Industry Clusters in Texas

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Advances in technology have dramatically reduced transportation and communication costs. Access to distant goods, services and even labor has become much easier. Increased access to markets has also brought increased competition, pressuring firms to reduce costs to maintain profitability. In this age of globalization, as Michael Porter notes, the importance of generalized urban economies diminishes, and agglomeration economies become much more important.[1]

An agglomeration economy, also known as a cluster, is defined as a geographically concentrated group of industries related by technology or skills, with close linkages among buyers and suppliers. Clusters are important because they provide their participants with easy and lucrative access to knowledge and specialized resources required to operate efficiently. This enhances participants' productivity and spurs innovation. Clusters also attract new business and investment

to the region. It is this increased efficiency and the ability to innovate and attract outside investment that give cluster participants a competitive advantage.[2] A good example of an industry cluster is the Dallas telecom corridor that attracted hundreds of high-tech manufacturing and services firms to the metro during the high-tech boom in the 1990s.

Industry clusters lead and shape the economic growth of a region. One simple way of determining industry clusters is through economic base analysis. The economic base of a region is defined as industries whose external demand generates outside revenues and stimulates local economic growth. The assumption is that nontraded goods and services tend to be uniformly distributed, do not bring outside income into the region, and therefore, do not form the region's economic base.

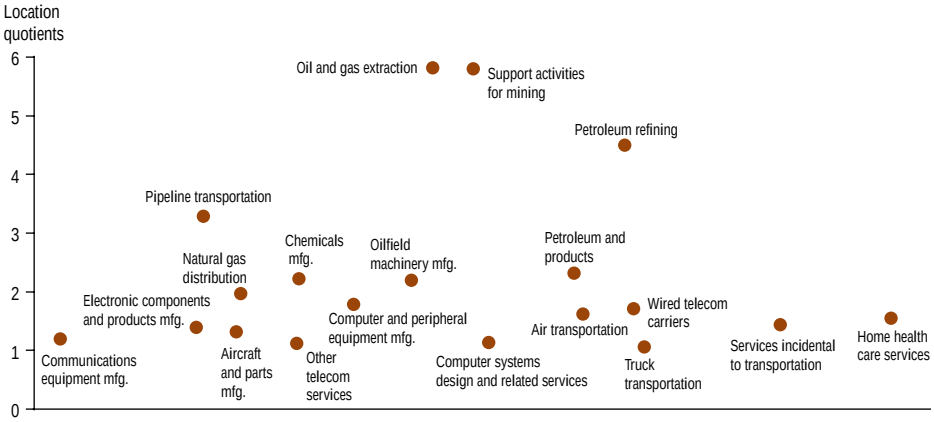
To determine which goods and services produced in Texas and its major metropolitan areas are basic, or exportable, we use location quotients (LQ), a tool commonly used to analyze the economic base of a region. Location quotients compare the local economy with a reference economy (for example, the Dallas economy with the U.S. economy) to identify areas of specialization. The quotients are computed as follows:

$$LQ_i = \frac{\text{local employment in industry } i / \text{U.S. employment in industry } i}{\text{total local employment} / \text{total U.S. employment}}$$

Location quotients higher than 1 indicate that the regional concentration of these industries is greater than their national concentration and so they are likely to be part of the economic base of the region. The greater the location quotient, the higher the concentration and the more certain we are of the basic nature of the industry.[3]

Our location quotients are computed using 2000 census employment data from Integrated Public Use Microdata Series (IPUMS) files.[4] We first analyze Texas' economic base and compare the state's geographic dispersion of industries with that of the nation.[5] We then look at the basic activities of the six major metropolitan areas in Texas and compare the degree of agglomeration with both Texas and the United States.

Chart 1
Texas Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

How Texas Compares With the United States

Historically, Texas has been known for oil, cotton and cattle. But in recent decades the state's image has changed substantially. Today, the economic base is more diverse and includes transportation, computer, semiconductor and telecommunication firms.

Chart 1 plots the location quotients of Texas with the United States as the reference region.[6] The chart shows that even though Texas has diversified, the energy industry is still a large part of its economic base. Oil and gas extraction and its support activities, pipelines, natural gas distribution, refining and oilfield-machinery manufacturing are still agglomerated in Texas. However, high-tech and transportation industries have been added to this mix. Computers, telecommunication services, semiconductors and air transportation firms now have a larger presence in Texas than in the nation.

