50 percent more GSP than expected based on its share of employment.

Manufacturing's productivity peak in 1993 was achieved by three factors: increasing investments in plants and equipment, changes in business practices, and cyclical hoarding of labor. The first, and arguably the most important, factor in increasing manufacturing productivity was a long-term, secular change in business investment behavior. Those manufacturing firms that survived the 1979-1983 recession invested relentlessly in technology and new capital from 1983 onward, resulting in a decade-long string of manufacturing process improvements. The second factor was a series of fundamental changes in business management practices. Management aggressively adopted lean inventory techniques, statistical process and quality control procedures, and different forms of formal and informal improvements to labor-management relations. The results of these changes in management practices were lower operating costs and improved product quality.

Figure 1-6

The Productivity Advantage of Manufacturing in Ohio Has Grown Over Time

Real Difference in Productivity in Ohio Manufacturing Compared to the Rest of the Economy: GSP per Job in 1999 Real Dollars

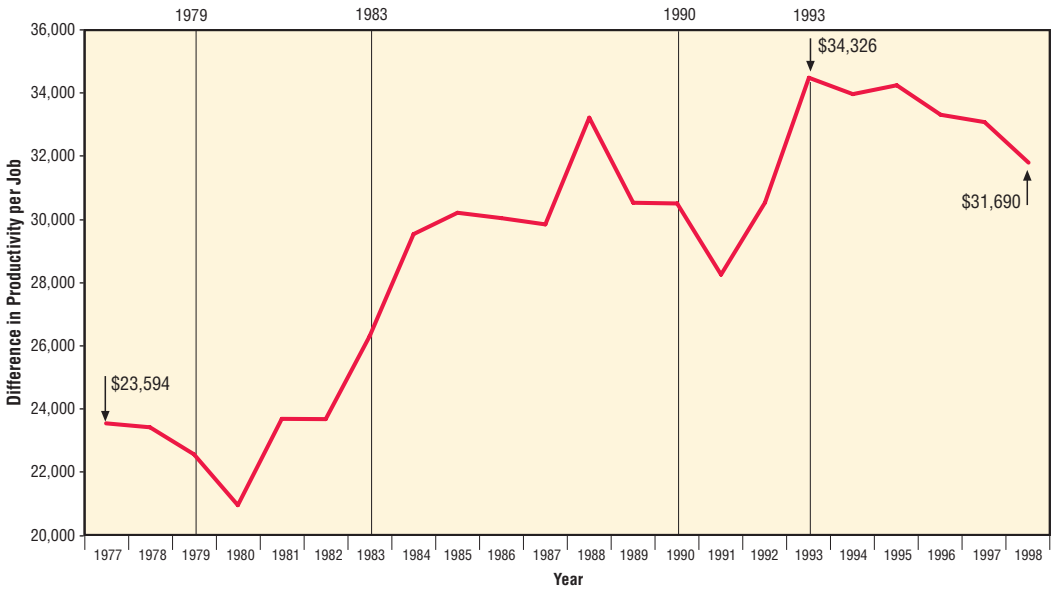
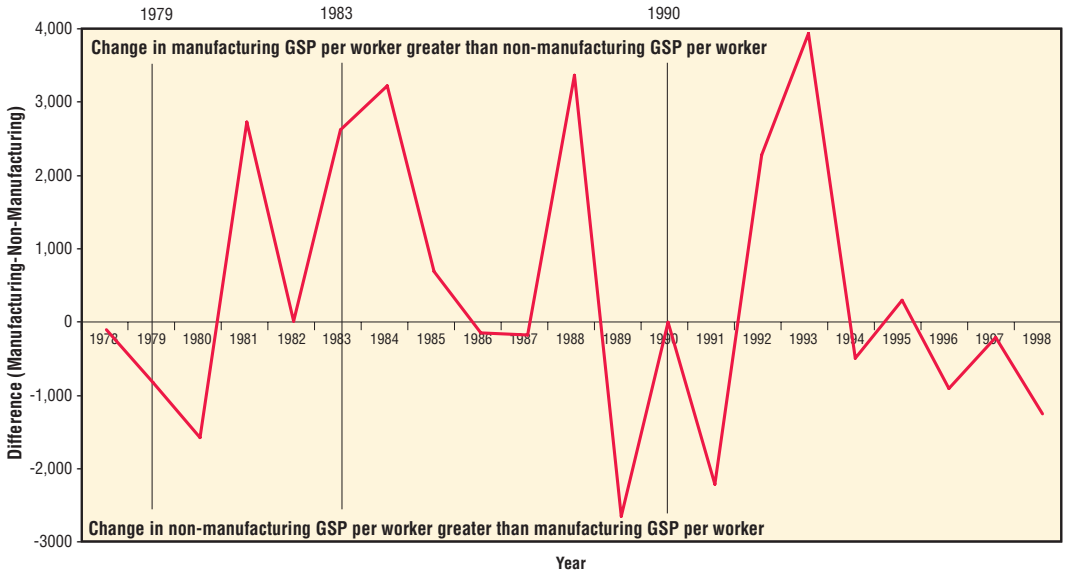


Figure 1-7

The Business Cycle Affects the Difference in Manufacturing and Non-Manufacturing Productivity

Annual Difference in the Increase in GSP per Job (Manufacturing – Non-Manufacturing)



The third factor in the movement of manufacturing productivity is the typical response of firms to changes in the business cycle. Firms hoard labor going into recessions because they do not want to lose their skilled workers and the investments they have made in those workers. Labor hoarding causes productivity per job to drop as recessions begin, and it also increases productivity as business conditions improve. Firms are reluctant to add labor toward the end of recessions because they are unsure of the future of their orders and if the business recovery will stick. At the end of a recession, firms tend to use overtime rather than make new hires. Because the data are measured as GSP per job, rather than per hour worked, the swings in productivity caused by using overtime rather than making new hires are exaggerated. As firms hire workers and reduce overtime, this productivity measure drops. This dynamic was especially important as the 1990 recession ended, because at that time healthcare costs were increasing rapidly; firms that offered those benefits did not want to cover the benefit load of a new hire and thus used overtime extensively until the recovery was well-established. The effect of labor hoarding on productivity is displayed in Figure 1-7, where annual changes in the difference in GSP per job in the manufacturing and non-manufacturing sectors of Ohio's economy are graphed.

The difference in manufacturing and non-manufacturing productivity is plotted in Figure 1-7. If the line is above the zero point (the horizontal line in the figure), then manufacturing productivity increased at a faster rate than non-manufacturing productivity. If it is below the horizontal line, non-manufacturing productivity is increasing at a faster rate. When recessions end, productivity in manufacturing increases at a faster rate than it does in the non-manufacturing sector. As recessions begin, manufacturing productivity drops relative to non-manufacturing productivity. This is demonstrated by the position of the plotted line just to the right of the vertical lines that mark the bottoms of recessions. The only change in this pattern is the gain made in non-manufacturing productivity relative to manufacturing productivity in the mid-1990s. This may be a sign that gains made in manufacturing process investments are slowing and non-manufacturing firms are applying technology more effectively to increase their productivity levels as labor markets tighten and labor becomes more expensive.

Manufacturing productivity has increased throughout the United States since the 1979 recession (Figure 1-8). In 1977, GSP per worker in Ohio stood at $70,798 (in 1999 dollars), compared to $78,432 in 1998. Each Ohio worker was about $7,500 more productive in 1998 than the average manufacturing worker in the United States in 1977. The gap between the productivity of a manufacturing worker in Ohio and a manufacturing worker in the United

Figure 1-8

Ohio's Manufacturing Productivity Advantage Over the Nation Has Narrowed

Real GSP per Manufacturing Job in Ohio and the US ($1999)

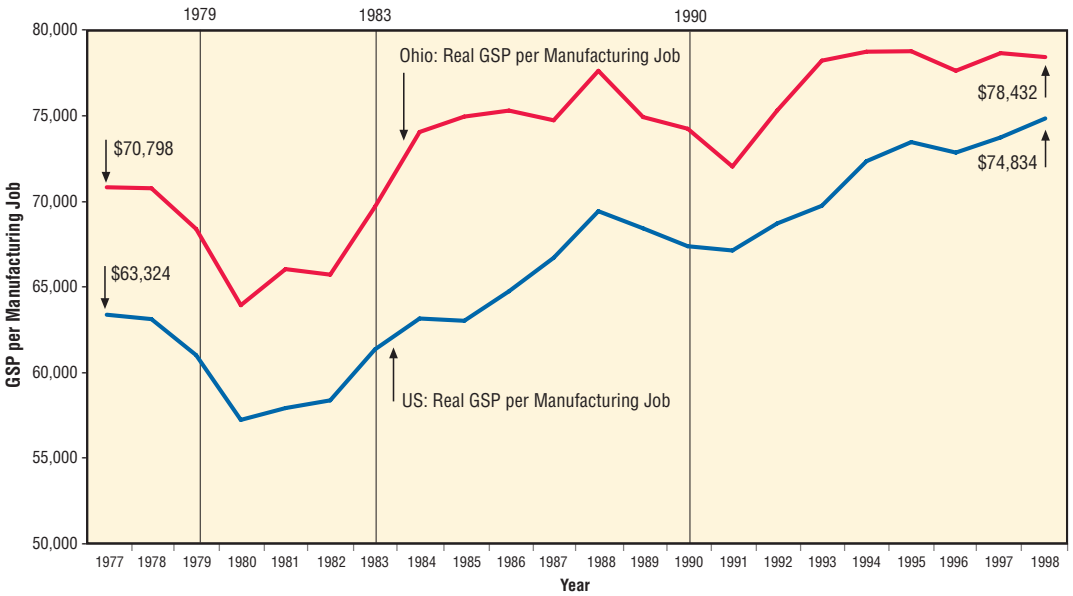
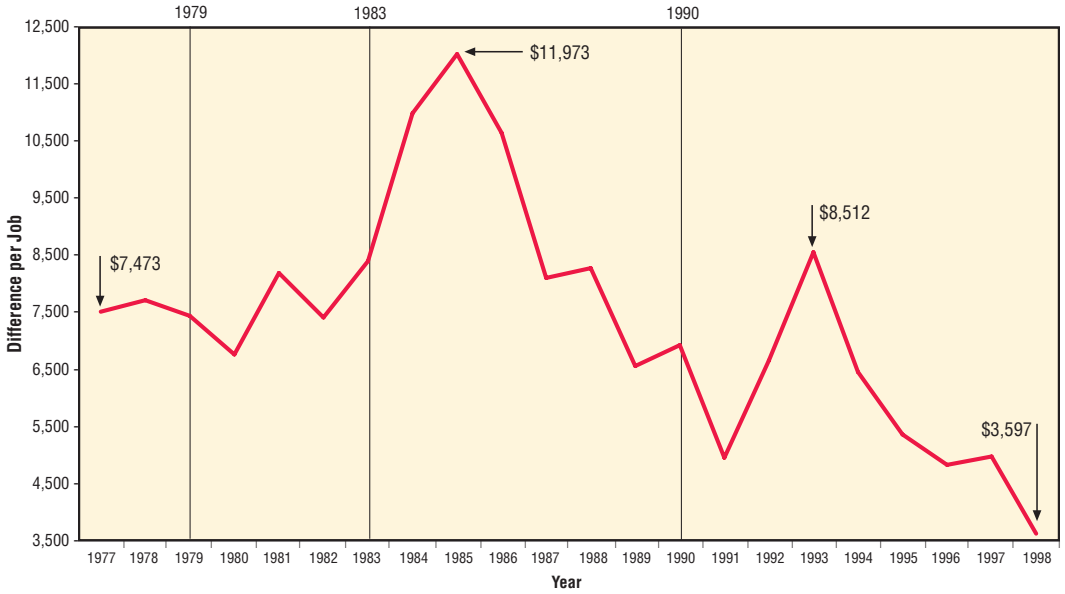


Figure 1-9

Down But Still Ahead, the Slow Decline in Ohio's Manufacturing Productivity Advantage

The Difference in Real GSP per Manufacturing Job (Ohio – US)



States taken as a whole has narrowed by nearly half, to $3,600 in 1998 (Figure 1-9). The reason for the narrowing is not completely clear. The most likely reason is that new, high valued, rapidly growing products—products that are in the take-off stage of the product life-cycle and are made out of state—became a larger fraction of consumer purchases in the mid- to late-1990s.

This surmise is consistent with the reporting that has been done as part of *IndustryWeek* magazine's annual world-class (manufacturing) community special issue since 1997 (the first issue included data from the early 1990s).[7] Those metropolitan areas that performed well in the *IndustryWeek* rankings that included data from the early portion of the 1990s had significant clusters of manufacturing activities in the motor vehicle industry. The relative position of these metropolitan areas began to shift as data from the mid-1990s entered the formula. In the mid- to late-1990s, those metropolitan areas that specialized in various aspects of the information technology manufacturing business moved up in the rankings. The conclusion to be reached is that the relative value and volumes of products related to the information technology industry outstripped the values and volumes of goods sold by the motor vehicle industry. Because productivity begins with the value and consumer acceptance of products sold, differences in manufacturing productivity narrowed between Ohio and the United States as a whole.

[7] The world-class communities issue of *IndustryWeek* is released in the first two weeks of April and has been published since 1997.

PUBLIC POLICY, MANUFACTURING, AND OHIO'S COMPETITIVE ADVANTAGE

The data are clear: productivity gains (and through productivity, increases in incomes) in Ohio have been based on investments in manufacturing.

The data are clear: productivity gains (and through productivity, increases in incomes) in Ohio have been based on investments in manufacturing. A major reason why this is true is because manufacturers have made Ohio a high technology state, if by high technology we mean the use of technology and technology workers. This is not the conventional perception about work in Ohio, but it is the reality. Ohio's economic base is dominated by industries that are far above the national average in their use of technologically sophisticated workers. This is the result of nearly two decades of investment and a reflection of Ohio's specialization in highly engineered materials, machinery, and products. The technological specialization of Ohio's economy is a theme that is explored in depth in the third chapter.

Ohio cannot rest on the rewards earned since the economy restructured in 1983. It needs to focus on productivity-enhancing investments. Doing so requires two sets of actions. The first is to encourage a shift in business' attention from process innovations to product innovations. The second is to continue the investments and innovative thinking needed to continue the steady stream of process innovations that has yielded the state its economic rewards. These consist of investments in education and training, new capital, and management innovations.

Product innovation is not a strong part of the business culture in Ohio and it needs to be. However, this orientation is a product of business risk and reward calculations and strategic orientation: it is not a psychological attitude. Ohio's largest firms have found that risk is lower and short-term rewards higher if they purchase innovation from smaller firms (often by purchasing the firm) than by developing innovative products internally. This is especially true given that Ohio has a large number of Fortune 1000 firms in its base. These companies often find it difficult to discover internal innovations that provide risk-adjusted, after-tax rates of return that near 20 percent and are able to generate cash flows large enough to noticeably affect the bottom lines of corporations. The unfortunate consequence for Ohio's economic base and residents is that those innovative firms and products that are purchased are often located out of state, which means that, over time, the headquarters' function has less to tie it to Ohio.

To protect the state's existing competitive advantage, and to build upon it, Ohio's manufacturing leadership needs to form a strong forward-looking partnership with the higher educational establishment to foster product innovation and to continue improving productivity. A private-public partnership needs to be developed that strengthens the elements of industrial innovation that relate to the parts of Ohio's economic base where there is a clearly demonstrated competitive advantage: product design; materials development; materials shaping and forming (no matter if the material in question is a metal, polymer, ceramic, or compos-

Ohio's manufacturing leadership needs to form a strong forward-looking partnership with the higher educational establishment to foster product innovation and to continue improving productivity.

ite); paints, coatings, and adhesives; and portable energy production and storage (engines, turbines, and batteries). At the same time, Ohio is one of the world-class centers of high value added production and the application of manufacturing process innovations. The state needs to ensure that it remains a leader in factory automation and manufacturing integration through both supply and customer chains.

Ohio's educational establishment cannot succeed in developing an industrial policy on its own; it needs the partnership and investment of the state's industrialists. The partnership should focus on three time periods, each with a distinct set of outcomes: near term, intermediate term (five to 15 years out), and long term (more than 15 years). Each set of outcomes should specifically address industrial specializations where the state currently has a competitive advantage. The largest, risk-adjusted economic rewards come from investing and building on existing areas of strength and then moving toward correcting weakness. Additionally, most economic innovations relate to existing strengths.

The value of economic benefits to any program of investment is always sensitive to the timing of costs and rewards. The largest returns are realized in the short run, and returns become more speculative as the time horizon of the investment lengthens. In Ohio, the largest rewards will come from solving existing workforce shortages and from investing in education and training of the incumbent workforce, coupled with applying existing technological advances to production processes. Over the intermediate term, the focus should be on product and fundamental process innovations that are directly tied to the state's economic base. This is the branch of state development policy that is too often ignored because it lies outside of the traditional purview of economic development departments and public educational institutions, yet efforts in this area are most likely to have a long-term impact on the state's economy. Finally, over the long term, the state needs to enhance its basic research capacity to investigate new areas of science and to be in a position to bring federal research and development funds back home after its taxpayers have sent them to Washington.

There are two ways of looking at these longer-term research efforts. One is to justify them with economic development assertions—some day in the distant future these investments will yield new businesses and wealth. While such assertions may prove to be true, they are impervious to a cost-benefit analysis because the costs are current and well-known and the benefits are distant and speculative. A sounder footing for these investments is to view the research in and of itself as an industry with exportable products. The federal government is increasing funding in selected areas of inquiry and the money will be spent somewhere. If research institutions in the state can compete for those funds, bring the money home, and make products that satisfy their customers, this would be another source of exportable goods and services, that, as an added benefit, may result in new business activities.

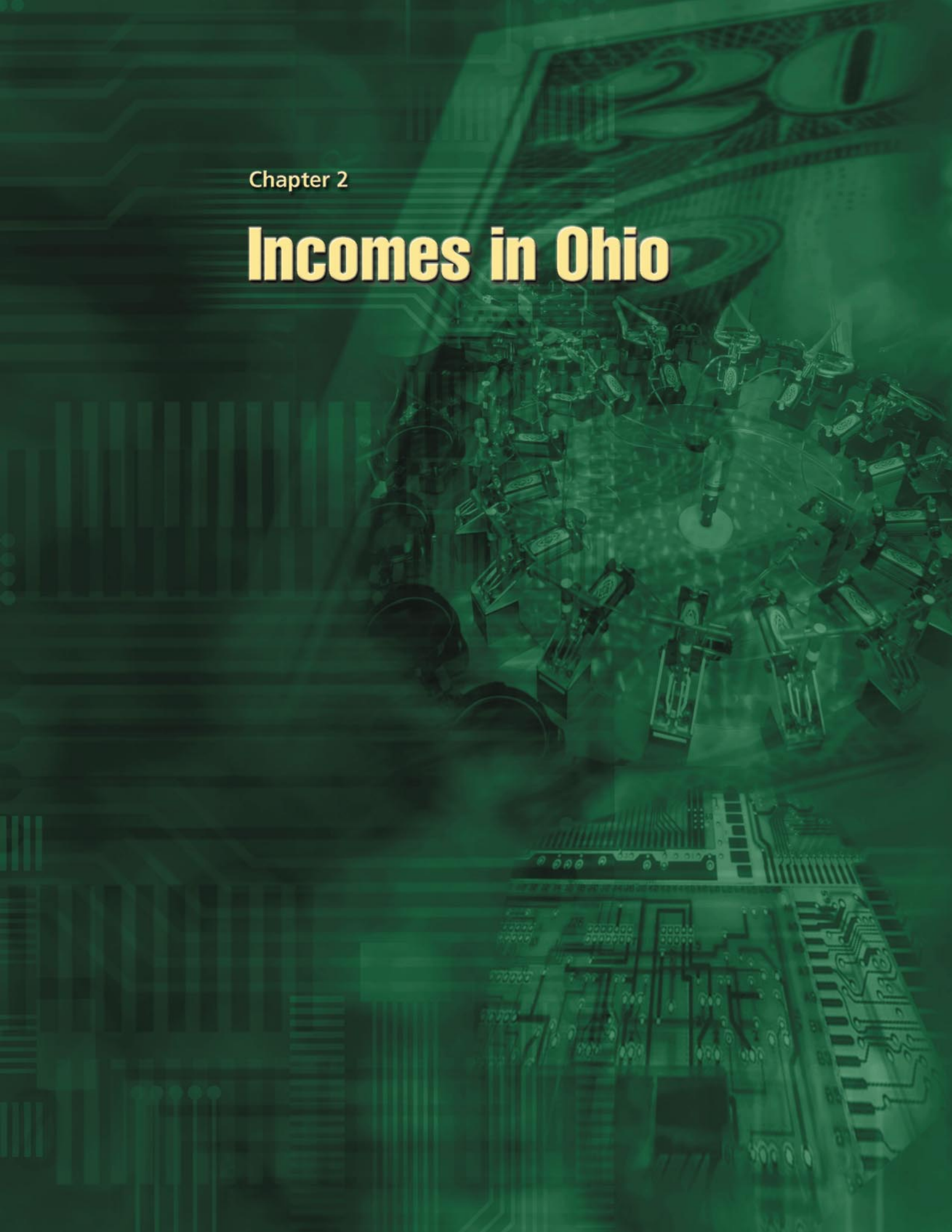
The share of the nation's economy located in Ohio is less important to its residents than is the productivity of Ohio's establishments and the income that productivity generates for the state's residents. Thinking in relative terms is useful in constructing performance benchmarks, but the absolute performance of the state's economy must be kept in mind. Focusing solely on the relative position of the state's economy will overlook the state's competitive strengths and true economic position. London has a vastly reduced share of the globe's economy compared to the time when Charles Dickens was writing about the street urchin Oliver. Are Londoners pining for the return of Dickensian London? New York City has a greatly reduced share of the US economy compared to its position in the mid-1800s when New York's Boss Tweed was creating the patronage machine that became the material for William Riordan's *Plunkett of Tammany Hall*. Are New York's residents better off today or in 1880? Ohio has declined relative to the nation based on comparisons of the state's share of the national economy when Sherwood Anderson was making his observations for *Winesburg, Ohio*. At what time would you rather be a wage earner in Ohio, today or in the late 1800s? To put the question closer to the context that is being posed in too many public policy debates: When were most Ohioans better off, today or in 1969 (when the state had 300,000 more manufacturing jobs than it does today)?

The share of the nation's economy located in Ohio is less important to its residents than is the productivity of Ohio's establishments and the income that productivity generates for the state's residents.

The next chapter looks at the rewards from productivity—income. That chapter examines growth in per capita income in the state of Ohio and its constituent labor markets and addresses current concerns that per capita incomes in Ohio are declining relative to the nation by disaggregating the data and seeing how the state's various labor markets have been faring since the economy restructured. The third chapter is a look at the competitive position of the state of Ohio in technology-intensive industries and discusses the myth that Ohio is not a "high tech" state. Ohio is above the national average in terms of the share of employment accounted for by industries that are intense users of technologically sophisticated labor. The fourth chapter is an in-depth view of the structure of taxation in the state of Ohio. The research in this chapter leads to the conclusion that the business tax structure in the state of Ohio offers disincentives to increasing productivity and inhibits the state's natural sources of competitive advantage. Both of these factors work to inhibit the growth of incomes in the state. The chapter concludes by proposing a new business tax structure for the state that removes barriers to productivity growth, and through productivity growth, income growth in the state.

Chapter 2

Incomes in Ohio



INCOMES IN OHIO

Another myth that haunts Ohio's economic public policies is that incomes in the state are suffering major declines—they are not. Public policy in Ohio that is motivated by statistics that show a relative decline in per capita incomes should look at the sub-state level and see where those below average returns are being generated. It makes sense that the major source of these low incomes be addressed directly: the low level of educational accomplishment in these same regions of the state and the drag that old industrial brownfield sites have placed on the development prospects of these regions. The data examined in this chapter show that there are two Ohios. One Ohio is the job growth machine for the state—these places are clustered along the exit ramps of the highways that ring the state's major cities. The other Ohio is in its smaller central cities, the rural counties that do not abut a major urban area, and the older industrial areas of the core cities.

The theme discussed in the first chapter about the role of manufacturing in the state's economy is repeated here: real absolute gains for most Ohioans coupled with slow relative decline.

- Ohio's real inflation-adjusted per capita income is 116 percent higher than it was in 1958.
- Ohio's per capita income has declined relative to the national average from the lofty perch the state held in the 1950s and 1960s.
- Despite the declines in per capita income relative to the nation, average real incomes in Ohio increased every year, with the exception of the extreme double-dip recession that started in 1979 and ended in 1983.
- There is a strong positive relationship between the size of the metropolitan area, job generation, and growth in per capita income among Ohio's labor market areas. The anomaly is the Youngstown-Warren MSA.

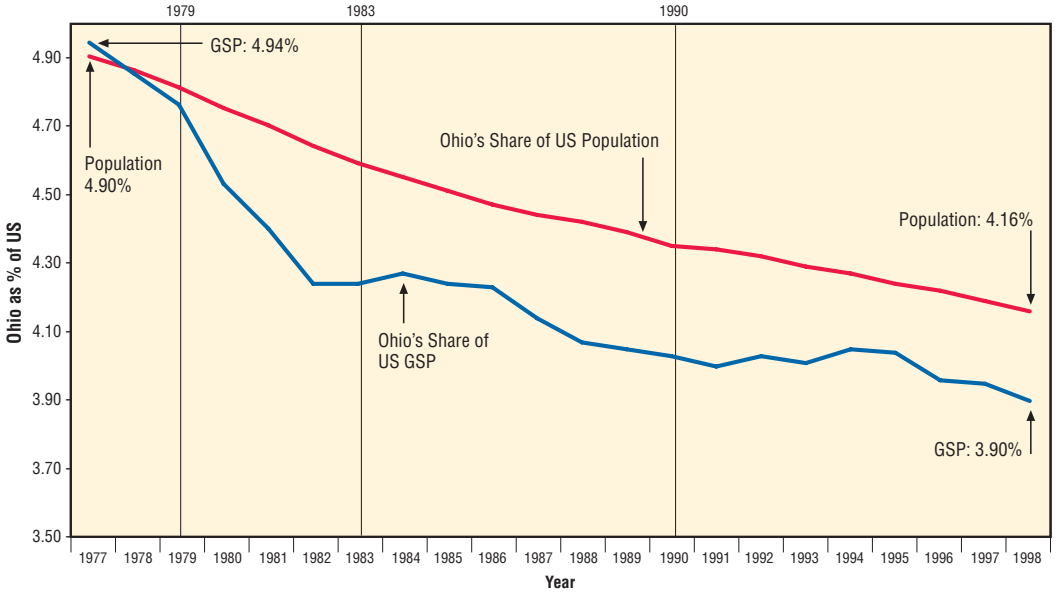
Incomes are generated in the labor market and reflect workers' contribution to the workplace—their productivity. Underlying any successful economy is a productive workforce. This not only means that the workforce is hard-working, literate, and numerate, it also means that it produces high valued products with minimal supervision and relatively large amounts of capital. Thinking in relative terms is useful as a performance benchmark, but important economic outcomes need to be kept in mind. Two of the most important outcomes are per capita income, which is the average reward from work, and the distribution of income. A third outcome is something less tangible, but no less real: quality of life (the package of goods and services consumed in a place and the monetary and psychic costs of consuming them).

