# Industry Clusters Shape Texas Economy

*By Laila Assanie and Mine Yücel*

**T**exas' economy flourished in the 1990s, took a hard hit in the 2001 recession and bounced back beginning in mid-2003. The state's four major metros and its border cities also went through the expansion and contraction, albeit at different paces.

Many characteristics contribute to an area's economic performance in the long run, including amenities, natural resources, labor force characteristics and industrial mix. Another important factor is industry agglomeration, or clusters. They're geographically concentrated groups of companies related by the technologies they use, the markets they serve, the goods and services they produce and the labor skills they require.

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Firms benefit from being close to others in the same or related industries because of access to specialized labor, vital resources and intermediate input suppliers. These positive spillovers lower costs and raise productivity. Hence, firms are more likely to locate in cities that already have high concentrations of employment in their industries.

Texas has several clusters. An abundance of oil and gas has traditionally made energy the state's major industry cluster. Since World War II, Texas has also evolved into a major high-tech center, surpassing the nation in share of high-tech manufacturing output and employment. The energy and high-tech clusters continue to dominate, but Texas' central location and proximity to Mexico have also boosted the concentration of the transportation industry.

Industry clusters provide a key to understanding Texas metros' varying fortunes. These clusters have significant effects on average earnings and earnings growth. Clustered industries generally have higher wages than ones that aren't as geographically concentrated. Clusters don't necessarily have faster job growth.

## Texas Clusters

Just about every area has an economic base of several dominant industries that ex-ceed the nation in employment, output or earnings. In cluster analysis, these concentrations are called local export industries.

In a 2000 article, Robert W. Gilmer and Thomas Wang explain why: "The term local export encompasses any export that leaves the local area, whether it's going to a neighboring state or halfway around the world. Exports are critical because they pay for imports from other cities—such as financial services from New York or cars from Detroit—and they support such local activities as dry cleaners and grocery stores."[1]

Economic-base analysis provides a way to identify industry clusters. We use employment to measure Texas' industry shares and compare them with the nation's. The data come from the Census Bureau's *County Business Patterns* report, which compiles annual statistics at the national, state and county levels.

The data set covers employment and earnings for a large part of the private sector but excludes the self-employed and workers in farming, railroad and household jobs. We're limited to 1998 through 2005, the time span with detailed industry-level data by North American Industry Classification System code.[2]

To determine local-export goods and services for Texas and its metros, we calculate location quotients, a commonly used tool for analyzing a region's economic base. Location quotients compare an area's economy with a larger, more diversified one—for example, Dallas with the U.S.—to identify areas of specialization. We compute the quotients 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 above 1 indicate industries with concentrations above the national average. These industries are part

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of the area's economic base and deemed local exports. The higher the location quotient, the higher the industry's concentration. We refer to nonexport goods and services as local—that is, purchased or consumed by people living within the area.

What are Texas' industry clusters? Energy-related activities account for four of the state's top five clusters (*Table 1*). The oil and gas industry (extraction and support activities for mining) is nearly six times more concentrated in Texas than the U.S., and petrochemical production is nearly three times more concentrated. These industries' shares haven't changed from 1998 to 2005, while the pipeline industry increased its location quotient by a third—from 3.1 to 4.3.

Texas has also become a high-tech center. The industry took off in Texas after World War II as Dallas-based Texas Instruments and other military-electronics manufacturers branched into civil electronics.

Houston became the base of firms specializing in geophysical instrumentation and automation systems, drawing upon the expertise of the oil industry. Dallas continued to prosper in defense-related telecommunications, electronic hardware and transmission systems, but it developed a more diversified electronics base. In Austin, the University of Texas was the catalyst for the high-tech sector, providing know-how and skilled engineers and landing government contracts.

The high-tech industry drove the state's strong growth rates in the 1990s. Although high-tech manufacturing employment fell between 1998 and 2005, the state's share grew, implying that the sector's job losses were greater in the nation than in Texas.

In 2005, local export industries made up nearly 21 percent of Texas employment (*Table 2*). More than three-fourths of that total is in services. The metros vary in their local-export industry concentration, ranging from a high of almost 40 percent in McAllen to lows of 26 percent in Houston and San Antonio. Houston and El Paso have the high-est employment share of goods industries that are local exports, while the border cities have the greatest concentration of service exports.

