Comparative High-Technology Industrial Growth: Texas, California, Massachusetts, and North Carolina

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Abstract:

To better understand the development of high technology industry in Texas, this monograph compares the high-technology industrial composition of Texas with that of California, Massachusetts, and North Carolina. Chapters examine interstate differences in high-technology industrial development by comparing (1) recent shifts in high-technology industry mix, (2) size distribution of firms, and (3) measures of locational specialization of labor, such as the ratio of production workers to scientists and engineers, levels of employee education, income distribution, and the comparative influence of education and work experience on earnings.

Keywords:
high technology; industrial development; Texas; California; Massachusetts; North Carolina

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Comparative High-Technology Industrial Growth

Texas, California, Massachusetts, and North Carolina

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1 Introduction

Within the past decade, Texas has become the home of many high-technology industries in communications, electronics, aviation, and computers. Recent national attention has focused on the location of the Microelectronics and Computer Technology Corporation (MCC) in Austin and the rapid growth of the high-technology sector in both Austin and Dallas–Fort Worth. San Antonio is promoting the development of biotechnology industry, and Houston has begun to promote private space industries. In sum, Texas is now competing with other states to recruit new high-technology industries.[1]

The Texas state government has recently begun to actively pursue policies and programs to further the growth of high-technology industries. Such efforts are ultimately designed to serve several economic purposes: to supplant or resurrect declining industries; to develop "growth poles" around which other industries will flourish; and to diversify the existing industry mix to offset the cyclical swings of individual industries.[2] These strategies will presumably create additional demand for labor by attracting successful new industries through capital assistance and technology transfer or generate an adequate labor supply through education and training programs.

The ability of high-technology industries to generate dynamic local economies may greatly depend upon the stage of growth of those industries. Industries that have high proportions of small firms with relatively large numbers of scientists and engineers are more likely to be, in the aggregate, in the start-up phase of industrial development. Industries that have relatively more large firms with fewer scientists and engineers are in the mature phases of industrial development.[3] Industries with predominantly large firms and few scientists and engineers would be characteristic of the branch-plant phenomenon, in which production plants are separate from the home office, which is located elsewhere. Relocated production plants, for instance, will generate different employment and service company patterns than start-up companies or mature, home-based manufacturing firms. Industries with larger proportions of small firms and greater attention to new product development are more dynamic in creating specialized market niches, incubating future large indigenous industries, and supporting existent larger industries through subcomponent manufacture and services.[4]

Recent studies of research and development location have indicated that research and development is concentrated in the Northeast and West whereas production plants predominate in the Sunbelt. These studies imply that the United States is developing a dual manufacturing economy, with a spatial division of labor between regions.[5] Should this trend hold true for high-technology industries locating in Texas, then the possibilities for high-technology industry to generate dynamic economic growth would be cast into doubt.

To better understand the development of high-technology industry in Texas, this monograph compares the high-technology industrial composition of Texas with that of California, Massachusetts, and North Carolina. Since the early 1950s, California has been an international center for advanced aviation, missiles, and more recently microelectronics, particularly in the San Jose area. Likewise, Massachusetts has been a center of high-technology industrial development, with the Boston area serving as the home of pioneering industries in electronics, scientific instruments, and biotechnology. Since the 1960s, North Carolina state government officials have actively encouraged the formation of high-technology firms in the

Chapel Hill-Raleigh-Durham area and the location of electronics, electrical, and pharmaceutical production firms throughout that state.[6]

Subsequent chapters examine interstate differences in high-technology industrial development by comparing (1) recent shifts in high-technology industry mix, (2) size distribution of firms, and (3) measures of locational specialization of labor, such as the ratio of production workers to scientists and engineers, levels of employee education, income distribution, and the comparative influence of education and work experience on earnings.

As employment in these industries continues to grow through this decade, knowledge of the comparative characteristics of the high-technology work force in Texas is useful for private- and public-sector policy making. Information on the Texas high-technology industrial mix and the patterns of occupation, education, and wages for the high-technology labor force can aid the private sector in planning further industrial expansion. The public sector can use this analysis for economic development planning as well as for education and human resource programs.

2 High-Technology Industrial Composition

Manufacturing industries generally evolve within specific geographic areas depending upon the special needs of each industry, such as proximity to raw materials, energy sources, transportation, labor markets, and consumers. High-technology industries have been characterized as "footloose"—having relative freedom to locate in any area. However, a number of factors (primarily at the city level) have been identified as important in attracting high-technology industry, including proximity to research universities, availability of skilled labor, tax incentives, and quality of life.[7] Factors affecting the location of high-technology industries differ depending on whether the firm is a start-up facility, a mature company, or a branch plant.

To identify high-technology industrial growth trends in Texas, California, Massachusetts, and North Carolina, the study analyzed data from the *1982 Census of Manufactures*, the most recent comprehensive survey of employment composition. The industries listed under the rubric of "high techonology" include aircraft, communication equipment, computers and office machines, electrical equipment, electronic components, instruments, missiles, and pharmaceuticals (see table 1).[8]

During 1981 the United States entered an economic recession that slowed or reversed the rate of growth for many industries, a situation to be kept in mind when considering the results of this analysis. Aircraft industries suffered a national decline between 1977 and 1982, with the aircraft parts industries suffering the most precipitous slowdown. Communication equipment industries, on the other hand, experienced high growth rates in the telephone and television communication equipment industry, yet suffered a long-term decline in the radio and television receiving equipment industry. Very high growth rates were found in the computer and office equipment industries, even during the 1982 recession. Likewise, in the electronic components industries there was a strong growth rate in the manufacturing of semiconductors and connectors but a continued general decline in the electron tube and resistor industry. In the instruments industries there were positive growth rates in the manufacture of process controls and optical, surgical, dental, and photographic instruments. During this period, the manufacture of guided missiles saw modest growth rates, while the slowdown in the U.S. space program resulted in decreases in the production of space vehicles and space equipment. The pharmaceuticals industries showed growth in all areas, including biological products, medicinals and botanicals, and pharmaceutical preparations.[9]

Role of High Technology in State Economies

California dominates high-technology employment in the United States. Between 1977 and 1982 California captured nearly 30 percent of the new national employment in high-technology industries, compared to 9 percent for Texas, 5 percent for Massachusetts, and 4 percent for North Carolina.

California has nearly four times more high-technology manufacturing workers than does Texas, while Massachusetts has an equal number, and North Carolina less than half. In 1982, high-technology employees in Texas totalled 190,000 compared to California with 745,000, Massachusetts with 190,500, and North Carolina with 78,500 (see figure 1).

The high-technology manufacturing sector plays a much smaller role in the economies of Texas and North Carolina than in either California or Massachusetts. As total employment in California exceeds that of Texas by

Table 1

High-Technology Industries (1982 Census of Manufactures)

Aircraft	
Aircraft	
Aircraft engines and parts	
Aircraft equipment	
Computers and Office Machines	
Electronic computing machines	
Calculating and accounting machines	
Office machines	
Typewriters	
Communication Equipment	
Radio and TV communication equipment	
Radio and TV receiving equipment	
Telephone and telegraph apparatus	
Electrical Equipment	
Electrical distributing equipment	
Electrical industrial apparatus	
Electronic Components	
Semiconductors	
Electron tubes	
Instruments	
Scientific instruments	
Measuring and controlling devices	
Optical instruments and lenses	
Medical instruments	
Ophthalmic goods	
Photographic equipment	
Watches and clockwork devices	
Missiles	
Guided missiles and space vehicles	
Space propulsion units	
Space vehicle equipment	
Pharmaceuticals	
Biological products	
Medicinals and botanicals	
Pharmaceutical preparations	

more than half and as Massachusetts has less than half the employment of Texas, the relative importance of the high-technology sector to the overall economic base of these states is apparent. As a percentage of total employment, both California and Massachusetts have proportionately more than twice (about 9 percent) the high-technology manufacturing work force of either Texas (4 percent) or North Carolina (4 percent) (see table 2).

The proportionately smaller size of the Texas high-technology manufacturing work force is in part due to the smaller role of manufacturing in the Texas economy. In 1982 Texas manufacturing workers made up only 20 percent of the Texas work force, compared to 24 percent in California, 28 percent in Massachusetts, and a huge 40 percent in North Carolina.

High-technology employment constitutes a smaller proportion of manufacturing employment in Texas than in either California or Massachusetts. In 1982, Texas high-technology employment comprised 18 percent of the state's manufacturing work force, compared to 37 percent for California and 30 percent for Massachusetts. The Texas economy has a proportionately larger share of petrochemical manufacturing employees, which partly explains the relatively lower concentration of high-technology manufacturing employment in Texas. In North Carolina, standard manufacturing employment (largely in textiles) makes up an enormous share of the state's total work force—37 percent, compared to only 15 percent for Texas.

However, between 1977 and 1982 high-technology employment in Texas grew faster than it did in these other states. The higher rates of growth in Texas manufacturing employment and total employment between 1977 and 1982 were reflected in a higher growth rate for the state's high-technology manufacturing employment, with an annual compound rate of growth at 8 percent, compared to 7 percent for California and 4 percent for Massachusetts. North Carolina experienced the same growth rate in high-technology manufacturing employment as Texas, despite its relatively slower overall employment growth, reflecting a smaller starting base.

Yet because of rapid growth in Texas employment in general, high-technology manufacturing employment in Texas constituted a smaller share of new employment than it did in these other states. Between 1977 and 1982,

Figure 1

High-Technology Employment for 1982 by Industry and State (In thousands)

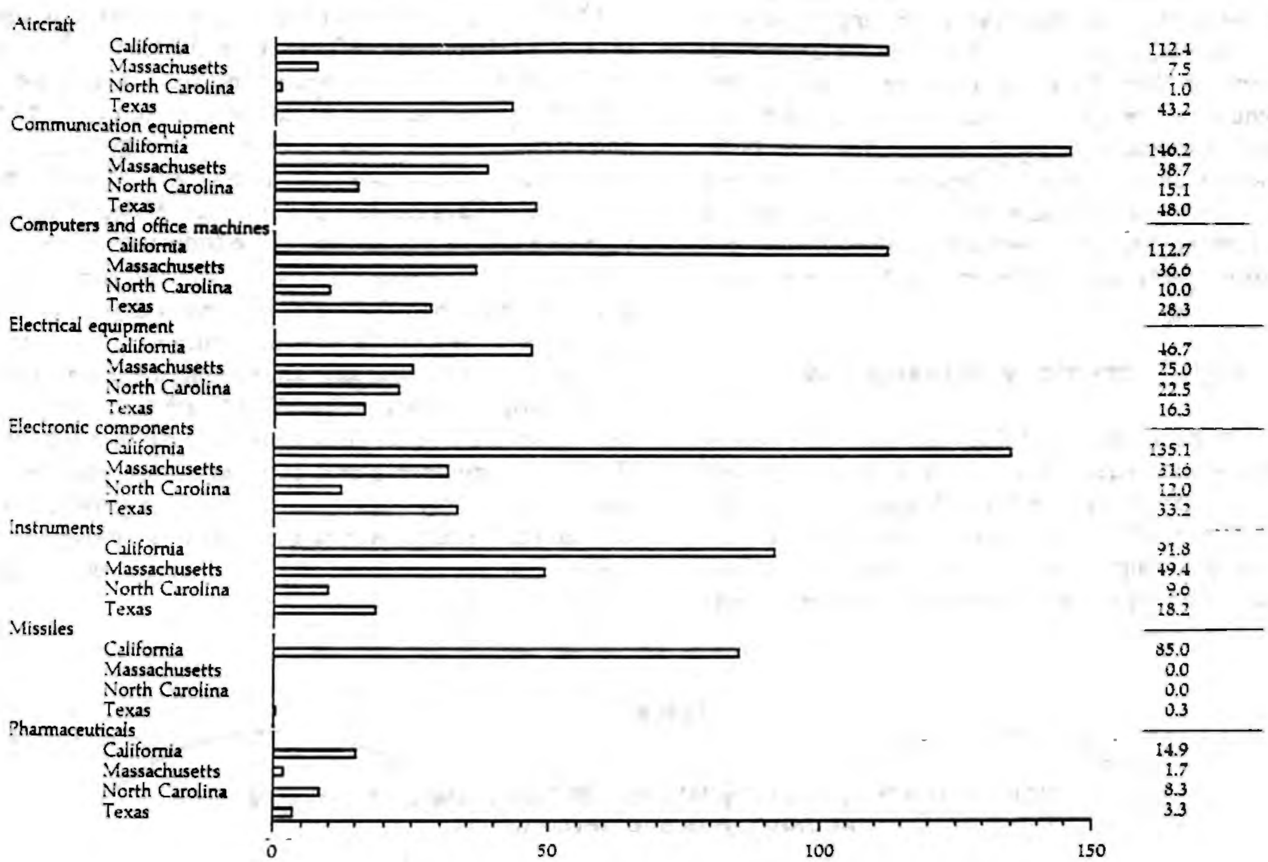


Table 2

High-Technology Employment for 1982 by State (In percentage)

State	Manufacturing employment	Total employment
California	37.1	8.9
Massachusetts	29.6	8.2
North Carolina	9.8	4.0
Texas	18.0	3.5

high-technology employment accounted for only a third of the net increase in manufacturing employment in Texas. This is in contrast with 81 percent for California, 73 percent for North Carolina, and over 100 percent for Massachusetts (in which standard manufacturing employment actually declined). During this time, high-technology manufacturing employment made up only 4 percent of the net increase in total employment in Texas, compared to 13 percent for California, 9 percent for Massachusetts, and 11 percent for North Carolina.

High-Technology Industry Mix

The dominant high-technology industry in Texas is commmunication equipment, followed by aircraft and electronic components (see table 3 and figure 2). Between 1977 and 1982, the state experienced high annual growth rates in employment in the following industries: communication equipment, computers and office machines, and electrical equipment (see table 4). As a consequence, the high-technology industrial mix in Texas appears to have shifted toward these industries during this five-year period (see table 5).

High-technology industry in California is more diversified than in Texas, but it is also characterized by a large concentration of industries in communication equipment, followed by electronic components, computers and office machines, and aircraft. The state experienced high growth rates in computers and office machines, electronic components, and communication equipment, resulting in a shift in the California high-technology industrial mix.