A productive workforce is hard-working, literate, and numerate.… It also produces high valued products with minimal supervision and relatively large amounts of capital.

The commonly accepted story—the headlines about Ohio's economic performance—is depicted in Figures 2-1 to 2-4. Ohio's share of the nation's economy slipped from 4.9 percent of the value of production in 1977 as measured by Gross State Product (GSP) to 3.9 percent of total US GSP in 1998 (Figure 2-1).[1] Over this same time period, the state's share of population also slipped, but not by as much. In 1977 the state accounted for 4.9 percent of the total population of the US; in 1998 it was a bit less than 4.2 percent.

Figure 2-1

Ohio's Recent Share of US Gross Product and Population Has Declined—But Not Drastically



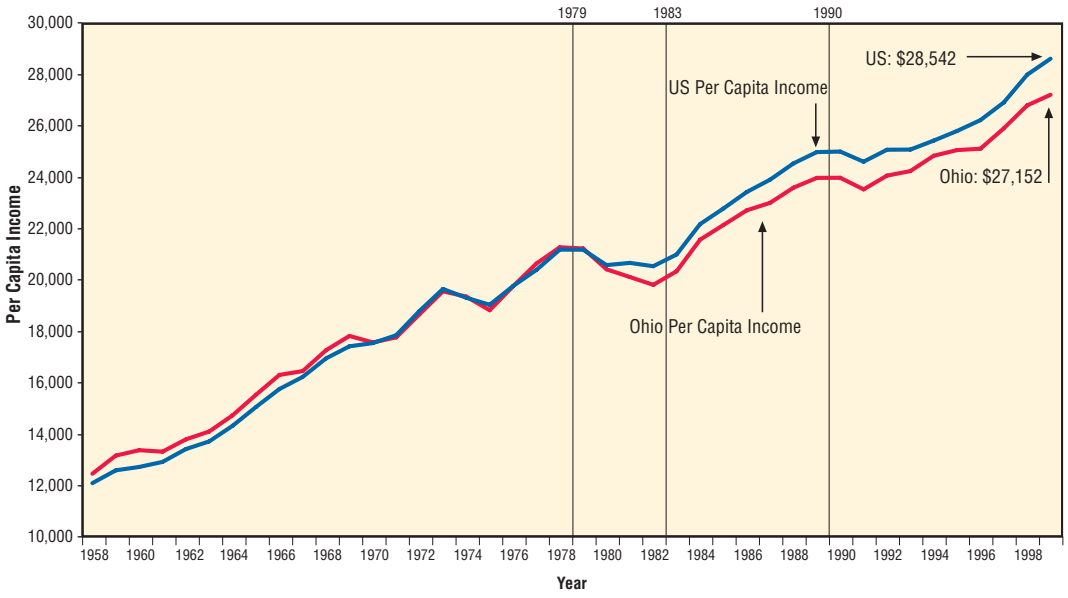
[1] Figure 2-1 is similar to Figure 1-1 in the first chapter. In this figure, the State of Ohio's share of GSP from manufacturing is not included. The data for each of the figures are available on the web site constructed to support *Ohio's Competitive Advantage*: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>. The appendix tables are keyed to the number of the figure: Appendix Table 2-1 has the data for Figure 2-1, etc.

The performance indicator of greatest concern is inflation-adjusted, or real, per capita money income (Figure 2-2).[2] Historically, Ohio's per capita income was close to, but higher than, the national average. Our data series begins in 1958, when the state's per capita income was above the national average. It remained there until the recession of the early 1970s, when the old manufacturing base of the state began to slip. Average incomes in the state began to slip below the national average with the double-dip recessions of 1979 and 1983 (marked by the vertical lines in Figure 2-2), and widened yet again with the mild recession in the early 1990s. Despite these relative declines, average real incomes in Ohio increased every year, with the exception of the 1979 to 1983 period when the state suffered from an extreme double dip recession. In 1998, the average income for every person in Ohio was $27,152, compared to the US average of $28,542.

The differences in real per capita income between Ohio and the United States over time are graphed in Figure 2-3. In 1958 average incomes in Ohio were $363 higher than the national average. In 1998 they were $1,390 lower. The impact of recessions on the state's economic base are clear—they accelerate relative decline. The 30-year secular change in the relative performance of the state's economy is also clear—it is also a picture of relative decline. This graph is evidence enough that concern should be expressed about the performance of the economy. The state is not in rapid absolute decline; it is in a slow relative decline.

Figure 2-2

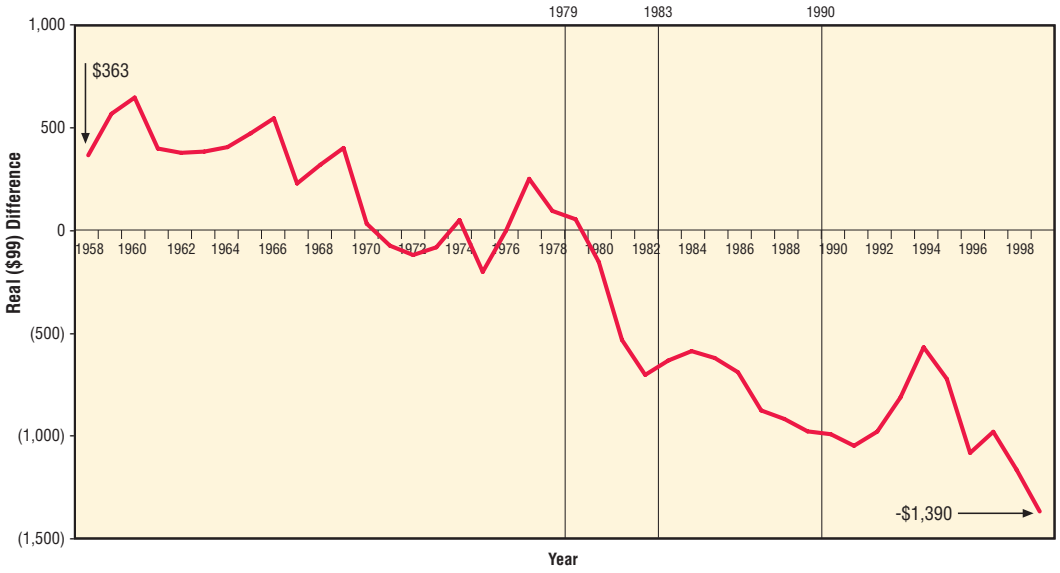
Ohio's Per Capita Income: Ahead of US Before 1971; Trailing US Since 1979 ($1999)



[2] All dollar figures used are expressed in 1999 constant (inflation-adjusted) dollars, unless noted in the text. Using real dollars rather than current dollars is required to make comparisons across time. The data in this section are from the US Bureau of Economic Analysis, Regional Economic Information System. They were obtained from the interactive data library maintained by the Fisher Library, University of Virginia: <http://fisher.lib.virginia.edu/reis/county.html>. The data for each of the figures are available on the web site developed for this book and are listed as Appendix Tables to this chapter: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>.

Figure 2-3

Difference Between Ohio and US Real Per Capita Income: 1958 to 1999 ($1999)



The change in the structure of the state's economy has been good for most of the state's residents because real average incomes have increased, and the increase has been dramatic.

The change in the structure of the state's economy has been good for most of the state's residents. Real average incomes have increased, and the increase has been dramatic (Figure 2-4). The cumulative increase in real per capita income in the state of Ohio from 1958 to 1999 is 116 percent; the same number for the US is 134 percent. The economy of the state is producing a better quality of life for most of its residents than it was in the glory days of big business and big labor. Few, except the under-educated, should want to return to the "good old days" of the 1960s. The climb in per capita incomes signals absolute income gains that are superimposed upon a background of decline relative to the nation. Focusing solely on the relative decline will hide what is right about the state's economy and what could be built upon. At the same time, looking only at the absolute gain is an exercise in optimism that would make Pollyanna blush.

Figures 2-1 to 2-4 put the discussion about Ohio's relative fall in average incomes into perspective and provide the context for discussing the role manufacturing has played in Ohio's recent economic history and is likely to play in its immediate future. The connection between average incomes and the path average income is taking in the state's economy is through the products that are made in the state and the productivity of the private sector. Understanding the sources and location of productivity gains in the state's economy is critical to forming public policies that affect the state's economic development.

The problem with drawing conclusions using only statewide average per capita income—as is currently being done by those interested in the state's economic development—is that the wrong conclusions are often drawn. The two most common mistakes are:

Understanding the sources and location of productivity gains in the state's economy is critical to forming public policies that affect the state's economic development.

1 These income relationships are true for all parts of the state. They are not, as is demonstrated below.

2 Because the relative decline in per capita income occurred when the state's manufacturing base was restructuring and there were massive losses in manufacturing employment, the state's "productivity problem," and hence the state's income problem, rests in the manufacturing sector of the economy. The first chapter demonstrated that the productivity problem is firmly rooted in the non-manufacturing sector of the economy, which has seen per-job productivity decline.

The comparison of Ohio's per capita income with that of the United States as a whole implicitly assumes that the state is a unified economy, which it is not. Ohio is composed of at least seven large metropolitan-centered labor markets, the Appalachian southeastern corner of the state, two agricultural belts, and four smaller metropolitan area labor markets. Incomes in each of these markets are determined by the value that is added to the goods produced in each regional market. The focus should be on the products made in each labor market, the part of the production process that takes place in these regional labor markets, the factors of production that are offered in these markets and their connection to the economic spine of the state, which is the three-C corridor: Akron-Cleveland-Canton, Columbus, and Cincinnati.

Figure 2-4

Despite Lagging Behind the National Average, Real Per Capita Incomes in Ohio Have Increased 116% Since 1958

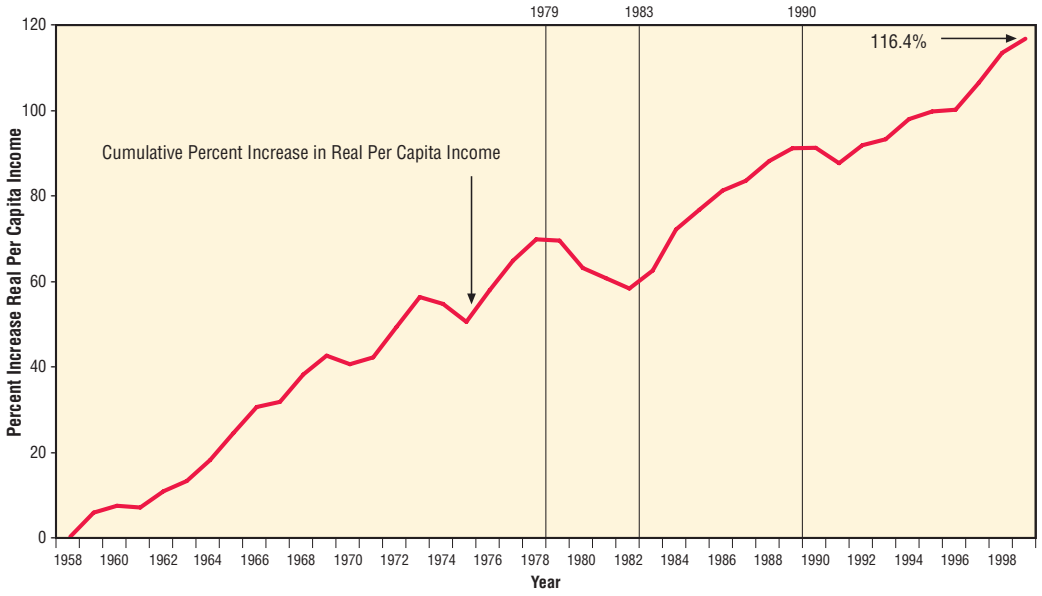
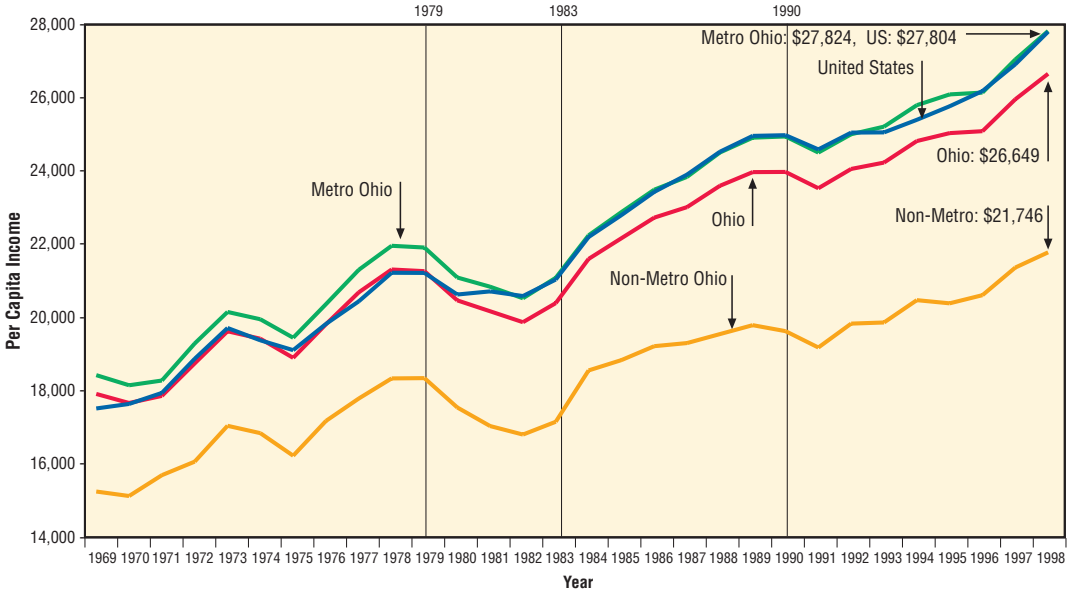


Figure 2-5

Real Per Capita Income in Ohio Follows the US Average in Metropolitan Areas

Per Capita Income from 1969 to 1998 in $1999



As a first cut at understanding the performance of Ohio's regional economies, the state data were re-aggregated into two groups in Figure 2-5: metropolitan areas and non-metropolitan areas; both were compared to per capita income for the state as a whole and for the nation.[3] Per capita incomes in the metropolitan portions of the state have closely tracked the national average since 1981 and have exceeded the national average since the mid-1990s. In 1998 per capita income for all of Ohio's metropolitan areas was $27,824, compared to per capita income in the US of $27,804 and the state's average of $26,649. It is clear from the data presented in Figure 2-5 that the performance of non-metropolitan Ohio helps to bring down the state's average. Estimated per capita income in the non-metropolitan portion of the state of Ohio is $21,746. But, as we shall see later, all is not glum for non-metropolitan portions of the state.

The general pattern of real income gains in the non-metropolitan portion of the state is similar to that of the state as a whole, the nation, and of metropolitan Ohio, but the real income gains since 1982 have been flatter—slower and less robust. These income movements need to be kept in mind when considering the pattern of population gains and losses in the state.

[3] Total metropolitan area personal income and population were calculated by adding together those variables for all of Ohio's metropolitan areas. These data include those portions of the Cincinnati and Steubenville Metropolitan Areas that are outside of Ohio. Per capita income was calculated by dividing total metropolitan personal income by total metropolitan population. The values for the non-metropolitan portion of Ohio were calculated by adding together personal income and population for the counties in Ohio that are part of metropolitan areas and subtracting those values from the state totals provided in the Regional Economic Information System for Ohio. Therefore, total non-metropolitan personal income and population are accurate for the state.

The exit ramps of the highways built around Ohio's cities in the 1960s remain the locus of much of the state's job growth.

The general trend in the data indicates that the larger the labor market, the better its performance in terms of per capita income. One reason for this occurrence is that the largest centers of job creation in the state are in the suburbs of the state's large central cities.[4]

- Three-quarters of the state's jobs were located in its seven metropolitan areas in 1998—Akron, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown-Warren;
- These seven large metropolitan areas accounted for 103 percent of the state's employment growth from 1994 to 1998. This means that job growth in the major metropolitan areas offset losses in the non-metropolitan portions of the state;
- The Cincinnati Metropolitan Area, the Cleveland-Akron Consolidated Metropolitan Area, and Columbus's Metropolitan Area accounted for 85.4 percent of the net addition to Ohio's employment base over these four years;
- At the same time, Ohio's seven major central business districts lost nearly 1,500 jobs while their prime competitor development areas—suburban employment areas that developed before 1970—gained 78,500 positions. The exit ramps of the highways built around Ohio's cities in the 1960s remain the locus of much of the state's job growth.
- Job loss was not uniform across Ohio's large downtowns. Cleveland and Akron saw much stronger gains than did the central business districts (CBD) of the other metropolitan areas.[5]

The spatial pattern of real income gain is investigated in more detail in Figures 2-6 to 2-11. Figure 2-6 presents data for the three largest metropolitan areas in the state: the Cleveland-Akron Consolidated Metropolitan Statistical Area (CMSA), the Columbus Metropolitan Statistical Area (MSA), and the Cincinnati-Hamilton CMSA. The state's three mid-sized metropolitan statistical areas, Dayton, Toledo, and Youngstown-Warren, are plotted in Figure 2-9. Per capita income data for three of the state's four small metropolitan statistical areas are displayed in Figure 2-10: Canton, Lima, and Mansfield. Figure 2-11 contains the data for the Steubenville MSA and the non-metropolitan portion of the state of Ohio. Figures 2-7 and 2-8 compare the income gains in the state's three largest metropolitan areas with two different sets of comparison, or benchmark, metropolitan areas.

[4] Edward W. Hill and John F. Brennan (forthcoming). "The Performance of Ohio's Metropolitan Development Areas," in John Brennan and Edward W. Hill (eds.) *Where is the Renaissance?* (Washington, DC: The Brookings Institution).

[5] Akron had an employment growth rate in its CBD of 2.8%, Cleveland 1.4%, Columbus 0.0%, Cincinnati -1.9%, Toledo -4.2%, and Dayton -5.8%.

MARKET SIZE AND PER CAPITA INCOMES

The ability of the several regional economies in Ohio to generate income for their residents is different from the picture painted from the aggregate state data. There is a definite relationship between the size of the regional economy and average real income. The reason for this consistent finding—with the exception of the Youngstown-Warren Metropolitan Area—is that both economic diversity and productivity increase with the size of the labor market. The relationship between size of the market and rate of economic return, as measured by per capita income, should be kept in mind when metropolitan areas are selected to compare the ability of Ohio's metropolitan areas to generate income.

The association between market size and income, coupled with the location of job growth in the state, also implies that the state should be concerned about the spatial distribution of work and the ability of these labor and site location markets to compete for high productivity jobs. State government does not allocate jobs: the market performs this task. Firms search for the business sites in the state that provide the most productive combinations of workers and infrastructure (roads, water and sewer lines, power, transportation, telecommunications, and government), balanced by the market and tax cost of these inputs. The state's rural areas (with the exception of those places that are at the edge of a metropolitan area with good highway access), small metropolitan areas, and the inner cities of its largest metropolitan areas are not passing this site selection market test.

THE THREE Cs: CINCINNATI, CLEVELAND, AND COLUMBUS

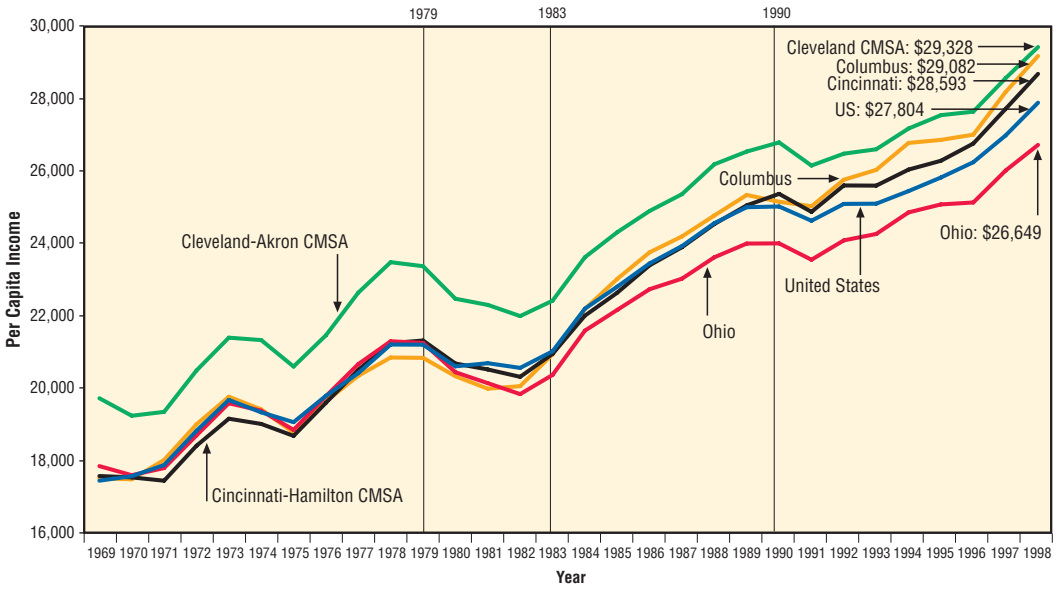
Real per capita incomes in the three major metropolitan areas of the state—the three Cs—have consistently outpaced per capita income in the United States as a whole (Figure 2-6). Over time, the Cleveland-Akron labor market had consistently higher average incomes than the other metropolitan areas in the state, the state as a whole, and the United States. Since the end of the 1983 recession, average incomes in the state's three large metropolitan areas have converged and the gap between per capita incomes in the Cincinnati and Columbus metropolitan areas and the nation as a whole has decreased. The Cleveland-Akron CMSA has the highest per capita income at $29,328, closely followed by the Columbus MSA at $29,082, and Cincinnati CMSA with per capita income in 1998 of $28,593.

It is reasonable to ask: How have these three metropolitan areas fared compared to their peer metropolitan areas? Two comparison groups were selected. The first were the 31 metropolitan areas in the United States of similar size (the national comparison group) and the second were all medium and large metropolitan areas in the Midwest (the regional comparison group).[6]

[6] The Cincinnati, Cleveland-Akron, and Columbus metropolitan areas were excluded from both groups.

Figure 2-6

Real Per Capita Incomes in Ohio's Three Largest Metropolitan Areas Exceed the US



The 31 metropolitan areas in the national comparison group were all metropolitan areas with populations that ranged from 900,000 to 3,000,000 in population in 1983.[7] This year was selected as the benchmark year because it is the end of the major economic restructuring in the nation and the time when concerns about the relative income growth in the state of Ohio became apparent. The 1998 population in this set of metropolitan areas ranged from 962,000 in Dayton-Springfield to nearly 5,000,000 in Dallas-Fort Worth. The regional comparison group of 11 metropolitan areas consisted of all of those metropolitan areas in the Midwest with populations of at least 900,000 in 1983; there was no maximum size. The Midwest was defined to include competitor metropolitan areas, i.e., those metropolitan areas that are in states that border the East North Central Census region: Rochester and Buffalo, Pittsburgh, St. Louis, and Minneapolis-St. Paul. The two largest metropolitan areas in this group heavily skew the data for the regional comparison group: the Detroit-Ann Arbor and Chicago CMSAs.

How have the three Cs performed relative to the national comparison group? The answer is convergence (Figure 2-7). The ratio between per capita income in the Cleveland-Akron metropolitan area and per capita income in the national group was 1.10 in 1969, meaning that per capita incomes in the Cleveland-Akron area were 10 percent higher than the national group average. There was sharp decline in this relative measure of performance from 1969 until 1983, then a recovery until the 1990 recession, followed by a second period of decline.

[7] The names of the metropolitan areas and their population sizes for the national comparison group are available in Appendix Table 2-12 and for the Midwest group in Appendix 2-13 on the book's web site.

In 1998 per capita income in the Cleveland-Akron metropolitan area was equal to that of the comparison group. Over the same time period the other two large metropolitan areas have climbed, nearly reaching the group average. They have both experienced steady per capita income growth since the end of the double-dip recession of the early 1980s. In 1998 the ratio between the Columbus metropolitan area and the group was 0.99; the ratio between Cincinnati and the group was 0.98.

The substantial income premiums that the Cleveland-Akron area received from big industries that had little competition in the pre-1970 period are gone.

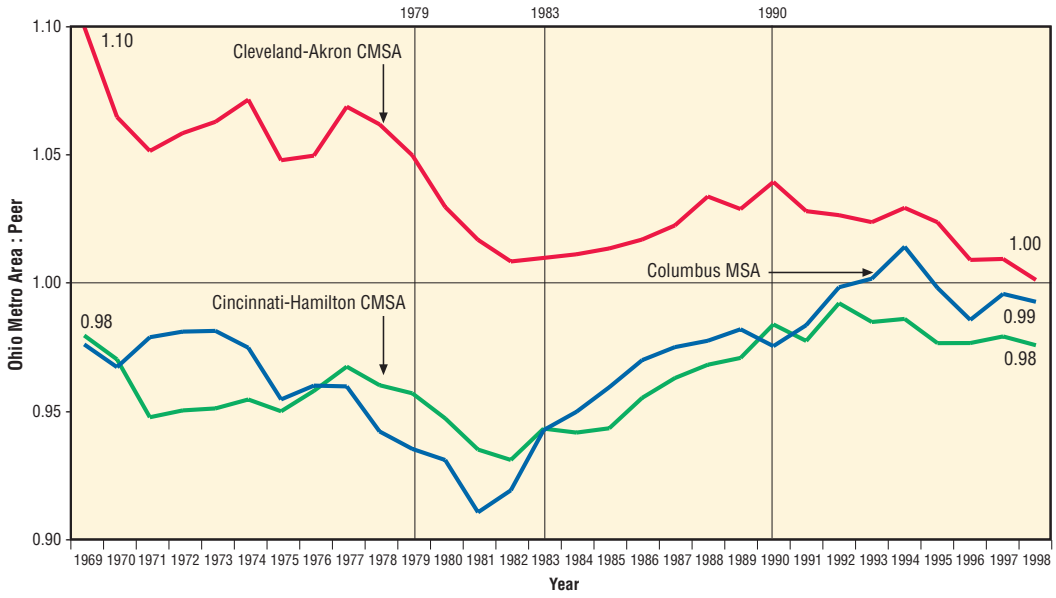
The picture painted from the regional peer group is less rosy, due to the presence of the Detroit-Ann Arbor and Chicago metropolitan regions in the group (Figure 2-8). In 1969 the Cleveland-Akron region was at the regional group average and has witnessed steady relative decline, reaching a ratio of 0.95 in 1998. The ratio for Columbus was 0.94 and for Cincinnati 0.92. These three ratios reflect the stronger performance of the Chicago and Detroit-Ann Arbor metropolitan areas in generating high productivity employment and incomes (and reinforce the observation made for Ohio that there is a strong positive relationship between the size of the metropolitan area and per capita income).