## Metro Clusters

The major and border metropolitan areas account for more than three-fourths of Texas' total employment. Their economies aren't carbon copies of the state's, however. Each metro has a distinct set of industries, diversifying and strengthening Texas' economy.

**Austin.** The state capital bounced back from the technology bust, and its top local-export industry—computer and electronics manufacturing—maintained an employment concentration four times greater than the nation's (*Table 3*).

Other major clusters—publishing, and information and data processing services—reflect the area's strengths in government and education. Most of Austin's location quotients changed little from 1998 to 2005, but information and data processing services rose by almost two-thirds, reflecting the increased clustering of high-tech services firms in the metro area compared with the nation.

**Dallas–Fort Worth.** Activity in the Barnett Shale has recently made oil and gas exploration Dallas–Fort Worth's top local export industry (see "Noteworthy" on page 14). The industry had three times the U.S. employment share in 2005. Air transportation, information and data processing services, and computer and electronic product

### Table 1
### Texas' Top Industry Clusters, 2005

| Rank | Industry | Location quotient |
|------|----------|-------------------|
| 1 | Oil and gas extraction | 5.90 |
| 2 | Support activities for mining | 5.60 |
| 3 | Pipeline transportation | 4.33 |
| 4 | Funds, trusts and other financial vehicles | 2.78 |
| 5 | Petroleum and coal products manufacturing | 2.78 |
| 6 | Air transportation | 1.67 |
| 7 | Leather and allied product manufacturing | 1.54 |
| 8 | Support activities for transportation | 1.51 |
| 9 | Information and data processing services | 1.42 |
| 10 | Fishing, hunting and trapping | 1.32 |
| 11 | Computer and electronic product manufacturing | 1.24 |
| 12 | Wholesale trade, durable goods | 1.21 |
| 13 | Broadcasting and telecommunications | 1.20 |
| 14 | Management of companies and enterprises | 1.18 |
| 15 | Nonmetallic mineral product manufacturing | 1.15 |

SOURCES: Census Bureau, *County Business Patterns* data; authors' calculations.

### Table 2
### Share of Total Employment, 2005
(Percent)

| Area | Local export industry | | Local industry | |
|------|------|----------|------|----------|
| | Goods | Services | Goods | Services |
| **Major Metros** | | | | |
| Austin | 5.3 | 23.2 | 10.0 | 60.8 |
| Dallas–Fort Worth | 5.4 | 24.9 | 12.0 | 57.7 |
| Houston | 6.8 | 19.5 | 12.4 | 61.3 |
| San Antonio | 1.6 | 24.5 | 11.5 | 62.2 |
| **Border Metros** | | | | |
| Brownsville | 2.2 | 32.6 | 8.9 | 55.5 |
| El Paso | 6.0 | 32.5 | 8.4 | 52.8 |
| Laredo | .7 | 37.0 | 6.0 | 55.7 |
| McAllen | 1.9 | 37.9 | 9.0 | 51.1 |
| **Texas** | 4.1 | 16.7 | 13.8 | 64.2 |

NOTE: Percentages do not add up to 100 because some workers in the data set are not categorized in an industry.

SOURCES: Census Bureau, *County Business Patterns* data; authors' calculations.

manufacturing are other industries with major clusters in the area.

Although the tech bust decimated the area's high-tech industries, the overall decline has been less than in the nation because Dallas–Fort Worth's share of computer and electronics manufacturing and information and data processing increased from 1998 to 2005.

**Houston.** The nation's energy capital has more than 10 times the U.S. concentration of pipeline transportation and nearly nine times the U.S. share in oil and gas exploration. Petroleum and coal products manufacturing and mining support activities are also important local export industries. Its energy concentration helped Houston weather the 2001 recession better than other major Texas metros.

Other key Houston clusters are air and water transportation. The Port of Houston ranks first in the nation in foreign water-borne tonnage and second in total tonnage. When such assets as Continental Airlines' headquarters are added, Houston's water and air transportation shares rise to more than three times the national average.

**San Antonio.** The Alamo City's clusters include such white-collar industries as information and data processing services, management of companies and enterprises, and insurance carriers, all with at least 1.7 times the nation's employment concentration. In recent years, the health care industry has been growing rapidly, reaching 1.5 times the nation's share.