Looking first at energy-related industries, the state's share of employment in oil and gas extraction and mining is nearly six times the national share. Much less dramatic, yet significant, are the location quotients for high-tech manufacturing and services. The share of computer and peripheral equipment manufacturing in Texas employment is 78 percent higher than in the nation, wired telecommunication services 50 percent higher, other telecom services 21 percent greater and electronic components manufacturing, which includes semiconductor manufacturing, is 44 percent higher than in the nation. Finally, the nation's employment share in air transportation is approximately 60 percent less than that of Texas. Moreover, the high-tech, oil and gas, and air transportation industries are the largest employers in Texas, confirming their importance to the state's economic base.

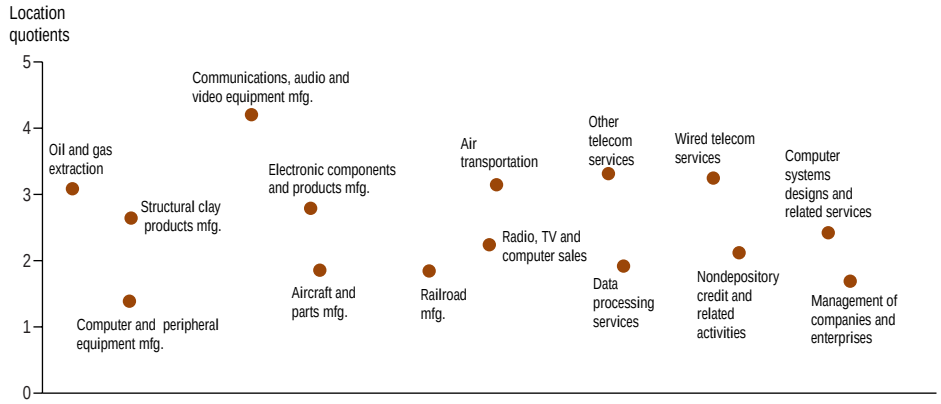
Since higher concentration indicates the presence of clusters, or specialization, these industries are the central drivers of the Texas economy. The prominence of these industries—high tech, telecommunication services and air transportation—helps to explain why the state's economy fared worse than the nation's during the recent downturn. Despite the high-tech bust, high-tech manufacturing and service sectors remain clustered in Texas.[7]

Based on location quotients, nearly 35 percent of Texas' employment is in industries that can be classified as "basic" or exportable. In these basic industries, 17 percent of Texas' workforce produces goods and services that satisfy nonlocal demand.

Texas Major Metros

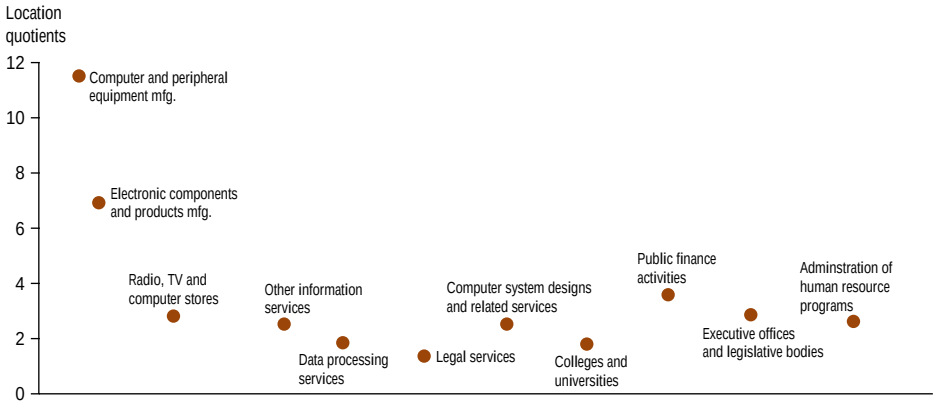
The major metropolitan areas in Texas account for more than two-thirds of the state's employment, so the sectors that lead these metro economies determine the state's overall economic base. The composition of economic activity varies significantly among Texas' major metros.