The Massachusetts high-technology industry is less diversified than that of Texas, with the largest concentration of industries in scientific, measuring, and medical instruments, followed by communication equipment and computers and office machines. High growth rates in computers and office machines as well as electronic components have resulted in a shift in the Massachusetts high-technology mix toward these industries.

The North Carolina high-technology industry is also less diversified than that of Texas and is dominated by employment in the electrical equipment industry, followed by the communication equipment and electronic components industries. The North Carolina high-technology industrial mix has shifted toward the electronic components and communication equipment industries, the only ones to experience high growth rates (a large statistical growth rate in aircraft employment is the result of the very small number of employees in that state industry).

Table 3

High-Technology Industry Mix for 1982 by State and Industry (In thousands and percentage)

Industry	California		Massachusetts		North Carolina		Texas	
	Employment	Percentage	Employment	Percentage	Employment	Percentage	Employment	Percentage
Aircraft	112.4	15.1	7.5*	3.9	1.0	1.3	43.2	22.0
Communication equipment	146.2	19.6	38.7	20.3	15.1*	19.2	48.0	25.2
Computers and office equipment	112.7	15.1	36.6	19.2	10.0*	12.7	28.3	14.8
Electrical equipment	46.7	6.3	25.0	13.1	22.5	28.7	16.3	8.5
Electronic components	135.1	18.1	31.6	16.6	12.0*	15.3	33.2	17.4
Instruments	91.8	12.3	49.4	25.9	9.6	12.2	18.2	9.5
Missiles	85.0	11.4	0.0	0.0	0.0	0.0	0.3*	0.2
Pharmaceuticals	14.9	2.0	1.7	0.9	8.3	10.6	3.3	1.7
Total	744.8	100.0	190.5	100.0	78.5	100.0	190.8	100.0

Note: Percentages have been rounded.
* Estimates

Figure 2

High-Technology Industrial Mix for 1982
(In percentage)

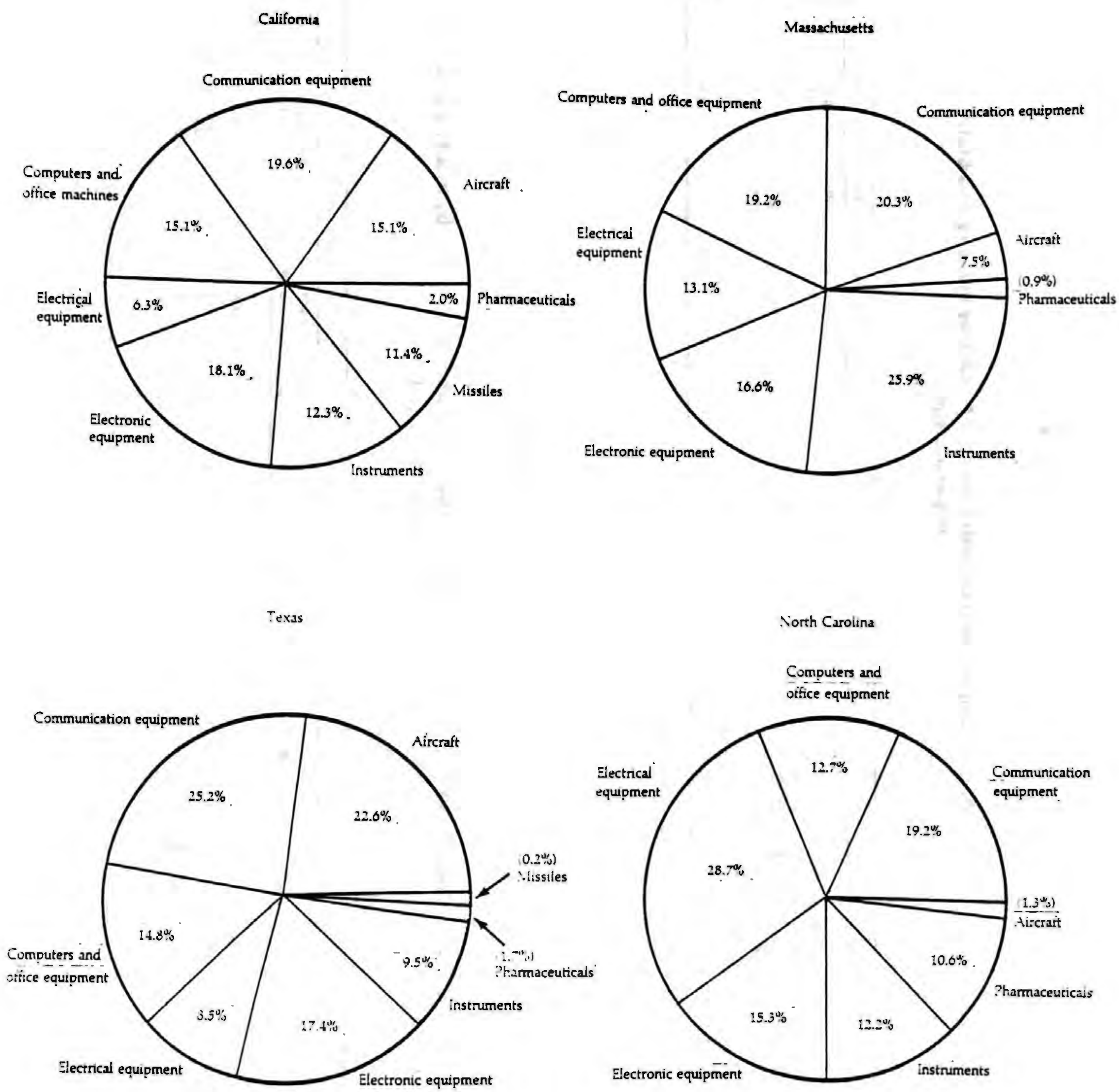


Table 4

Annual Employment Growth Rates 1977 – 1982 by Industry and State (In percentage)

Industry	California	Massachusetts	North Carolina	Texas
Aircraft	3.7	0.0	20.1	5.7
Communication equipment	7.5	2.7	13.8	8.9
Computers and office equipment	12.2	9.2	5.9	11.7
Electrical equipment	4.5	2.7	4.8	9.2
Electronic components	9.7	8.4	18.7	6.6
Instruments	5.9	0.8	2.7	5.2
Missiles	2.1	.	.	0.0
Pharmaceuticals	4.8	4.0	4.4	4.9

Note: Dots indicate unavailable data.

Table 5

Change in High-Technology Employment Composition 1977 – 1982 by Industry and State (In percentage)

	California			Massachusetts			North Carolina			Texas		
Industry	1977 employment	1982 employment	Percentage change	1977 employment	1982 employment	Percentage change	1977 employment	1982 employment	Percentage change	1977 employment	1982 employment	Percentage change
Aircraft	17.4	15.1	-2.3	4.7	3.9	-0.8	0.7	1.3	0.5	24.8	22.6	-2.1
Communication equipment	18.9	19.6	0.8	21.3	20.3	-1.0	14.7	19.2	4.6	23.7	25.2	1.4
Computers and office equipment	11.8	15.1	3.4	14.9	19.2	4.3	13.9	12.7	-1.2	12.4	14.8	2.5
Electrical equipment	6.9	6.3	-0.7	13.8	13.1	-0.7	33.1	28.7	-4.4	8.0	8.5	0.6
Electronic components	15.8	18.1	2.3	13.3	16.6	3.3	9.5	15.3	5.8	18.3	17.4	-0.9
Instruments	12.8	12.3	-0.5	29.9	25.9	-4.0	15.6	12.2	-3.4	10.7	9.5	-1.2
Missiles	14.2	11.4	-2.8	1.1	0.0	-1.1	0.0	0.0	0.0	0.2	0.2	-0.1
Pharmaceuticals	2.2	2.0	-0.2	0.9	0.9	0.0	12.5	10.6	-1.9	2.0	1.7	-0.2

Note: Percentages have been rounded.

3 Size of Firms

In order to identify the size distribution of high-technology industries in these states, this study analyzed data from *County Business Patterns, 1982* for each state.[10] The industries listed under the rubric of "high technology" include aircraft, computers and office machines, communication equipment, electrical equipment, electronic components, instruments, missiles, and pharmaceuticals. Firms were identified as small (less than 100 employees), medium-sized (100–500 employees), or large (more than 500 employees).

California, with 5,730 high-technology firms, has more than four times the number that Texas has, with 1,325. Massachusetts, with 1,263, has nearly the same number as Texas, and North Carolina, with 355, has nearly a fourth that number (see table 6). These ratios approximate those for high-technology employment for Texas, California, and Massachusetts, yet not for North Carolina, which has a significantly larger ratio of employees per firm.

California and Texas have similar proportions of small firms in all high-technology industries, except for communication equipment, in which California has relatively more small firms. Compared with Texas, California has proportionately fewer large computer companies and proportionately more large-scale pharmaceutical firms (see table 7).

Massachusetts has proportionately fewer small firms than Texas in the computer, electrical equipment, electronic components, and instruments industries and relatively more small firms in the pharmaceuticals industry. That state also has relatively more large-scale manufacturing plants in the instruments and electronic components industries.

North Carolina has proportionately fewer small firms than Texas in every high-technology industry but relatively more large-scale manufacturing plants in communication equipment, electrical equipment, electronic components, instruments, and pharmaceuticals.

Table 6

Number of Firms for 1982 by State, Industry, and Size of Firm

Industry	California			Massachusetts			North Carolina			Texas		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Aircraft	302	57	29	18	3	2	1	4	0	69	10	8
Communication equipment	423	95	58	85	27	12	16	5	5	101	33	18
Computers and office equipment	472	118	42	96	35	17	15	5	3	66	11	12
Electrical equipment	813	118	10	101	45	10	77	31	15	263	42	5
Electronic components	1196	159	60	214	58	15	42	17	4	204	28	9
Instruments	1385	154	31	346	64	23	74	10	5	349	35	6
Missiles	16	10	16	.	.	.	.	.	.	.	1	.
Pharmaceuticals	141	15	10	29	2	1	15	7	4	46	8	1
Total	4748	726	256	949	234	80	240	79	36	1098	168	59

Note: Dots indicate unavailable data.

Table 7

Size Distribution of Firms for 1982 by State and Industry (In percentage)

Industry	California			Massachusetts			North Carolina			Texas		
	Percentage small	Percentage medium	Percentage large	Percentage small	Percentage medium	Percentage large	Percentage small	Percentage medium	Percentage large	Percentage small	Percentage medium	Percentage large
Aircraft	77.8	14.7	7.5	78.3	13.0	8.7	20.0	80.0	0.0	79.3	11.5	9.2
Communication equipment	73.4	16.5	10.1	68.5	21.8	9.7	61.5	19.2	19.2	66.4	21.7	11.8
Computers and office equipment	74.7	18.7	6.6	64.9	23.6	11.5	65.2	21.7	13.0	74.2	12.4	13.5
Electrical equipment	86.4	12.5	1.1	74.5	20.8	4.6	62.6	25.2	12.2	84.8	13.5	1.6
Electronic components	84.5	11.2	4.2	74.6	20.2	5.2	66.7	27.0	6.3	84.6	11.6	3.7
Instruments	88.2	9.8	2.0	79.9	14.8	5.3	83.1	11.2	5.6	89.5	9.0	1.5
Missiles	38.1	23.8	38.1	.	.	.	.	.	.	.	100.0	.
Pharmaceuticals	84.9	9.0	6.0	90.6	6.3	3.1	57.7	26.9	15.4	83.6	14.5	1.8

Note: Percentages have been rounded. Dots indicate unavailable data.

4 High-Technology Employment

The importance of innovation and the character of production technology in high-technology industries are reflected in the employment composition. There are significantly greater proportions of scientific, engineering, and technical occupations in high-technology industry than in standard manufacturing. As a consequence, the high-technology work force as a whole has accumulated more years of education. Production workers make up a significantly smaller segment of the high-technology work force than they do in standard manufacturing. Because of the dexterous hand-assembly work required in most high-technology industries, half of that sector's production work force consists of women. Ethnic employment patterns reflect the demographic composition of the industry locale.[11]

Employment composition varies among high-technology industries according to the industry's stage of development, which determines staffing patterns as well as capital/labor ratios. Where technically advanced products are required for successful market competition, a large number of employees will be needed in the product and process design phase. Where the product is technologically complex, employees will likely have additional educational experience or on-the-job training. Thus the occupational and educational attributes of an industrial work force are measures of technological complexity and change within that industry.

The occupational composition of each high-technology industry also varies among the states, with greater research in some and greater production in others. The composition of the labor force within each industry differs geographically as corporate functions are distributed throughout the nation and even the world. As a firm goes through its product cycle, from start-up to maturity, its administrative, research, and production facilities may be located in different regions of the country, according to labor availability, wage patterns, and transportation and construction costs.

For this employee profile, occupations were classified into five broad categories reflecting general skill requirements: managers and professionals, technicians, administrative support personnel, production workers, and other production-related employees. Managerial employees plan, organize, direct, and control the operations of the company. Professional specialists, such as scientists and engineers, are concerned with the application of specialized fields of knowledge to the design of industrial products or processes. Technicians provide assistance in the research, development, testing, operation, and programming of products, equipment, or systems. Administrative support personnel prepare, transcribe, transfer, systematize, and preserve written communications and records. Production workers include those who perform hand production work as well as set up, operate, and tend production machines. Other occupations include service and transportation workers.[12]

Wage patterns often differ among industries as well as regions due to the complex and changing interaction of labor markets, industrial organization, commodity markets, and institutional forces. Concentrated industries with large product demand tend to have higher and more uniform wage patterns, whereas smaller, highly competitive industries tend to have lower and more wide-ranging wage levels. Within occupations, wages differ according to the education, skill level, experience, and productivity of individual employees.[13] All these factors combine to produce a unique wage structure for each industry in each state.

Such descriptive statistics do not reveal the independent effects of each of these factors on the wage patterns of each industry. For a comparative analysis of the wage structures of high-technology industries, it is thus necessary to know the relative weights attached to these factors in setting wage rates within each sector. To measure the differential effects of labor-force characteristics on the wage structures of these states, earnings for high-technology manufacturing employees were estimated as functions of various personal attributes, including years of education, work experience, age, occupation, race, and sex. The variables included in the wage equation are those frequently used in empirical studies of human capital.