Although ambulatory health care wouldn't usually be included as a local export sector, San Antonio has emerged as a regional health care center for Southwest Texas and serves a large number of patients from Mexico and Latin America. In fact, the city has broadened its package deals for out-of-town visitors to include health care as well as shopping. The relatively noncyclical health care and insurance clusters helped San Antonio fare better than most other Texas metros during the 2001 downturn.

The city's high location quotient for leather products reflects the industry's collapse in the U.S. more than its expansion locally. San Antonio saw its employment share in leather manufacturing increase from five times the nation's in 1998 to eight times the nation's in 2005. However, the city's employment in leather products in 2005 was 20 percent less than in 1998. The leather industry has been moving out of San Antonio and into the border cities and Mexico.

**Border metros.** Strong cultural and economic ties to Mexico shape the industry composition of Brownsville, McAllen, Laredo and El Paso. Many Mexican citizens cross the Rio Grande to shop for clothing and other goods in the U.S., a fact that helps create clusters around retail trade in these cities (*Table 4*).

Shopping isn't usually classified as an export industry, but a Dallas Fed study estimates that Mexican customers' share of retail trade is 51 percent in Laredo, 36 percent in McAllen and 26

## Table 3
## Major Metros' Top Industry Clusters, 2005

| Rank | Industry | Location quotient |
|---|---|---|
| **Austin** | | |
| 1 | Computer and electronic product manufacturing | 4.09 |
| 2 | Publishing industries | 2.01 |
| 3 | Information and data processing services | 1.78 |
| 4 | Wholesale trade, durable goods | 1.63 |
| 5 | Lessors of nonfinancial intangible assets (except copyrighted works) | 1.57 |
| **Dallas–Fort Worth** | | |
| 1 | Oil and gas extraction | 3.05 |
| 2 | Air transportation | 2.78 |
| 3 | Information and data processing services | 2.45 |
| 4 | Computer and electronic product manufacturing | 2.11 |
| 5 | Funds, trusts and other financial vehicles | 1.82 |
| **Houston** | | |
| 1 | Pipeline transportation | 10.22 |
| 2 | Oil and gas extraction | 8.44 |
| 3 | Funds, trusts and other financial vehicles | 8.29 |
| 4 | Petroleum and coal products manufacturing | 5.08 |
| 5 | Support activities for mining | 5.07 |
| **San Antonio** | | |
| 1 | Leather and allied product manufacturing | 7.86 |
| 2 | Information and data processing services | 2.20 |
| 3 | Management of companies and enterprises | 1.79 |
| 4 | Insurance carriers and related activities | 1.65 |
| 5 | Pipeline transportation | 1.53 |

SOURCES: Census Bureau, *County Business Patterns* data; authors' calculations.

percent in Brownsville.[3] Cross-border trade also clusters the transportation services and trucking industries along the border. Laredo has a particularly strong presence in transportation services, with 21 times the industry's national employment share.

Although the border metros have moved away from their historical dependence on manufacturing to diversified service economies, they still have higher shares in some manufacturing industries. El Paso has more than nine times the nation's share in leather products manufacturing, and McAllen holds a 3-to-1 edge over the U.S. in the industry.

Like San Antonio, the border metros have a growing specialization in health care. The industry's employment share increased significantly from 1998 to 2005, rising to four times the national share in Brownsville and more than twice the national share in Laredo and McAllen. Shrimping is also important in Brownsville, which has nine times the nation's concentration in the fishing and hunting industry.

Identifying the key local export industries has given us a glimpse of the economic base in each Texas metro. We now look at how the differences play out in terms of economic performance.

## Clusters and Growth

Earnings differ across industries for many reasons, including productivity, competition, unionization and labor supply. Industry clusters are also a factor in higher earnings because they help companies achieve higher productivity from knowledge spillovers and lower costs.[4]

From 1998 to 2005, real earnings per worker grew 4.9 percent in Texas, but the performance of major and border metros varied considerably. Houston posted the largest gains, followed by San Antonio and Dallas–Fort Worth. With the exception of McAllen's modest increase, the border cities lost ground in real earnings, led by Laredo's 8 percent decline.

The picture changes when we focus on local export industries. In all metros, 2005 average real earnings per worker were higher in these sectors than in those catering to local customers (*Table 5*). The

earnings differentials between local export and local industries are quite large in some metros—$35,000 in Houston, $28,000 in Austin and $27,500 in Dallas–Fort Worth. The difference is less striking in the border metros.