The critical point to be made about Ohio's larger metropolitan areas is that the substantial income premiums that the Cleveland-Akron area received from big industries that had little competition in the pre-1970 period are gone. Expecting to see income premiums of that size to return is unreasonable unless the region generates a new set of products that have few

Figure 2-7

Convergence Over Time

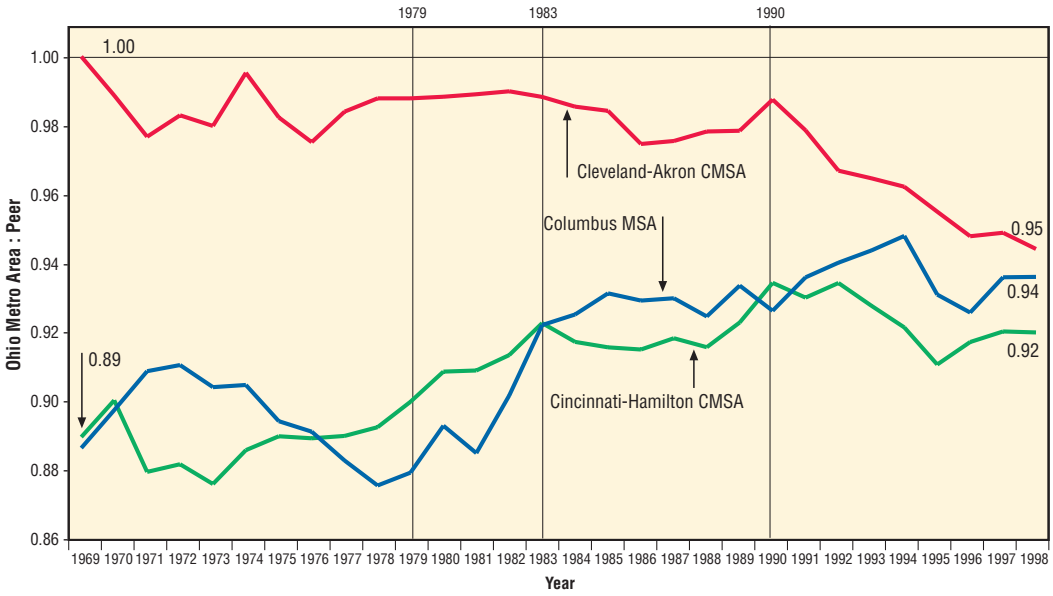
Ratio of Per Capita Income in Three Cs to 31 National Peer Group Metropolitan Areas: 1969 to 1998



Ohio's large metropolitan areas are operating at the average of their national peer group and they are not the locus of the decline in per capita income that appears to be driving state development policy. That problem is located in the state's smaller metropolitan areas and in rural Ohio—the solution is to link them to the state's economic spine.

Figure 2-8

Ratio of Per Capita Income in Three Cs to 11 Midwestern Peer Group Metropolitan Areas: 1969 to 1998



competitors. However, the income recovery and growth that has taken place since the restructuring ended in the early 1980s has been remarkable. Ohio's large metropolitan areas are operating at the average of their national peer group and they are not the locus of the decline in per capita income that appears to be driving state development concerns. That problem is located in the state's smaller metropolitan areas and in rural Ohio—the solution is to link them to the state's economic spine.

OHIO'S SMALLER LABOR MARKETS

The income performance of the three mid-sized metropolitan areas in Ohio, Dayton, Toledo, and Youngstown-Warren, is decidedly mixed (Figure 2-9). The blue line in the graph portrays per capita income in the US. It is hard to distinguish because it is closely bracketed by Dayton (yellow) and Toledo (green). These two Ohio metropolitan areas fell below the US average in the late 1980s and have fluctuated a bit below the national average since. In 1998 US per capita income was $27,804; per capita income in Ohio was $26,649; Dayton-Springfield's was $27,006; and Toledo's was $26,653. The laggard was the Youngstown-Warren metropolitan area, which ended 1998 with per capita income of $23,599.

The Youngstown-Warren metropolitan area broke Ohio's version of the rank-size rule (the larger the labor market area in terms of population and workforce, the higher per capita income). Per capita income in the Mahoning River Valley was below that of Canton-Massillon and close to Lima's. The Youngstown-Warren metropolitan area started this time period with

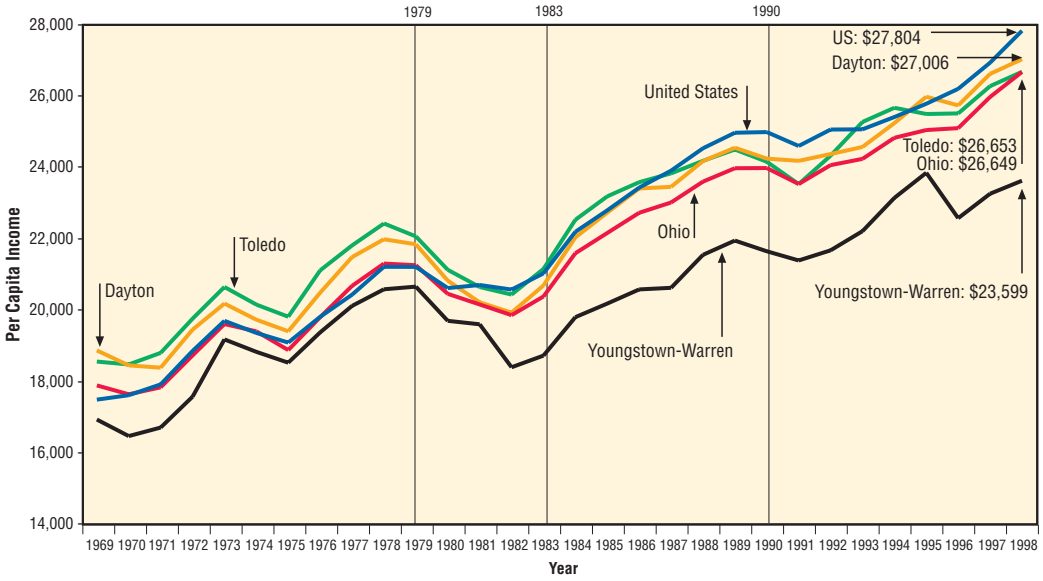
per capita income below the national average, plummeted from 1979 to the mid-1980s, and recovered slowly. It is important to note that even in the case of the Youngstown-Warren metropolitan area, per capita incomes have recovered in absolute inflation-adjusted terms. They exceeded their 1979 peak in 1984 in real dollar terms and today are about $3,000 per person higher than at the pre-crash peak. However, the weakened position of the Youngstown-Warren labor market is brought sharply into focus by noting that the metropolitan area's per capita income was about $4,200 below the national average in 1998.

Figures 2-10 and 2-11 document the weakest performing parts of the state's economy. These places, together with the Youngstown-Warren MSA, are the major reason for the relatively weak income performance of the state as a whole. The Canton-Massillon MSA had a per capita income of $25,133—lower than the state and US average, but nearly $1,500 higher than 1998 per capita income in the Youngstown-Warren MSA. The path of income growth in Canton-Massillon mirrors that of the US and the state from the late 1980s on, but never recovered the ground that was lost in the early and mid-1980s. Per capita incomes in Mansfield and Lima, small metropolitan areas that are not closely connected to larger urban complexes, are low. Lima's per capita income is $23,322, while Mansfield's is a bit lower at $22,265. Both of these smaller metropolitan areas were 98 percent of the national average in 1969, but are currently at 84 percent and 80 percent of the national average.

The worst performing metropolitan labor market in the state of Ohio in terms of per capita income is the Steubenville metropolitan area. While incomes earned in non-metropolitan

Figure 2-9

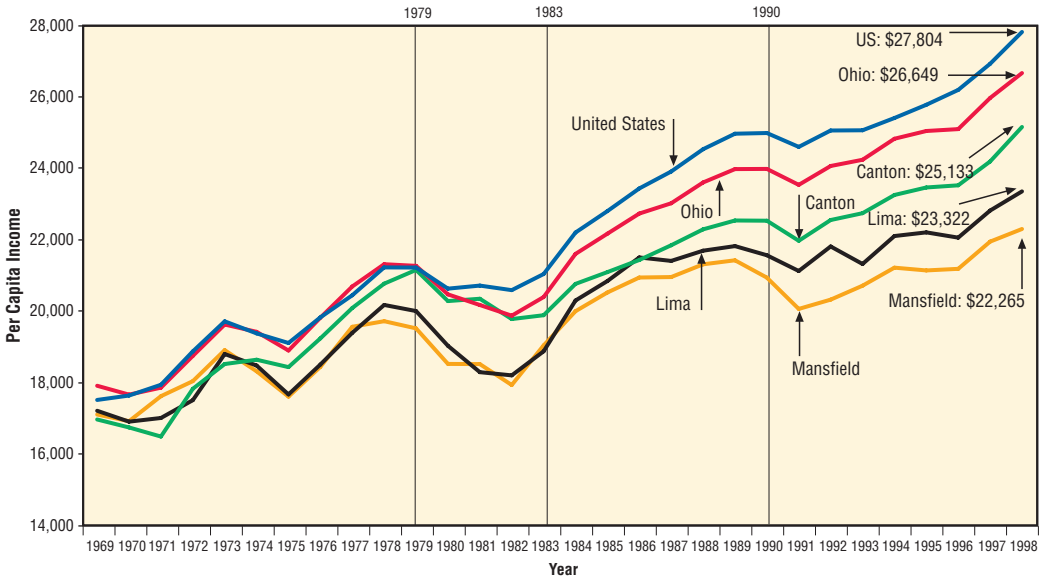
Real Per Capita Incomes in Ohio's Mid-Size MSAs are Below the US and Mostly Above State's



There is an ironclad link between income growth in a regional labor market or economy, the value of products made and sold from enterprises located in that economy, and the total productivity of the workforce.

Figure 2-10

Real Per Capita Incomes in Ohio's Smaller MSAs Lag Behind the Nation and State



Ohio began noticeably improving in 1983, as of 1998 they were $7,000 below the US average. The city of Steubenville is building the correct development strategy by trying to link itself to Pittsburgh, but unfortunately Pittsburgh is a much weaker economic engine than is either Columbus or Cleveland.

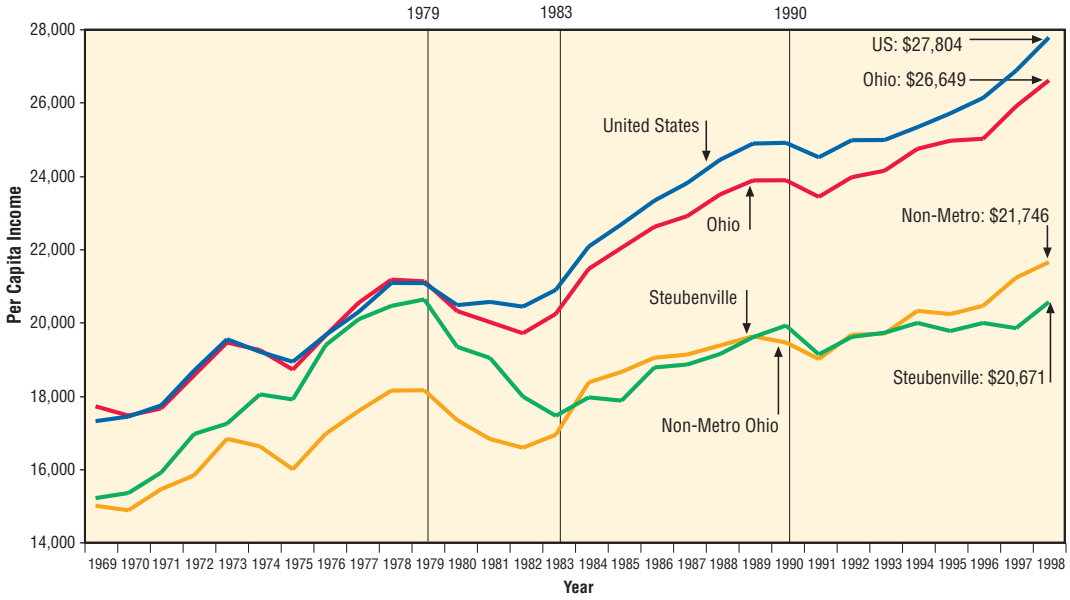
The data that were surprising are those for non-metropolitan Ohio. There have been real, meaningful income gains outside of the metropolitan core of the state and those gains appear to be accelerating since 1993. Inspecting the data shows that those rural counties that lie at the edge of the metropolitan core of the state have seen the most rapid income growth. This suggests linkage to the core and building from economic strength to be the most reasonable development strategy.

The data on per capita incomes demonstrate that:

- There is a strong positive relationship between the size of the metropolitan area, job generation, and growth in per capita income among Ohio's labor market areas. The anomaly is the Youngstown-Warren MSA.
- The central business districts of Ohio's major cities have not kept pace in terms of the number of jobs generated, and this has been translated into weak income growth. The locus of the state's economic development and income generation has migrated to the inner-suburban industrial beltways.
- Ohio's per capita income is below that of the national average, and the state's relative performance has slipped since the mid-1970s.

Figure 2-11

Real Per Capita Incomes in Non-Metropolitan Ohio Lag Behind All and Are a Drag on the State's Average



- There is reason to be concerned about the income performance of the regional economies that make up the state of Ohio. They are on a path of slow relative decline. The greatest sources of that decline are in the rural economies of the state and smaller metropolitan areas. However, the central cities of the state have also slowed dramatically as places of job growth (the exceptions are the portions of Columbus and Dayton that have greenfields available for development and are located near limited-access highways).

There is an ironclad link between income growth in a regional labor market or economy, the value of products made and sold from enterprises located in that economy, and the total productivity of the workforce. Economic development and the income of the state's residents are closely tied to products and product sales. The income of workers is tied to products sold through the value they add to the product.

IMPLICATIONS FOR OHIO AND MANUFACTURING

Revealing that all portions of the state are not equally well off could lead to distributional arguments and place-bashing in the legislature that take the state away from an integrative economic development policy. The key to turning the facts presented here into the basis for a coherent set of development policies is to put two development principles into play. The first principle is: successful economic development investing takes root in strength and competitive advantage and grows toward reducing weakness and competitive disadvantage. The second is: government should pursue investments on the supply side of markets, making

investments that strengthen those places left behind by pure market forces that can become viable competitors. The two most important investments are accumulating viable development sites and investing in human capital (education and training). Both of these actions can increase the market value of underused assets as long as the investments are competently made and executed. In the case of Ohio, the competitive advantage to build from is manufacturing.

The introduction to this book made the case that manufacturing is widely distributed throughout the state and that the rural portions of this state in particular are dependent on manufacturing employment for their economic viability. Rural and exurban locations in particular are dependent on the manufacturing production and distribution portions of the production process. Some communities may also be able to attract call centers and other routine parts of the sales, marketing, and service function. The state's major metropolitan areas have captured the majority of the high value added components of the production process—headquarters and research, development, and product deployment. The same case can be made for the inner-ring neighborhoods and central business districts of the state's urban areas. They also have labor assets and potential business locations that do not currently have value that can be brought into the market if they benefit from wise investment.

The key to increasing incomes in all parts of Ohio is to ensure that the products made in manufacturing production platforms remain competitive, which means vigorously pursuing public policies that enhance productivity—investing in both labor and capital (more will be written on this point in the fourth chapter). It also means that land that has fallen fallow needs to be brought back into production as long as the local governmental involved can efficiently bring the land back into the marketplace, and substantial financial leverage can be generated by state investments as a sign of viability in the market for business locations.

The parts of Ohio that are not closely connected to the state's major metropolitan areas are dependent on the core to generate new firms and employment opportunities. The per capita income increases in rural incomes appears to be linked to direct spillovers from the metropolitan core of the state (some would call this sprawl). The future of lagging areas that are not near the core depends on making those places viable production and distribution platforms for businesses that are expanding in the state; those expansions are most likely to be connected with manufacturing operations. However, capturing these expansions is more likely if the state already houses the headquarters of either the corporation or division making the investment.

In the next chapter, the most likely source of expansion and income generation is analyzed. These are the group of industries that are the most intense users of technology in the American economy.

Chapter 3

Ohio: A High Technology Economy

OHIO: A HIGH TECHNOLOGY ECONOMY

It is widely accepted that Ohio is not a "high tech," "new economy," or entrepreneurial state. This popular perception is reinforced by various surveys and press releases from advocacy groups that rate the economies of states and metropolitan areas based upon the groups' pre-conceived notions as to what constitutes a "high tech" economic environment or membership in the new economy.[1] There is just one problem with this body of work; it is wrong.

Each of these reports is valid given the assumptions that lie behind them, but they have varying degrees of applicability to the economic reality of Ohio—or to economic development. Despite what these reports preach, the critical economic variables are not the technological depth of a state, its research excellence, or its depth of entrepreneurial talent. These are all means to an end, and it is the end that counts most in economic life. The end result of public economic development policy should be wealth creation, income generation, and the distribution of income within a labor market, not technology development for its own sake. This chapter examines the technological intensity of Ohio's economy, doing so by measuring the intensity with which Ohio's firms use technologically oriented labor. As is true of so much about Ohio, the state is a bit above average on this measure.

The occupational approach to defining technologically intense industries does not take into account a major dimension of the popular interest in "high tech" development—innovation. However, there are two ways of assessing innovation. There is the engineer's account, which is based on technological innovation independent of products. Investors and economists subscribe to the second way of assessing innovation, which consists of new products and new value propositions for older products that are accepted by customers in the marketplace. Ohio's economy should be evaluated from the perspective of the economics of economic development, not the pure technological virtuosity of its business establishments.

[1] Among them are: Atkinson, Robert D., Randolph H. Court, and Joseph M. Ward, *The State New Economy Index* (Washington, DC: Progressive Policy Institute, 1999); American Electronics Association's reports *Cyberstates 4.0* (1998); *Cybercities* (2000); Corporation for Enterprise Development (CfED), *1999 Report Card for the States* (1999); DeVol, Ross, *America's High-Tech Economy* (Milken Institute, 1999); Institute of Advanced Manufacturing Sciences, Inc. *NE Ohio Technology Benchmarking Study* (1999); and Kotkin, Joel and Ross C. DeVol, *Knowledge-Value Cities in the Digital Age* (Milken Institute, 2001).

The data on Ohio's base of technological industries is clear on five points:

1. A common sense approach to identifying high technology industries is to look for those that use the greatest proportions of technologically sophisticated labor in their production processes.
2. Ohio has a well-developed specialization in manufacturing industries that are moderately intense users of technologically sophisticated labor. This is the state's technology base.
3. When Ohio is a business location for an establishment that is part of an industry that is a very intense employer of technologically sophisticated workers, the state is used as a production platform.
4. A very large share of Ohio's technology base rests either directly or indirectly on the automobile assembly industry or industries that either shape or finish materials.
5. The state's technology base rests on mature products, and the productivity gains the state has made to date have come from process and managerial innovations, not product innovations.

Ohio's economy should be evaluated from the perspective of the economics of economic development, not the pure technological virtuosity of its business establishments… A common sense approach to identifying high technology industries is to look for those that use the greatest proportions of technologically sophisticated labor in their production processes.

The combination of the economic age of the state's products and the continued need to squeeze process innovations out of the production system is the economic Achilles heel of the state's economy. At some point in time, diminishing returns will set in for process innovations and the rate of productivity increase in the state's technology base will slow. The only way to counter this inevitable outcome is to offset diminishing returns with a set of new products that can command price premiums in the marketplace.

There are three pictures of high technology or "new economy" industries. The first depiction has taken root in popular culture. In this snapshot the new economy is an amalgam of information technology industries (computers, software, the plumbing of the Internet, and gizmos that use microchips), and pharmaceutical and biotechnology industries (the bio-life sciences).[2] This definition is clearly too limited because it does not account for how intensely technology is used in making goods and services. A second common portrait of high technology industries confuses the technological content of products with new products—goods and services that have been recently created and are in the early, rapidly growing stages of their product life cycles. The problem with this second vision is that it does not provide insights about the technological content of the production process. The third image of technology industries links products to the technological intensity of their production processes. Thinking of technology industries in this manner is critical for public policy because government

[2] See Joseph Cortright and Heike Mayer, *High Tech Specialization: A Comparison of High Technology Centers*, The Brookings Institution, Center on Urban and Metropolitan Policy, Survey Series (January 2001).

Government can invest in the technological capital base (both physical and human), but it needs to discipline those investments by thinking about how they will generate returns for taxpayers.

can invest in the technological capital base (both physical and human), but it needs to discipline those investments by thinking about how they will generate returns for taxpayers. Both of the first two images of technology industries leave out products that are intense users of technology but lie outside of the popular frames of understanding, such as chemicals, paints and coatings, and automobile production. The difference between these technologically intense products and those that are commonly acknowledged to be "new economy" products is that they are in the mature phase of the product cycle. The weakness of the third definition is that it does not explicitly account for product innovation.

Lynn E. Browne best captured the dimension of innovation when she wrote that a high technology industry is one that is actively engaged in developing new products and production processes through the application of scientific and technical knowledge.[3] Innovations embodied in new products are often difficult to see because they can embody process innovations (new ways of producing and engineering existing products, including innovations in management), intermediate product innovation (innovations in supply chain management and in the engineering and design of intermediate products), or product innovation (the invention of new products or new categories of products). Ohio's technologically intense industries have revitalized products through process and management innovations. Ohio's businesses have lagged in term of product innovations that have been widely recognized and applauded by the popular culture and, more importantly, by the stock market.

When Joseph Schumpeter coined the phrase "creative destruction" 70 years ago, he meant more than new technologies and new industries replacing old stagnant firms.[4] He wrote about new combinations of capital that destroy inefficient, lagging firms. These combinations can be an amalgam of product, process, management, or marketing innovations. There is, therefore, a difference between firms that are intense users of technology, entrepreneurial firms, and firms that sell new products. In this chapter Ohio's competitive position among industries that are intense users of technology is examined.

DEFINING TECHNOLOGICALLY INTENSE INDUSTRIES

The most objective identification of technologically intense industries, as well as the most widely adopted definition in the academic literature, is one that objectively identifies those industries that are intense users of technologically sophisticated labor. Daniel Hecker, of the US Bureau of Labor Statistics, defined these industries in a stream of work that culminated in

[3] Browne, Lynne E. (1986), "High Technology Industries in the World Marketplace," *New England Economic Review* (May/June).

[4] Joseph A. Schumpeter, "The Fundamental Phenomenon of Economic Development," Chapter 2 in *The Theory of Economic Development* (Cambridge, MA: Harvard University Press, 1934).

a 1999 publication.[5] Hecker identified two sets of industries that are intense users of technologically sophisticated labor—very intense and moderately intense users of technologically sophisticated labor.

- *Very intense technology industries* employ at least five times the US average of research and development workers and technologically oriented workers per thousand workers.
- *Moderately intense technology industries* employ between two and five times the US average.

Hecker identified 10 very intense technology industries and 19 moderately intense technology industries at the three-digit level of the Standard Industrial Classification (SIC) system. Four of these 29 three-digit SIC industries are service industries; the remainder are in the manufacturing sector of the economy.

This research begins by mapping Hecker's two sets of technologically intense industries into the new North American Industry Classification System (NAICS) at the four-digit level to take advantage of the recently released 1997 Economic Census.[6] There are 13 four-digit NAICS industries that are very intense users of technologically sophisticated labor and 26 four-digit industries that are moderately intense users of technologically sophisticated labor (Table 3-1). Twenty-seven of these technologically intense industries are manufacturing industries. Six of the very intense industries are service industries, and another six service industries are moderately intense users of technology.

Ohio has a technology-intense industrial base compared to the nation as a whole.

OHIO'S TECHNOLOGY EMPLOYMENT BASE

Ohio has a technology-intense industrial base compared to the nation as a whole. A bit more than 10 percent of the nation's private sector jobs are in the group of technologically intense

[5] Hecker calculated that the average number of research and development workers per 1,000 employees across all industries at the three-digit level of the Standard Industrial Classification (SIC) in the US is three and that the average number of technologically oriented workers per 1,000 is 38. Hecker, Daniel, "High-technology employment: A broader view," *Monthly Labor Review* (June 1999): 18-28. Similar, but not identical, definitions have been developed by the Organization of Economic Cooperation and Development (OECD) (see Hecker note 10) and by the US Department of Housing and Urban Development in *State of the Nation's Cities* (2000). Hecker eliminated all industries from consideration that had less than 30,000 jobs nationally.

[6] The US Census Bureau's 1997 Economic Census was used to examine the performance of Ohio's technologically intense industries because it is the most current source of information that contains data on both manufacturing and service industries. Data from the Economic Census was accessed in several forms. Data and reports were downloaded from the American FactFinder search engine: <http://www.census.gov/>, obtained from compact disk products (CD-EC97-1, CD-EC97-2), and the Economic Census portion of the Bureau's web site: <http://www.census.gov/epcd/www/econ97.html>. These data were supplemented with 1997 data on production workers from the US Census Bureau's *1998 Annual Survey of Manufacturers*.