A comparative analysis of the work-force composition of high-technology manufacturing industries in Texas, California, Massachusetts, and North Carolina was conducted by examining various occupational, educational, sex, and racial characteristics (see Appendix). Data on the characteristics of high-technology employment for Texas, California, Massachusetts, and North Carolina industries were obtained from the *Public-Use Microdata Samples* (PUMS), a 5 percent sample based on the 1980 U.S. census of population (see table 8). For purposes of this study, only those individuals employed in manufacturing full time for at least one year were included. The industry characteristics are in aggregate terms and reflect the characteristics of that state's industry as a whole, not those of a typical firm.

Aircraft

Employment patterns in the Texas aircraft industry indicate a greater emphasis on both research and production than that found in other Texas high-technology industries as a whole.[14] The Texas aircraft industry employs a larger proportion of production workers, scientists, and engineers, and relatively fewer managers and technicians. Production workers make up 35 percent of the work force in Texas aircraft manufacturing, while scientists and engineers constitute 19 percent. Thus the ratio of production workers to scientists and engineers is nearly two to one. The educational characteristics of Texas aircraft employees resemble those of workers in high-technology industries as a

Table 8

High-Technology Industries (U.S. Census of Population)

<u>Aircraft</u>
Aircraft
Aircraft engines and parts
Aircraft equipment
<u>Computers</u>
Electronic computing machines
<u>Communication Equipment</u>
Radio and TV communication equipment
Radio and TV receiving equipment
Telephone and telegraph apparatus
<u>Electrical Equipment</u>
Semiconductors
Electron tubes
Cathode ray tubes
Electrical distributing equipment
Electrical industrial apparatus
<u>Instruments</u>
Scientific instruments
Measuring and controlling devices
Optical instruments and lenses
Medical instruments
Ophthalmic goods
Photographic equipment
Watches and clockwork devices
<u>Missiles</u>
Guided missiles and space vehicles
Space propulsion units
Space vehicle equipment
<u>Office Machines</u>
Calculating and accounting machines
Office machines
Typewriters
<u>Pharmaceuticals</u>
Biological products
Medicinals and botanicals
Pharmaceutical preparations

whole, with nearly one of every four employees having at least a college degree. Likewise, the wage structure in this industry is similar to that in other Texas high-technology industries as a whole. The work force is predominantly Anglo, with Blacks and Hispanics holding 5 and 7 percent, respectively, of all jobs. Men hold nearly all managerial, scientific, and technical occupations in this industry. However, unlike most other high-technology industries, the aircraft industry also employs men in most (86 percent) production jobs. Anglo men hold 70 percent of the production jobs, with Hispanic and Black men holding 10 percent and 5 percent, respectively, of these jobs.

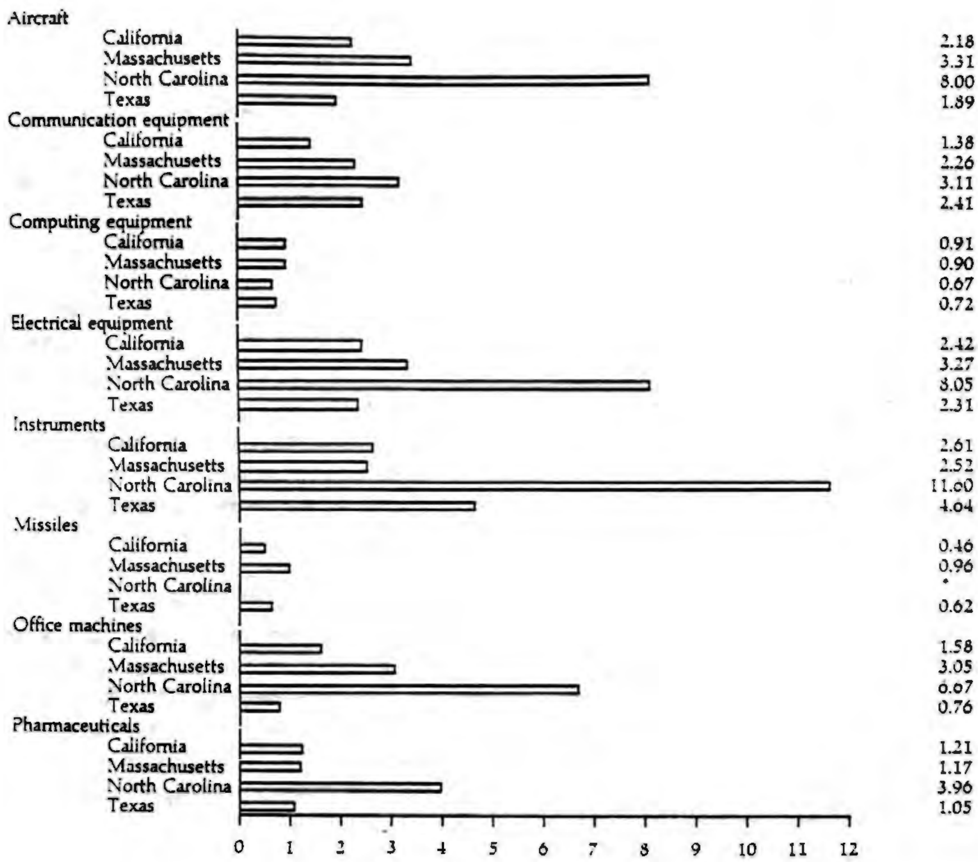
The California aircraft industry is similar to that of Texas. The occupational structure is statistically no different with respect to the proportion of scientists and engineers as well as production workers. Scientists and engineers in the California aircraft industry comprise 17 percent of that industry's work force, and production workers 37 percent (see table 9). As in Texas, the ratio of production workers to scientists and engineers is approximately two to one (see figure 3). Thus in the aggregate, it would appear that the aircraft industry in California, albeit much larger, is in a similar stage of industrial development as the one in Texas, with similar corporate concentrations in research and development as well as manufacturing. The educational characteristics of California aircraft employees differ from those of their counterparts in Texas. Relatively fewer employees in California have college degrees (see figure 4)—only about one in every five (see table 10). On the other hand, the wage structure of the California aircraft industry reveals a larger proportion of employees earning higher wages (see table 11 and figure 5). Wage equations, taking into account the independent effects of experience, age, race, sex, and education for the California aircraft industry, indicate that the effects of work experience and education on wages are the same for both California and Texas. However, the sex of employees in California is less important in determining wages than it is in Texas, implying less wage bias against women in the California aircraft industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry and also hold most of the production jobs, or 83 percent. The California aircraft industry hires relatively larger numbers of employees from ethnic minorities, with Hispanics holding almost 15 percent of all jobs and Blacks and Asian-Americans holding 10 and 4 percent, respectively (see table 12). Anglo men hold half of all production jobs, with Blacks and Hispanics holding 9 and 19 percent, respectively, of these jobs (see table 13).

The Massachusetts aircraft industry is unlike that of Texas. The occupational structure differs statistically in proportion of production workers and scientists and engineers. Production workers make up a larger share of the aircraft work force (43 percent) than do scientists and engineers (13 percent). The ratio of production workers to scientists is thus greater than three to one. In the aggregate, it would appear that the aircraft industry in Massachusetts, although much smaller, is in a different stage of industrial development than it is in Texas, with relatively greater emphasis on production. The educational characteristics of Massachusetts aircraft employees differ from those of their counterparts in Texas. Relatively fewer employees have college degrees—about one in every five. The wage structure is not statistically different from that in Texas. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the work experience of employees in the Massachusetts aircraft industry has the same effect on wages as it does in Texas. However, because of the greater prevalence of production workers, the effect of having an undergraduate or graduate degree is significantly greater in Massachusetts than it is in Texas. The effect of sex on wages is the same in both states. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry and hold most of the production jobs (85 percent). The Massachusetts aircraft industry hires relatively fewer ethnic minority employees than the Texas aircraft industry, with Blacks holding about 5 percent of all jobs. Anglo men hold 81 percent of the aircraft production jobs, and Black men hold 4 percent.

The North Carolina aircraft industry is also unlike that of Texas. The proportion of production workers and scientists and engineers is statistically different. Production workers make up a larger share of the work force (46 percent) than do scientists and engineers (6 percent). The ratio of production workers to scientists is thus greater than eight to one. In the aggregate, it would appear that the aircraft industry in North Carolina, although much smaller, is in a different stage of industrial development than the one in Texas, with relatively greater emphasis on production and less on

Figure 3

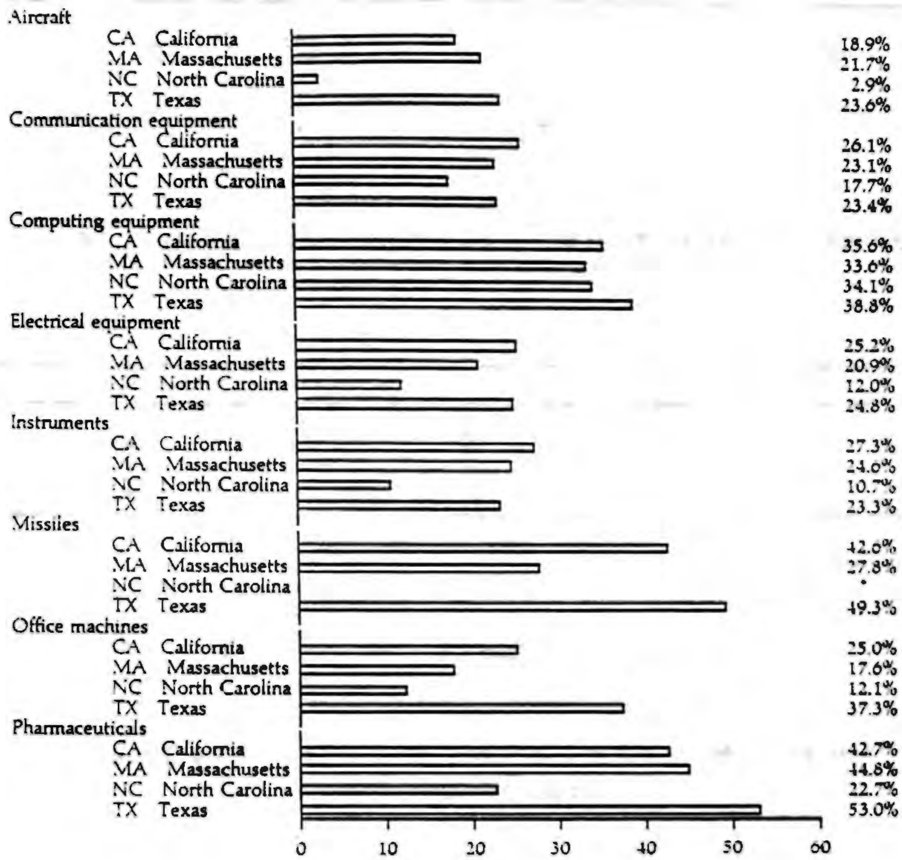
Ratio of Production Workers to Scientists and Engineers for 1980



* Insufficient data.

Figure 4

High-Technology Employees with College Degrees for 1980 (In percentage)



*Insufficient data.

Table 9

Occupational Distribution in Aircraft Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	10.0	10.6	2.9	8.8
Scientists and engineers	16.8	12.9	5.7	18.5
Technicians	11.1	9.9	11.4	10.6
Sales personnel	0.7	0.3	5.7	0.5
Administrative support	16.7	11.6	17.1	17.0
Production	36.6	42.9	45.7	35.0
Other occupations	8.2	11.8	11.4	9.5

Note: Percentages have been rounded.

Table 10

Educational Attainment in Aircraft Industry for 1980 by State (In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	15.8	12.4	25.7	16.5
High school (9-12)	36.3	44.5	51.4	33.7
Postsecondary (13-15)	29.1	21.5	20.0	26.2
College degree (16–)	18.9	21.7	2.9	23.6

Note: Percentages have been rounded.

Table 11

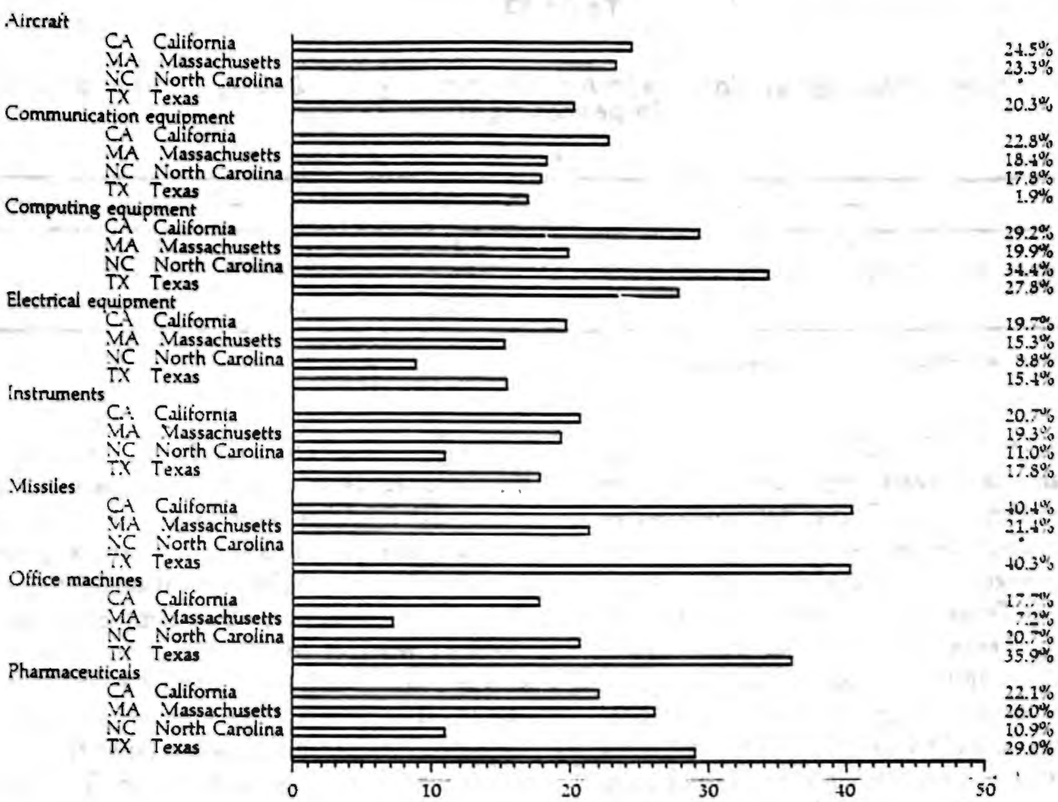
Income Distribution in Aircraft Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	8.1	7.0	31.4	7.8
10,000-14,999	17.5	22.2	28.6	18.7
15,000-19,999	25.8	27.2	28.6	29.1
20,000-24,999	24.1	20.3	5.7	24.1
25,000-29,999	12.7	10.6	2.9	11.3
30,000-34,999	6.2	6.2	.	4.7
35,000–	5.5	6.4	2.9	4.4

Note: Percentages have been rounded. Dots indicate unavailable data.