Just as important, earnings growth in local export industries was nearly three times as high as in the rest of the economy. From 1998 to 2005, earnings per worker in Texas' local export industries grew 10.3 percent versus 2.8 percent for local industries. Similarly, average local-export earnings rose 16 percent in Houston and over 6 percent in Austin and Dallas–Fort Worth (*Chart 1*).

The tech bust stunted growth in the high-tech industry between 1998 and 2005, but Austin and Dallas–Fort Worth continued to see bigger paychecks in computer manufacturing, information and data processing, and broadcasting and telecommunications. Moreover, the pace of earnings growth in these industries was much higher than in the nation.

The energy industry had considerable earnings gains in Houston and Dallas–Fort Worth. Air and water transportation were among the few local export industries with declines in real earnings per worker. The decline in air transport earnings probably reflects the industry's troubles after the September 11, 2001, terrorist attacks.

Along the border, overall real earnings per worker declined about 3.8 percent

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*Earnings per worker in Texas' local export industries grew 10.3 percent versus 2.8 percent for local industries.*

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## Table 4
### Border's Top Industry Clusters, 2005

| Rank | Industry | Location quotient |
|------|----------|-------------------|
| **Brownsville** | | |
| 1 | Fishing, hunting and trapping | 8.99 |
| 2 | Ambulatory health care services | 3.96 |
| 3 | Support activities for transportation | 2.72 |
| 4 | Clothing and clothing accessories stores | 1.51 |
| 5 | Museums, historical sites and similar institutions | 1.39 |
| **El Paso** | | |
| 1 | Leather and allied product manufacturing | 9.59 |
| 2 | Apparel manufacturing | 4.44 |
| 3 | Truck transportation | 2.18 |
| 4 | Petroleum and coal products manufacturing | 2.17 |
| 5 | Support activities for transportation | 2.03 |
| **Laredo** | | |
| 1 | Support activities for transportation | 20.93 |
| 2 | Truck transportation | 5.59 |
| 3 | Oil and gas extraction | 3.80 |
| 4 | Leather and allied product manufacturing | 2.73 |
| 5 | Clothing and clothing accessories stores | 2.54 |
| **McAllen** | | |
| 1 | Leather and allied product manufacturing | 3.41 |
| 2 | Support activities for mining | 3.35 |
| 3 | Ambulatory health care services | 3.23 |
| 4 | Clothing and clothing accessories stores | 1.70 |
| 5 | General merchandise stores | 1.66 |

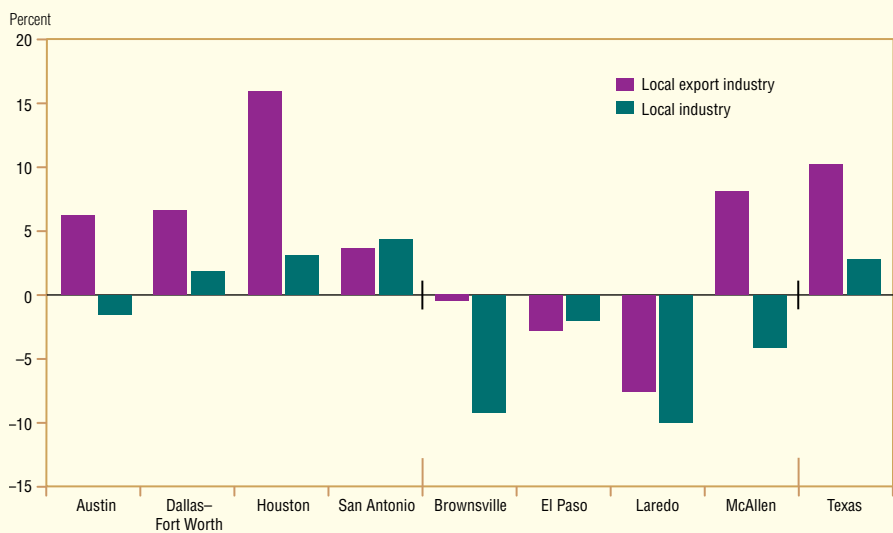SOURCES: Census Bureau, *County Business Patterns* data; authors' calculations.