Table 3-1

NAICS Industries That Are Intense Users of Technologically Sophisticated Labor

NAICS Industry Name	NAICS Code
Very Intense Users	
Basic Chemical Manufacturing	3251
Pharmaceuticals and Medicine Manufacturing	3254
Computer and Peripheral Equipment Manufacturing	3341
Communications Equipment Manufacturing	3342
Semiconductor & Other Electronic Component Manufacturing	3344
Navigation, Measuring, Electromedical & Control Instruments Manufacturing	3345
Aerospace Product and Parts Manufacturing	3364
Software Publishers	5112
Information Services	5141
Data Processing Services	5142
Computer Systems Design and Related Services	5415
Scientific Research and Development Services	5417
Other Professional, Scientific, and Technical Services	5419
Moderately Intense Users	
Petroleum and Coal Products Manufacturing	3241
Resin, Synthetic Rubber, & Artificial & Synthetic Fibers and Filament Mfg.	3252
Pesticide, Fertilizer, & Other Agricultural Chemical Manufacturing	3253
Paints, Coating, & Adhesive Manufacturing	3255
Soap, Cleaning Compound, and Toilet Preparation Manufacturing	3256
Other Chemical Product and Preparation Manufacturing	3259
All Other Fabricated Metal Products Manufacturing	3329
Agriculture, Construction, and Mining Equipment Machinery Manufacturing	3331
Industrial Machinery Manufacturing	3332
Ventilating, Heating, Air-Conditioning, & Commercial Refrigeration Equip. Mfg.	3334
Engine, Turbine, and Power Transmission Equipment Manufacturing	3336
Other General Purpose Machinery Manufacturing	3339
Audio and Video Equipment Manufacturing	3343
Manufacturing and Reproducing Magnetic and Optical Media Manufacturing	3346
Electrical Equipment Manufacturing	3353
Other Electrical Equipment Component Manufacturing	3359
Motor Vehicle Manufacturing	3361
Motor Vehicle Body and Trailer Manufacturing	3362
Motor Vehicle Parts Manufacturing	3363
Medical Equipment and Supplies Manufacturing	3391
Architectural, Engineering, and Related Services	5413
Management, Scientific, and Technical Consulting Services	5416
Advertising and Related Services	5418
Industrial Design Services	54142
Graphic Design Services	54143
Other Design Services	54149

industries; the figure for Ohio is 11.7 percent (Table 3-2).[7] However, the state does not do equally well in all categories of technology employment; Ohio specializes in moderately technologically intense manufacturing industries. More than one half-million of Ohio's non-governmental jobs are in industries that are intense users of technologically oriented labor. Nearly two-thirds, or 330,000, of Ohio's employment in the group of technologically intense

[7] The data are from the 1997 Economic Census, which is a census of business activity. Data are not collected on governmental entities and all data should be interpreted as being private sector employment, including non-governmental not-for-profit employers.

industries is in the moderately intense manufacturing sector (Table 3-3), this is nearly twice the national percentage. Correspondingly, Ohio has about half the nation's proportion of manufacturing jobs that are in industries that are very intense users of technologically oriented labor. These 65,000 jobs are 12 percent of total employment in Ohio's technology sector. About one-quarter of Ohio's technology employment is in the service sector: 14 percent is in the moderately intense services sector, and a bit less than 12 percent is in very intense service industries.

Examining the location quotients (LQ) for Ohio's technologically intense industries sharpens our understanding of the employment specialization of the state's technology employment base. The LQ is calculated by dividing the percentage of Ohio's jobs that are in a particular industry by the same percentage for the remainder of the nation (see the right-hand column of Table 3-2).[8] If the ratio is greater than one, then Ohio has a greater share of employment in the particular sector than does the rest of the nation, revealing an employment specialization.

The LQ is 1.15 for the entire set of technologically intense industries, indicating that Ohio is indeed a technology state. This result is driven by Ohio's strength in the subset of moderately intense manufacturing industries, where the LQ is 1.95. The LQ for the other groups of technology industries is less than one.

Table 3-2

Ohio Is Not Lacking Jobs in Moderately Technology-Intense Jobs

Share of Technology-Intense Jobs in Ohio and the United States in 1997

	Ohio		US		Location
Industry	**Employed**	**Percent**	**Employed**	**Percent**	**Quotient (US Less Ohio)**
Total Number of Private Sector Jobs	4,571,387	100.0%	101,372,992	100.0%	
Total Technology-Intense Jobs	532,756	11.7%	10,364,460	10.2%	1.15
Very Technology-Intense Jobs	127,712	2.8%	4,398,062	4.3%	0.63
Manufacturing	64,594	1.4%	2,502,714	2.5%	0.56
Services	63,118	1.4%	1,895,348	1.9%	0.73
Moderately Technology-Intense Jobs	405,044	8.9%	5,966,398	5.9%	1.54
Manufacturing	330,749	7.2%	3,920,495	3.9%	1.95
Services	74,295	1.6%	2,045,903	2.0%	0.80

Source: U.S. Census Bureau, 1997 Economic Census

[8] When Location Quotients are calculated, the denominator is typically the decimal fraction of national employment accounted for by an industry. In this chapter national data are not used in the denominator in any of the LQ calculations. The remainder of the nation is used in both parts of the denominator. In other words, Ohio's data are subtracted from the national totals of both sector and total employment in the denominator. This is done because the rest of the nation is being used as the control, or comparison, group for the state and it does not make sense to have the state as part of its own control group. This is especially important if the ratio is being calculated for a geographical unit that makes up a large fraction of the nation's employment in the sector. This is a common occurrence because of the way industries cluster spatially. Ohio, for example, accounts for nearly 17 percent of the national value of shipments from the automotive parts industry.

Auto manufacturing represents about one-third of all manufacturing jobs in the state directly and indirectly through its supply chain.

Table 3-3

What Is Ohio's Market Share of Work in Technology-Intense Industries?

Distribution of Employment Within the Technology-Intense Sector of the Economy in 1997

Industry	Distribution: Technology-Intense Jobs Ohio	US	Ohio as % of US
Total Technology-Intense Jobs	100.0%	100.0%	5.1%
Very Technology-Intense Jobs	24.0%	42.4%	2.9%
Manufacturing	12.1%	24.1%	2.6%
Services	11.8%	18.3%	3.3%
Moderately Technology-Intense Jobs	76.0%	57.6%	6.8%
Manufacturing	62.1%	37.8%	8.4%
Services	13.9%	19.7%	3.6%

The Location Quotient is calculated with Ohio's share of the percentage of technology-intense jobs in the US economy as the denominator.

Source: Table 3-2

Nationally, the largest employer among the industries that are intense users of technologically oriented labor is architectural, engineering, and related services followed by motor vehicle parts manufacturing, computer systems design and related services, and semiconductor and other electronic component manufacturing (Table 3-4). In Ohio the automobile industry and its suppliers dominate the list of large employers in the state's technology base. The five largest employers among manufacturing industries are all moderate users of technologically sophisticated labor: motor vehicle parts (112,000 jobs), motor vehicle manufacturing (36,500), other general purpose machinery (36,400), other fabricated metal product manufacturing (28,000), and electrical equipment (15,400). The largest employer among Ohio's manufacturers that are very intense users of technologically sophisticated labor is the aerospace product and parts manufacturing industry (14,900 employees), followed by navigation, measuring, electromedical, and control instruments (14,700) and basic chemical manufacturing (12,100). While not all of these workers are technology workers (the data are the sum of all workers in those industries that are intense employers of technology workers), they all work in technology industries.

The importance of the automobile industry to the state of Ohio cannot be overstated. The Office of Strategic Research of Ohio's Department of Development estimates that auto manufacturing represents about one-third of all manufacturing jobs in the state directly and indirectly through its supply chain. Not only is the motor vehicle industry a critical employer, it is also central to the state's technology base. Motor vehicle parts manufacturing is by far the largest employer among the state's technologically intense industries, with three times the workforce of the next largest industry. Motor vehicle manufacturing is in third place. These two industries account for nearly 150,000 of the 533,000 jobs in Ohio's technology industries. This is 28 percent of total employment in the state's technology sector.

Table 3-4

Technology-Intensive Industries in the United States and Ohio in 1997 Ranked by Employment Size

Rank	NAICS Code	NAICS Industry Name	United States Employment
1	5413	Architectural, Engineering, Related Services	1,038,317
2	3363	Motor Vehicle Parts Manufacturing	788,210
3	5415	Computer Systems Design, Related Services	764,659
4	3344	Semiconductor & Other Electronic Component Mfg.	589,015
5	5416	Management, Scientific, Technical Consulting	511,252
6	3364	Aerospace Product and Parts Manufacturing	486,480
7	3345	Navigation, Measuring, Electromedical Instruments	485,179
8	5418	Advertising and Related Services	417,214
9	3339	Other General Purpose Machinery Mfg.	359,945
10	3329	All Other Fabricated Metal Product Mfg.	324,784
11	5417	Scientific Research and Development Services	302,123
12	3391	Medical Equipment and Supplies Manufacturing	296,330
13	3342	Communications Equipment Manufacturing	294,495
14	5112	Software Publishers	266,380
15	5142	Data Processing Services	262,250
16	3341	Computer and Peripheral Equipment Mfg.	241,119
17	3361	Motor Vehicle Manufacturing	236,052
18	5419	Other Professional, Scientific, Technical Services	212,669
19	3331	Agriculture, Construction, and Mining Equip. Mfg.	212,405
20	3359	Other Electrical Equipment Component Mfg.	211,287
21	3353	Electrical Equipment Manufacturing	210,628
22	3254	Pharmaceutical and Medicine Manufacturing	205,448
23	3251	Basic Chemical Manufacturing	200,978
24	3332	Industrial Machinery Manufacturing	194,112
25	3334	Ventilating, Heating, Air-Cond., Refrigeration Equip.	174,416
26	3256	Soap, Cleaning Compound, and Toilet Preparations	126,948
27	3362	Motor Vehicle Body and Trailer Manufacturing	125,574
28	3259	Other Chemical Product and Preparation Mfg.	124,931
29	3252	Resin, Synthetic Rubber, Artificial & Synth. Fibers	115,660
30	3336	Engine, Turbine, and Power Transmission Equip.	113,739
31	3241	Petroleum and Coal Products Manufacturing	107,811
32	5141	Information Services	87,267
33	3255	Paints, Coating, & Adhesive Manufacturing	75,100
34	54143	Graphic Design Services	61,622
35	3346	Mfg. and Reproducing Magnetic & Optical Media	54,926
36	3253	Pesticide, Fertilizer & Other Agricultural Chem. Mfg.	37,206
37	3343	Audio and Video Equipment Manufacturing	30,431
38	54142	Industrial Design Services	13,607
39	54149	Other Design Services	3,891

Rank	NAICS Code	NAICS Industry Name	Ohio Employment
1	3363	Motor Vehicle Parts Manufacturing	112,066
2	5413	Architectural, Engineering, Related Services	37,298
3	3361	Motor Vehicle Manufacturing	36,503
4	3339	Other General Purpose Machinery Mfg.	36,464
5	3329	All Other Fabricated Metal Product Mfg.	27,973
6	5415	Computer Systems Design, Related Services	26,134
7	5416	Management, Scientific, Technical Consulting	18,413
8	3353	Electrical Equipment Manufacturing	15,380
9	3364	Aerospace Product and Parts Manufacturing	14,932
10	3345	Navigation, Measuring, Electromedical Instruments	14,720
11	3332	Industrial Machinery Manufacturing	14,529
12	5418	Advertising and Related Services	14,141
13	3251	Basic Chemical Manufacturing	12,123
14	3344	Semiconductor & Other Electronic Component Mfg.	11,225
15	3391	Medical Equipment and Supplies Manufacturing	11,209
16	3334	Ventilating, Heating, Air-Cond., Refrigeration Equip.	11,018
17	5419	Other Professional, Scientific, Technical Services	10,431
18	3359	Other Electrical Equipment Component Mfg.	10,014
19	3255	Paints, Coating, & Adhesive Manufacturing	9,543
20	5142	Data Processing Services	8,753
21	3259	Other Chemical Product and Preparation Mfg.	8,441
22	5417	Scientific Research and Development Services	8,105
23	3256	Soap, Cleaning Compound, and Toilet Preparations	7,866
24	3331	Agriculture, Construction, and Mining Equip. Mfg.	7,280
25	5112	Software Publishers	6,453
26	3342	Communications Equipment Manufacturing	5,987
27	3241	Petroleum and Coal Products Manufacturing	5,697
28	3336	Engine, Turbine, and Power Transmission Equip.	5,592
29	3362	Motor Vehicle Body and Trailer Manufacturing	5,256
30	3252	Resin, Synthetic Rubber, Artificial & Synth. Fibers	4,123
31	5141	Information Services	3,242
32	3254	Pharmaceutical and Medicine Manufacturing	3,052
33	54143	Graphic Design Services	2,631
34	3341	Computer and Peripheral Equipment Mfg.	2,555
35	3253	Pesticide, Fertilizer & Other Agricultural Chem. Mfg.	1,795
36	54142	Industrial Design Services	1,622
37	54149	Other Design Services	190
38	3346	Mfg. and Reproducing Magnetic & Optical Media	0
39	3343	Audio and Video Equipment Manufacturing	0

Source: US Census Bureau, 1997 Economic Census

Where Are Information Technology Workers Employed?

Pre-conceived ideas of what industries are high technology industries constrains our understanding of where technology workers are employed; this is especially true for those with information technology skills. Survey research for Ohio reinforces a finding that is repeated in a number of studies of workers who have information technology skills: at least two out of three workers with information technology skills find work outside of the information technology industry.[9] Firms outside of the information technology industry are applying these technologies to manage their business, reduce production costs, and better coordinate their supply and customer chains. In the future, the largest productivity gains the economy will experience will come from these applications—as long as industrial and service firms continue to make information technology capital investments.

These figures demonstrate that Ohio is a state with a technologically intense employment base, and they show that this base is built on manufacturing industries that are moderately intense users of technology workers. In order to develop a deeper understanding of the role of technologically sophisticated labor in Ohio's economy, three related questions need to be answered:

1. What are the technology industries where Ohio has a competitive advantage?
2. What parts of the production processes of these industries are located in Ohio?
3. What are the technologically oriented manufacturing industries where the state has a productivity advantage?

OHIO'S COMPARATIVE ADVANTAGE IN TECHNOLOGICALLY INTENSE INDUSTRIES

There are two ways of measuring a state's comparative advantage in product markets. The first is to measure value added in the industry generated in the state's economy and compare it to the distribution of value added nationally. The second is to examine employment specializations by industry. Both of these measures show the comparative economic advantage of the state of Ohio through revealed preferences. The competitiveness of the state's industries is revealed through the pattern of trade and employment. These patterns can only be created and sustained if the regional economy has a comparative advantage in the product markets.

[9] *Information Technology Staffing Needs Assessment of Northeast Ohio, Survey of Employers* prepared by Cypress Research Group for the Greater Cleveland Growth Association (November 17, 2000). The research showed that firms in the information technology (IT) industry employed 38.8 percent of the region's employed information technology workers, 61.2 percent worked outside of the industry (p. 12). Philadelphia's Urban Information Technology Alliance estimated that nationally the IT workforce consists of nine million jobs in non-IT industry firms and 900,000 in IT companies for a 10-to-1 ratio (Connecting the Urban Workforce to IT Career Opportunities, 2001).

The distribution of value added in a state, compared to its distribution in the rest of the nation, is a direct measure of comparative advantage—identifying the industries where the market has determined the state's production advantage.[10] By definition, the state will make and trade those goods and services where it has a relative production advantage when compared to its trading partner. Ohio's major trading partner is the rest of the United States. The analytical problem is that value added data are not available either for non-manufacturing industries or for establishments within the manufacturing sector that are not engaged in physical production (headquarters, research, marketing, or distribution sites). The value of shipments is used as the basis for a second-best measure of comparative advantage in this chapter.[11]

A second perspective on a state's comparative advantage comes from the state's employment specializations. As noted earlier, there is no direct demand for labor in a market economy. Instead, demand for labor is derived from product demand—the goods and services workers make, which in turn sparks demand for people to make them. This section looks at both measures of the state's comparative advantage in the technology-intense industries. The value added in the product markets is examined first. Specialization in the employment market follows.

Product Specialization

The commercial viability of products is the foundation of any state or regional economy. Whether Ohio has a high tech economy or not is determined by business and consumer demand for technology-intense products made within the state's borders. Manufacturing firms that are moderately intense users of technologically oriented labor ship most of Ohio's technology products, thereby constituting Ohio's commercially viable technology base.

The ratio used to measure comparative advantage in production is a variant of the LQ called the shipment ratio. The ratio is derived by calculating the percentage share of the value of shipments made by industries in Ohio and dividing that number by the percentage share of shipments by industry in the rest of the United States. If the shipment ratio is greater than 1.00, then Ohio has a comparative advantage in making the product compared to the rest of

[10] The theory of comparative advantage is the basis for analyzing trading relationships in economics. The theory of comparative advantage holds, and trade patterns validate, that trading units (usually nations, but in this case states) specialize in the production of goods and services where they have a trading advantage based on the relative costs of different factors of production. Because labor costs in Ohio are relatively expensive and the state does not have a competitive occupational specialization (Fagan, Jocelyn, "Do Northeast Ohio's Drivers Derive Competitive Advantage from Shared Labor," *Economic Development Quarterly* 14(1) (February 2000): 111-125), the source of Ohio's competitive advantage has to lie elsewhere. While the data analysis performed in this chapter cannot establish causation, they do suggest that the advantage lies in the productivity of the state's established manufacturing base and in its general manufacturing environment.

[11] Value added can overstate the worth of goods and services produced because it does not subtract intermediate goods that are purchased from suppliers and incorporated into the final product. This can be especially serious in Ohio due to the value of some of the final products that are assembled in the state, such as automobiles, trucks, and aircraft engines.

the United States. The shipment ratios are plotted for all of the technology-intense industries in Figure 3-1.[12] The higher the shipment ratio, the greater the state's comparative trade advantage in the industry.

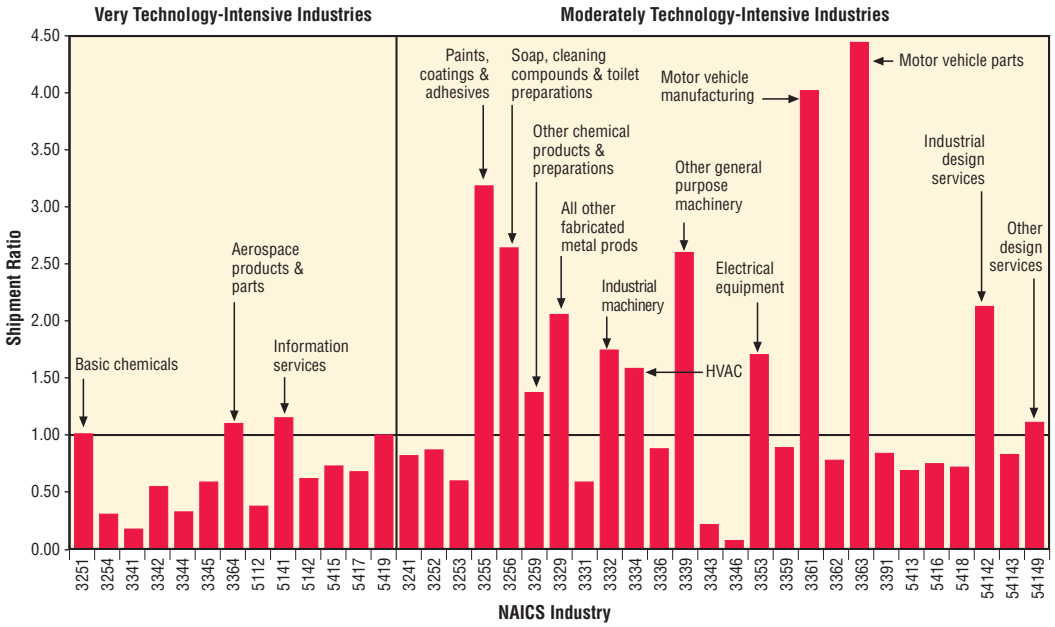
Ohio has a weak comparative advantage, as measured by the shipment ratio, in only two of the very intense technology industries: aerospace products and parts and information services. There are also two very intense technology industries where the state is competitively neutral: basic chemical manufacturing (ratio of 1.00) and other professional, scientific, and technical services (ratio of 0.99). The state does not have an advantage in the value of shipments in the other very intense industries.

The result for the group of moderately intense industries is much stronger. Motor vehicle parts manufacturing has a shipment ratio of 4.41. This means that the motor vehicle parts industry ships nearly four and a half times the value of product than expected if Ohio's economy was structured like the rest of the United States. This is a very strong production specialization. This means that whatever happens to the automotive supply chain will be felt more strongly in Ohio than in other parts of the nation. This is both a competitive opportunity and a threat.

Figure 3-1

Ohio's Comparative Advantage

Location Quotient of the Value of Shipments



[12] Appendix Table 3-1, containing the data that is plotted, is available on a web site developed for this book: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>. All of the figures have a corresponding table in the data appendix on the web.

Examining the list of industries where the state of Ohio has more than twice the share of the value of shipments than does the rest of the nation provides a good idea of the state's technological base. Following motor vehicle parts is the motor vehicle manufacturing industry at 3.99; paints, coatings, and adhesives with a ratio of 3.16; soap, cleaning, and toilet preparations (2.62); general-purpose machine building (2.58); industrial design services (2.11); and other fabricated metal products (2.04). This is a list that outlines the automotive, coatings, and material forming and shaping industries. Both current technologies in these three areas and future technologies are of vital importance to Ohio's economy, with industrial design and other design services being one of the keys to developing new products or to reviving the economic fortunes of older industries and their products. Product design and moving closer to end users are ways of moving these industries back down the product cycle, increasing the share of value added they are able to retain, and reviving their growth and income-generating prospects.

Both current technologies in these three areas [the automotive, coatings, and material forming and shaping industries] and future technologies are of vital importance to Ohio's economy, with industrial design and other design services being one of the keys to developing new products or to reviving the economic fortunes of older industries and their products.

Employment Specialization

Ohio has employment specializations in 18 of the 39 industries that are intense users of technologically sophisticated labor. However, the state is a specialized employment location in only two of the very intense technology industries—basic chemical manufacturing and other professional, scientific, and technical services. Ohio has an employment specialization in 14 of the 20 moderately technology-intense manufacturing industries and in two of the moderately intense service industries. Ohio's employment specializations are revealed through the use of the employment LQ, which is graphed in Figure 3-2. A quick way of identifying the industries where Ohio has an employment specialization is to focus on those industries where the state's share of employment exceeds the industries' share of employment in the rest of the nation—those industries that are above the horizontal line in Figure 3-2.

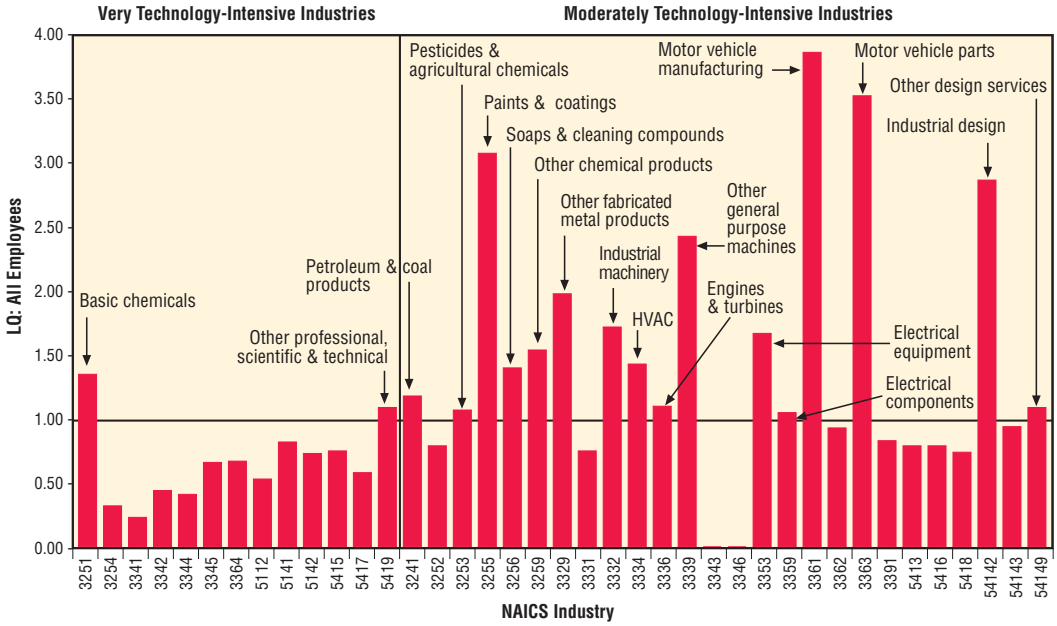
There are 16 moderately intense manufacturing industries where Ohio's employment share exceeds the national share. The only two service industries with LQs that exceed 1.00 are industrial design services and other design services, industries that are hidden assets in Ohio's search for new products. The deepest employment specializations in Ohio's technology base are in the two motor vehicle industries, assembly and parts manufacturing, and the paints, coatings, and adhesives industry.

Ohio's technology base is firmly rooted in moderately technologically intense manufacturing. But firms do not locate all of their corporate activities and all of their technology workers across all of their business locations equally. The state's competitive advantages in each of the five parts of the production process cannot be pinpointed because the research required to do so has not been undertaken. However, the way Ohio's technology industries use the

Figure 3-2

Does Ohio Have Technology-Based Employment?

Ohio's Share of US Employment in Technology-Intensive Industries in 1997



state as a production platform, as contrasted with more integrated locations for their business activities or as a facility that specializes in one of the other parts of the production process, can be tested. The data displayed in Figure 3-3 show how the technologically intense industries use their business locations in Ohio.

Figure 3-3 is a graph of Ohio's share of production workers in each technologically intense manufacturing industry divided by the same ratio for the nation (this is the LQ for production employment).[13] If the ratio is greater than 1.00, then Ohio has proportionately more production workers in its employee mix in a given industry than does the industry nationally. If the ratio is less than 1.00, Ohio has proportionately fewer production workers than does the industry nationally. The horizontal line plotted in Figure 3-3 has the value of 1.00, indicating where Ohio's employment composition is equal to the national average.

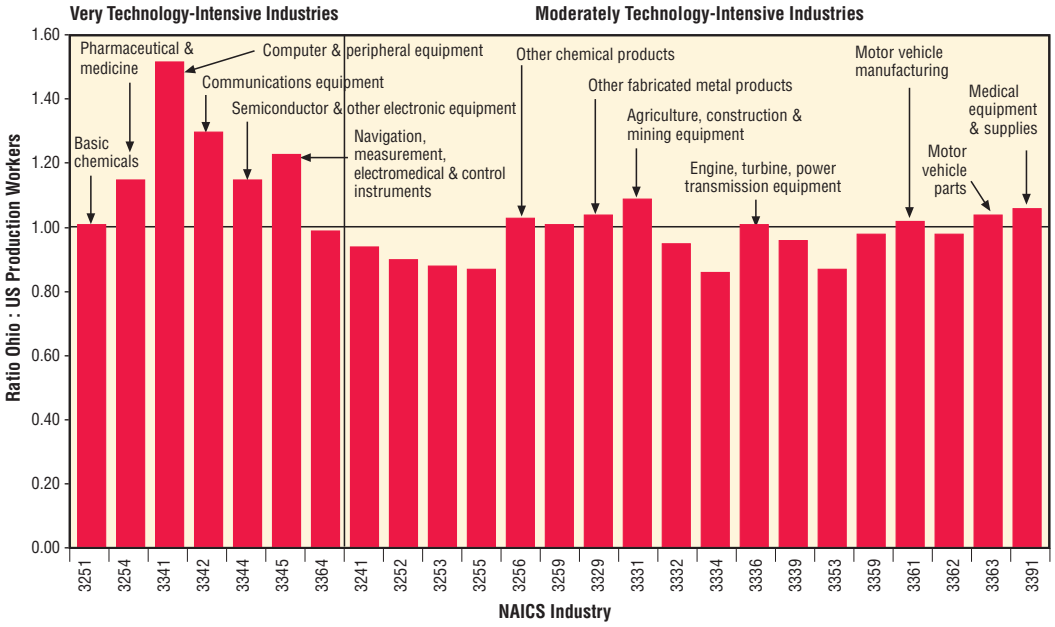
When Ohio houses a business in one of the very technologically intense industries, it tends to be as a production platform. When moderately intense industries have production facilities in the state, they are balanced with the other four components of the production process.