Figure 5

High-Technology Employees with Salaries over $25,000 (1979 Income) (In percentage)



* Insufficient data.

Table 12

Ethnic Distribution in Aircraft Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	71.0	93.9	91.4	86.8
Asian	3.6	0.1	.	0.5
Black	9.5	4.8	8.6	5.4
Hispanic	14.9	0.9	.	6.8
Other	1.0	0.3	.	0.5

Note: Percentages have been rounded. Dots indicate unavailable data.

Table 13

Sex Distribution of Production Workers in Aircraft Industry for 1980 by State and Ethnicity (In percentage)

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	8.9	51.0	10.8	81.0	12.5	81.3	11.3	69.8
Asian	1.0	2.5	.	.	.	.	0.1	.
Black	2.9	9.2	3.1	4.1	6.3	.	1.8	5.3
Hispanic	4.4	18.9	0.7	.	.	.	0.8	10.2
Other	0.4	0.9	.	0.3	.	.	.	0.6

Note: Percentages have been rounded. Dots indicate unavailable data.

research and development. The educational characteristics of North Carolina aircraft employees differ from those of their counterparts in Texas. Relatively fewer employees have college degrees—apparently less than one in thirty. The wage structure is also statistically different from that in Texas, with relatively fewer high-paid jobs. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry and hold most of the production jobs (81 percent). The North Carolina aircraft industry hires relatively fewer ethnic minority employees than does the Texas aircraft industry, with Blacks holding about 9 percent of all jobs. Anglo men hold 81 percent of the aircraft production jobs, Anglo women hold 13 percent, and Black women 6 percent.

Communication Equipment

Employment patterns in the Texas communication equipment industry indicate that this industry has the same emphasis on research and development, as well as production, as other Texas high-technology industries as a whole. Production workers comprise 33 percent of the work force in this industry, while scientists and engineers constitute only 14 percent. Thus the ratio of production workers to scientists and engineers is more than two to one. The educational characteristics of Texas communication equipment employees resemble those of workers in other high-technology industries as a whole, with almost one of every four employees having at least a college degree. Likewise, the wage structure in this industry is similar to that in other high-technology industries as a whole. The work force is predominantly Anglo, with Blacks and Hispanics holding 11 and 10 percent, respectively, of all jobs. Men hold nearly all managerial, scientific, and technical occupations in this industry. However, as in most other high-technology industries, women hold more than half of the production jobs (54 percent). Anglo men fill 34 percent of the production jobs, and Hispanic and Black men fill 6 and 5 percent, respectively. Anglo women hold 29 percent of the production jobs, with Hispanic and Black women holding 9 and 14 percent, respectively.

The California communication equipment industry is unlike that of Texas, with relatively greater attention to research and development and less emphasis on production. Scientists and engineers in the California communication equipment industry make up 18 percent of that industry's work force, and production workers 25 percent (see table 14). The ratio of production workers to scientists and engineers is a little more than one to one. Thus, in the aggregate, it would appear that the communication equipment industry in California, although larger, is in a different stage of industrial development than the one in Texas, with somewhat greater concentration on research and development and relatively less on production. The educational characteristics of California communication equipment employees are similar to those of their counterparts in Texas in that a large proportion of these employees have college degrees—more than one in every four (see table 15). The wage structure of the California communication equipment industry reveals a larger proportion of employees earning high wages (see table 16). Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that work experience in the California communication equipment industry has a greater positive effect on wages than it does in Texas. In addition, California employees with some postsecondary education apparently earn relatively larger salaries than do their counterparts in Texas. As in other industries, the sex of communication equipment employees in California is less important in determining wages than it is in Texas (see Appendix), implying less wage bias against women in the California communication equipment industry. As in Texas, men fill the majority of managerial, scientific, and technical occupations in this industry, and women fill nearly half of the production jobs (49 per-

Table 14

Occupational Distribution in Communication Equipment Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	15.4	9.9	8.8	11.5
Scientists and engineers	18.3	16.0	12.0	13.6
Technicians	15.2	12.5	10.8	17.7
Sales personnel	1.7	1.2	1.9	2.0
Administrative support	17.0	14.5	16.3	13.5
Production	25.2	36.3	37.2	32.9
Other occupations	7.3	9.6	13.1	8.6

Note: Percentages have been rounded.

Table 15

Educational Attainment in Communication Equipment Industry for 1980 by State (In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	10.2	14.6	18.2	13.9
High school (9-12)	32.6	43.3	46.0	35.0
Postsecondary (13-15)	31.1	19.0	18.2	27.7
College degree (16+)	26.1	23.1	17.7	23.4

Note: Percentages have been rounded.

Table 16

Income Distribution in Communication Equipment Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	16.5	13.7	17.0	23.5
10,000-14,999	25.7	28.3	31.3	24.3
15,000-19,999	20.2	24.8	21.4	18.2
20,000-24,999	14.9	14.9	12.5	17.1
25,000-29,999	9.2	7.8	7.7	8.3
30,000-34,999	5.9	4.6	5.1	4.2
35,000+	7.7	5.9	5.1	4.5

Note: Percentages have been rounded.

cent). However, the California communication equipment industry hires relatively larger numbers of Hispanic and Asian-American employees, with Hispanics holding 13 percent of all jobs, Asian-Americans 7 percent, and Blacks 5 percent (see table 17). Anglo men hold 34 percent of all production jobs, with Asian-American, Black, and Hispanic men holding 3, 2, and 11 percent, respectively. Anglo women hold 27 percent of the production jobs, with Asian-American, Black, and Hispanic women holding 5, 3, and 14 percent of these jobs, respectively (see table 18).

The Massachusetts communication equipment industry is like that of Texas. The occupational structure is statistically the same with respect to the proportion of production workers and scientists and engineers. Production workers comprise a small share of the work force (17 percent) when compared with scientists and engineers (19 percent). The ratio of production workers to scientists is thus less than one to one. In the aggregate, it would appear that the communication equipment industry in Massachusetts is in a stage of industrial development similar to the one in Texas, with similar occupational composition in research and development as well as production. The educational characteristics of Massachusetts communication equipment employees, however, are the same as those of their counterparts in Texas, with about one in every four communication equipment employees in that state having a college degree. The wage structure is also statistically similar to that of Texas. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that in the Massachusetts communication equipment industry the effect of an undergraduate or graduate degree on wages is significantly greater than it is in Texas. The effect of the sex of employees on wages appears to be less in Massachusetts. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry. However, women hold relatively fewer production jobs (44 percent) than they do in Texas. The Massachusetts communication equipment industry hires relatively fewer ethnic minority employees than the one in Texas, with Anglos holding 95 percent of all jobs in this industry. Anglo men hold 51 percent of the communication equipment production jobs, Black men 1 percent, and Hispanics 2 percent. Anglo women hold 40 percent of the production jobs, Black women 1 percent, and Hispanic women 2 percent.

The North Carolina communication equipment industry is also similar to that of Texas with respect to the proportion of production workers and scientists and engineers. Production workers comprise 36 percent of the work force, and scientists and engineers 16 percent. The ratio of production workers to scientists is thus more than two to one. In the aggregate, it would appear that the communication equipment industry in North Carolina, although much smaller, is in the same stage of industrial development as the one in Texas, with a concentration on production and research and development relatively similar to that found in other high-technology industries. The educational characteristics of North Carolina communication equipment employees are the same as those of their counterparts in Texas, with a similar proportion of employees having college degrees—apparently about one in five. The wage structure is statistically similar to that of Texas. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that work experience and higher education among these employees in the North Carolina communication equip-

Table 17

Ethnic Distribution in Communication Equipment Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	74.0	95.3	83.5	76.5
Asian	7.4	1.2	0.5	1.7
Black	4.7	1.5	15.2	11.2
Hispanic	13.0	1.8	0.7	9.8
Other	0.9	0.2	0.2	0.8

Note: Percentages have been rounded.

Table 18

Sex Distribution of Production Workers in Communication Equipment Industry for 1980 by State and Ethnicity (In percentage)

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	27.1	34.2	40.3	51.2	34.4	39.8	28.8	33.7
Asian	4.6	3.4	1.0	1.0	0.9	0.5	1.1	1.7
Black	2.9	1.6	1.0	1.0	18.1	5.0	14.4	4.7
Hispanic	13.7	10.8	1.8	2.1	0.5	0.9	9.2	5.6
Other	0.4	1.3	0.3	0.3	.	.	0.4	0.4

Note: Percentages have been rounded. Dots indicate unavailable data.

ment industry have a greater effect on wages than these factors do in Texas. The effect of sex of employees on wages appears to be less in the North Carolina industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women occupy more than half of the production jobs. Anglo men hold 40 percent of the production jobs, and Black men 5 percent. Anglo women hold 34 percent of the production jobs, and Black women 18 percent.

Computing Equipment

Employment patterns in the Texas computing equipment industry reveal a greater emphasis on research and development and a far smaller concentration on production than in other Texas high-technology industries as a whole. The Texas computing equipment industry employs a smaller proportion of production workers but relatively more managers. Production workers comprise only 16 percent of the state's computing equipment employees, while scientists and engineers constitute 23 percent. Thus the ratio of production workers to scientists and engineers is less than one to one. The educational characteristics of Texas computing equipment employees differ from those of workers in other high-technology industries as a whole in that more than one of every three employees has at least a college degree. Likewise, the wage structure in this industry is different from that of other Texas high-technology industries as a whole, with far larger numbers earning higher salaries. The work force is predominantly Anglo, with Blacks and Hispanics each holding 9 percent of all jobs. Men fill nearly all managerial, scientific, and technical positions in this industry. However, as in most other high-technology industries, women hold more than half of the production jobs (53 percent). Anglo men make up 33 percent of the production work force, and Hispanic and Black men make up 8 and 3 percent, respectively. Anglo women hold 25 percent of the production jobs, and Hispanic and Black women 12 and 14 percent.

The California computing equipment industry is like that of Texas. Scientists and engineers in the California computing equipment industry comprise 21 percent of that industry's work force, and production workers 19 percent (see table 19). The ratio of production workers to scientists and engineers is less than one to one. Thus, in the aggregate, it would appear that the computing equipment industry in California, although larger, is in a stage of industrial development similar to the one in Texas. The educational characteristics of California computing equipment employees are also similar to those of their Texas counterparts in that a large proportion of employees have college degrees—more than one in every three (see table 20). The wage structure of the California computing equipment industry reveals a similar proportion of employees earning high wages (see table 21). Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that for the California computing equipment industry the effect of work experience on wages is no different from that in Texas. However, California employees with graduate degrees apparently earn relatively larger salaries for that industry than do their counterparts in Texas (see Appendix). As in other industries, the sex of computing equipment employees in California is less important in determining wages than it is in Texas, implying less wage bias against women in the California industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women occupy more than half of the production jobs (51 percent). The California computing equipment industry hires relatively larger numbers of Hispanic and Asian-American employees, with Hispanics holding 12 percent of all jobs and Asian-Americans holding 10 percent (see table 22). Anglo men hold 29 percent of all production jobs, with Asian-American, Black, and Hispanic men holding 5, 2, and 13 percent of these jobs, respectively. Anglo women hold 26 percent of the production jobs, with Asian-American, Black, and Hispanic women constituting 8, 2, and 15 percent of the production work force, respectively (see table 23).

The Massachusetts computing equipment industry is also like that of Texas. The proportion of production workers and scientists and engineers is statistically the same. Production workers comprise a small share of the work force or 17 percent, and scientists and engineers make up 19 percent. The ratio of production workers to scientists is thus less than one to one. In the aggregate, it would appear that the computing equipment industries in Massachusetts and in Texas are in a similar stage of industrial development, with relatively less emphasis on production and more on research and development compared to other industries. The educational charac-

Table 19

Occupational Distribution in Computing Equipment Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	18.5	17.8	21.0	16.0
Scientists and engineers	20.9	19.0	20.0	22.6
Technicians	16.2	14.8	17.7	18.7
Sales personnel	3.1	1.9	2.1	5.2
Administrative support	16.2	21.9	18.6	13.1
Production	19.0	17.1	13.4	16.2
Other occupations	6.1	7.5	7.2	8.2

Note: Percentages have been rounded.

Table 20

Educational Attainment in Computing Equipment Industry for 1980 by State (In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	7.7	8.3	5.3	7.1
High school (9-12)	23.8	32.0	29.8	25.9
Postsecondary (13-15)	32.8	26.0	30.8	28.2
College degree (16+)	35.6	33.6	34.1	38.8

Note: Percentages have been rounded.

Table 21

Income Distribution in Computing Equipment Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	12.4	17.3	11.0	15.2
10,000-14,999	23.2	28.4	17.4	22.1
15,000-19,999	18.1	20.5	18.9	17.8
20,000-24,999	17.0	14.0	18.4	17.1
25,000-29,999	11.4	9.9	11.2	12.4
30,000-34,999	7.8	4.0	10.3	4.4
35,000+	10.0	6.0	12.9	11.0

Note: Percentages have been rounded.