Chart 2
Dallas Compared with the United States



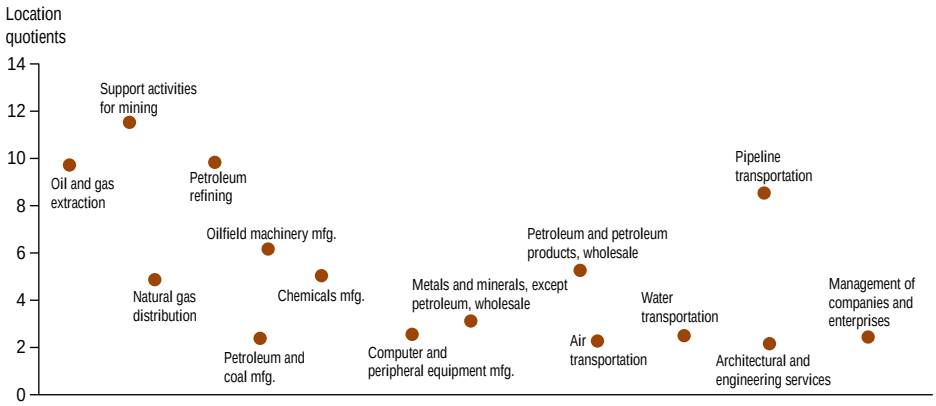
SOURCE: 2000 Census IPUMS data; authors' calculations.

Chart 3
Austin Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

Chart 4
Houston Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

Each metro area specializes in a unique set of industries, diversifying and strengthening the state's economy.[8]

Dallas. Location quotients for Dallas confirm the metro is the high-tech mecca, transportation hub and telecommunication nexus of Texas. Dallas' share of workers in other telecom services, air transportation services, communications equipment manufacturing and computer systems design and services is twice or more when compared with the overall state. This concentration of high tech becomes even more striking when the metro is compared with the United States (*Chart 2*). Employment shares of communications equipment manufacturing are four times greater than in the nation, while those of telecom services (both wired and other) and air transportation exceed the national shares by three times. Moreover, although Dallas doesn't have much energy industry concentration compared with the state, oil and gas extraction is—surprisingly—Dallas' fifth-most-concentrated industry in comparison with the nation. Despite the recent downturn, high-tech manufacturing and services firms remain key contributors of the metro's economic base.

Austin. High tech and state government compose Austin's economic base. This is evident from the metro's location quotients, which surpass the state's employment shares in computer and peripheral manufacturing (6.4 times), electronic components manufacturing (4.8 times), public administration of environmental quality programs (3.8 times), public finance activities (3.6 times), and executive and legislative bodies (3.3 times). Compared with the nation, Austin's larger presence of computer and chip makers is even more pronounced (*Chart 3*), and the metro's share of workers employed in these industries significantly exceeds the national share (11.5 and 6.9 times, respectively). Although the recent high-tech bust hit Austin hard, semiconductor and computer manufacturing industries remain key elements of the metro's economic base.

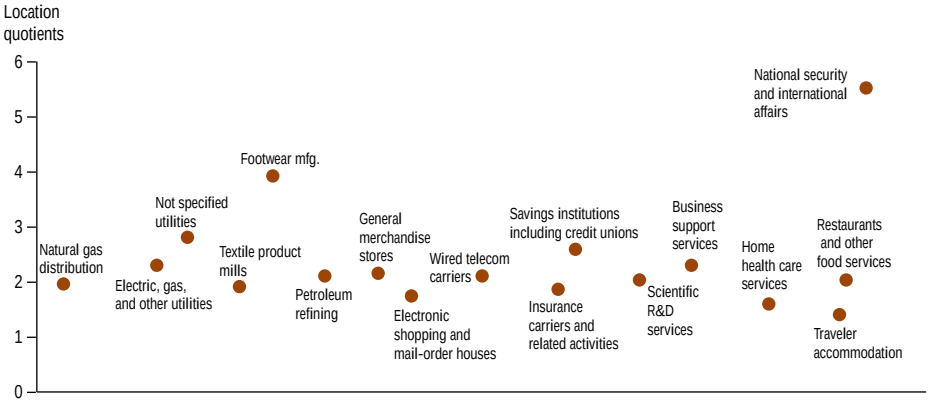
Houston. Houston is Texas' oil and gas capital and home to the sixth largest seaport in the world. Not surprisingly, the location quotients convey a similar story. Five of the 10 most geographically concentrated industries compared with the

state as well as the nation are related to oil and gas production, drilling and oil services (*Chart 4*). Given that the oil and gas industry is more prevalent in Texas than in the United States, Houston exhibits much stronger oil- and gas-related industry clusters in reference to the nation than to Texas. Location quotients for both upstream and downstream oil and gas activities such as extraction, support activities for mining, pipeline transportation, petroleum refining and wholesaling of petroleum products more than double when the base region changes from Texas to the United States. Downstream activities such as petroleum refining and chemicals manufacturing also bolster port activity. Hence, the share of water transportation employment is twice as high in Houston when it is compared with the rest of Texas (2.6 times) as well as the nation (2.4 times). Also, because Texas has a high share of computer manufacturing, Houston's edge over the nation in computer and peripheral equipment manufacturing (2.5 times higher) is larger than its edge over Texas (1.4 times higher).