[13] According to the Bureau of the Census and US Department of Labor definition, there are no production workers in the services sector so the analysis is restricted to manufacturing industries. This is the reason why production worker and value added data are not given for industries outside of the manufacturing sector. Ohio data were subtracted from the national data to form the comparison group.

Figure 3-3

Is Ohio's Technology Employment Dominated by Production?

Share of Production Workers in Ohio's Technology-Intensive Industries Compared to the US Share in 1997



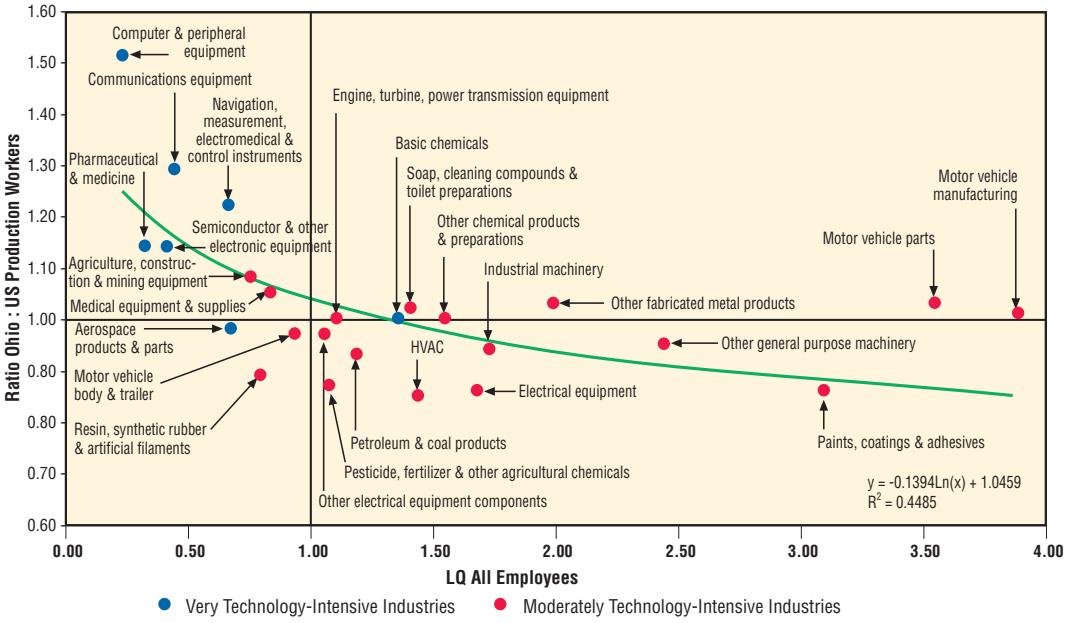
This is the pattern evident in Figure 3-3. The production worker ratio is well above 1.00 for all of the very intense manufacturing industries, with the exception of basic chemicals (1.01) and aerospace products and manufacturing (0.99). The ratio is marginally above 1.00 in only seven moderately intense manufacturing industries: other chemical production; other fabricated metal products; agricultural machinery and construction equipment manufacturing (this is the highest at 1.09); engines, turbines, and transmission power equipment; motor vehicle manufacturing; motor vehicle parts (tied for third highest at 1.04); and medical equipment and supplies (1.06).

Figure 3-4 puts together the data from the two previous figures, generating a clearer picture of the way Ohio's technology manufacturing industries use the state's resources. The LQs for total employment are plotted along the horizontal axis of Figure 3-4, with a heavy vertical line marking the place where the ratio of Ohio's portion of employment in the technology-intense manufacturing sector is equal to the average for the rest of the nation (1.00). The relative proportion of production workers in the industry is plotted along the vertical axis; the heavy horizontal line at 1.00 marks the place where the national and state percentages are the same. The intersection of the two lines of equal proportionality divides the graph into four quadrants. (The very intense technology industries are identified by blue dots in the figure and the moderately intense industries by red dots).

Figure 3-4

The More Specialized Ohio Is in the Manufacturing Industry, the Less Dependent It Is on Production Work

Ohio's Employment Specializations in Technology-Intense Manufacturing Industries



Industries using Ohio as a production platform are clustered in the upper left-hand quadrant. Those that have a diversified presence in the state but have placed a proportionately greater share of their production out of state are in the lower right-hand quadrant. A regression line is plotted (in green) in Figure 3-4 that displays the relationship between the LQ for total employment and the ratio of production workers. Most of the industries fall along a line that moves from the upper left-hand corner to the lower right quadrant along the green line.[14]

The green line in the graph indicates that, as the state's employment concentration in a technology industry increases, its specialization as a production platform falls. This indicates that the more specialized the state is in a particular industry, the more diversified its employment is within the industry in terms of occupations and, presumably, the more diversified its business locations are in terms of functions of the production process that are performed within the state. This statistical relationship helps to explain Ohio's role in the very technologically intense manufacturing industries: if the state houses a business establishment in an industry, and at the same time does not have a high degree of employment specialization in the industry, then it is likely to serve as a production platform.

[14] The regression line has an r^2 of 0.45 and was estimated in bivariate semi-logarithmic form.

Those industries where Ohio has a high employment specialization and relatively low specialization in production workers are those where the state has historical strength. This relationship verifies the importance of product and industry innovation: homegrown industries become the economic anchors of the future with employment in all portions of the production process. If the state only serves as a production platform, it is difficult to expand employment into those parts of the business that generate the highest shares of value added and the highest incomes. This displays the economic challenge of technology industries in the future for the state of Ohio. The state's economy needs product innovation to take its existing base of technology industries into the future—and those industries that can provide the innovation are the moderately intense manufacturing industries that do not use the state as a pure production platform.

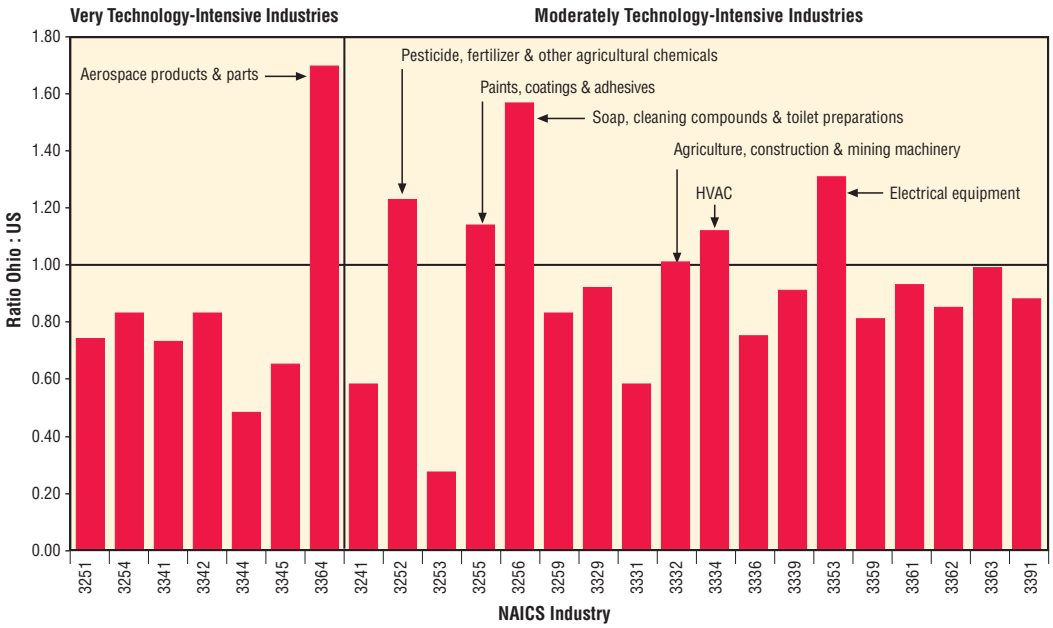
The state's economy needs product innovation to take its existing base of technology industries into the future—and those industries that can provide the innovation are the moderately intense manufacturing industries that do not use the state as a pure production platform.

In most cases it is difficult to be optimistic about using Ohio's base of very intense technology industries as a platform for sustained growth, with the exception of aerospace products and parts. The high LQ for production workers in these industries is accompanied by relatively low measures of productivity for production workers. The traditional definition of productivity, manufacturing value added per hour worked by production workers, is used in Figure 3-5 as the basis for the ratio of relative productivity. The ratio is created by dividing the productivity measure for Ohio's manufacturing technology industries by the same figure for the remainder of the United States.

Figure 3-5

Measuring Relative Productivity:

Value Added per Hour in Ohio Compared to the US Average



The fact that the motor vehicle parts and motor vehicle manufacturing industries are either at or below the national average in terms of productivity is a source of concern, and it is a sign of problems in either the age of products or in the cost structure of production.

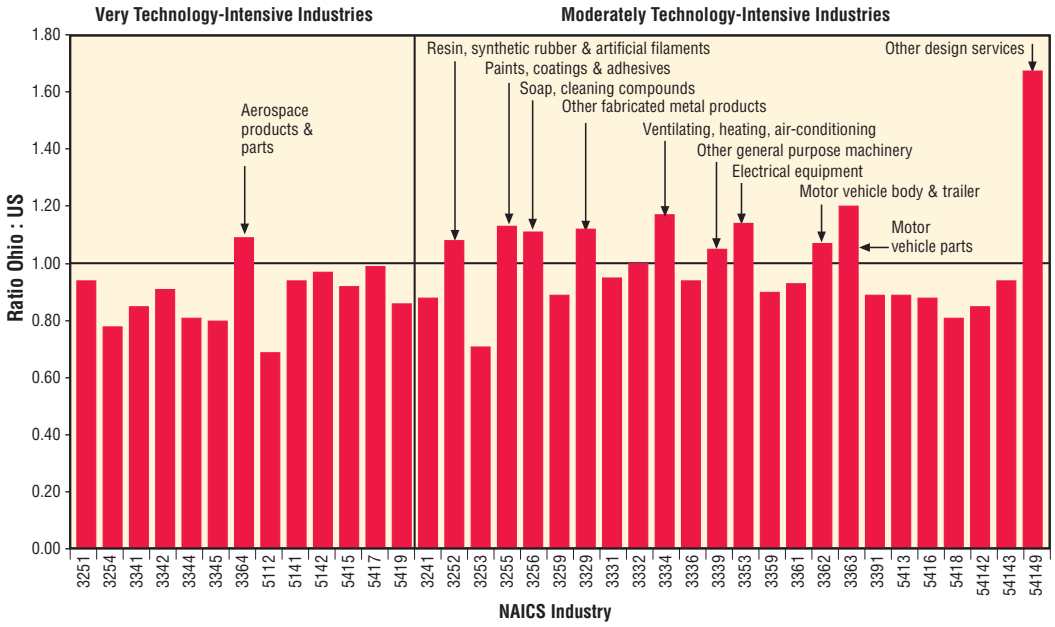
The aerospace products and parts industry has the highest ratio of productivity among the very intense technology industries (in fact, it is the only very intense industry where the ratio is above 1.00). The picture brightens when the moderately intense manufacturing industries are considered, because six of them have productivity ratios that are above 1.00: pesticides, fertilizers and other agricultural chemicals; paints, coatings and adhesives; soap, cleaning compounds, and toilet preparations; agriculture, construction, and mining machines; ventilating, heating, air-conditioning, and commercial refrigeration; and electrical equipment. Motor vehicle parts manufacturing is at 0.99 and motor vehicle manufacturing is at 0.93.

These data indicate that despite the huge increases in productivity across the manufacturing sector, the state of Ohio's technology base is not dramatically more productive than is the rest of the nation. In terms of relative productivity, Ohio does well in the aerospace industry, soaps and cleaning compounds, electrical equipment, agricultural chemicals, and paints and related products. The fact that the motor vehicle parts and motor vehicle manufacturing industries are either at or below the national average in terms of productivity is a source of concern, and it is a sign of problems in either the age of products or in the cost structure of production.

Average or below average levels of productivity can be offset by relatively low earnings on the part of employees; conversely, high levels of productivity can support above average

Figure 3-6

Ohio Payroll per Employee as a Percent of US Payroll per Employee



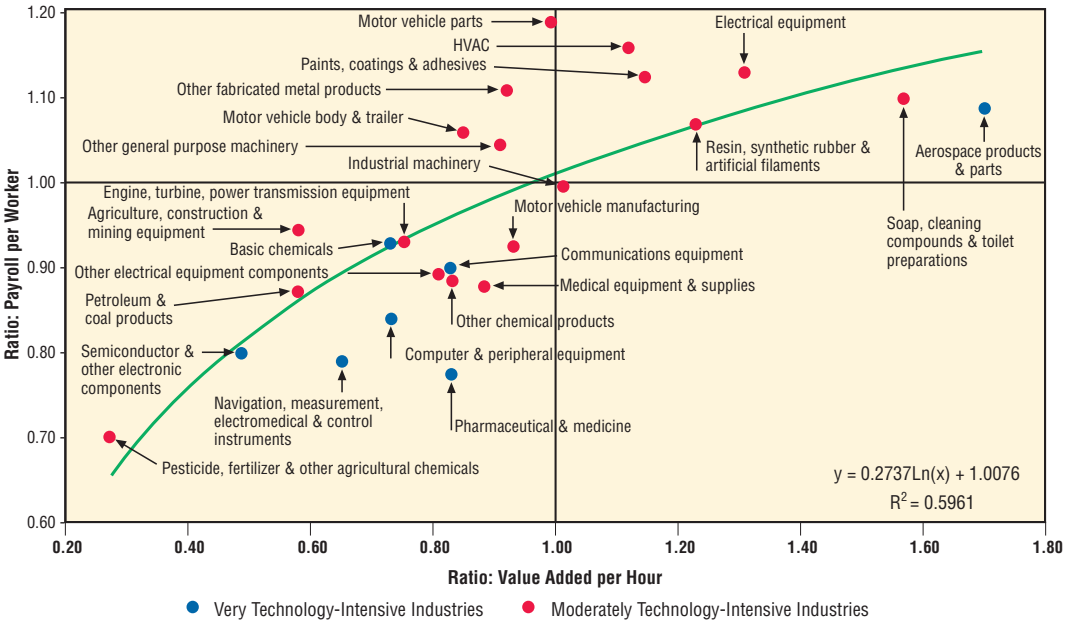
labor costs. Figure 3-6 plots the average payroll of employees in Ohio and compares them to the average employment cost in the rest of the nation for technology-intense industries (both manufacturing and service industries are included). Relative payroll costs are lower than the national average in all of the very intense technology industries, with the exception of aerospace products and parts, where productivity more than makes up the difference. Relative pay levels are also higher in 10 of the 24 moderately intense technology industries—the most worrisome are in motor vehicle parts manufacturing, basic chemical manufacturing, and ventilating, heating, air-conditioning, and commercial refrigeration manufacturing (HVAC). These industries are large, technologically sophisticated employers and function under competitive cost pressures. Unless they generate higher value added, they may gravitate to lower-cost production platforms.

There is a well-defined statistical relationship between the measure of relative productivity used in this report and relative payroll cost in the technologically intense manufacturing sector (the service industries could not be included because of the absence of productivity data). Pay rates are rooted in productivity and in the clustering of an industry. Figure 3-7 displays the relationship between these two variables; the green line plots their statistical relationship. Figure 3-7 is divided into quadrants in the same way as Figure 3-4. The relative levels of productivity in the technology industries divide the right- and left-hand sides of the graph. The heavy vertical line marks the place where productivity would be the same in both

Figure 3-7

Higher Productivity Leads to Higher Earnings

Relationship Between Productivity and Payroll per Employee in Manufacturing



the rest of the nation and state at 1.00. Those industries with relative rates of productivity that are higher than the average for the rest of the nation are to the right of the line, and those that are lower are to the left. The heavy horizontal line at 1.00 marks the relative cost of labor. Ohio's technology industries with average payrolls that are higher than the national average are above the heavy line (the industry's payroll ratio is greater than 1.00), and those with average payrolls that are lower than the rest of the nation are below the line. The four quadrants are:

- Upper right corner: high relative productivity and high relative payroll;
- Lower right corner: high relative productivity and low relative payroll;
- Upper left corner: low relative productivity and high relative payroll;
- Lower left corner: low relative productivity and low relative payroll.

The regression line moves, as expected, from the low relative productivity-low relative payroll quadrant (lower left) to the high relative productivity-high relative payroll quadrant (upper right). There are no industries in the lower right quadrant, but a number are well positioned in the high relative productivity-high relative pay quadrant: resins, synthetic rubber and artificial and synthetic fibers and filaments; soaps, cleaning compounds, and toilet preparations; and aerospace products. These industries generate high relative productivity and have average payrolls that are either expected or lower than expected based on the simple regression equation displayed on the graph.

There are a number of industries that are positioned off of the green line. There is a set of industries where the relative payroll per workers is higher than expected based on relative value added (motor vehicle parts; HVAC; paints, coatings and adhesives; and electrical equipment manufacturing). Motor vehicle parts; other fabricated metal products; and other general purpose machinery are in the upper left-hand quadrant of the figure, which is a sign of potential competitive weakness. Motor vehicle parts is most prominently placed in this quadrant. There is another group where payroll is lower than expected (aerospace; soaps and cleaning compounds; and a number of very intense technology industries) and, with the exception of aerospace products, they are predominantly in the low relative productivity-low relative pay quadrant.

The hypothesis that the concentration of employment within an industry, coupled with relative value added, explains the relative payroll of an industry was tested using regression

analysis.[15] The regression equation indicates that 70 percent of the relative payroll per employee is due to the level of productivity in the industry and about 30 percent is due to clustering of national industry employment in the state. In other words, payroll per worker increases with both productivity, which reflects cost competitiveness in the production process, and cluster effects, which reflect increased revenue opportunities and the other cost-reducing benefits firms receive through the dense co-location of the industry in the state. A number of Ohio's prominent moderately intense technology industries are located above the green line plotted in Figure 3-7. The reason why they can survive with a combination of relatively high average payroll per employee and low productivity per production worker is that agglomeration effects result in the location of other higher value added activities being located in the state—activities other than production or procurement.

The recipe for economic success in Ohio is a highly efficient workplace in an industry where a relatively large share of national employment is concentrated. Conversely, if Ohio's moderately intense technology industries do not continue to innovate, if they ride out their current stable of products, making only process improvements to their product base and thinking of their set of products as cash cows to be milked, an important fraction of the state's economy is at risk.

THE COMPETITIVE POSITION OF OHIO'S TECHNOLOGICALLY INTENSE INDUSTRIES

The competitive position of Ohio in each of the four-digit NAICS technology industries, and for the five-digit NAICS industries that are contained within the larger four-digit groups, was analyzed in a series of tables. These tables are available on the web site that is maintained as part of this book.[16] Table 3-5, which describes the competitive position of the largest employer among the technology industries in Ohio—the motor vehicle parts industry (NAICS

[15] Ordinary least squares regression was used to estimate the relationship between the dependent variable, relative payroll per employee, and relative value added and the percentage of the industry's national employment that is located in Ohio as the independent variables. The value added variable was included as the determinant of pay rates and the share of national industry employment located in Ohio was included to proxy what economists call agglomeration effects (cost savings or revenue opportunities that are created by the co-location of firms in the same industry). The regression equation was estimated in log-log form (all of the variables were transformed into natural logarithms); the unstandardized coefficients can be interpreted as elasticities. The regression result is:

Variable	Unstandardized Coefficient	Standardized Coefficient	t Ratio	Significance Level
constant	-0.101		-2.288	0.033
Ln (Ratio of Value Added)	0.263	0.735	6.541	0.000
Ln (Ohio's % Share of US Employment)	0.006	0.299	2.664	0.015

$r^2 = 0.757$; adjusted $r^2 = 0.734$; Ln represents the natural logarithm.

[16] See Appendix Tables 3-13 to 3-115 at <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>.

Table 3-5

Ohio's Competitive Position in the Motor Vehicle Parts Manufacturing Industry (NAICS 3363)

Ordered by Total Value of Shipments per Employee

State	Number of Employees	Rank	Total Value of Shipments $1,000	Rank	Total Value Shipments per Employee $1,000	Rank	Annual Payroll per Employee $1,000	Rank
United States	**783,405**	**–**	**177,256,416**	**–**	**226.3**	**7**	**39.6**	**6**
Michigan	195,706	1	51,312,366	1	262.2	3	48.2	3
Ohio	**111,445**	**2**	**29,724,705**	**2**	**266.7**	**2**	**45.9**	**4**
Indiana	96,419	3	20,995,605	3	217.8	11	43.3	5
New York	31,062	4	9,208,924	4	296.5	1	51.5	1
Tennessee	29,626	7	6,618,719	5	223.4	8	30.3	19
Illinois	30,464	6	5,366,217	6	176.1	19	31.9	12
Kentucky	22,726	8	5,218,653	7	229.6	6	29.3	21
North Carolina	19,223	10	4,609,109	8	239.8	5	32.6	11
Wisconsin	19,087	11	4,339,251	9	227.3	7	35.7	9
California	30,487	5	3,727,234	10	122.3	30	26.8	25
Pennsylvania	19,612	9	3,699,672	11	188.6	16	38.3	7
South Carolina	13,858	14	3,556,676	12	256.7	4	31.7	13
Missouri	17,845	12	3,470,345	13	194.5	14	25.9	28
Texas	15,280	13	2,958,412	14	193.6	15	27.1	24
Alabama	11,990	15	2,624,674	15	218.9	10	48.4	2
Mississippi	11,363	16	2,077,902	16	182.9	18	23.7	31
Virginia	7,620	21	1,613,266	17	211.7	12	31.6	14
Utah	7,138	22	1,591,079	18	222.9	9	30.3	18
Georgia	9,430	17	1,569,320	19	166.4	22	26.2	27
Iowa	9,215	18	1,475,199	20	160.1	24	30.8	17
Arizona	7,777	19	1,329,078	21	170.9	20	28.0	23
Arkansas	7,759	20	1,161,395	22	149.7	28	22.1	32
Oklahoma	6,299	24	1,025,530	23	162.8	23	24.3	29
Massachusetts	6,100	25	932,125	24	152.8	27	39.1	6
Florida	7,062	23	793,992	25	112.4	31	24.2	30
Nebraska	4,514	26	709,808	26	157.2	25	31.2	15
Minnesota	3,969	27	610,045	27	153.7	26	28.9	22
Oregon	2,615	28	444,488	28	170.0	21	35.1	10
Colorado	2,353	29	334,749	29	142.3	29	30.9	16
West Virginia	1,290	30	253,164	30	196.3	13	36.1	8
South Dakota	960	31	179,569	31	187.1	17	26.4	26
North Dakota	664	32	34,802	32	52.4	33	16.9	33
New Mexico	134	33	11,414	33	85.2	32	29.7	20
Connecticut	5,000 to 9,999		D					
Kansas	2,500 to 4,999		D					
Washington	2,500 to 4,999		D					
Louisiana	1,000 to 2,499		D					
Maryland	1,000 to 2,499		D					
New Hampshire	1,000 to 2,499		D					
New Jersey	1,000 to 2,499		D					
Nevada	500 to 999		D					
Vermont	500 to 999		D					
Maine	250 to 499		D					
Delaware	100 to 249		D					
Idaho	100 to 249		D					
Rhode Island	100 to 249		D					

D means data are suppressed to preserve confidentiality.

Source: U.S. Census Bureau, 1997 Census of Business

3363) is taken from the posted data appendix and is presented here as an example of what is available in the individual industry tables. Each of the tables contains total industry employment, value of shipments, value of shipments per employee, and annual payroll per employee by state and the national total from the 1997 Economic Census. The tables also rank the states on their standing on each of these variables from highest to lowest.

A larger fraction of Ohio's jobs are in industries that are intense users of technology than is true in the rest of the nation.

Motor Vehicle Parts

The motor vehicle parts industry is concentrated in the eastern portion of the Great Lakes basin. Ohio is the second largest employment location in the industry, with 111,000 jobs, trailing Michigan's 196,000 workers. Indiana is in third place with 96,000 employees. New York is a distant fourth, with 31,000 employees. The total value of shipments by state follows the employment totals. The picture shifts a bit when measures of competitive strength are considered. New York produces the highest value of shipments per employee, at $296,000, with Ohio in second place ($267,000), and Michigan in third ($262,000). South Carolina—the heart of the southeastern auto supply belt—is in fourth place as measured by the value of shipments per employee, with $257,000 per job. South Carolina has the 13th highest payroll per employee among all of the states, giving it an employment cost advantage as a production platform over its competitor locations. The state with the highest payroll per motor vehicle parts employee is New York, followed by Alabama. Ohio is in fourth place, with a payroll cost of $45,900 per job.

CONCLUSION

A larger fraction of Ohio's jobs are in industries that are intense users of technology than is true in the rest of the nation. The vast majority of these jobs are in moderately intense manufacturing industries where a major source of product demand comes directly and indirectly from the automobile industry. The largest employer among Ohio's technologically intense industries is the motor vehicle parts industry; the third largest employer is motor vehicle assembly, followed by other general-purpose machinery and other fabricated metal products.

The central role that the aerospace products and parts industry plays in Ohio's technology base is recognized by public policy investments and the creation of a number of development intermediaries. Unfortunately, technologically intense industries, the majority of them in the manufacturing sector, are not often recognized as being technologically sophisticated sources of competitive strength for the state. Prominent among these industries are paints and coatings, soaps and cleaners, industrial machinery, and HVAC systems. There is also a poor understanding of the technologies and institutions that provide vital businesses services

and skilled labor to Ohio's technological industrial base. The state is in need of a series of strategic studies that document industry-driven demands for more competitive factors of production and develop practical ways of satisfying the demands that can be effectively met. These studies need to focus on the role that the state's higher educational system can play in reinforcing Ohio's technology base and the competitive position and structure of Ohio's information technology industry.