Table 22

Ethnic Distribution in Computing Equipment Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	74.3	92.7	85.2	79.5
Asian	9.8	1.6	0.5	2.7
Black	3.7	3.6	13.6	8.7
Hispanic	11.5	2.0	0.7	8.6
Other	0.6	0.1	.	0.5

Note: Percentages have been rounded. Dots indicate unavailable data.

Table 23

Sex Distribution of Production Workers in Computing Equipment Industry for 1980 by State and Ethnicity (In percentage)

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	25.5	29.1	42.0	46.5	32.1	33.9	24.8	33.1
Asian	8.0	4.6	0.3	0.3	.	.	2.5	2.5
Black	2.0	2.1	3.2	4.3	28.6	3.6	14.0	3.3
Hispanic	15.1	12.6	1.6	1.6	.	1.8	11.6	3.3
Other	0.8	0.1	.	0.3	.	.	.	.

Note: Percentages have been rounded. Dots indicate unavailable data.

teristics of Massachusetts computing equipment employees are the same as those of their counterparts in Texas, with about one in every three employees having a college degree. The wage structure is statistically different from that of Texas, however, with relatively fewer employees in the higher salary ranges. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that for the Massachusetts computing equipment industry the work experience of these employees has less effect on wages than it does in Texas. As in California, the effect of a graduate degree on wages is significantly greater in Massachusetts than in Texas. The effect of sex of employees on wages appears to be less in Massachusetts. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women hold nearly half of the production jobs (47 percent). The Massachusetts computing equipment industry hires relatively fewer ethnic minority employees than it does in Texas, with Anglos constituting 85 percent of all employees in this industry. Anglo men hold 47 percent of the computing equipment production jobs whereas Black men hold more than 4 percent. Anglo women hold 42 percent of the production jobs, and Black women 3 percent.

The North Carolina computing equipment industry is also similar to that of Texas with respect to the proportion of production workers and scientists and engineers. Production workers comprise a small share of the work force (13 percent), and scientists and engineers constitute 20 percent. The ratio of production workers to scientists is less than one to one. Thus in the aggregate, it would appear that the computing equipment industry in North Carolina, although much smaller, is in the same stage of industrial development as the one in Texas, with relatively less emphasis on production and more on research and development compared with other high-technology industries. The educational characteristics of North Carolina computing equipment employees are the same as those of their counterparts in Texas, with a relatively large number of employees having college degrees—apparently about one in three. The wage structure is statistically different from that in Texas, with relatively fewer high-paid jobs. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the work experience of employees in the North Carolina computing equipment industry has more effect on wages than it does in Texas whereas the effect of the sex of employees on wages appears to be less. As in Texas, men fill the majority of managerial, scientific, and technical occupations in this industry, and women occupy more than half of the production jobs. Anglo men hold 34 percent of the computing equipment production jobs, and Black men 4 percent. Anglo women hold 32 percent of these jobs, and Black women 29 percent.

Electrical Equipment

Employment patterns in the Texas electrical equipment industry indicate a similar emphasis on research and development but a greater emphasis on production than that seen in Texas high-technology industries as a whole. The electrical equipment industry employs a larger proportion of production workers with relatively fewer managers. Production workers make up 34 percent of the Texas electrical equipment manufacturing work force, whereas scientists and engineers constitute 15 percent. Thus the ratio of production workers to scientists and engineers is more than two to one. The educational characteristics of Texas electrical equipment employees resemble those of employees in other high-technology industries as a whole, with nearly one of every four employees having a college degree. Likewise, the wage structure in this industry is similar to that of Texas high-technology industries as a whole. The work force is predominantly Anglo, with Blacks and Hispanics holding 11 and 10 percent, respectively, of all jobs. As in most other high-technology industries, men hold nearly all managerial, scientific, and technical positions in this industry, and women hold half of the production jobs (52 percent). Anglo men make up 33 percent of the production work force, and Hispanic and Black men 7 percent and 5 percent, respectively. Anglo women hold 28 percent of the production jobs, and Hispanic and Black women 9 and 13 percent, respectively.

The California electrical equipment industry is similar to that of Texas with respect to the proportion of scientists and engineers as well as production workers. Scientists and engineers in the California electrical equipment industry comprise 14 percent of that industry's work force, and production workers make up 33 percent (see table 24). As in Texas, the ratio of production workers to scientists and engineers is more than two to one. Thus in the aggregate, it would appear that the electrical equipment industry in California, although larger, is in a similar stage of industrial development as the one in

Table 24

Occupational Distribution in Electrical Equipment Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	15.1	12.0	8.5	11.3
Scientists and engineers	13.8	12.2	6.0	14.7
Technicians	11.4	9.4	8.1	15.2
Sales personnel	2.5	2.4	1.6	2.3
Administrative support	15.4	13.8	11.9	11.7
Production	33.4	39.9	48.0	33.9
Other occupations	8.3	10.4	16.0	10.9

Note: Percentages have been rounded.

Texas, with similar corporate concentrations in research and development as well as manufacturing. The educational characteristics of California electrical equipment employees are the same as those of their counterparts in Texas. About one in every four electrical equipment employees in that state has a college degree (see table 25). On the other hand, the wage structure of the California electrical equipment industry reveals a larger proportion of employees earning higher wages (see table 26). Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that in the electrical equipment industry work experience affects wages in California more than it does in Texas (see Appendix). The sex of employees in California is less important in determining wages than it is in Texas, implying less wage bias against women in the California electrical equipment industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women hold half of the production jobs (54 percent). The California electrical equipment industry hires relatively larger numbers of Hispanic and Asian-American employees, with Hispanics holding 18 percent of all jobs, Asian-Americans 11 percent, and Blacks only 4 percent (see table 27). Anglo men hold 26 percent of all production jobs, with Asian-American, Black, and Hispanic men holding 4, 2, and 14 percent of these jobs. Anglo women hold 24 percent of the production jobs, with Asian-American, Black, and Hispanic women holding 9, 4, and 17 percent of these jobs (see table 28).

The Massachusetts electrical equipment industry is unlike that of Texas. The proportion of production workers and scientists and engineers is statistically different. Production workers comprise a larger share of the work force or 40 percent, and scientists and engineers make up 12 percent. The ratio of production workers to scientists is thus more than three to one. In the aggregate, it would appear that the electrical equipment industry in Massachusetts is in a different stage of industrial development than the one in Texas, with relatively greater emphasis on production. The educational characteristics of Massachusetts electrical equipment employees differ from those of their counterparts in Texas, with relatively fewer employees having college degrees—about one in every five. The wage structure is not statistically different from that in Texas. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the work experience of employees in the Massachusetts electrical equipment industry has the same effect on wages as it does in Texas. However, because of the greater prevalence of production workers, the effect of having an undergraduate or graduate degree is significantly greater in Massachusetts than in Texas. The effect of the sex of employees on wages appears to be the same for both states. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, but unlike Texas women, Massachusetts women hold relatively fewer production jobs (47 percent) in this industry. The Massachusetts electrical equipment industry hires relatively fewer ethnic employees than Texas does, with Blacks and Hispanics each holding about 2 percent of all jobs. Anglo men hold 50 percent of the electrical equipment produc-

Table 25

Educational Attainment in Electrical Equipment Industry for 1980 by State (In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	15.9	20.9	22.7	14.8
High school (9-12)	31.4	41.0	46.5	36.1
Postsecondary (13-15)	27.5	17.2	18.8	24.3
College degree (16+)	25.2	20.9	12.0	24.8

Note: Percentages have been rounded.

Table 26

Income Distribution in Electrical Equipment Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	21.6	25.6	30.1	26.5
10,000-14,999	28.3	29.1	37.2	27.7
15,000-19,999	18.2	18.7	17.1	17.3
20,000-24,999	12.1	11.4	6.8	13.0
25,000-29,999	8.0	6.7	3.8	6.8
30,000-34,999	5.0	3.1	2.3	3.6
35,000+	6.7	5.5	2.7	5.0

Note: Percentages have been rounded.

Table 27

Ethnic Distribution in Electrical Equipment Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	66.0	94.9	86.1	75.7
Asian	10.5	1.0	0.1	2.6
Black	4.4	2.0	12.2	11.1
Hispanic	18.1	1.8	1.0	10.2
Other	1.0	0.4	0.5	0.3

Note: Percentages have been rounded.

Table 28

**Sex Distribution of Production Workers in Electrical Equipment Industry for 1980
by State and Ethnicity
(In percentage)**

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	23.5	25.5	42.4	50.2	41.9	42.9	27.7	33.4
Asian	8.9	4.2	0.7	0.1	.	0.2	2.5	2.0
Black	3.6	2.1	2.0	1.3	6.5	6.8	13.0	5.3
Hispanic	17.1	13.8	1.2	1.5	0.8	0.5	8.8	6.9
Other	0.6	0.5	0.4	0.2	0.3	0.2	0.3	0.2

Note: Percentages have been rounded. Dots indicate unavailable data.

tion jobs, and Black and Hispanic men each hold less than 2 percent of these jobs. Anglo women hold 42 percent of such jobs, and Black and Hispanic women each less than 2 percent.

The North Carolina electrical equipment industry is also unlike that of Texas. The proportion of production workers and scientists and engineers is statistically different. Production workers comprise a larger share of the work force or 48 percent, and scientists and engineers make up 6 percent. The ratio of production workers to scientists and engineers is thus eight to one. In the aggregate, it would appear that the electrical equipment industry in North Carolina, although much smaller, is also in a different stage of industrial development than the one in Texas, with relatively greater emphasis on production and less on research and development. The educational characteristics of North Carolina electrical equipment employees differ from those of their counterparts in Texas. Relatively fewer have college degrees—apparently less than one in eight. The wage structure is statistically different from that in Texas, with relatively fewer high-paid jobs. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the work experience of employees in the North Carolina electrical equipment industry has a less positive effect on wages than it does in Texas. Because of the greater prevalence of production workers, a graduate degree has a significantly greater relative effect on wages in North Carolina than in Texas among electrical equipment employees. The sex of employees in North Carolina is less important in determining wages than it is in Texas, implying less wage bias against women in North Carolina's electrical equipment industry. As in Texas, men fill the majority of managerial, scientific, and technical occupations in this industry, and women occupy half of the production jobs. Anglo men hold 43 percent of the electrical equipment production jobs, with Black and Hispanic men holding 7 and 0.5 percent, respectively. Anglo women hold 42 percent of the production jobs, with Black and Hispanic women holding 7 and 0.8 percent of such jobs, respectively.

Instruments

Employment patterns in the Texas instruments industry reveal less emphasis on research and development than that found in Texas high-technology industries as a whole. The Texas instruments industry employs a smaller proportion of scientists and engineers. Production workers comprise 35 percent of the instruments manufacturing work force in Texas, while scientists and engineers constitute 7 percent. Thus the ratio of production workers to scientists and engineers is five to one. The educational characteristics of Texas instruments employees are similar to those of workers in high-technology industries as a whole, with one of every four employees having a college degree. Likewise, the wage structure in this industry is similar to that of Texas high-technology industries as a whole. The work force is predominantly Anglo, with Blacks and Hispanics holding 9 and 16 percent, respectively, of all jobs. Men hold nearly all managerial, scientific, and technical positions in this industry. However, as in most other high-technology industries, women hold more than half of the production jobs, or 51 percent. Anglo men hold 31 percent of the production jobs; Hispanic and Black men 15 and 2 percent, respectively. Anglo women hold 29 percent of the production jobs, Hispanic women 12 percent, and Black women 8 percent.

The California instruments industry is like that of Texas, with a similar concentration on production. Scientists and engineers in the California instruments industry comprise 12 percent of that industry's work force, with production workers making up 32 percent (see table 29). The ratio of production workers to scientists and engineers is thus more than two to one. In the aggregate, it would appear that the instruments industry in California, although larger, is in a similar stage of industrial development as the one in Texas but with a somewhat greater concentration in research and development. The educational characteristics of California instruments employees are similar to those of their counterparts in Texas in that a larger proportion of employees have college degrees—more than one in every four (see table 30). The wage structure of the California instruments industry reveals that the proportion of employees earning high wages is no larger than it is for Texas employees (see table 31). Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that work experience has a greater positive effect on wages in the California instruments industry than it does in Texas (see Appendix). In addition, California employees with some postsecondary education, an undergraduate degree, or a graduate degree apparently earn relatively larger salaries in the instruments industry than do their counterparts in Texas. As in Texas, men fill the majority of managerial, scientific, and technical occupations in this industry, and women occupy nearly half of the production jobs (49 percent). The California instruments industry hires relatively larger numbers of Hispanic and Asian-American employees than the Texas instruments industry does. Hispanics hold 15 percent of all jobs, Asian-Americans 8 percent, and Blacks 5 percent (see table 32). Anglo men hold 35 percent of all production jobs, with Asian-American, Black, and Hispanic men holding 3, 2, and 12 percent, respectively. Anglo women fill 24 percent of the production jobs, and Asian-American, Black, and Hispanic women fill 7, 3, and 15 percent of these jobs, respectively (see table 33).

The Massachusetts instruments industry is also like that of Texas, except for somewhat greater attention to research and development. Scientists and engineers in the Massachusetts instruments industry comprise 13 percent of that industry's work force, with production workers making up 32 percent. The ratio of production workers to scientists and engineers is thus more

Table 29

Occupational Distribution in Instruments Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	16.1	12.9	5.6	14.5
Scientists and engineers	12.4	13.0	4.2	7.4
Technicians	11.7	13.0	13.0	11.5
Sales personnel	4.6	2.3	4.2	0.7
Administrative support	16.0	15.4	11.8	13.4
Production	32.3	32.8	49.0	34.5
Other occupations	6.8	10.7	12.1	12.0

Note: Percentages have been rounded.

Table 30

Educational Attainment in Instruments Industry for 1980 by State (In Percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	12.0	15.0	20.6	19.5
High school (9-12)	32.2	40.1	52.4	33.0
Postsecondary (13-15)	28.5	20.3	16.3	24.1
College degree (16+)	27.3	24.6	10.7	23.3

Note: Percentages have been rounded.