San Antonio. San Antonio's economic base thrives on tourism and the presence of large insurance firms, electric and gas production and distribution firms, and four military bases. Also, the metro has a significant presence of health care organizations and recently has become home to several telemarketing companies (*Chart 5*). The metro exhibits similar employment share ratios when compared with the state or nation. First, San Antonio's share of employment in national security and international affairs is more than five times that of the nation as well as the state, largely because of the strong military presence in the metro. Second, there is sizable specialization of insurance providers and electric and gas producers and distributors. Third, San Antonio has more than twice the share of its aggregate labor force employed in scientific research and development compared with the country and Texas. Last, specialization in industries related to tourist activity—general merchandise stores, restaurants and traveler accommodation services—is at least one and a half times higher in the metro than in the state and nation. The only vivid difference is the concentration of workers in wired telecom services; the metro's share of these workers exceeds the national share by 112 percent and the state share by merely 38 percent. Job losses during the recent downturn were mitigated in San Antonio because of the metro's low concentration of high-tech industries. Thus, the concentration of the metro's base industries has held steady.

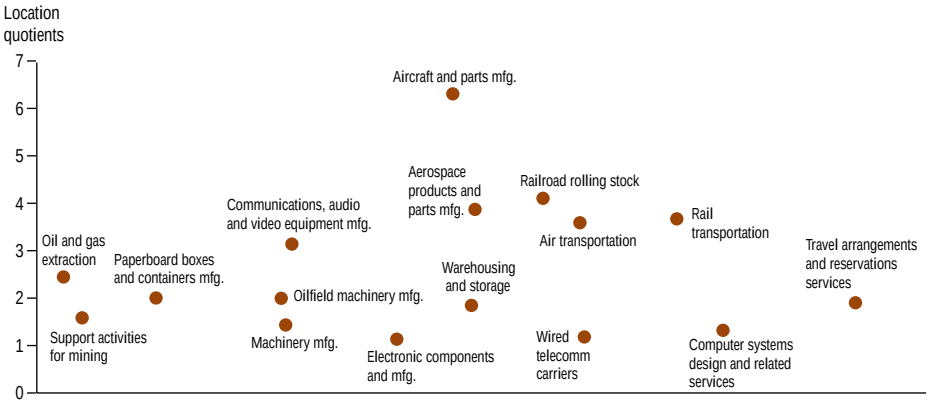
Fort Worth–Arlington. Fort Worth–Arlington is a major air and rail transportation hub in Texas with historic ties to oil, aircraft and aerospace product manufacturers. Fort Worth's employment shares in aircraft, aerospace products and parts manufacturing, communications equipment manufacturing as well as air and rail transportation are two to four times higher than the state's shares. This agglomeration becomes more prominent when compared with the nation (*Chart 6*). Fort

Chart 5
San Antonio Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

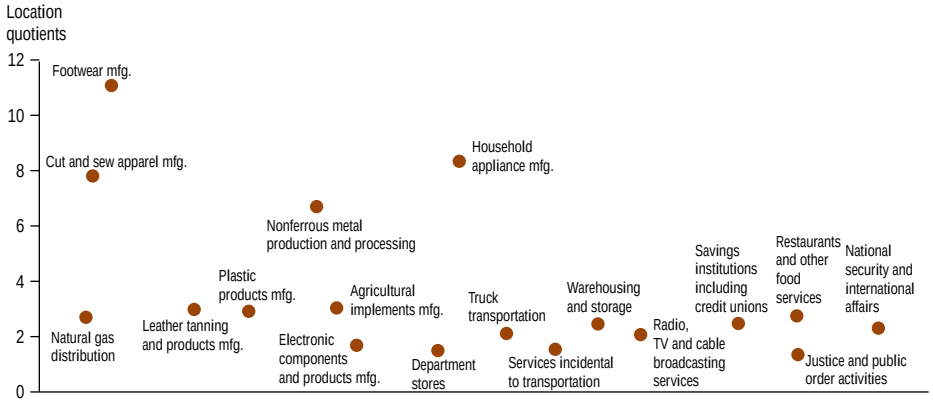
Chart 6
Fort Worth Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

Exportable goods and services are important because they generate out-of-state revenue and stimulate state growth.