Higher Education

To sustain the state's economic base, Ohio's manufacturing leadership needs to form a strong forward-looking partnership with higher education to reinforce and advance the state's existing industry-driven technology base. The higher educational system interacts with existing technology industries in two ways, education and training and research. The first, and most important, interaction between the higher educational system and industry is indirect; it is through education and training. A clear understanding of the skills demanded by Ohio's technology industries needs to be developed. This understanding should go beyond the entry level skill requirements for production operations. It needs to include the skill demands for each of the five parts of the production process that are located within the state, by industry. The second major area of interaction that can be developed between the higher educational system and the state's technology industries is through research. Part of that interaction could be built by linking the university system more closely with the existing manufacturing extension partnership network that is in place statewide. Technology assessments should be performed that map out the basic and applied research needs of Ohio's technology industries, with the recognition that meaningful industry leadership and cooperation is required. Industry-academic external juries should be used to judge research and development grant competitions for any state-provided research funds.[17] Special consideration needs to be given to the state's public and private educational resources in the areas of industrial and product design, because product design coupled with applying information technologies to the state's existing base of technology firms will yield the products of tomorrow.

Information Technology

Information technologies and electronic communications are growing rapidly in Ohio because this is where demand for their products lie. To Ohio's business community, the information technology industry has three separate components—the information technology triad. The first is the wiring and capital required to run a business electronically and to communicate with the globe. The second is the human capital and knowledge needed to make all of the electronic infrastructure work. The third are special applications of software that can be

[17] This is a model that the American Academy of Sciences Research Competitiveness Service recommended to the state of Maine as part of their technology initiative.

sold to customers externally. In the words of one business observer: "The first two parts of your list are like water and air; you can't run a business without them." The first two parts of the IT triad have joined electricity, roads, water, and labor as part of the state's business infrastructure—you cannot run an economy without them. They are necessary, but not sufficient, ingredients for economic success.

The state's higher educational system should recognize that each part of the triad has different education and training requirements. The marketplace and vocational schools address the labor demands of the first leg. The second leg is the province of proprietary schools, community colleges, and universities. The products that could comprise the third leg are not well understood outside of the information technology industry itself, but should be subject to vigorous university support.

The state has a long and storied tradition in factory automation, manufacturing consulting, and industrial and commercial design services because of the customer base that is here. This is the base from which the third part of Ohio's IT triad has the best chance of developing, but it can only be done with industry leadership.

Innovation and the Changing Competitive Environment

Ohio's technologically intense industries have done well over the past decade by increasing productivity through investments in process innovation. The challenge these same industries face in the ensuing decade is how to capture as much value added in their products as is competitively feasible. The best route is through product innovation. There are two ways to innovate. The first is to invent new classes of products. This is why it is insufficient to talk about a firm's research and development (R & D) capacity. R & D means little if it does not result in new products. R, D & D (research, development, and product deployment) is where the action should be in firms that become innovators. R & D only adds value to a company if its work gets deployed into the marketplace. The second path toward innovation is to reinvent or revitalize existing products. This can be done in the traditional way—the application of new product designs and of new production processes or techniques. Products can also become revitalized through the application of new management, inventory, and distribution techniques.

Last decade's formula for success in Ohio's manufacturing technology base is changing due to the spread of e-business and fundamental changes in business strategies. In the early 1990s the major concern of product assemblers, known as original equipment manufacturers or OEMs in the language of supply chain management, was product quality first, then on-time delivery as OEMs perfected just-in-time inventory systems, and finally price. Lower-tier suppliers (second-tier firms that are sub-assembly suppliers and third-tier firms that supply parts

While Ohio has a relatively technologically intense employment base, it is working on too many products that are long in the tooth—in the mature phase of the product cycle.

to the sub-assemblers and OEMs) became part of loose business partnerships as the OEMs and second-tier firms narrowed their supplier base in Japanese-style supplier networks. The key to the arrangement was that the lower-tier firms kept some of the control over their products through engineering, design, or quality. Now that quality has improved ubiquitously throughout the manufacturing sector, the quality and dependability component of the supply equation has dropped in importance and price is gaining.

OEMs are attempting to make the lower levels of their supply chain a globally liquid business through on-line auctions and publicly announced price cuts. As the marketplace globalizes and as auto assemblers in particular face near-term profit pressure and demand price cuts, the balance between quality, just-in-time delivery, and price will shift towards price (despite all the nice words uttered over the past decade about manufacturing partnerships). If the dominant partner is not making enough money to satisfy the rate-of-return demands of the financial markets and there is too much capacity, suppliers' lives will become more, rather than less, difficult.

While Ohio has a relatively technologically intense employment base, it is working on too many products that are long in the tooth—in the mature phase of the product cycle.

The key to the future for Ohio's technology jobs and incomes is to innovate new products and production processes and to apply technologies in ways that allow firms to better manage their supply and customer chains. The more generic the product, the more the firm will be involved in procurement and the less it will be involved in production; the more generic the product, the more susceptible the firm is to either being bought out or failing. The economic challenge is at hand: As these firms are bought out and globalize, where will knowledge and innovation reside? If the Ohio establishment is merely a sales and service office, value added will be transferred to other regional economies.

The challenge of aging products is not new to Ohio's economy and the process of firms riding out product cycles is in many ways the reason for the decline of many of the state's small- to mid-sized cities and labor markets. Ohio has many older manufacturing companies with national or global market presence that are riding out products or strategies that have worked throughout the post-World War II era. These companies are the hubs of what were once *de facto* company towns. The products of the company were world-class.

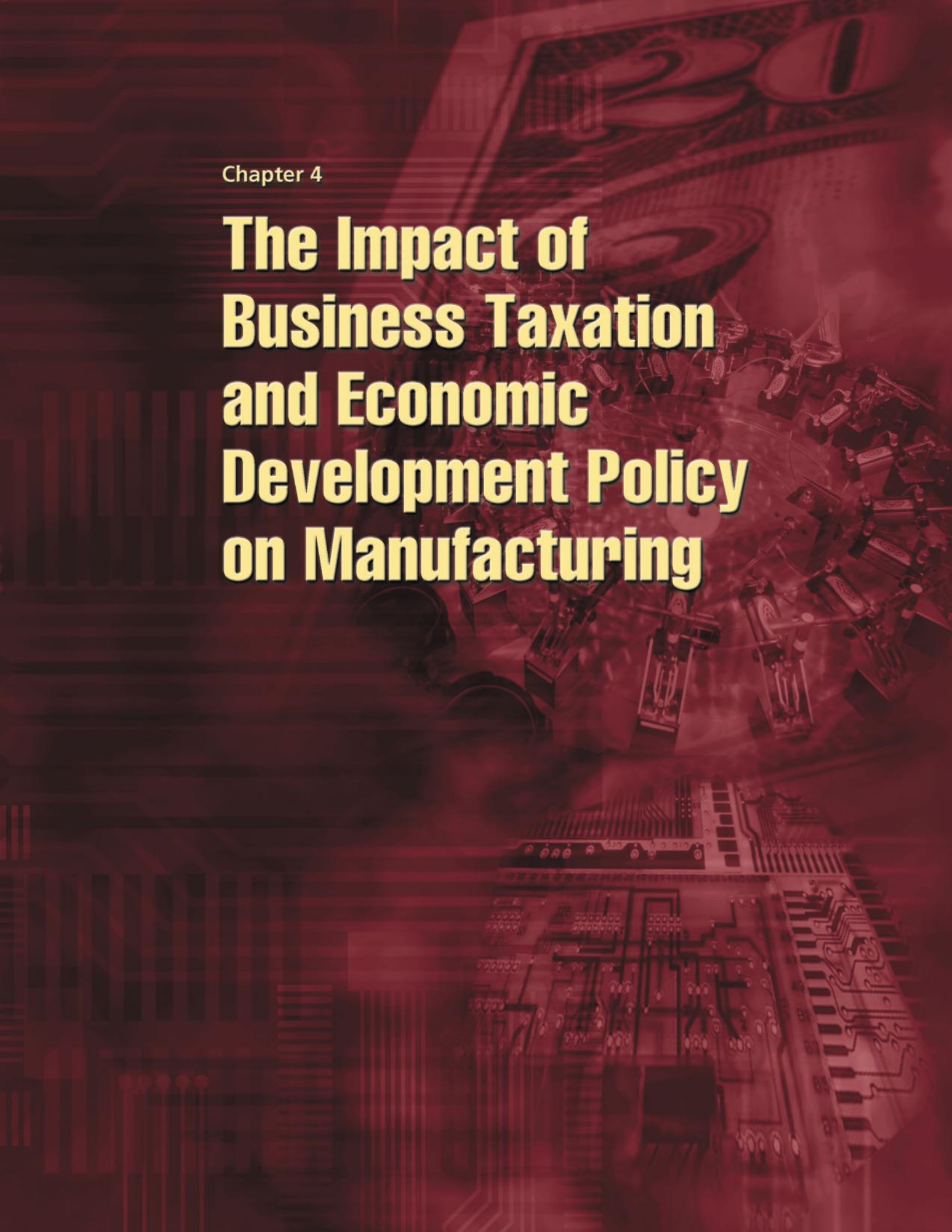
Too many of these companies and their host communities now face the same story. If the product dies, the town suffers. At least this is a straightforward process and is easy to understand. The more common story is harder to understand because the product and brand name still exists. The product's sales are either stagnant or they are losing market share to a rival. In

one common scenario, stockholders demand better performance from management and they decide to sell the product line; production slowly withers in Ohio and investment takes place elsewhere. The second scenario is also a familiar occurrence. The family that once owned the firm is into its third or fourth generation; most of the heirs are not employed by the company and live far away from the headquarters city. They demand better returns from their trust funds and the result is the same—the company is sold. The townspeople are the ones who suffer the most because they are place bound as the product line dies and the workers' ties to high levels of income are cut. This is the stake that the State of Ohio has in manufacturing product innovation: innovation is the key to keeping companies vital through vibrant product sales, and vital companies are the connection to high incomes for the state's labor markets.

What is the role of public policy in a very competitive world?

- First, it must encourage capital deepening. Any public policy that is a deterrent to applying capital—equipment and knowledge—to the workplace works against the long-term incomes of the residents of the state. This point is addressed in the next chapter.
- Second, the state must act on the near-term needs of employers when it comes to workplace skill shortages. These shortages will persist despite the vagaries of the product and business cycles.
- Third, the state and its higher education system should address the intermediate term (five to 15 years out) product and process innovation needs of Ohio's industrial base. This should be a concerted effort with real partnerships with the business community. A state (or higher educational system) cannot have an industrial policy without the cooperation of industrialists.
- Fourth, the State of Ohio needs to work with its universities to promote research excellence in basic scientific and technological developments that may yield businesses in the long-term future.

Ohio's business community has an established track record both in applying technologies to production processes and in product excellence. It is one of the few places on the globe where four of the five parts of the production process have been competitive: headquarters, production, sales and marketing, and distribution. The missing ingredient to vitalize the state's technology-intensive manufacturing industries is new product innovation and adding the fifth part of the production process to the competitive strengths of the state: research, development, and product deployment.



Chapter 4

The Impact of Business Taxation and Economic Development Policy on Manufacturing

THE IMPACT OF BUSINESS TAXATION AND ECONOMIC DEVELOPMENT POLICY ON MANUFACTURING

An overview of the State of Ohio's business tax structure is relevant to the current statewide policy discussions about tax policy and school funding because one of the outcomes of the state's current economic development programs is to counteract parts of the business tax code, specifically the Tangible Personal Property Tax, that put the state at a cost disadvantage compared with neighboring states. This tax in particular, and business taxation in general, needs to be reconsidered within the context of the state's overall system of public finance. In this chapter, particular attention is paid to the role that business taxation plays in state and local government finance and the horizontal equity—or fairness—of the state's business tax system.

The overall level of business taxation is not at issue in Ohio—the state is near the average of its immediate neighbor and competitor states on this measure of competitiveness. The problem is with the structure of taxation, the way it penalizes Ohio's demonstrated competitive advantage, and (most seriously of all) the way it provides disincentives for investing in both productivity-enhancing capital and new ventures—which are at the foundation of income growth in the state. A competitive analysis of Ohio's business taxes released in the fall of 1997 determined that "Ohio's average tax burden on all businesses is the fifth lowest among these 11 [competitor] states.... Ohio's business share of total tax collections is smaller than six of these 10 neighboring and competing states.... It is important to remember that these gross tax burden measures mask significant variations in the level of taxation imposed on businesses within specific industries."[1]

Both the Tangible Personal Property Tax and the Corporate Franchise Tax:

1 Treat businesses in different industrial sectors that have similar financial performance unequally;

[1] Growth Strategies Organization, *Ohio's Competitive Position in the Economic Development Marketplace*, prepared for the Ohio Economic Development Study Advisory Committee, September 15, 1997, pp.1-2.

2 Counteract the state's natural sources of competitive advantage;

3 Discourage capital investment that would improve both productivity and the incomes of the state's residents; and

4 Discourage new firm formation in capital-intense manufacturing, research and development, service, and distribution industries.

The business tax code is a relic from Ohio's economic past, not a gateway to its future.

At the same time, the share of the total state and local tax burden borne by business has been falling and continues to fall. However, the Tangible Personal Property Tax offers a major challenge for reform because this tax is businesses' major payment for public education, and a portion of the business community is leading a statewide effort to improve the quality of outcomes from that system. Despite the difficulty of reforming the tax, the Governor and General Assembly have enacted a schedule of reductions in the Tangible Personal Property Tax to help ease its burden and improve the distribution of business taxation in the state.[2]

The Tangible Personal Property Tax and the Corporate Franchise Tax place Ohio in an uncompetitive position compared to a number of surrounding states, especially in regard to manufacturing and distribution establishments. Firms actively seek tax relief for the value of their inventories and the value of their capital equipment as a means of achieving interstate tax parity. The State of Ohio relies to a large degree on Enterprise Zone tax incentives to offset the tax cost differential (Free Trade Zones are a second mechanism employed to avoid the inventory portion of the tax). This in turn stimulates intra-regional tax competition and generates deal-by-deal brush fires between municipalities. A more efficient and equitable way of dealing with the problems generated by the business tax code is to change the code. But the code must be changed in ways that promote economic efficiency and productivity, encourage tax fairness across the business sector, and encourage businesses in Ohio to take the high road to a competitive future. Change the business tax code, and the reason behind the most contentious of Ohio's economic development incentive programs also changes.

The business tax code is a relic from Ohio's economic past, not a gateway to its future. Because of this fact, changing the business tax code should not be done for purely tactical reasons. That is, incremental changes in the code should not be introduced to respond to one perceived problem. The result will be more of what Ohio already has with the code—a jury-rigged system of patches made to an economically outdated foundation of tax policy. Changes should be strategic, tied to specific and economically viable economic development goals that benefit the residents of the state and encourage the long-term fundamentals

[2] Ohio House Bill 283 became effective on June 30, 1999. The bill reduces the assessment rate on the inventory portion of the Tangible Personal Property Tax by one percent per year from 2002 to 2006, depending upon certain conditions. After 2007, the rate will be reduced by one percent per year until it is eliminated, which should be no later than 2031 (Ohio Department of Taxation's *2000 Annual Report*, November 2000: p.144).

of wealth creation. The most important of these goals is enhancing productivity through capital investment, or what is called capital deepening. The changes should also respond to court mandates and the fiscal requirements and responsibilities of state and local government. Changing the business tax code—whether the result is tax reduction or greater business tax equity—is neither politically nor economically feasible without this larger context.

The state has four options in its attempt to rid itself of the Tangible Personal Property Tax and the Corporate Franchise Tax. One is to gradually eliminate these taxes and rely on the proceeds of the General Revenue Fund without levying additional taxes (thereby taking advantage of the natural growth in the state's income and sales tax base and shifting larger shares of the tax burden to voters). The second is to replace the taxes with an expanded sales tax. The third is to hike the state's income tax. A fourth option is to consider a replacement business tax. The state has chosen the first route to reform; however, the fourth should receive serious consideration.

Each of these approaches has problems. First, present business taxes earn too much money to be quickly discontinued without significant budget cuts, and legal and political demands for the funding of public education do not allow these cuts to be made. Second, the suggested reforms shift more of the direct tax burden onto voters at a time when the direct tax burden has been moving from business taxpayers to non-business taxpayers. Third, increases in sales taxes in general are regressive. Fourth, expanding the sales tax to cover food is extremely regressive unless it is accompanied by a means-tested tax credit. Fifth, expanding the sales tax to services may affect the location of high-income producing service firms that export services out of state. Increasing the income tax is a desirable option from an economic perspective, in terms of both vertical and horizontal equity[3] and the efficiency of collection, but such increases are politically contentious and do not respond to the falling share of state and local taxation paid for by business.

There are a number of possible replacement business taxes that can be considered. A successful tax would be one that is horizontally equitable among business establishments, revenue elastic,[4] provide incentives for firms to invest in capital to enhance their productivity, generate enough revenue to maintain business' share of state and local tax collections, and is simple to administer for both the payee and government.[5] A possible replacement for the

[3] Vertical equity means that those with higher incomes pay proportionately more in taxes than do those with lower incomes. Horizontal equity means that those in similar financial circumstances have equal tax burdens.

[4] Elasticity means that tax income grows at least proportionately with increases in the state's economy.

[5] The Ohio Public Expenditure Council provides six principles for tax policy: simplicity, horizontal and vertical equity, competitiveness, economic neutrality, intergovernmental neutrality, revenue productivity, and administrative feasibility. A distillation of different tax principles is contained in *Principles for Evaluating Tax and Revenue Systems*, prepared for the Ohio Department of Education by the Urban Center, Cleveland State University, February 2001.

state-imposed business Tangible Personal Property and Corporate Franchise Taxes is a flat payroll tax, without a cap, paid for by employers. This alternative will be explored in depth later in this chapter.

A possible replacement for the state imposed business Tangible Personal Property and Corporate Franchise Taxes is a flat payroll tax, without a cap, paid for by employers.

We classify taxes, licenses, and fees as paid for by businesses, consumers, or individual taxpayers—who are really non-business taxpayers, or a mix of businesses and individuals. This classification is given in the explanatory addendum at the end of this chapter.[6] The tables in the report list tax collection numbers two ways. Some tables list the current dollar, or nominal dollar, values of tax collections. These numbers are not corrected to account for changes in the purchasing power of the dollar. Dollar figures that are corrected for inflation use 1999 purchasing power.

THE STRUCTURE OF STATE AND LOCAL TAXATION

The Changing Composition of Taxes Paid: 1976 to 1999

As the composition of the state's economy has changed, and as the tax code itself has been modified, there have been major changes in both the sources of tax collections and the real dollar values of state and municipal taxes collected. We graph the percentage share of state and local tax payments made by businesses, consumers (or non-business taxpayers), and mixed sources of tax revenue from 1976 to 1999 in Figure 4-1.

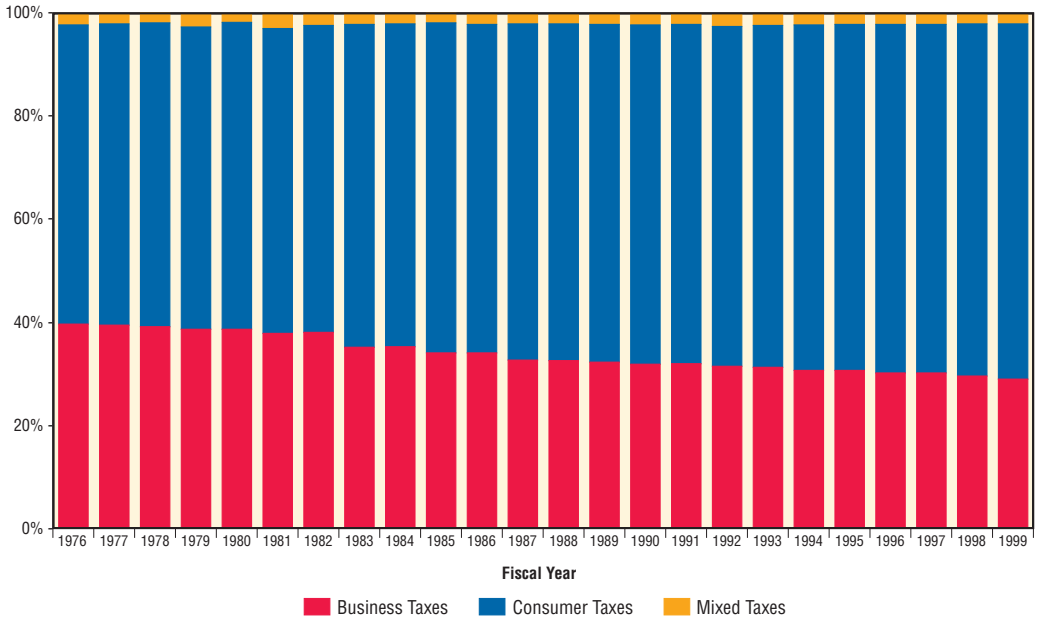
Business' share of the total state and local tax burden has been dropping over time. Figure 4-1 shows this change in composition of tax payments. Business taxpayers paid nearly 40 percent of total state and local taxes in 1976; this figure dropped to 28.9 percent of total payments in fiscal year 1999. Over the same time period, there has also been a shift in the level of government collecting taxes. In the mid-1970s there was a nearly even split in the state and local share of tax collections. In fiscal year 1976, the state collected 49.1 percent of total taxes. The state's share of total tax collections increased in the early 1980s, reaching 58 percent in fiscal year 1984 and then dropping to 56.5 percent in fiscal year 1991. The state's share of total collections has been relatively stable throughout the 1990s. In fiscal year 1999, the state's share of total tax collections was 55.9 percent.

In inflation-adjusted terms, the total value of taxes raised by state and local sources has increased by $13.0 billion, or 69.7 percent, over this 23-year time period (Figure 4-2). Total

[6] The data used to construct the figures in the chapter are available in the data appendix that is posted on the web site developed for this book: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>. The number of each appendix table corresponds to the figure number. The estimates provided in this chapter differ from those in the previous report to the Ohio Economic Development Study Advisory Committee due to the improved allocation algorithms obtained from Ohio's Department of Taxation. These allocation formulae allowed us to reduce the size of the mixed tax category substantially.

Figure 4-1

The Composition of State and Municipal Taxes Paid in Ohio: 1976 to 1999



real tax collections only dipped from 1980 through 1983, reflecting the impact of the recession. Since that time tax collections have recovered, reflecting growth in the state's economy, a shift to more elastic sources of tax revenue, and a change in the composition of taxation. The drop in the proportion of taxes paid for by business is also evident in Figure 4-2.

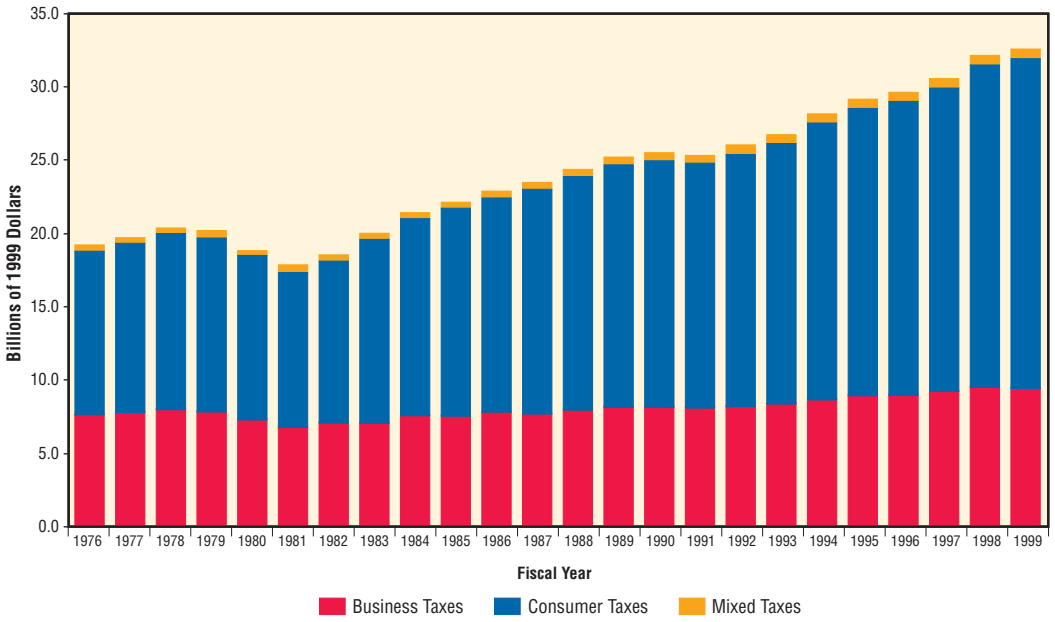
Despite the drop in the share of total state and local taxes paid for by business, the real, inflation-adjusted amount of taxes paid by both sets of taxpayers has increased over time. The detailed data in Appendix Table 4-2 show that businesses paid $9.2 billion in state and local taxes in fiscal year 1999, while non-business taxpayers paid $22.0 billion.[7] The corresponding figures for 1976, in 1999 dollars, are $7.4 billion for business and $10.9 billion for consumers. Figure 4-2 shows the inflation-adjusted dollar amount and composition of state and local taxes paid in Ohio from fiscal year 1976 to 1999. The figure shows that the total dollar amount paid by consumers has increased both in terms of share of total taxes paid and also in real dollar terms. Business tax payments have increased over time in real terms. In the late 1970s, business taxes generated $7.5 billion in revenue. This figure declined in the early 1980s and did not exceed $7.5 billion until 1988. Business tax revenues have increased by $1.0 billion from fiscal year 1993 to fiscal year 1999, showing the strength of the business cycle recovery over that time period.

In real terms the dollar amount of taxes collected from purely business sources and paid to both state and local governments increased by 23.8 percent over this 23-year time period.

[7] The table is posted on the web site: <http://urbancenter.csuohio.edu/ohiomanufacturing.htm>.

Figure 4-2

Inflation-Adjusted Composition of State and Local Taxes Paid in Ohio ($1999)



Despite the drop in the share of total state and local taxes paid for by business, the real, inflation-adjusted amount of taxes paid by both sets of taxpayers has increased over time.

Taxes paid by individuals, or consumers, increased by 101.6 percent, and revenues from mixed tax sources—paid for by both individuals and business—increased by 52.9 percent. Taken together, the total real value of taxes paid to state and municipal governments in Ohio increased by $13 billion since 1976; 65.7 percent of the increase was in taxes collected by state government.

The largest real dollar gains in tax collections came from the state personal income tax ($5.7 billion), followed by the state and local sales and use taxes ($3.8 billion), real property taxes ($1.6 billion), and municipal income taxes ($1.5 billion). The growth in these receipts is contrasted with a proportionately small real increase in receipts from the Corporate Franchise Tax of $55 million and a real decline in Tangible Personal Property Tax revenue of $9.2 million. Part of the decline in the Tangible Personal Property Tax is a result of a change in state tax policy. From 1984 to 1993 there was a scheduled reduction in this tax rate of one percentage point per year (from 35 percent to 25 percent).[8] There have also been changes in depreciation schedules, and as investments in plant and equipment age, new investment has increasingly become tax exempt due to the use of the Enterprise Zone legislation. Receipts from the Motor Fuels Tax—paid by both business and personal fuel users—increased by $265 million.