Table 31

Income Distribution in Instruments Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	20.1	16.8	36.3	28.8
10,000-14,999	27.3	29.7	25.4	26.3
15,000-19,999	18.2	20.8	19.4	16.0
20,000-24,999	13.7	13.4	7.9	10.5
25,000-29,999	7.9	7.2	4.8	7.9
30,000-34,999	5.1	5.3	3.1	3.3
35,000	7.7	6.8	3.1	6.6

Note: Percentages have been rounded.

Table 32

Ethnic Distribution in Instruments Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	71.8	93.3	82.5	73.0
Asian	7.6	0.6	0.3	1.5
Black	4.5	3.9	14.1	8.8
Hispanic	15.2	1.7	1.1	10.0
Other	0.9	0.5	2.0	0.7

Note: Percentages have been rounded.

Table 33

Sex Distribution of Production Workers in Instruments Industry for 1980 by State and Ethnicity (In percentage)

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	23.9	34.3	33.8	56.5	39.7	40.2	29.0	30.7
Asian	6.5	3.2	0.4	0.1	0.6	.	0.7	1.8
Black	2.7	2.1	2.3	3.6	7.5	6.9	8.1	1.8
Hispanic	15.1	11.5	1.3	1.5	1.1	1.1	12.0	14.8
Other	0.4	0.4	0.4	0.1	1.7	1.1	1.1	.

Note: Percentages have been rounded. Dots indicate unavailable data.

than two to one. The educational characteristics of Massachusetts instruments employees are similar to those of their counterparts in Texas. Almost one in every four instruments employees in that state has a college degree. The wage structure of the Massachusetts instruments industry reveals a similar proportion of employees earning high wages. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that work experience and higher education in the Massachusetts instruments industry have no significantly different effect on wages than these factors do in Texas. As in other industries, the sex of instruments employees in Massachusetts is less important in determining wages than it is in Texas, implying less wage bias against women in the Massachusetts instruments industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry. Women occupy proportionately fewer jobs in production (38 percent). The Massachusetts instruments industry hires relatively fewer Hispanic and Asian-American employees: Hispanics hold 2 percent of the industry's jobs, Asian-Americans hold 1 percent, and Blacks 4 percent. Anglo men hold 57 percent of all production jobs, with Black and Hispanic men holding 4 and 2 percent, of these jobs respectively. Anglo women hold 34 percent of the production jobs, and Black and Hispanic women hold 2 and 1 percent, respectively.

The North Carolina instruments industry differs from the one in Texas. Production workers comprise a larger share of the work force (49 percent), with scientists and engineers making up 4 percent. The ratio of production workers to scientists and engineers is thus ten to one. In the aggregate, it would appear that the instruments industry in North Carolina is in a different stage of industrial development than it is in Texas, with relatively greater emphasis on production. The educational characteristics of North Carolina instruments employees differ from those of their counterparts in Texas. Relatively fewer employees have college degrees—apparently one in eight. The wage structure is statistically different from that in Texas, with relatively fewer high-paid jobs. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the effects of experience and education on wages for the North Carolina instruments industry are the same as those for the Texas instruments industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women occupy more than half of the production jobs. Anglo men hold 40 percent of the production jobs, with Black and Hispanic men holding 7 and 1 percent, respectively. Anglo women hold 40 percent of these jobs, and Black women 8 percent.

Missiles

Employment patterns in the Texas missiles industry reveal a far greater emphasis on research and development and less on production than in the state's other high-technology industries as a whole. The Texas missiles industry employs a smaller proportion of production workers with relatively more managers. Production workers comprise only 20 percent of the employees in missiles manufacturing in Texas, while scientists and engineers constitute 33 percent. Thus the ratio of production workers to scientists and engineers is less than one to one. The educational characteristics of Texas missiles employees differ from those of employees in other high-technology industries as a whole, with one of two employees having at least a college degree. Likewise, the wage structure in this industry is different from that of Texas high-technology industries as a whole, with far larger numbers of employees earning higher salaries. The work force is predominantly Anglo, with Blacks and Hispanics holding 5 and 6 percent, respectively, of all jobs. Men hold nearly all managerial, scientific, and technical positions in this industry. However, unlike most other high-technology industries, women hold relatively few production jobs (14 percent). Anglo men make up 72 percent of the production work force, and Hispanic and Black men make up 10 and 3 percent, respectively. Anglo women hold the remaining production jobs (14 percent).

The California missiles industry is like that of Texas, with relatively greater attention to research and development and less emphasis on production. Scientists and engineers in the California missiles industry comprise 35 percent of that industry's work force, and production workers make up 16 percent (see table 34). Thus, the ratio of production workers to scientists and engineers is much less than one to one. In the aggregate, it would appear that the missiles industry in California, although larger, is in a similar stage of industrial development to the one in Texas. The educational characteristics of missiles employees in California are also similar to those of their counterparts in Texas, although a larger proportion of employees have graduate degrees (see table 35). More than 40 percent of the missiles employees in that state have college degrees. The wage structure of the California missiles industry reveals a similar proportion of employees earning high wages (see table 36). Wage equations, taking into account the independent effects of experience, age, race, sex, and education indicate that in the California missiles industry the effect of work experience on wages is no different than it is in Texas (see Appendix). However, California employees with only undergraduate degrees apparently earn relatively smaller salaries in this industry when compared to Texas employees. As in other industries, the sex of missiles employees in California is less important in determining wages than it is in Texas, implying less wage bias against women in the California missiles industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women occupy relatively few production jobs (11 percent). The California missiles industry hires relatively larger numbers of Asian-American employees (6 percent) and Hispanics (8 percent) but about the same proportion of Blacks (5 percent) (see table 37). Anglo men hold 61 percent of all production jobs, and Asian-American, Black, and Hispanic men hold 4, 4, and 12 percent, respectively. Anglo women hold 11 percent of the production jobs, and Asian-American, Black, and Hispanic women 1, 2, and 4 percent, respectively (see table 38).

The Massachusetts missiles industry is also like that of Texas. The proportion of production workers and

Table 34

Occupational Distribution in Missiles Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	16.3	7.2	.	15.3
Scientists and engineers	34.5	26.9	.	32.6
Technicians	10.6	9.7	.	11.8
Sales personnel	0.7	.	.	0.7
Administrative support	16.5	16.7	.	13.2
Production	15.8	25.8	33.3	20.1
Other occupations	5.6	13.6	66.7	6.2

Note: Percentages have been rounded. Dots indicate unavailable data.

Table 35

Educational Attainment in Missiles Industry for 1980 by State (In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	5.4	17.8	.	8.3
High school (9-12)	23.2	36.9	66.7	20.1
Postsecondary (13-15)	28.8	17.5	33.3	22.2
College degree (16+)	42.6	27.8	.	49.3

Note: Percentages have been rounded. Dots indicate unavailable data.

Table 36

Income Distribution in Missiles Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	4.1	9.7	66.7	10.4
10,000-14,999	12.9	27.8	.	11.8
15,000-19,999	19.6	24.4	.	14.6
20,000-24,999	23.0	16.7	33.3	22.9
25,000-29,999	16.8	8.1	.	17.4
30,000-34,999	11.8	6.1	.	11.1
35,000+	11.8	7.2	.	11.8

Note: Dots indicate unavailable data.

Table 37

Ethnic Distribution in Missiles Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	80.5	95.0	100.0	87.5
Asian	6.1	0.6	.	1.4
Black	4.6	2.5	.	4.9
Hispanic	7.9	1.9	.	6.2
Other	0.8	.	.	.

Note: Dots indicate unavailable data.

Table 38

Sex Distribution of Production Workers in Missiles Industry for 1980 by State and Ethnicity (In percentage)

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	11.2	61.4	37.6	57.0	.	100.0	13.8	72.4
Asian	0.9	3.6	.	.	.	.	.	
Black	1.5	4.1	2.2	.	.	.	.	3.4
Hispanic	4.1	11.7	2.2	1.1	.	.	.	10.3
Other	0.7	0.7	.	.	.	.	.	.

Note: Dots indicate unavailable data.

scientists and engineers is statistically the same. Production workers make up a small share of the work force or 26 percent, and scientists and engineers comprise 27 percent. The ratio of production workers to scientists and engineers is thus about one to one. In the aggregate, it would appear that the missiles industry in Massachusetts is in a similar stage of industrial development as the one in Texas, with relatively less emphasis on production and more on research and development compared to other industries. The educational characteristics of the Massachusetts missiles employees are unlike those of their counterparts in Texas, with about one in every three having a college degree. The wage structure is also statistically different, with relatively fewer employees in the higher salary ranges. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the work experience of missiles employees in Massachusetts has less effect on wages than it does in Texas. The effect of a graduate degree on wages is significantly greater in Massachusetts. As in Texas, men fill the majority of managerial, scientific, and technical occupations in this industry. However, women hold relatively more production jobs (42 percent). The Massachusetts missiles industry hires relatively fewer ethnic minorities than the one in Texas, with Anglos holding 95 percent of all jobs in this industry. Anglo men hold 57 percent of the missiles production jobs, and Anglo women 38 percent.

North Carolina employment in the missiles industry is too small for reliable statistical analyses of employee characteristics.

Office Machines

Employment patterns in the Texas office machines industry indicate a much greater emphasis on research and development and a far smaller emphasis on production than in other Texas high-technology industries as a whole. The Texas office machines industry employs relatively fewer production workers and more managers. Production workers comprise only 16 percent of the work force in Texas office machines manufacturing, while scientists and engineers constitute 21 percent. Thus the ratio of production workers to scientists and engineers is less than one to one. The educational characteristics of Texas office machines employees differ from those of workers in other high-technology industries as a whole, with more than one of every three employees having a college degree. Likewise, the wage structure in this industry differs from that of Texas high-technology industries as a whole, with far larger numbers earning higher salaries. The work force is predominantly Anglo (83 percent); Blacks and Hispanics hold 8 and 7 percent, respectively, of all jobs. Men hold nearly all managerial, scientific, and technical positions in this industry. However, unlike in most other high-technology industries, women hold relatively fewer pro duction jobs (38 percent). Anglo men hold 50 percent of all production jobs, and Hispanic men 9 percent. Anglo women hold 15 percent of the production jobs, and Hispanic and Black women 6 and 15 percent, respectively.

The California office machines industry is unlike that of Texas, with its relatively greater proportion of production workers and fewer scientists and engineers. Scientists and engineers in the California office machines industry make up 13 percent of that industry's work force, and production workers constitute 21 percent (see table 39). The ratio of production workers to scientists and engineers is thus less than two to one. In the aggregate, it would appear that the office machines industry in California, although larger, is in a different stage of industrial development than it is in Texas, with greater corporate concentrations in production. The educational characteristics of California office machines employees are also different from those of their counterparts in Texas in that relatively fewer employees have college degrees—about one in every four (see table 40). The wage structure of the California office machines industry reveals a smaller proportion of employees earning high wages (see table 41). Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that for the office machines industry the effects of education and work experience on wages are no different in California than they are in Texas (see Appendix). However, as in other industries, the sex of office machines employees in California is less important in determining wages than it is in Texas, implying less wage bias against women in the California office machines industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women occupy more than a third of the production jobs (35 percent). The California office machines industry hires relatively larger numbers of Hispanic and Asian-American employees: Hispanics hold 16 percent of all jobs, Asian-Americans 4 percent, and Blacks 6 percent (see table 42). Anglo men hold 42 percent of all production jobs, with Asian-American, Black, and Hispanic men holding

Table 39

Occupational Distribution in Office Machines Industry for 1980 by State
(In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	16.7	10.0	8.6	16.6
Scientists	13.2	9.5	5.2	20.7
Technicians	14.6	9.0	22.4	17.1
Sales personnel	8.7	3.6	8.6	9.7
Administrative support	20.8	28.5	13.8	14.7
Production	20.8	29.0	34.5	15.7
Other occupations	5.2	10.4	6.9	5.5

Table 40

Educational Attainment in Office Machines Industry for 1980 by State
(In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	9.4	14.9	15.5	4.1
High school (9-12)	33.3	48.0	43.1	33.6
Postsecondary (13-15)	32.3	19.5	29.3	24.9
College degree (16 +)	25.0	17.6	12.1	37.3

Table 41

Income Distribution in Office Machines Industry for 1979 by State
(In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	16.7	38.9	29.3	8.8
10,000-14,999	28.1	28.1	19.0	15.7
15,000-19,999	21.5	18.6	24.1	20.7
20,000-24,999	16.0	7.2	6.9	18.9
25,000-29,999	5.2	3.6	12.1	13.8
30,000-34,999	4.9	0.9	6.9	9.2
35,000+	7.6	2.7	1.7	12.9

Table 42

Ethnic Distribution in Office Machines Industry for 1980 by State
(In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	72.6	98.2	86.2	82.9
Asian	3.8	1.4	.	1.8
Black	6.2	0.5	13.8	7.8
Hispanic	16.3	.	.	7.4
Other	1.0	.	.	

Note: Dots indicate unavailable data.

2, 5, and 15 percent of these jobs, respectively. Anglo women fill 25 percent of the production jobs, with Asian-American and Hispanic women filling 2 and 8 percent of these positions, respectively (see table 43).

The Massachusetts office machines industry is also unlike that of Texas. The occupational structure is statistically different with respect to the proportion of production workers and scientists and engineers. Production workers comprise a larger share of the work force or 30 percent, and scientists and engineers make up 10 percent. The ratio of production workers to scientists is thus three to one. In the aggregate, it would appear that the office machines industry in Massachusetts is in a different stage of industrial development than the one in Texas, with relatively greater emphasis on production and less on research and development. The educational characteristics of Massachusetts office machines employees differ from those of their counterparts in Texas, with relatively fewer employees having college degrees—about one in every five. The wage structure is statistically different from that in Texas, with relatively fewer employees in the higher salary ranges. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the work experience of office machine employees has less effect on wages in Massachusetts than it does in Texas. However, because of the greater prevalence of production workers, the effects on wages of a postsecondary education or a graduate degree are significantly greater in Massachusetts than in Texas. The effect of the sex of employees on wages appears to be less in Massachusetts. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry. However, women hold relatively more production jobs (53 percent) than they do in Texas. The Massachusetts office machines industry hires relatively fewer employees from ethnic minorities than the Texas office machines industry, with Anglos constituting 98 percent of all employment in this industry. Anglo men hold 45 percent of the production jobs, and Black men hold nearly 2 percent. Anglo women hold 53 percent of the production jobs.