## Table 5
### Earnings Are Higher in Local Export Industries

| Area | 2005 earnings* | |
|------|--------------|-------|
| | Local export | Local |
| **Major Metros** | | |
| Austin | $56,713 | $28,593 |
| Dallas–Fort Worth | $55,773 | $28,200 |
| Houston | $65,292 | $30,191 |
| San Antonio | $37,031 | $25,397 |
| **Border Metros** | | |
| Brownsville | $20,755 | $17,305 |
| El Paso | $27,097 | $19,462 |
| Laredo | $20,774 | $17,689 |
| McAllen | $21,975 | $18,334 |
| **Texas** | $48,742 | $29,463 |

*Average, per worker, in 2000 dollars.

SOURCES: Census Bureau, *County Business Patterns* data; authors' calculations.

## Chart 1
## Local Export Industries' Wages Rise Faster, Fall Less (1998–2005)

Percent

Legend:
- Local export industry
- Local industry

SOURCES: Census Bureau, *County Business Patterns* data; authors' calculations.

*Although industry clusters have a strong impact on earnings, the implications are less clear for employment growth.*

from 1998 to 2005. Local export workers, however, saw much smaller declines. In Brownsville, earnings were basically flat in the local export sectors, compared with a 9 percent decline in the rest of the economy. Laredo showed a similar pattern, with real average earnings falling 10 percent in local industries, compared with a 7.7 percent decline in local export industries. In McAllen, earnings were down 4.2 percent in local sectors, while local export earnings were up 8 percent.

Only in El Paso did local export earnings per worker fall faster than in the rest of the economy. They declined 2.8 percent, compared with 2 percent for earnings in local industries. Huge job losses in manufacturing, a sector that usually paid above-average wages to border workers, contributed to the poor performance.

The migration of manufacturing out of border cities shifted their industrial composition. Manufacturing work has been replaced by lower-paying service jobs. Together with strong employment growth along the border, this change in industry mix has lowered average earnings per worker.

Sectors related to the cross-border trade saw earnings growth along the border. These included warehousing and storage, support activities for transportation and general merchandise stores. These industries also saw rapid employment growth.

Although clusters have a strong impact on earnings, the implications are less

clear for employment growth. In a given industry, higher productivity growth leads to higher earnings but less job growth over time. Along the border, the rationalization of the manufacturing sector and offshoring of some industries led to employment declines in these cities, even if the industry's share stayed higher than the national average. Such industries as leather and apparel manufacturing saw neither employment nor wage growth, largely because operations moved across the border and overseas.

The downsizing of the technology industry after the recession resulted in employment declines in computer and electronics manufacturing in all cities. Even so, the information and data processing services sector added jobs between 1998 and 2005. Similarly, while the Texas oil and gas extraction sector saw employment declines, the oil and gas services sector had gains in both Houston and Dallas–Fort Worth.

Industry clusters have played a prominent role in earnings growth in Texas. Data limitations have confined the analysis to a short period that covers a recession, but the differential between earnings for industry clusters and those for the rest of the economy is still evident. Even clusters that were hard hit by the 2001 recession and lost employment saw earnings growth. A longer time frame may provide a better picture of growth differentials between local industries and local export industries.

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### Notes

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[1] "Diversification of Houston's Economic Base," by Robert W. Gilmer and Thomas Wang, Federal Reserve Bank of Dallas *Houston Business*, September 2000.

[2] We use 2000 census definitions to construct data for Texas metropolitan areas. The metropolitan employment and earnings per worker data are computed by summing up the county-level figures from the *County Business Patterns* data set. At this level, the data are suppressed for a particular company if disclosure would compromise that company's identity. When data are suppressed, a range is reported for employment, and we use the midpoint of the range in our analysis. For the wage data, however, no information is provided when data are suppressed and, hence, the average wage figures by three-digit NAICS industry may be underestimated for the metros. The 1997 three-digit NAICS codes were used to sort industries.

[3] "Border Benefits from Mexican Shoppers," by Jesus Cañas, Roberto Coronado and Keith R. Phillips, Federal Reserve Bank of Dallas *Southwest Economy*, May/June 2006.

[4] For information on regional growth across all U.S. metropolitan areas, see "The Economic Performance of Regions," by Michael E. Porter, *Regional Studies*, vol. 37, August/October 2003, pp. 549–78.