[8] Ohio House Bill 291 reduced the assessment rate on all tangible personal property from 35 percent in 1983 to 25 percent in 1993 and exempted the first $10,000 of taxable value from taxation (*Revenue Generation for Ohio's Schools: Primary and Secondary Education Funding Overview*: p. O-2, The Urban Center, Cleveland State University, prepared for the Ohio Department of Education, October 2000.)

There has been a steady increase in the share of state and local tax payments made by non-business, or consumer, taxpayers over the 23-year time period covered in our database. In the late 1970s, consumers paid close to 59 percent of all taxes in the state. Their burden has increased to 69 percent of total taxes paid. The burden on business taxpayers has dropped from about 39.6 percent of total payments in 1976 to 28.9 percent in 1999. At the same time there has been a 6.8 percentage point increase in the share of total taxes collected by the state. Mixed taxes, those paid by both business taxpayers and consumers, have fluctuated between 1.7 percent and 2.5 percent of total state and municipal taxes paid over this time period. It is most often in the range of two to 2.2 percent.

State Tax Revenue

Revenues that the State of Ohio uses to fund its operations come from three sources: taxes, transfers from the federal government, and various licenses and fees. Taxes account for 60 per-

Table 4-1

State Tax Revenue Composition by Class: FY 1998 & FY 1999

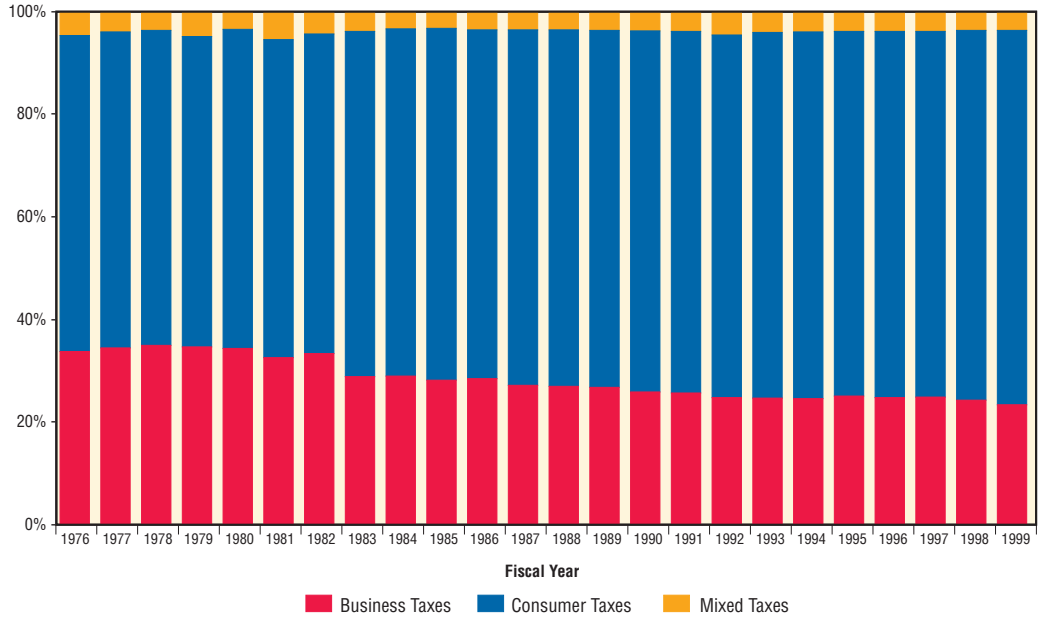
Tax	Class	FY 1998 Net Collections	FY 1999 Net Collections	FY 1998-1999 Biennial Net Collections	% Total Tax Collections
Corporate Franchise*	Business	$1,268,666,276	$1,150,325,834	$2,418,992,110	6.9%
Public Utility Excise*	Business	429,037,152	406,395,210	835,432,362	2.4%
Intangible Personal Property	Business	16,968,370	16,516,024	33,484,394	0.1%
Motor Fuel Use	Business	64,872,934	64,264,622	129,137,556	0.4%
Severance	Business	9,077,704	8,848,550	17,926,254	0.1%
Domestic Insurance	Business	25,280,000	31,000,000	56,280,000	0.2%
Foreign Insurance	Business	112,360,000	108,640,000	221,000,000	0.6%
State Personal Income*	Business	694,615,271	717,380,022	1,411,995,293	4.0%
State Sales & Use*	Business	1,107,020,276	1,165,487,631	2,272,507,907	6.5%
Motor Vehicle Fuel	Business	464,942,261	479,744,376	944,686,637	2.7%
TOTAL BUSINESS TAXES		**$4,192,840,244**	**$4,148,602,269**	**$8,341,442,513**	**23.8%**
State Personal Income*	Consumer	$6,251,537,439	$6,456,420,196	$12,707,957,635	36.2%
State Sales & Use*	Consumer	4,428,081,104	4,661,950,524	9,090,031,628	25.9%
Public Utility Excise*	Consumer	278,944,947	264,223,948	543,168,895	1.5%
Domestic Insurance	Consumer	37,920,000	46,500,000	84,420,000	0.2%
Foreign Insurance	Consumer	168,540,000	162,960,000	331,500,000	0.9%
Motor Vehicle Fuel	Consumer	863,464,200	890,953,842	1,754,418,042	5.0%
Cigarette Excise*	Consumer	296,645,287	290,565,947	587,211,234	1.7%
Alcoholic Beverage Excise *	Consumer	53,065,605	54,464,923	107,530,528	0.3%
Replacement Tire Fee*	Consumer	3,467,080	3,306,419	6,773,499	0.0%
Carbonated Beverage* †	Consumer	91	—	91	0.0%
Resort Area Excise	Consumer	288,853	293,660	582,513	0.0%
Horse Racing*	Consumer	15,782,059	16,529,120	32,311,179	0.1%
Estate*	Consumer	116,577,316	146,548,927	263,126,243	0.7%
TOTAL CONSUMER TAXES		**$12,514,313,981**	**$12,994,717,506**	**$25,509,031,487**	**72.7%**
Motor Vehicle License	Mixed	$620,800,000	$635,500,000	$1,256,300,000	3.6%
TOTAL MIXED TAXES		**$620,800,000**	**$635,500,000**	**$1,256,300,000**	**3.6%**
TOTAL TAX REVENUES		**$17,327,954,225**	**$17,778,819,775**	**$35,106,774,000**	**100.0%**

* Revenues from these taxes go directly to the General Revenue Fund on either an entire or partial basis.
† Repealed as of December 8, 1994.

Source: Ohio Department of Taxation Annual Reports

Figure 4-3

Composition of State Tax Collections by Source: 1976 to 1999



cent of total state expenditures,[9] revenue transferred from federal to state government are 33 percent of the total, while the remaining seven percent comes from various licenses, fees, permits, investments, and miscellaneous income. In inflation-adjusted terms, total state taxes paid increased by 93.3 percent. State tax payments from the business sector increased by 33.7 percent ($1.0 billion) from fiscal year 1976 to fiscal year 1999, while consumer taxes increased by 128.8 percent ($7.3 billion).

Over the 1998-1999 biennium, direct business taxation accounted for 23.8 percent of all of the taxes paid to the state (Table 4-1). The Corporate Franchise Tax was the single largest source of business tax payments at 6.9 percent of the total, followed by business' share of the state's Sales and Use Tax payments at 6.5 percent, and the Public Utility Excise Tax at 2.4 percent of total state tax collections.[10] Figure 4-3 shows how the share of state taxes paid by business has decreased over time, while the share of mixed taxes paid has remained fairly constant.

Consumers, or non-business taxpayers, paid 72.7 percent of total state taxes. State personal income taxes accounted for 36.2 percent of the state's tax revenue over the biennium. The State Sales and Use Tax paid by consumers was 25.9 percent of total state taxes paid.

[9] Data come from different sources and there is a $2 billion difference between reported tax revenue by source—which shows $15.4 billion in state tax revenue—and our accounting for taxes by source —which shows $17.2 bilion of Ohio state taxes collected. Much of this difference is due to the fact that some taxes are collected and reported by fiscal year and others by calendar year.

[10] The Tangible Personal Property Tax is considered to be a local tax.

The local tax burden being carried by consumers has increased over time, but not to the same degree as has happened at the state level.

Local Tax Revenue

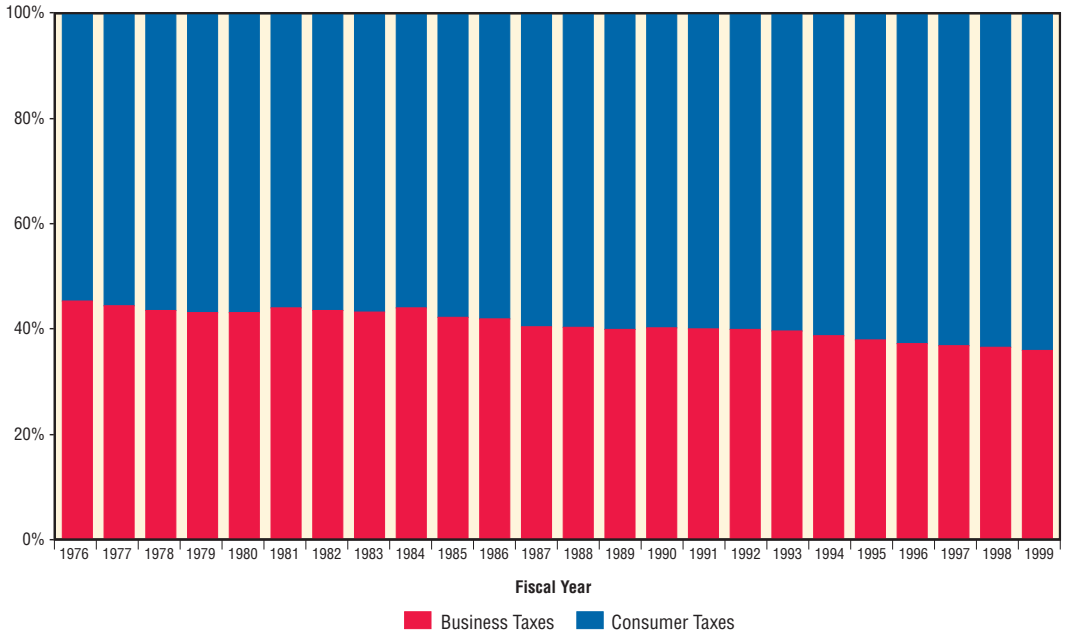
At the local level there are no mixed taxes and the share of the local tax burden carried by consumers has increased over time, but not to the same degree as has happened at the state level (Figure 4-4). While the real, inflation-adjusted local tax take in Ohio has increased by nearly 47 percent from 1976 to 1999, business tax payments have increased by 16.7 percent ($720.1 million), and payments by non-business taxpayers have increased by 72 percent. Local tax payments by consumers have increased by $3.8 billion. The local taxes that have carried the brunt of increased payments are identified in Appendix Table 4-12.

The largest source of local tax payments is residential real property tax payments (in 1999 they were 34 percent of total local payments). Residential property tax payments were followed by municipal income taxes (19.3 percent), business real property tax payments (13.4 percent), business' tangible personal property tax payments (11.2 percent), public utility property taxes (7.1 percent), and then a group of minor taxes.

The amount of municipal taxes directly paid by businesses increased by 16.7 percent (or $721 million) in real terms from 1976 to 1999, while direct payments by consumers (non-business) taxpayers increased by 72 percent, or $3.8 billion.[11] These differential increases in

Figure 4-4

Composition of Local Tax Collections by Source: 1976 to 1999



[11] See Appendix Table 4-11 on the web site.

revenue resulted in shifts in the composition of local tax payments by source. Direct business tax payments equaled nearly 44.8 percent of municipal tax payments in 1976, dropping to 33.9 percent at the end of the time period. The shifts in the local tax burden are partially a result of legislative changes in the tax code and partly due to growth in the income and residential property tax and business tax abatements.

The Tangible Personal Property Tax is declining by legislative design, while business real property tax payments have declined by about two percentage points of the total *share* of local tax payments over the past two decades but have increased in *real absolute dollar terms* by 30.2 percent.[12] In real dollar terms, the only two taxes that have declined are business' Intangible Personal Property Tax, which was eliminated in fiscal year 1997, and the Tangible Personal Property Tax. Business real property taxes have increased by $436 million and business municipal income taxes have increased by $153 million (or 102 percent) from fiscal year 1976 to 1999—more than offsetting declines in business personal property taxes. Over the same time period, consumer municipal income taxes jumped $1.4 billion, and residential real property taxes increased by $1.2 billion.

Public utility property tax payments peaked in fiscal year 1995 and have declined since. They will continue to decline because they have been replaced with a kilowatt-hour tax and inclusion of utilities in the Gross Receipts Tax.[13] This source of tax payments is under severe strain due to competitive pressures triggered by the deregulation of energy prices; however, the replacement taxes were designed to be revenue neutral with some of the direct incidence of the tax being shifted back to utility users.

BUSINESS TAXATION: THE LACK OF HORIZONTAL TAX EQUITY AND MANUFACTURING'S BURDEN

The tax burden imposed by state and local governments on businesses operating in different industries must be approximated because data are not collected on total business tax payments by industry. In addition, accounting measures of business profits are flawed from an economic perspective. Because of these difficulties, tax burden is measured indirectly, employing the principle of horizontal equity to fashion the yardstick.

A tax that is horizontally equitable should be roughly the same for firms in similar circumstances. What makes this principle of equitable taxation hard to use is that "similar circum-

[12] See Appendix Table 4-12 on the web site.

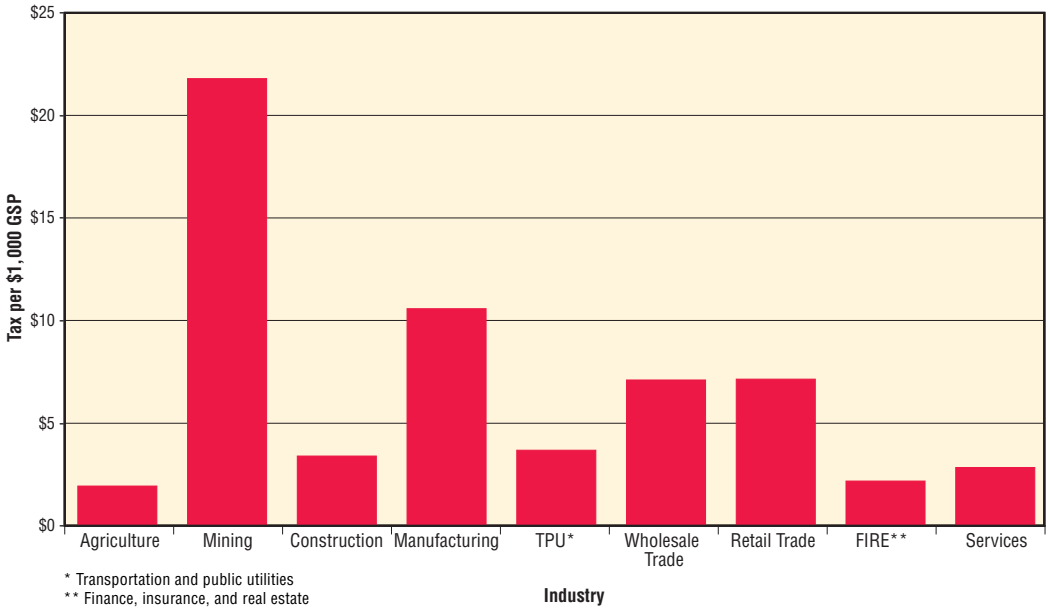
[13] "Electricity Deregulation and the Impact on School Funding," *Revenue Generation for Ohio's Schools: Primary and Secondary Education Funding Overview*: The Urban Center, Cleveland State University, prepared for the Ohio Department of Education, October 2000, page R-2.

stances" is a difficult concept to define. Does this mean equal taxation of firms with the same level of sales, or of profits? Does equal taxation mean a similar percentage tax burden for all businesses regardless of their size or product? How do you treat industries dominated by small firms where owners commingle their personal accounts and expenses with that of their businesses and then compare the results with those of large publicly traded corporations? How is profit measured when accounting profits are managed to minimize tax payments and do not reflect the opportunity cost of invested capital? Most economists favor the use of value added as a measure of "similar economic circumstances" when comparing firms of vastly different sizes, when measuring industries that use different production methods, or when examining industries with different legal organizational structures. (Value added is the amount of total value that the firm or industry adds to the product at its stage of the production process.) We use estimates of Gross State Product (GSP) at the major division (two-digit) level of the Standard Industrial Classification (SIC) as an approximation of value added.[14]

We restricted our efforts at approximating the business tax burden of industries to the two most important business taxes—the Tangible Personal Property Tax and the Corporate Franchise Tax—because data on business tax payments that had to be allocated by formula do not exist by major division of the SIC, and because these are the two major business taxes that are directly affected by state public policy.[15] The proportion of value added accounted

Figure 4-5

Tangible Personal Property Tax and Corporate Franchise Tax Paid per $1,000 in GSP in 1998



[14] The data were obtained from the US Department of Commerce, Bureau of Economic Analysis.

[15] The Domestic and Foreign Insurance Tax yields $355 million in revenue, of which 40 percent is allocated to businesses, yielding $142 million in business tax revenues. This cannot be attributed to the Finance, Insurance

for by these two taxes at the two-digit level of the SIC is estimated. Each of these taxes is expressed as the dollar amount of taxes paid for each $1,000 of GSP (which we call the "effective tax rate" as a simplified term for the calculation) and is graphed for 1998 in Figure 4-5. Table 4-2 is the source for the data graphed in Figure 4-5 and lists the effective rates for the Tangible Personal Property Tax, the Corporate Franchise Tax, and the two taxes combined for each of the major industrial divisions. Figure 4-6 is a graph of the effective tax rate for five of the major divisions from 1980 to 1998.[16]

There are major disparities in the proportion of GSP each industry devotes to the payment of these two major business taxes. The data displayed in Figure 4-5 show that Ohio's business taxes are unequal across the major industrial divisions, with the mining, manufacturing, retail, and wholesale industries carrying a disproportionately large share of the state's business tax burden based on their contributions to GSP. Finance, insurance and real estate (FIRE), agriculture, and services carry much lower tax burdens. Mining pays about $21.39 per $1,000 of GSP in Tangible Personal Property Taxes and Corporate Franchise Taxes; manufacturing pays $10.35; and wholesale pays $6.93 (see Table 4-2). There is an economically sound reason why mining pays higher state taxes based on the negative spillovers, or externalities, it imposes on the environment. Mining generates a need for monitoring and regulation of

Table 4-2

Tax Incidence and Rank Order of Tax Incidence per $1,000 of Gross State Product by Major Industrial Division in 1998

Industrial Division	Tangible Personal Property Tax		Corporate Franchise Tax		Combined Tax Burden	
	Tax Per $1,000 of GSP	Rank	Tax Per $1,000 of GSP	Rank	Tax Per $1,000 of GSP	Rank
Agriculture	0.80	7	1.04	9	1.84	9
Mining	11.50	1	9.89	1	21.39	1
Construction	0.69	8	2.59	5	3.28	6
Manufacturing	5.93	2	4.42	2	10.35	2
Transportation & Public Utilities	0.88	6	2.68	4	3.56	5
Wholesale Trade	3.47	4	3.45	3	6.93	4
Retail Trade	4.38	3	2.59	5	6.97	3
FIRE*	0.67	9	1.42	8	2.08	8
Services	1.10	5	1.63	7	2.73	7
Average	3.27		3.30		6.57	
Standard Deviation	3.64		2.68		6.24	
Coefficient of Variation (CV)	1.11		0.81		0.95	

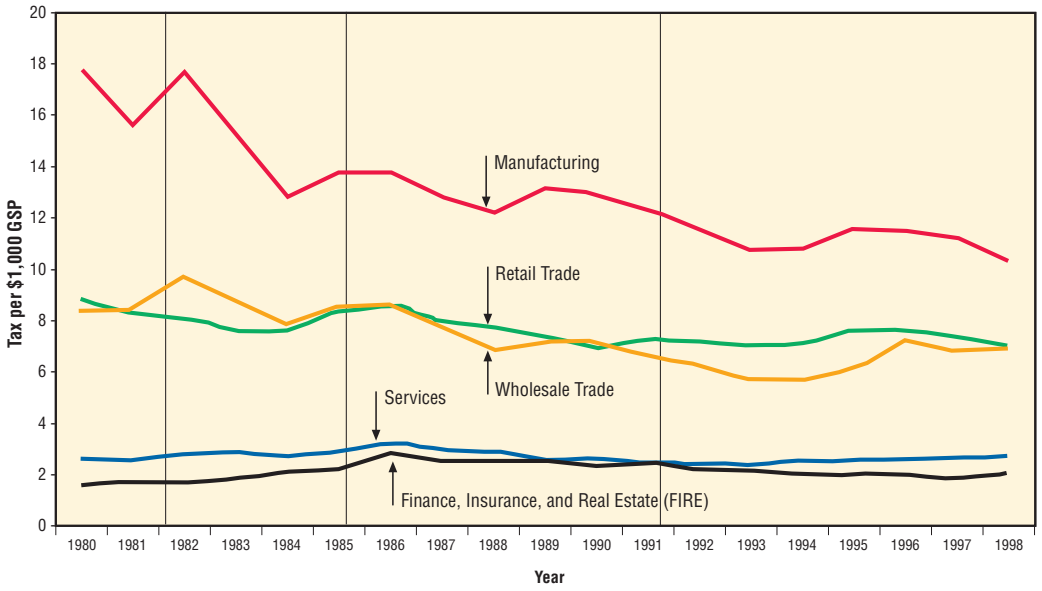
* FIRE represents finance, insurance, and real estate

and Real Estate (FIRE) Industry because it is passed back to business insurance policy holders. There are business intangibles taxes paid by the FIRE industry, but they amounted to $16 million in Fiscal Year 1999 and do not affect the tax calculations in this section to any meaningful degree.

[16] Appendix Table 4-6 contains the data graphed in Figure 4-6. The historical data for the effective rate of taxation of the Tangible Personal Property Tax by major division is given in Appendix Table 4-14. The data on the Corporate Franchise Tax is in Appendix Table 4-15. All are posted on the web site.

Figure 4-6

Tangible Personal Property Taxes and Corporate Franchise Taxes Paid per $1,000 GSP by Sector: FY 1980 to 1999 ($1999)



worker safety in addition to monitoring, regulation, and reclamation of land and water quality. The case for taxing manufacturing and wholesale at a much higher rate than the services and finance industries is more difficult to justify on economic grounds.

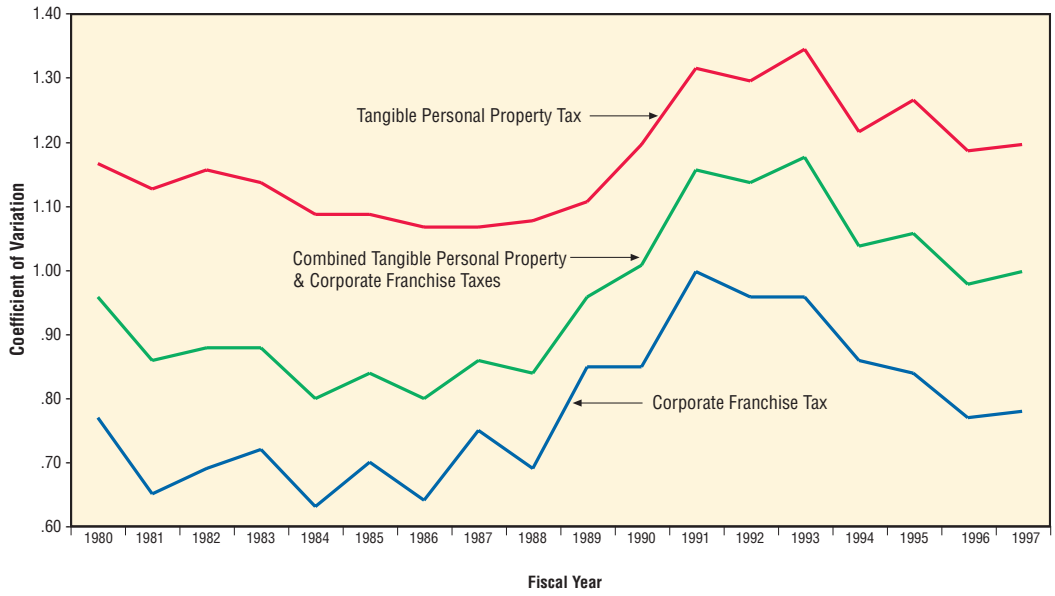
The state's effort to lower the effective rate of taxation on manufacturing is clearly demonstrated in Figure 4-6. The effective tax rate on manufacturing is slowly approaching the level of taxation experienced by retail sales and wholesale trade. Despite this movement, the tax rate remains $3 per thousand dollars of GSP greater than the other two sectors and more than $7 per thousand dollars greater than the effective rate for services.

The horizontal equity of the business tax burden has followed a distinct long-term trend. We plot a summary measure of horizontal tax equity, called the coefficient of variation (CV), from 1980 to 1998 in Figure 4-7.[17] As the CV increases in numerical value, measured inequality becomes larger. The effective business tax rate across industries generally became more equitable from 1980 to 1986. The business tax burden then became more inequitable beginning with the economic recovery of 1986 until 1993. Since 1993 business taxes have become more equitable, but inequality is still above the levels that existed in the mid-1980s when the run-up in tax inequality began.

[17] The Coefficient of Variation (CV) is a measure of the spread of a distribution. It is calculated by dividing the standard deviation of a distribution by its mean.

Figure 4-7

Coefficient of Variation of the Distribution of Business Taxes by Major Industrial Division: 1980 to 1997



The major industrial divisions that pay high tangible personal property taxes tend to be the same divisions that pay high corporate franchise taxes.

The rank orderings of the effective tax rates listed in Table 4-2 and the CVs demonstrate that the pattern of incidence of the two taxes is reinforcing. In other words, the incidence of the Corporate Franchise Tax does not offset the burden of the Tangible Personal Property Tax. The major industrial divisions that pay high tangible personal property taxes tend to be the same divisions that pay high corporate franchise taxes. The coefficient of variation indicates that the Tangible Personal Property Tax is about 40 percent more inequitable than the Corporate Franchise Tax. While the CV for the Corporate Franchise Tax in 1998 was 0.81—indicating that it is more horizontally equitable than the Tangible Personal Property Tax, which had a CV of 1.11—the CV for the combination of the two taxes is a very high 0.95.