The North Carolina office machines industry is also unlike that of Texas with respect to the proportion of production workers and scientists and engineers. Production workers comprise a larger share of the work force or 35 percent, and scientists and engineers constitute 5 percent. The ratio of production workers to scientists and engineers is thus seven to one. In the aggregate, it would appear that the office machines industry in North Carolina, although much smaller, is in a different stage of industrial development than the industry in Texas, with relatively greater emphasis on production and less on research and development. The educational characteristics of North Carolina office machines employees differ from those of their counterparts in Texas, with relatively far fewer employees having college degrees—apparently less than one in eight. The wage structure is statistically different from that in Texas, with relatively fewer high-paid jobs. As in Texas, men fill the majority of managerial, scientific and technical occupations in this industry. However, unlike Texas women, North Carolina women occupy half of the production jobs. Anglo men hold 45 percent of the office machines production jobs, and Black men hold 5 percent of these jobs. Anglo women hold 40 per-

Table 43

Sex Distribution of Production Workers in Office Machines Industry for 1980 by State and Ethnicity (In percentage)

	California		Massachusetts		North Carolina		Texas	
Ethnic group	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	25.0	41.7	53.1	45.3	40.0	45.0	14.7	50.0
Asian	1.7	1.7	.	.	.	.	2.9	2.9
Black	.	5.0	.	1.6	10.0	5.0	14.7	.
Hispanic	8.3	15.0	.	.	.	.	5.9	8.8
Other	.	1.7	.	.	.	.	.	.

Note: Dots indicate unavailable data.

cent of the production jobs, and Black women 10 percent.

Pharmaceuticals

Employment patterns in the Texas pharmaceutical industry reveal a similar emphasis on research and development and yet a far smaller concentration on production than that found in Texas high-technology industries as a whole. The Texas pharmaceutical industry employs relatively fewer production workers and more managers. Production workers comprise only 12 percent of the state's pharmaceutical manufacturing employment, while scientists and engineers constitute 12 percent. Thus the ratio of production workers to scientists and engineers is one to one. The educational characteristics of Texas pharmaceutical employees differ from those of workers in other high-technology industries as a whole, with more than one of every two employees having a college degree. Likewise, the wage structure in this industry is different from that in Texas high-technology industries as a whole, with far larger numbers of employees earning higher salaries. The work force is predominantly Anglo; Blacks and Hispanics fill only 2 and 8 percent, respectively, of all jobs. Men hold nearly all managerial, scientific, and technical positions in this industry. However, as in most other high-technology industries, women hold more than half of the production jobs (55 percent). Anglo men make up 32 percent of the production work force, and Hispanic and Black men constitute 5 and 9 percent, respectively. Anglo women hold 41 percent of the production jobs, and Hispanic women 14 percent.

The California pharmaceutical industry is like that of Texas, with a relatively low concentration on production. Scientists and engineers in the California pharmaceutical industry comprise 14 percent of that industry's work force, and production workers constitute 17 percent (see table 44). The ratio of production workers to scientists and engineers is thus less than one to one. In the aggregate, it would appear that the pharmaceutical industry in California, although larger, is in a similar stage of industrial development as the one in Texas. The educational characteristics of California pharmaceutical employees are also similar to those of their counterparts in Texas in that a large proportion of employees have college degrees—about one out of two (see table 45). The wage structure of the California pharmaceutical industry reveals a similar proportion of employees earning high wages (see table 46). Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that work experience has less effect on wages for the pharmaceutical industry in California than it does in Texas (see Appendix). Furthermore, California employees with some postsecondary education but no college degree apparently earn relatively smaller salaries for that industry when compared to their counterparts in Texas. As in other industries, the sex of employees in the California pharmaceutical industry is less important in determining wages than it is in Texas, implying less wage bias against women in the California pharmaceutical industry. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women occupy nearly half the production jobs (43 percent). The California pharmaceutical industry hires relatively larger numbers of Asian-American and Hispanic employees—9 and 12 percent, respectively (see table 47). Anglo men hold 32 percent of all production jobs, with Asian-American, Black, and Hispanic men holding 4, 5, and 16 percent of these jobs, respectively. Anglo women hold 27 percent of these jobs, and Asian-American, Black, and Hispanic women hold 4, 1, and 11 percent, respectively (see table 48).

The Massachusetts pharmaceutical industry is also like that of Texas. The proportion of production workers and scientists and engineers is statistically the same. Production workers comprise a small share of the work force or 15 percent, and scientists and engineers make up 13 percent. The ratio of production workers to scientists and engineers is thus more than one to one. In the aggregate, it would appear that the pharmaceutical industries in both Massachusetts and Texas are in a similar stage of industrial development, with similar occupational composition in research and development as well as in production. The educational characteristics of Massachusetts pharmaceutical employees are the same as those of their counterparts in Texas, with almost one in every two pharmaceutical employees in that state having a college degree. The wage structure is statistically similar to that in Texas. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that the effects of work experience and higher education on wages are the same for the pharmaceutical industry in Massachusetts as in Texas. The effect of the sex of employees on wages appears to be less in Massachusetts. As in Texas, men fill the majority of managerial, scientific, and technical positions in this industry, and women hold more than half of all production jobs (57 percent). The

Table 44

Occupational Distribution in Pharmaceuticals Industry for 1980 by State (In percentage)

Occupation	California	Massachusetts	North Carolina	Texas
Management	18.6	18.7	10.4	18.0
Scientists and engineers	14.0	12.5	7.4	11.5
Technicians	9.4	11.5	13.1	8.2
Sales personnel	11.6	18.7	5.7	27.3
Administrative support	19.8	12.5	14.2	15.8
Production	17.0	14.6	29.2	12.0
Other occupations	9.6	11.5	19.9	7.1

Table 45

Educational Attainment in Pharmaceuticals Industry for 1980 by State (In percentage)

Level of education (years attained)	California	Massachusetts	North Carolina	Texas
Grade school (0-8)	10.6	8.3	19.4	9.3
High school (9-12)	22.3	24.0	43.7	18.6
Postsecondary (13-15)	24.4	22.9	14.2	19.1
College degree (16+)	42.7	44.8	22.7	53.0

Table 46

Income Distribution in Pharmaceuticals Industry for 1979 by State (In percentage)

1979 income (in dollars)	California	Massachusetts	North Carolina	Texas
5,000-9,999	13.2	15.6	34.4	19.7
10,00-14,999	28.9	29.2	33.6	20.2
15,000-19,999	21.0	17.7	14.8	14.2
20,000-24,999	14.9	11.5	6.3	16.9
25,000-29,999	9.2	8.3	4.1	14.2
30,000-34,999	5.6	6.2	4.4	6.0
35,000+	7.3	11.5	2.5	8.7

Table 47

Ethnic Distribution in Pharmaceuticals Industry for 1980 by State (In percentage)

Ethnic group	California	Massachusetts	North Carolina	Texas
Anglo	73.3	99.0	78.1	87.4
Asian	8.9	1.0	0.3	1.6
Black	4.5	.	21.0	2.2
Hispanic	12.4	.	0.5	8.2
Other	1.0	.	.	0.5

Note: Dots indicate unavailable data.

Table 48

Sex Distribution of Production Workers in Pharmaceuticals Industry for 1980 by State and Ethnicity (In percentage)

Ethnic group	California		Massachusetts		North Carolina		Texas	
	Women	Men	Women	Men	Women	Men	Women	Men
Anglo	27.2	32.0	50.0	42.9	43.9	27.1	40.9	31.8
Asian	3.9	3.9	7.1	.	.	.	.	.
Black	1.0	4.9	.	.	14.0	13.1	.	9.1
Hispanic	10.7	15.5	.	.	.	1.9	13.6	4.5
Other	.	1.0	.	.	.	.	.	.

Note: Dots indicate unavailable data.

Massachusetts pharmaceutical industry hires relatively fewer ethnic minorities than does the one in Texas, with Anglos holding 99 percent of all positions in this industry. Anglo men hold 43 percent of the pharmaceutical production jobs. Anglo women hold 50 percent of the production jobs, and Asian-American women 7 percent.

The North Carolina pharmaceutical industry differs from that of Texas. The occupational structure is statistically different with respect to the proportion of production workers and scientists and engineers. Production workers comprise a larger share of the work force or 29 percent, and scientists and engineers make up 7 percent. The ratio of production workers to scientists and engineers is thus four to one. In the aggregate, it would appear that the pharmaceutical industry in North Carolina, although much larger, is in a different stage of industrial development than the one in Texas, with relatively greater emphasis on production. The educational characteristics of North Carolina pharmaceutical employees differ from those of their counterparts in Texas, with relatively fewer employees having college degrees—apparently one in five. The wage structure is statistically different from that of Texas, with relatively fewer high-paid jobs. Wage equations, taking into account the independent effects of experience, age, race, sex, and education, indicate that work experience has a less positive effect on wages in North Carolina for the pharmaceutical industry than it does in Texas. The sex of employees is less important in determining wages in North Carolina than it is in Texas, implying less wage bias against women in the North Carolina pharmaceutical industry when the effects of education are accounted for. As in Texas, men fill the majority of managerial, scientific, and technical occupations in this industry, and women occupy more than half of the production jobs. Anglo men hold 27 percent of the pharmaceutical production jobs, with Black and Hispanic men holding 13 and 2 percent, respectively. Anglo women hold 44 percent of the production jobs, and Black women 14 percent.

5 Summary

Recent studies of national manufacturing location have suggested that research and development functions generally remain located in the Northeast and West, with production plants locating in the Sunbelt. This phenomenon implies that the United States is developing a dual manufacturing economy, with a spatial division of labor between regions. The growth of large-scale production facilities using low-skill workers in the Sunbelt would not likely generate dynamic local economies.

To ascertain whether this phenomenon applies to the emerging Texas high-technology industries, this study compared the composition of this sector in Texas to those in California, Massachusetts, and North Carolina. Interstate differences in high-technology industrial development were examined by comparing recent shifts in these states' high-technology industry mix, size distribution of firms, and measures of locational specialization of labor, such as the ratio of scientists and engineers to production workers, levels of employee education, and income distribution.

Both California and Massachusetts have proportionately more than twice the number of high-technology manufacturing workers than either Texas or North Carolina. California has nearly four times the number of high-technology manufacturing workers of Texas, while Massachusetts has an equal number, and North Carolina less than half. However, despite the difference in size, in the high-technology sector Texas resembles California more than either Massachusetts or North Carolina.

Although the California high-technology sector is more diversified than that of Texas, communication equipment, computers, electronic components, and aircraft are the dominant high-technology industries in both states. Most California high-technology industries resemble those of Texas. Industrial stages are apparently the same for the aircraft, missiles, computer, electrical, instruments, and pharmaceutical industries, with both states having similar proportions of employees in production work. The states differ with respect to only two industries. The California communication equipment industry devotes relatively greater attention to research and development and has relatively more small firms. The California office machines industry has relatively greater concentration in product manufacturing. In only two industries, communication equipment and scientific instruments, does California employ relatively more scientists and engineers. In only two industries, communication equipment and missiles, does California have proportionately more small firms. Thus, while California has a much larger high-technology industrial sector, the character of that sector is remarkably similar to that of Texas.

The Massachusetts high-technology manufacturing sector is less diversified, with instruments being the dominant industry. Industrial stages are apparently the same in both states for the missiles, computer, communication, instruments, and pharmaceutical industries, with both states having similar proportions of employees in production work. However, the Massachusetts computer, electrical, electronic components, and instruments industries have relatively fewer small firms. The states differ with respect to the production employment characteristics of three industries. The Massachusetts aircraft, electrical, and office machines industries have a greater emphasis on production. In only one industry, scientific instruments, does Massachusetts employ relatively more scientists and engineers than does Texas.

The North Carolina high-technology sector least resembles that of Texas. It is less diversified, with the greatest concentration in electrical machinery. The aircraft, electrical equipment, instruments, office machines, and pharmaceutical industries have a far greater emphasis on production and less on research and development. Industrial stages are apparently the same for only the missiles, computer, and communication equipment industries, with both states having similar proportions of employees in production work. Yet all North Carolina high-technology industries have relatively fewer small firms and, with the exception of the computer, aircraft, and missiles industries, relatively more large-scale production firms. No North Carolina high-technology industry employs relatively more scientists and engineers than does that industry in Texas.

Shifts in the high-technology industry mix between 1977 and 1982 in Texas, California, and Massachusetts created a somewhat greater demand for professionals and technicians than for production workers as well as a greater demand for college graduates than for those with a high school education or less. Conversely, the high-technology industrial shift in North Carolina created a greater demand for production workers and those with only secondary education. In this respect, Texas again resembles California and Massachusetts more than North Carolina.

The shift in the industrial mix of these states has no dramatic effect on the occupational and educational characteristics of the high-technology work forces in these states. However, common trends were discernible.

Shifts in the Texas high-technology industry mix between 1977 and 1982, assuming constant occupational and educational composition for each state industry throughout that period, resulted in increased proportions of professional and technical employees and decreased proportions of administrative support and production and service workers (see table 49). Likewise, there was a shift toward hiring more college graduates and fewer workers with a high school education or less (see table 50).[15]

Shifts in the California high-technology industry mix between 1977 and 1982 resulted in increased proportions of managerial, technical, and sales employees and decreased proportions of scientists and production workers. There was a shift toward employing those with some postsecondary education and away from those with a high school education or less.

Shifts in the Massachusetts high-technology industry mix between 1977 and 1982 resulted in increased proportions of professional and technical employees and decreased proportions of production and service workers. Likewise, there was a shift toward employing those with a college degree or some postsecondary education and away from hiring those with a high school education or less.

Conversely, the high-technology industrial shift for North Carolina, *ceteris paribus*, created greater demand for production workers and those with only a secondary education.

In conclusion, most Texas high-technology industries do not fall within the Sunbelt manufacturing pattern of relocated large-scale production plants, typified by North Carolina. Instead, the emerging Texas high-technology sector as a whole shares with California the characteristics of a dynamic industry, with diversity of small and large firms and attention to innovation as well as production.

