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Rethinking High Tech in Texas: Policy Challenges

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A widely disseminated report predicted in 1994 that "the image of a Texas economy driven by natural resources, oil, gas, and agriculture is a thing of the past. While these resource-based industries will remain important to the state, technology-producing industries will increasingly share the spotlight."[1]

But, what are technology-producing industries? If R&D is used as a proxy for technology, the oil and gas extraction industry, for example, qualifies as high technology. However, if high technology is defined as skill-intensive industries, oil and gas extraction cannot be considered high technology. These designations are important because economic development policies in the state currently favor high-tech industries.

Defining "high technology" is not easy. However, one component is widely accepted: a high percentage of *both* R&D expenditures and engineers and scientists. The assumption here is that high-tech industries, because of their innovative nature, spend more on R&D and employ more skilled workers than other industries on average.

We use the definition that bases a high-tech designation on the percentage of engineers, engineering technicians, computer scientists, life scientists, and mathematicians employed in the industry labor force.[2] We chose this definition because human skills highly correlate with other indicators of "technological" performance, such as R&D, the stock of capital, and information intensity.

Why all the Fuss About High Technology?

High technology in Texas, and in the nation as a whole, represents a small percentage of total employment. This is so even in regions with a concentration of high-tech industries such as Silicon Valley, where, in fact, both high-tech manufacturing and services represented less than 12 percent of total employment in 1993. In Texas, the share of high-tech employment (manufacturing and services) relative to total employment remained flat at 8 percent between 1988 and 1997. High-tech employment has a much larger share in the metropolitan areas, but its share of total employment is still relatively small. In 1993, high-tech employment represented less than 12 percent of total employment in Austin, Fort Worth, Dallas, San Antonio, and Houston.

If most employment is still generated by industries other than high tech, then why is high technology a top priority for economic development policies? The answer is that we expect most innovations to occur in high-tech firms, especially those with a large percentage of engineers and scientists. And innovations are the engine of growth for cities and regions. The prime example is Silicon Valley, which reinvents itself

constantly by generating innovations that help the area develop more technologically sophisticated products and surpass competition from Japanese companies and Route 128. Using utility patents as a proxy for innovations, we find that, despite the relatively small participation of high-tech services and manufacturing in total employment in this region, Silicon Valley generates more patents than any other U.S. metropolitan area. In 1995, San Jose alone generated 2,415 patents. The Houston (1,190 patents), Dallas (1,060), and Austin (683) metropolitan areas occupied, respectively, the 9th, 11th, and 21st places.

High-Tech Sector Growth, 1988—1997

To analyze the growth of high-tech sectors in Texas, we defined as high technology those sectors employing a high percentage of engineers and scientists. Using 1988—1997 Bureau of Labor Statistics employment data, we reclassified high-tech industries in three groups: energy-related manufacturing, services, and nonenergy-related manufacturing.[3]

In 1988, Texas had 550,704 people employed in these three high-tech sectors. This number increased to 718,689 in 1997, a gain of 167,985 new high-tech jobs. Despite the overall gain, the performance of each of the three sectors differed significantly. Energy-related high-tech industries added only 3,270 jobs during this period and nonenergy-related high-tech manufacturing added 29,757 new jobs. Services, however, showed a much larger gain: 134,958 new jobs. These relative changes in employment affected the percentage participation of each sector within the high-tech industry. In 1988, the percentage distribution was 48 percent in nonenergy-related high-tech manufacturing, 34 percent in high-tech services, and 19 percent in energy-related high-tech manufacturing. In 1997, their respective participations were: 41 percent, 44 percent, and 15 percent. Thus, as the figure illustrates, from 1988—1997, services steadily gained participation within the high-tech industry in Texas at the expense of both energy- and nonenergy-related high-tech manufacturing.

Policy Issues

Regional patterns of growth in high-tech industries suggest a major revision to traditional location theory by emphasizing, in particular, the *role of government investment* or demand in tipping the balance toward firms in particular regions.[4] As Texans prepare to live in a state economy driven by high-tech sectors, policymakers should be careful in allocating resources and designing policies that favor a broad rather than a narrow base high-tech industry. An important share of high tech employment is generated in high-tech services and energy-related industries such as chemicals.

In the shift from crude oil to skill-intensive industries, policymakers have identified the supply of labor as a key component of growth for high-tech industries. It is necessary, however, to differentiate between factors that define the market for technicians and those that define it for engineers/scientists. While technicians are hired mainly locally, engineers and scientists come mainly from other high-tech regions. The need for a good *local* supply of technical personnel demands technology-focused programs at community colleges, while an abundant supply of engineers and scientists will depend on how well Texas cities can compete with other cities. The factors that attract these professionals suggest the term "quality of life" and are a component of the positive agglomeration economies in cities. The challenge for policymakers is to maintain and expand positive agglomeration economies associated with good schools, availability of amenities and green areas, good mobility within the city, safety, and the presence of a large university that offers continuing education for engineers and scientists. The new MBA customized for Texas Instruments at the Graduate School of Business at the University of Texas at Austin is a pioneer in this direction.

Notes

1. Texas Comptroller of Public Accounts, *Forces of Change: Shaping the Future of Texas*, 1994.

2. A. Markusen, P. Hall, and A. Glasmeier, *High tech America: The What, How, Where, and Why of the Sunrise Industries*, Boston: Allen & Unwin, 1986.

3. Energy -related high-tech manufacturing: SICs 2812, 2813, 2816, 2819, 2821, 2822, 2823, 2824, 2835, 2836, 2833, 2834, 2841, 2842, 2843, 2844, 2851, 2861, 2865, 2869, 2873, 2874, 2875, 2879, 2891, 2892, 2893, 2895, 2899, 2911. Services: SICs 737, 871, 873, 874, 8721. Nonenergy-related high-tech manufacturing: all other high-tech SICs. See E.L. Echeverri-Carrol, *Japanese Style Networks and Innovations in High-Technology Firms in Texas*, Bureau of Business Research and IC^2 Institute, University of Texas at Austin, 1997.

4. M. Oden, "From Assembly to Innovations," *Planning Forum*, 3:14—30.

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