Chart 7
El Paso Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

Worth–Arlington's employment shares in these same industries is more than three to six times those of the nation. Since the recent recession, the composition of Fort Worth's leading industries has remained unchanged.

El Paso. El Paso specializes in manufacturing, trade and transportation because of its close ties with Mexico (*Chart 7*). More recently, the metro has seen substantial growth in its high-wage manufacturing and service sector. Generally, the trade sector displays limited specialization. As a result of El Paso's location along the U.S.–Mexico border, however, the metro's employment share in warehousing and storage is twice that of Texas as well as the nation. The metro's employment shares in footwear, cut and sew apparel, textile and household appliance manufacturing are more than 10 times higher than the state's employment shares. These shares are also high when compared with the nation. Cut and sew apparel, footwear and household appliance manufacturing exceed national shares by eight times. Despite the high shares, the passage of NAFTA has led to much of this manufacturing going across the border. Thus, the number employed in these industries makes up only 4 percent of El Paso's total employment. The largest employers in El Paso today are still closely tied to the maquiladora industry across the border but are a different set of industries, including plastic products manufacturers, electronic component and product manufacturers, department stores, trucking, warehousing and storage firms.

Conclusion

The Texas economy thrives on a diverse mix of industries. Once known as the land of oil, cotton and cattle, Texas has developed into a high-tech hub. High-tech and energy sectors are the state's densest clusters, but Texas has many other industries whose shares in the state are higher than their shares in the nation and thus contribute to the state's economic base. Nearly 35 percent of Texas' employment is in industries that can be classified as basic, or exportable. In these basic industries, slightly less than half the workers are engaged in producing goods and services that satisfy nonlocal demand. Exportable goods and services are important because they generate out-of-state revenue and stimulate state growth. Moreover, because clusters improve efficiency and innovation, the formation and growth of clusters are important for Texas to maintain its competitive edge in this era of globalization.

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Notes

[1] See "Competitive Advantage, Agglomeration Economies and Regional Policy," by Michael E. Porter, *International Regional Science Review*, vol. 19, no. 1 & 2, 1996, pp. 85–94.

[2] For more information on what clusters are and how they affect competition and innovation, see "Location, Competition and Economic Development: Local Clusters in a Global Economy," by Michael E. Porter, *Economic Development Quarterly*, vol. 14, February 2000, pp. 15–34.

[3] Although the use of location quotients is prevalent, this measure of the economic base can have shortcomings. Some of the pitfalls of regional analysis using location quotients are underestimating the degree of geographic concentration if the reference region is a net exporter of the good or service and overestimating the degree of geographic concentration if the reference region is a net importer of the good or service.

[4] *Integrated Public Use Microdata Series: Version 3.0*, by Steven Ruggles, Matthew Sobek, Trent Alexander, Catherine A. Fitch, Ronald Goeken, Patricia Kelly Hall, Miriam King and Chad Ronnander, Minneapolis, Minn.: Minnesota Population Center, 2004. For more information, see www.ipums.org.

[5] The economic base is computed by adding surplus service-export employment (individuals employed in producing services in excess of local demand) to total manufacturing and mining employment. Therefore, the share of Texas employment included in the export base is

$$\frac{\text{total manufacturing employment + total mining employment + \{sum of [}(LQ - 1/LQ) \times \text{employment] for all service-providing sectors with } LQ \text{ above 1.1\}}}{\text{total Texas employment.}}$$

[6] For Texas and all its major metropolitan areas, industries with high location quotients, which have been referenced in the text as key contributors of their respective economic bases, were also the largest employers in the state and its major metros, unless otherwise noted.

[7] Evidence from the 2000 and 2004 Bureau of Labor Statistics data shows that the recession did not change the ordering of Texas' basic industries. The location quotients of several high-tech industries declined slightly, but their shares are still higher than U.S. shares.

[8] For an in-depth analysis of the attributes of the Texas major metros and how each of them grew during the 1990s, see, "Economic Recovery Under Way in Major Texas Metros," by D'Ann Petersen and Priscilla Caputo, Federal Reserve Bank of Dallas *Southwest Economy*, March/April 2004.