Table 49

Estimated Change in Total High-Technology Occupational Composition 1977–1982 by State (In percentage)

Occupation	California			Massachusetts			North Carolina			Texas		
	1977	1982	Percentage change	1977	1982	Percentage change	1977	1982	Percentage change	1977	1982	Percentage change
Management	15.1	15.2	0.2	12.6	12.9	0.3	10.0	9.9	-0.1	11.8	11.9	0.1
Scientists and engineers	18.8	18.4	-0.4	14.5	14.5	0.1	8.7	8.8	0.1	15.6	15.7	0.2
Technicians	12.5	12.7	0.2	12.0	12.0	0.1	11.2	11.0	-0.2	14.5	14.8	0.3
Sales personnel	2.3	2.4	0.1	2.0	2.1	0.0	2.7	2.5	-0.1	3.1	3.1	0.0
Administrative support	16.3	16.3	0.0	15.5	15.8	0.3	13.8	13.9	0.1	13.9	13.8	-0.1
Production	27.7	27.6	-0.1	33.4	32.8	-0.5	39.4	39.6	0.2	31.4	30.9	-0.4
Other occupations	7.3	7.3	0.0	10.0	9.8	-0.2	14.2	14.2	0.0	9.7	9.6	-0.1

Note: Percentages have been rounded. Dots indicate unavailable data.

Table 50

Estimated Change in Educational Characteristics of High-Technology Work Force 1977–1982 (In percentage)

Level of education (years attained)	California			Massachusetts			North Carolina			Texas		
	1977	1982	Percentage change	1977	1982	Percentage change	1977	1982	Percentage change	1977	1982	Percentage change
Grade school	11.7	11.7	0.0	15.4	15.3	-0.1	18.9	19.1	0.2	14.4	14.2	-0.3
High school	30.3	30.2	-0.1	39.9	39.5	-0.4	44.7	44.7	0.0	33.3	33.2	-0.1
Postsecondary	29.3	29.5	0.1	20.1	20.3	0.2	19.4	19.4	0.0	25.9	26.0	0.1
College degree	28.6	28.6	0.0	24.7	25.0	0.3	17.0	16.8	-0.2	26.3	26.6	0.3

Note: Percentages have been rounded.

Appendix

To measure the differential effects of labor-force characteristics on the wage structures of the Texas, California, Massachusetts, and North Carolina high-technology industries, earnings for high-technology manufacturing employees were estimated as functions of various personal attributes, including years of education, work experience, age, occupation, race, and sex (see table 51). The coefficients were compared to determine equality among the state industry equations.[16]

The model for estimating wages in these industries is specified as follows:

logINCOME = a + b1logAGE + b2MALE + b3BLACK + b4HISPANIC + b5POSTSECONDARY + b6COLLEGE + b7GRADUATE ED + b8WORK75 + e

where:

logINCOME	= natural logarithm of an individual's 1979 wage or salary earnings
logAGE	= natural logarithm of an individual's age in 1980
MALE	= gender recorded as male
BLACK	= ethnicity recorded as Black
HISPANIC	= ethnicity recorded as Hispanic
POSTSECONDARY	= individual with 13–15 years of formal education
COLLEGE	= individual with 16 years of formal education
GRADUATE ED	= individual with more than 16 years of formal education
WORK75	= individual having worked in 1975
a	= constant
e	= error

Except for AGE, all independent variables are dichotomous (dummy) variables. INCOME is used as a proxy for annual industrial wages paid to the individual employee. AGE is used as a proxy variable for years of work experience, with WORK75 used to control for recent employment among older employees. The variables BLACK and HISPANIC are used to reveal effects of wage bias against minorities. Likewise, MALE is used to determine effects of wage bias against women. The variables POSTSECONDARY, COLLEGE, and GRADUATE ED measure the direct effect of different levels of education on earnings.

The log transformation of the dependent variable, INCOME, was performed to reduce the influence of extremely low or high observations and to produce standardized independent variable regression coefficients, allowing for comparative sensitivity analysis among regressions of different populations. The log transformation of the independent variable AGE was performed because age takes on a wide range of values but produces less and less effect on the dependent variable beyond a certain level.

Wage equations were estimated using the ordinary-least-squares method for each high-technology industry within each state.

Data were obtained from the 1980 *Public-Use Microdata Samples* of the U.S. Census for the states of Texas, California, Massachusetts, and North Carolina.[17] Only those individuals employed in manufacturing full time for at least one year were included in the sample, thus excluding those individuals with an income of less than $5,000 in 1979, with a work week of less than thirty hours, and with a work year of less than forty-eight weeks. The resultant samples totaled 8,991 individuals for Texas, 29,661 for California, 9,677 for Massachusetts, and 3,291 for North Carolina.

Table 51

Wage Equation Estimates by State and Industry (1979 Income)

State and industry	LAGE	MALE	BLACK	HISP	POST	COLL	GRAD	WORK75	R^2C
Aircraft									
California	0.404	0.283	-.099	-.141	0.114	0.300	0.392	0.153	0.439
	(0.015)	(0.010)	(0.015)	(0.013)	(0.010)	(0.015)	(0.016)	(0.012)	
Massachusetts	0.383	0.329	-.095*	-.114*	0.156	0.418	0.485	0.201	0.445
	(0.042)	(0.033)	(0.058)	(0.131)	(0.031)	(0.039)	(0.042)	(0.039)	
North Carolina**									
Texas	0.400	0.313	-.138	-.199	0.135	0.327	0.412	0.147	0.445
	(0.024)	(0.017)	(0.029)	(0.027)	(0.016)	(0.020)	(0.023)	(0.020)	
Communication equipment									
California	0.437	0.397	-.086	-.133	0.121	0.345	0.434	0.199	0.525
	(0.023)	(0.015)	(0.031)	(0.020)	(0.015)	(0.021)	(0.022)	(0.017)	
Massachusetts	0.389	0.344	0.158*	-.200*	0.140	0.453	0.527	0.111	0.500
	(0.035)	(0.023)	(0.085)	(0.078)	(0.279)	(0.032)	(0.037)	(0.031)	
North Carolina	0.411	0.342	-.124	-.373*	0.058*	0.403	0.508	0.239	0.541
	0.052	0.030	0.040	0.165	0.036	0.044	0.061	0.042	
Texas	0.433	0.443	-.117	-.159	0.061	0.299	.406	0.143	0.570
	(0.034)	(0.021)	(0.029)	(0.031)	(0.022)	(0.030)	(0.032)	(0.023)	
Computing machines									
California	0.409	0.344	-.108	-.115	0.189	0.394	0.537	0.219	0.517
	(0.022)	(0.013)	(0.030)	(0.019)	(0.015)	(0.018)	(0.018)	(0.015)	
Massachusetts	0.348	0.348	-.163	-.207	0.181	0.439	0.564	0.174	0.540
	(0.026)	(0.016)	(0.038)	(0.050)	(0.018)	(0.021)	(0.021)	(0.018)	
North Carolina	0.644	0.332	-.133	-.271*	0.133	0.457	0.520	0.259	0.598
	(0.070)	(0.041)	(0.049)	(0.189)	(0.040)	(0.045)	(0.054)	(0.045)	
Texas	0.465	0.411	-.085*	-.249	0.185	0.430	0.462	0.239	0.553
	(0.060)	(0.032)	(0.049)	(0.049)	(0.036)	(0.039)	(0.043)	(0.035)	
Electrical equipment									
California	0.357	0.357	-.171	-.156	0.162	0.386	0.532	0.196	0.521
	(0.016)	(0.010)	(0.022)	(0.013)	(0.012)	(0.015)	(0.015)	(0.012)	
Massachusetts	0.346	0.412	-.055*	-.157*	0.188	0.472	0.661	0.183	0.588
	(0.022)	(0.015)	(0.048)	(0.050)	(0.019)	(0.022)	(0.024)	(0.019)	
North Carolina	0.267	0.360	-.110	-.095*	0.163	0.419	0.639	0.153	0.457
	(0.032)	(0.019)	(0.028)	(0.094)	(0.024)	(0.034)	(0.051)	(0.025)	
Texas	0.374	0.407	-.126	-.181	0.161	0.422	0.539	0.166	0.556
	(0.024)	(0.015)	(0.022)	(0.022)	(0.017)	(0.022)	(0.022)	(0.017)	
Instruments									
California	0.392	0.386	-.150	-.154	0.167	0.370	0.504	0.194	0.509
	(0.024)	(0.015)	(0.033)	(0.019)	(0.017)	(0.021)	(0.022)	(0.017)	
Massachusetts	0.322	0.379	-.001*	-.043*	0.172	0.436	0.594	0.201	0.523
	(0.024)	(0.016)	(0.037)	(0.055)	(0.019)	(0.022)	(0.024)	(0.020)	
North Carolina	0.282	0.421	-.150	-.019*	0.171	0.549	0.731	0.200	0.568
	(0.063)	(0.036)	(0.051)	(0.164)	(0.048)	(0.071)	(0.091)	(0.047)	
Texas	0.269	0.424	-.053*	-.207	0.220	0.449	0.632	0.196	0.567
	(0.046)	(0.028)	(0.046)	(0.037)	(0.033)	(0.041)	(0.048)	(0.032)	
Missiles									
California	0.389	0.320	-.098	-.083	0.094	0.316	0.423	0.187	0.530
	(0.016)	(0.010)	(0.019)	(0.015)	(0.011)	(0.012)	(0.012)	(0.013)	
Massachusetts	0.277	0.355	-.028*	0.029*	0.133	0.391	0.643	0.134	0.619
	(0.050)	(0.036)	(0.094)	(0.107)	(0.040)	(0.049)	(0.044)	(0.045)	
North Carolina**									
Texas	0.274*	0.459	0.001*	-.187*	0.097*	0.469	0.511	0.177*	0.559
	(0.117)	(0.077)	(0.143)	(0.118)	(0.083)	(0.077)	(0.082)	(0.090)	
Office machines									
California	0.329	0.303	-.288	-.219	0.155	0.434	0.377	0.231	0.424
	(0.087)	(0.052)	(0.099)	(0.066)	(0.056)	(0.072)	(0.083)	(0.062)	
Massachusetts	0.234	0.341	0.175*	.	0.244	0.385	0.636	0.208	0.606
	(0.063)	(0.040)	(0.294)	.	(0.051)	(0.069)	(0.073)	(0.049)	
North Carolina**									
Texas	0.498	0.467	0.014*	-.178*	0.097*	0.354	0.394	0.242	0.440
	(0.116)	(0.071)	(0.099)	(0.101)	(0.071)	(0.075)	(0.075)	(0.076)	
Pharmaceuticals									
California	0.353	0.349	-.116*	-.197	0.121	0.366	0.416	0.131	.
	(0.056)	(0.032)	(0.073)	(0.048)	(0.040)	(0.044)	(0.045)	.	
Massachusetts	0.500	0.310	.	.	0.352	0.645	0.539	0.212*	0.540
	(0.151)	(0.095)	.	.	(0.115)	(0.117)	(0.129)	(0.125)	
North Carolina	0.240	0.376	-.057*	0.003*	0.120*	0.449	0.576	0.150	0.545
	(0.065)	(0.039)	(0.042)	(0.232)	(0.050)	(0.059)	(0.061)	(0.047)	
Texas	0.480	0.508	-.076*	-.299	0.249	0.469	0.495	0.060*	0.577
	(0.112)	(0.063)	(0.197)	(0.104)	(0.085)	(0.080)	(0.088)	(0.071)	

Note: Unless otherwise indicated, all coefficients are significant at .01 level. Standard errors are in parentheses. Dots indicate unavailable data.
*Insignificant at .01 level.
**Insufficient data.

Notes

1. See Herb Brody, "High Tech Sweepstakes: States Vie for a Slice of the Pie," *High Technology* 5, no.1 (January 1985): 16–38; and Michael Peltz and Marc A. Weiss, "State and Local Government Roles in Industrial Innovation," *Journal of the American Planning Association* 50 (Summer 1984): 270–79.

2. See Edward J. Malecki, "High Technology and Local Economic Development," *Journal of the American Planning Association* 50 (Summer 1984): 262–69; R.P. Oakey, *High Technology and Industrial Location* (Hampshire, England: Gower, 1981); and R.P. Oakey, *High Technology Small Firms: Regional Development in Britain and the United States* (New York: St. Martin's Press, 1984).

3. M. D. Thomas, "Growth Pole Theory, Technological Change, and Regional Economic Development," *Papers of the Regional Science Association* 34 (1975): 3–25; Edward J. Malecki, "Product Cycles, Innovation Cycles, and Regional Economic Development," *Papers of the Regional Science Association* 47 (1981): 121–37.

4. See R.G. Morse, *The Role of New Technical Enterprises in the U.S. Economy, Report of the Commerce Technical Advisory Board to the Secretary of Commerce* (Washington, D.C.: U.S. Department of Commerce, 1976).

5. See R. D. Norton and J. Rees, "The Product Cycle and the Spatial Decentralization of American Manufacturing," *Regional Studies* 13 (1979): 141–51; Edward J. Malecki, "Locational Trends in R&D by Large U.S. Corporations, 1965–1977," *Economic Geography* 55 (1979): 309–23; Edward J. Malecki, "Dimensions of R&D Location in the United States," *Research Policy* 9 (1980): 2–22; Edward J. Malecki, "Firm Size, Location, and Industrial R&D," *Review of Business and Economic Research* 16 (1980): 29–42; Edward J. Malecki, "Corporate Organization of R&D and the Location of Technological Activities," *Regional Studies* 14 (1980): 219–34.

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15. Occupational and educational distributions were derived from U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1980: Public-Use Microdata Samples (computer tapes). Employee characteristics of the electronic components industry are assumed to be those of the electrical equipment industry. The office machines industry is included in the computing equipment category.

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16. For discussion of test of equality of coefficients of different regression equations, see Gregory C. Chow, "Tests of Equality between Sets of Coefficients in Two Linear Regressions," *Econometrica* 28 (July 1960): 591–605; and Franklin M. Fisher, "Tests of Equality between Coefficients in Two Linear Regressions: An Expository Note," *Econometrica* 36 (March 1970): 361–66.

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