The Tangible Personal Property Tax generated $1.6 billion in revenue in fiscal year 1999, making it an important source of tax revenues for local governments. However, the tax has four major problems.[18] First, it places an unequal burden on industries that hold high values of inventory and are capital-intensive (i.e., mining, manufacturing, and trade). Manufacturing and wholesale distribution are industries where Ohio has a particular competitive advantage due to its location and history, although that advantage has eroded over the past 20 years. Locations in the state face competition for businesses that did not exist when the tax code was formulated. Second, the tax provides a disincentive to invest in equipment and, as

[18] These problems are discussed by Roy Bahl in "Taxation in the Economy: A Plan for Reform," in Bahl (ed.) *Taxation and Economic Development: A Blueprint for Tax Reform in Ohio* (Columbus, OH: Battelle Press, 1996) pp. 27, 29, 37, 53-57, 511-578, and 699-750.

The [Tangible Personal Property] tax provides a disincentive to invest in equipment and, as such, retards growth in worker productivity.

such, retards growth in worker productivity—which is key to increasing incomes in the state. (The state's economic development programs have offset some of these disadvantages, but the way they accomplish this raises additional questions of horizontal tax equity and inter-jurisdictional tax competition.) Third, the tax is the business community's second largest payment to public education, after local real property taxes. School districts receive about 70 percent of the receipts from the Tangible Personal Property Tax. From the perspective of economic efficiency, there is a major problem with dedicating the Tangible Personal Property Tax to the school jurisdiction that houses the business. There is no connection between this tax payment and the benefit businesses receive from the services paid for by the tax. Businesses operate in regional labor markets and do not restrict their hires to the products of the particular school system where they happen to be paying taxes. Fourth, the tax is state mandated, but locally received (revenues are returned to the school district that houses the business). This means the tax is not redistributed by the state to meet patterns of need, and it encourages municipalities to engage in competition for business properties that can be taxed, which is a major disincentive for regional economic development cooperation and overall spatial economic efficiency.

The inventory component of the Tangible Personal Property Tax has been identified as a particularly difficult tax in terms of horizontal equity among industries and is a major stimulus for tax abatement and foreign trade zone activities to offset the tax cost disadvantages of operating distribution facilities in Ohio compared to competing states.[19] The tax cannot simply be eliminated because it provides a large stream of revenues to local school districts. The Legislative Budget Office estimated that in 1997 the inventory portion of the tax yielded $672.5 million to local government; $481.5 million of this amount was received by school districts.[20] (If the inventory component of the tax were eliminated, some of the loss would be picked up by the State's General Revenue Fund.) The non-inventory component of this tax also offers firms a disincentive to recapitalize and acts as a brake on the growth in productivity. The size of these effects cannot be estimated.

Consideration has been given to eliminating the inventory component of the Tangible Personal Property Tax (as opposed to the currently legislated gradual phase-out) as a response to interstate competitive pressures. While this will help ease the problems faced by those firms in the trade sector (wholesale and retail trade), it does not ease the larger problem of the economic effects of taxing assets, particularly capital equipment. Removing just the inventory component of this tax is a tactical move that does not answer three strategic problems

[19] The tax also has large administrative costs for businesses. Every year the business must invest time, energy, and money in counting inventory and evaluating the value of its capital goods. It is also difficult and expensive for the state to administer and monitor.

[20] Frederick Church, Memorandum to Representative E. J. Thomas, "Fiscal Impact of Eliminating the Inventory Portion of the Tangible Property Tax or Eliminating the Entire Tangible Property Tax," November 16, 1998.

the state should confront. First, while it will ease the business tax burden for the trade sector (helping large distribution facilities in particular), it does nothing to address the inequitably heavy taxation of firms that are capital intensive. Horizontal business tax equity will only be marginally improved. Second, removing the inventory component of the Tangible Personal Property Tax does nothing to promote productivity gains through the use of capital. This will continue to retard earnings increases that come from productivity gains. Third, this tactical response to a problem with the tax code does not address how the business community helps to pay for public education and how those funds are distributed throughout the entire labor markets that firms use.

The Corporate Franchise Tax also presents difficulties in furthering the state's economic development because of disincentives offered by the tax. The tax is either a corporate profit tax or a tax on a firm's net worth. It serves as a deterrent to capital investment, thereby weakening productivity enhancements in the state. The net worth component of the tax is an impediment to capital-intensive start-up operations, especially those that are likely to lose money for a period of time. The most egregious deterrent to entrepreneurship caused by this tax is the case of a capital-intensive start-up firm that just received venture capital financing but has not yet begun to generate revenues. The State of Ohio taxes the venture capital funding under the net worth provisions of the tax.

The discriminatory effect of the structure of the Corporate Franchise Tax is clearly seen in Table 4-2. Mining, manufacturing, and wholesale trade are the three most heavily taxed sectors of the economy as a percentage of GSP. Manufacturing is taxed at $4.42 per $1,000 of GSP; wholesale trade is taxed at $3.45 per $1,000; and mining is taxed at $9.89 per $1,000 of GSP. This is compared to $1.63 for services and $1.42 for finance, insurance, and real estate (FIRE). The tax is not horizontally equitable and it is distorting—the tax offsets historical and geographic economic strengths of the state.

The third business tax that causes distortions is the municipal income tax on business profits.[21] Municipalities can levy a tax on net business profits that are attributable to operations conducted within their borders. Townships cannot. This tax triggers accounting and compliance costs for multi-site operations when they allocate where the business makes its profits (this is also a problem shared with the Tangible Personal Property Tax). The business profits component of the Municipal Income Tax provides an incentive for firms to locate their high-valued operations in townships, where the tax cannot be levied. Because no data are available on the business portion of this tax, its impact cannot be assessed quantitatively.

[21] Sally Wallace and Barbara Edwards, "State and Local Income Taxes," in Bahl (ed.) *Taxation and Economic Development: A Blueprint for Tax Reform in Ohio* (Columbus, OH: Battelle Press, 1996) pp. 316-329.

CONCLUSION AND POLICY PROPOSAL

The current system of business taxation in Ohio treats businesses that make similar contributions to Gross State Product differently, violating the public finance principle of horizontal equity. The tax code also provides disincentives to invest in capital, hurting productivity and income growth, and putting those portions of the state's economy in which it has natural and historical competitive advantages at a disadvantage. Additionally, the tangible personal property, corporate franchise, and business profit component of the Municipal Income Tax are difficult and expensive for both business and government to administer. Trends in the Tangible Personal Property Tax and the Corporate Franchise Tax, and to some extent the local taxation of business profits under the Municipal Income Tax, leave the State of Ohio with a conundrum. These taxes are major sources of revenue, and abolishing them in a tax environment where business' share of the tax burden has been dropping is problematic. Additionally, the Tangible Personal Property Tax is a major funding source for public education; abolishing the tax at a time when the business community is leading arguments that the product of those very same school systems needs to be improved or the development of the state's economy will falter increases the difficulty of removing the tax. Yet the state's Supreme Court has ruled that school finance needs to become less reliant on local property tax sources. These facts argue for redesigning or abolishing the Tangible Personal Property and Corporate Franchise Taxes and substituting a new tax source for them.

The Gordian knot of business tax policy in Ohio is woven from four strands: (1) the interstate competitive environment has changed since the tax code was originally written; (2) Ohio's Enterprise Zone program is required to offset the interstate competitive disadvantage caused by these taxes, yet it promotes intra-state competition for business locations; (3) the two business taxes in question provide a significant volume of tax revenue; and (4) the state's Supreme Court has focused on the interjurisdictional incidence of these taxes in its decision on school funding.

The first strand in this policy knot is the state's reliance on a business tax code that reflects the competitive environment as it existed in the years immediately following the Second World War. The code makes four assumptions about the competitive environment in which the state's economy operates that are no longer accurate:

1. The code assumes that Ohio has no real competitors for capital-intensive manufacturing, distribution, and mining;
2. The code taxes capital, profits, and inventory—the ingredients required for jobs that provide high wages;

3 The code provides disincentives for increasing productivity and new business and industry formation;

4 The code creates horizontal inequities between businesses in similar financial circumstances based on the industries the firms are in and the capital they use in the production process.

The result is a tax code that hurts the state in the area of its greatest competitive advantage and a tax code that lowers the potential incomes of the state's residents.

The result is a tax code that hurts the state in the area of its greatest competitive advantage and a tax code that lowers the potential incomes of the state's residents.

The second of the knot's strands is contributed by Ohio's economic development programs. The Enterprise Zone program in particular is designed to offset the uncompetitive costs that the locally assessed Tangible Personal Property Tax and the state's Corporate Franchise Tax impose, but the taxes are offset by crafting specialized *ad hoc* deals for individual establishments. These tax deals create additional horizontal inequities among businesses that compete in the same industry.

The knot's third strand comes from the success of the Tangible Personal Property Tax as a revenue source. This tax contributes about three-quarters of a billion dollars to public education, which makes it difficult to give up unless a substitute source of revenue is found or funding for public education is cut.

Public policies and the business community contribute to the fourth and final strand in this knot. This is the strongest of the four because it is itself woven from four threads. The first comes from Ohio's Supreme Court, which has mandated that the state's system of public educational finance is too reliant on the property tax.[22] The Court found that reliance on property wealth for public school finance creates inequities among school districts—one of the major taxes in question is the Tangible Personal Property Tax. The Court has mandated that the system of school finance be more equitable across jurisdictions. The second thread in the public policy strand comes from those school districts that have large inflows of income from the Tangible Personal Property Tax. They—and their representatives—do not want to see that flow diminished. The third thread comes from the business community, which argues that the system of public education is producing too many sub-standard graduates, especially from districts that have either low per-pupil sources of property wealth or large concentrations of pupils from low-income families. The final thread comes from the falling share of total state and local taxes that is paid by business. It is politically difficult for the business community to argue for shifting a greater share of state and local government fi-

[22] See *Revenue Generation for Ohio's Schools: Primary and Secondary Education Funding Overview*: Sections R and S. The Urban Center, Cleveland State University, prepared for the Ohio Department of Education, October 2000.

At a minimum, whatever system of taxation is enacted should not tax capital, because a major goal of state economic policy should be to encourage capital deepening and increased productivity.… Nor should any system of taxation discourage new firm formation.

nances onto the voting taxpayer while expressing profound dissatisfaction about the product of a publicly provided service that is also the largest economic development investment made by the public sector.

The solution is to cleave the knot by moving to a broader-based system of business taxation.[23] It is important that the state engage with the business community to determine the share of state tax collections that can reasonably be assessed on Ohio's businesses and the form or forms the tax will take. At a minimum, whatever system of taxation is enacted should not tax capital, because a major goal of state economic policy should be to encourage capital deepening and increased productivity. The tax must serve as a continued spur to private business to continue making productivity-enhancing investments as they have over the past decade and a half. Machinery, equipment, capital, and inventory should not be taxed. Nor should any system of taxation discourage new firm formation. These are the legs upon which the evolution of Ohio's economy will be built. Business taxation in the state should be horizontally equitable, encourage productivity, be both stable over the business cycle and revenue elastic, be economically neutral in terms of labor and capital resources used in the production process (which may come into conflict with the goal of encouraging productivity), and be responsive to the mandates of the state Supreme Court. A final criterion is that the tax be administratively easy to assess, pay, and collect. One candidate tax is a statewide, nonabatable flat tax paid by employers on wage and salary income.[24]

There are two ways of enacting a flat tax on wages and salaries paid by business. The first is to replace the Tangible Personal Property Tax with the flat tax. The other is to replace both the Tangible Personal Property and the Corporate Franchise Taxes (the business profits component of the Municipal Income Tax could also be replaced with a piggy-back provision to the flat tax). The size of the corporate flat tax was estimated using data for 1998. The goal of the modeling was to identify the flat tax rates that could replace the two major business taxes that year and then to examine the horizontal equity of this tax across industries.

The calculations displayed in Table 4-3 show the taxes rates required to replace the two major business taxes used in Ohio.[25] A flat tax of 0.86 percent on business earnings (or wages

[23] There is a clash between political reality and economic logic, however. Political reality and popular perception is that the entity that writes the tax check actually pays the tax. This is the logic upon which this chapter was written. Economic reasoning leads to a different conclusion. In most cases a business never pays a tax, despite the fact that it writes the checks. Part of its tax burden is passed forward to its customers in the form of increased prices. The second portion of the tax is passed backwards to its workers in terms of slightly lower wages. If a tax regime is too high or if the business cannot pass the tax forward to its customers, the firm will stop operating at that location by either moving or closing, losing its business to its out-of-state rivals. The same is true if the firm cannot pass the tax back to its workers because the workers can get higher net wages elsewhere—either in other industries in the region or by moving out of state.

[24] This can be thought of as a tax on all income reported on IRS forms 1099 and 1040.

[25] The earnings data are from the Regional Information System of the US Bureau of Economic Analysis for calendar year 1998.

and salaries) would have raised sufficient revenues to replace the Tangible Personal Property Tax in 1998 and an additional tax of 0.52 percent on earnings would replace the Corporate Franchise Tax, for a combined flat tax rate of 1.38 percent. The combined tax would have raised about $2.5 billion in tax revenue, $1.6 billion as a replacement for the Tangible Per-

Table 4-3

Estimated Tax Revenues From the Flat Tax Compared to Current Tax Revenues From the Tangible Personal Property Tax and Corporate Franchise Tax, Variance by Major Industrial Sector

	1998 REVENUES (IN 1999 DOLLARS)		
Industrial Sector	**Tangible Personal Property (TPP) Taxes**	**Corporate Franchise (CF) Tax**	**Total TPP & CF Tax Revenues**
Agriculture & Forestry	4,362,749	4,056,626	8,419,375
Mining	25,626,924	13,926,403	39,553,326
Construction	12,994,866	35,218,197	48,213,063
Manufacturing	823,575,309	426,457,642	1,250,032,951
Transportation	33,020,336	72,798,544	105,818,880
Wholesale Trade	130,073,077	86,034,847	216,107,924
Retail Trade	219,586,014	85,047,872	304,633,886
Finance	48,997,498	76,872,572	125,870,070
Services	101,567,371	102,692,688	204,260,059
Unknown or Unclassified	160,101,935	30,117,157	190,219,092
All Sectors	1,559,906,078	933,222,548	2,493,128,626
	FLAT TAX ON EARNINGS		
	0.86% Tax Replacing Tangible Personal Property Taxes	**0.52% Tax Replacing Corporate Franchise Tax**	**1.38% Tax Replacing Both the TPP and Corporate Franchise Taxes**
Agriculture & Forestry	8,330,786	4,983,940	13,314,726
Mining	7,305,962	4,370,833	11,676,795
Construction	102,180,427	61,130,013	163,310,440
Manufacturing	467,955,826	279,957,194	747,913,019
Transportation	104,426,747	62,473,886	166,900,634
Wholesale Trade	119,555,187	71,524,560	191,079,748
Retail Trade	168,227,578	100,643,091	268,870,668
Finance	125,576,094	75,126,602	200,702,696
Services	456,347,470	273,012,430	729,359,900
Unknown or Unclassified			0
All Sectors	1,559,906,078	933,222,548	2,493,128,626
	VARIANCE (FLAT TAX LESS 1998 REVENUES)		
	Tangible Personal Property Tax	**Corporate Franchise Tax**	**Combined**
Agriculture & Forestry	3,968,038	927,313	4,895,351
Mining	-18,320,961	-9,555,570	-27,876,531
Construction	89,185,562	25,911,816	115,097,377
Manufacturing	-355,619,483	-146,500,448	-502,119,932
Transportation	71,406,412	-10,324,657	61,081,754
Wholesale Trade	-10,517,890	-14,510,287	-25,028,177
Retail Trade	-51,358,436	15,595,219	-35,763,217
Finance	76,578,596	-1,745,970	74,832,626
Services	354,780,099	170,319,742	525,099,841
Unknown or Unclassified	-160,101,935	-30,117,157	-190,219,092
All Sectors	0	0	0

Note: The FY 1998 Corporate Franchise Taxes (in 1999 dollars) as reflected above are based on tax revenues as opposed to the tax collection figures shown in Table 4-1 and Appendix Table 4-3. The reason for this is that collection figures were not available by industry type.

sonal Property Tax and $900,000 as a replacement for the Corporate Franchise Tax. These figures do not include earnings taxes on nonprofit organizations or governmental units.

There are differences in the industrial incidence of the flat tax compared to the current system of business taxation. The top panel of Table 4-3 shows the incidence of business taxation by major industrial sector in 1998. The second panel shows the estimated incidence of the flat tax on earnings that businesses would pay under this proposal. The final panel displays the differences between the current and proposed scheme of business taxation. Taxes would decrease on the manufacturing sector of the economy by one-half billion dollars. Retail trade would see their taxes decline by $36 million, and wholesale trade's taxes would drop by nearly $25 million. The mining sector would experience a drop in taxation of $28 million. The service sector would experience a tax increase of $525 million; taxes paid by the construction industry would go up by $115 million; the finance, insurance and real estate industry's taxes would increase by $75 million; the transportation and public utilities sector would see their business taxes go up by $61 million, and the agriculture and forestry industry would see an increase of about $5 million.

The distributional equity, or fairness, of the flat tax proposal is shown in Table 4-4. The incidence of taxation is much more equal under the flat tax than under the current system. Comparing the coefficients of variation in the two tables (4-2 and 4-4) reveals a striking difference, showing a great move towards tax fairness. The coefficient of variation decreases

Table 4-4

Projected Horizontal Equity of the Flat Tax by Industrial Sector

Estimated Tax Revenues per $1,000 of Gross State Product

Industrial Sector	.86% Tax Rate Replacing Tangible Personal Property	.52% Tax Rate Replacing Corporate Franchise Tax	1.38% Tax Rate Replacing Both Taxes
Agriculture & Forestry	2.19	1.31	3.50
Mining	5.32	3.19	8.51
Construction	7.71	4.61	12.32
Manufacturing	4.98	2.98	7.97
Transportation	3.95	2.36	6.31
Wholesale Trade	4.93	2.95	7.88
Retail Trade	5.25	3.14	8.40
Finance	2.37	1.42	3.79
Services	7.44	4.45	11.89
Other			
All Sectors (average)	5.04	3.02	8.06
Standard Deviation	1.91	1.14	3.06
Coefficient of Variation (CV)	0.38	0.38	0.38

by about two-thirds. In fact, this estimated move to tax equalization is understated because it is based on a simple average across all sectors and is not weighted by each sector's share of Gross State Product. If weights were applied, a greater move towards tax fairness would be shown because the manufacturing and retail industries would have a much greater weight in the calculation than with a simple average.

The flat tax rate was estimated at the value required to replace the Tangible Personal Property and Corporate Franchise Taxes in 1998. If a flat tax of 1.50% were levied, a cushion for revenue shortfalls would be provided and any surplus could be applied toward State Income Tax relief. The flat tax proposal compares favorably with the current system of business taxation on the other yardsticks of tax efficiency discussed earlier in this chapter. The tax is vastly simpler and cheaper to compute and administer for both business and government. The tax provides horizontal tax equity, is neutral in terms of vertical equity, and avoids the mist and confusion of defining what is a business profit under the tax code. Preliminary estimates show that the flat tax is revenue elastic and cyclically more stable than the current business taxes. The tax shift is not economically neutral. The current system is a disincentive toward capital deepening and holding inventory (thereby hurting both the production and distribution functions of the production process), and it is a disincentive to retain earnings. The flat tax offers a minor disincentive to the use of labor in favor of capital, but the flat taxes act as an incentive to increase productivity and encourage capital and new firm formation.

The form business taxes take is a public policy choice, but it is a choice between a minor disincentive on hiring and a significant incentive to boost worker productivity. The long-term interest of the state and its residents should favor capital deepening and productivity enhancement because they lead to higher incomes.

Addendum

Assignment and Allocation of State and Local Taxes

Taxes Collected by the State of Ohio
(1976 to 1998)

Taxes Paid by Businesses:

- Corporation Franchise
- Public Utility Excise[4] (60.6%)
- Intangible Personal Property*
- Highway Use (Repealed 1/1/91)
- Motor Fuel Use
- Severance
- Domestic Insurance[2] (40%)
- Foreign Insurance[2] (40%)
- Coal Consumption (Repealed in 1979)
- State Personal Income[1] (10%)
- Motor Vehicle Fuel[3] (35%)
- State Sales and Use[5] (20%)
- Local Sales and Use[5] (20%)**
- School District Income[7] (6.3%)**

Taxes Paid by Consumers:

- State personal Income[1] (90%)
- Resort Area Excise (Effective 6/30/93)**
- Cigarette Excise
- Local Cigarette Excise**
- Alcoholic Beverage Excise
- Replacement Tire Fee (Effective 12/1/93)
- Carbonated Beverage (Repealed in 1994)
- Local Alcoholic Beverage**
- Horse Racing
- Soft Drink Mix†
- Estate††
- Domestic Insurance[2] (60%)
- Foreign Insurance[2] (60%)
- Motor Vehicle Fuel[3] (65%)
- Public Utility Excise[4] (39.4%)
- State Sales and Use[5] (80%)
- Local Sales and Use[5] (80%)**
- School District Income[7] (93.7%)**

Taxes Paid by Both Business & Consumers (Mixed):

- Motor Vehicle License Tax**

* Collected both on the state level and the local level up until 1986. Collected only at the state level beginning in 1987.
** Taxes collected by the state but that go directly to local revenues. No revenues go to the state.
† This became known as the Carbonated Beverage Tax, effective February 1, 1993.
†† Locally collected, but 36% of the net collections goes to the State General Revenue Fund.

Taxes Collected by Ohio Localities
(1976 to 1998)

Taxes Paid by Businesses:

- Tangible Personal Property
- Intangible Personal Property (until 1986)
- Public Utility Property
- Municipal Income[6] (10%)
- Real Property[8] (70%)
- Lodging[9] (33%)

Taxes Paid by Consumers:

- Admissions Excise
- Lodging[9] (67%)
- Manufactured Home
- Estate*
- Municipal Income[6] (90%)**
- Real Property[8] (30%)

* 64% of net collections goes to localities and 36% goes to the State General Revenue Fund
**This tax is generally imposed on wages, salaries, and other compensation earned by residents of the municipality and by non-residents

The table in this exhibit lists the various state and local taxes that are assessed in Ohio and our assignment of those taxes as being paid for by businesses, by non-business taxpayers (consumers), or by a mix of business and non-business taxpayers. In a number of cases tax payments are mixed, but we were able to allocate the payments between businesses and consumers based on a series of allocation rules using methods established by the Advisory Commission on Intergovernmental Relation (ACIR) in 1980 and an early 1992 business share analysis done by the consulting firm of Levin and Driscoll (L&D). Some allocations were established by Ohio's Department of Taxation.

[1] State Income Tax

Including 100 percent of personal income tax in the State/Individual section does not reflect taxes paid by partnerships, subchapter S corporations, and other taxpayers using federal schedule C. Levin and Driscoll allocated that percentage of the income tax collections that can be attributed to business in 1987 and 1989. L&D and the state calculated the percentages at six percent and 6.3 percent, respectively. Since these taxpayers typically have relatively higher incomes, they tend to be taxed at higher than average marginal tax rates. Therefore, using a marginal tax rate of five percent, rather than an average tax rate of three percent (the overall average income tax rate), the state calculated the business share of the personal income tax to be 10 percent.

[2] Insurance Taxes

The state allocates money from insurance tax payments between business and non-business insurance policy holders because these taxes are gross receipts taxes, paid as a percentage of total premiums received. The state feels these taxes should be allocated based on the source of the premium payment. The state employed data on business and non-business property and casualty insurance policy purchases published in the 1990 *Statistical Abstract of the United States* to establish the allocation of insurance tax payments. Businesses accounted for 40 percent of the premium volume and non-business (consumer) policyholders were the other 60 percent of the policyholders. The Ohio Institute of Insurance indicated that annual life insurance premiums are roughly proportional to property and casualty insurance payments. Therefore, the state uses 40 percent as the business portion of these insurance taxes as well.

[3] Motor Vehicle Fuel Tax

An allocation of the entire tax to individuals does not reflect fuel used by trucks, as well as fuel used in corporate fleets. L&D allocate 35 percent of motor vehicle fuel usage to businesses. This allocation is predicated upon the finding that 17 percent of all taxed motor fuel in Ohio is diesel. Other indicators (conversation with dealers by L&D and an article in *Fortune Magazine)* indicate that about 22 percent of vehicle purchases were for business use. The state used this data to assign 35 percent of the tax to businesses (17 percent from diesel fuel consumption and 22 percent of the remaining 83 percent being assigned to businesses).

[4] Public Utility Excise Tax

The state believes this tax should be allocated between business and individuals based on usage. The *Ohio Energy Data Report*, published by Ohio's Public Utility Commission, showed that business and commercial customers account for 70.7 percent of electricity usage and 54.7 percent of natural gas usage. Local telephone receipts based on the *Telephone Engineer and Management Directory* contained an estimate that 25.3 percent of all access lines in the state are for business consumers. The state applied each of these percentages to that utility's share of the excise tax to allocate 60.6 percent of excise tax payments to businesses.

[5] State and Local Sales and Use Tax

ACIR indicates that 15 percent of sales tax is to business. L&D, in a study done 20 years later, shows that the percentage is closer to 30. L&D use data from specific components of the sales tax and the judgment of sales tax experts, and choose to put 20 percent as the business share. The state feels that the percentage may be a little higher, but has opted to use a 20 percent allocation to business.

[6] Municipal Income Tax

The ACIR allocated 15 percent of municipal income tax payments to business. Officials at the Municipal League stated that businesses pay about 20 percent of municipal income taxes. The state contacted several income tax divisions in municipalities across the state to provide their estimates of businesses' share of municipal tax payments. They reported the following business shares of municipal tax payments in Ohio:

Columbus	9.6 %
Toledo	9.5 %
Cincinnati	11.4 %
Chillicothe	8.0 %
Central collection agency	6.8 % Cleveland
	7.2 % Cleveland Suburbs (not including partnership receipts)

Based on these collection numbers, the state chose to use 10 percent as the business share of the municipal income tax payments statewide.

[7] School District Income Tax

The ACIR did not account for school district income taxes since they did not exist at the time of their report. L&D use six percent, the same percentage used in their state income tax calculation, as the business share of this tax. The state uses 6.3 percent, which reflects newer data. We apply this percentage.

[8] Real Property Tax

The state estimates that 30.4 percent of real property tax payments are made by businesses. We estimate that business pays 30 percent of real property taxes. This estimate is based on our analysis, which breaks down real property into its tax classes: Class I (residential and agriculture) property and Class II property.

[9] Lodging Tax

The state allocates 33 percent of the lodging tax to business. This judgment does not reflect any solid data analysis. It is an acknowledgement that business does pay a portion of this tax.

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