

At the Heart of Texas:

Cities' Industry Clusters Drive Growth

It is the age of the city. Paradoxically, as globalization has put everything and everywhere seemingly within reach, attention has been drawn from national boundaries to the smaller units of civilization—cities. This is not new when taking a longer perspective; after all, cities have typically been the rock stars of history, whether it's Babylon, the cradle of civilization; Athens, the birthplace of democracy; Florence, the origin of the Renaissance; or Birmingham, home of the Industrial Revolution.

Cities were centers of population, commerce, learning, wealth and economic opportunity long before economists explained why agglomeration matters to growth.

Cities are dense areas, with relatively high productivity and wages compared with noncities. The productivity advantage stems from agglomeration, which means firms that co-locate have ready access to a deep labor pool, the facile exchange of ideas and low transportation costs.¹ When firms in like industries cluster, they can further leverage the benefits of agglomeration. Examples are Silicon Valley, de facto headquarters of the U.S. high-tech industry, and Houston, home to the bulk of the na-

tion's oil and gas sector. Harvard economist Ed Glaeser calls cities "mankind's greatest invention" and argues in a 2011 book that cities have led human progress through the ages by acting as engines of innovation.²

With five metropolitan areas of 1 million or more residents, Texas has more big cities per capita than the other large U.S. states with the exception of Florida and Ohio. Dallas–Fort Worth and Houston rank among the top five largest metropolitan areas in the U.S. in terms of both population and economic output. In fact, Texas is the only state to have two metros in the top five.

The abundance of large cities is an additional growth advantage on the state's list of favorable economic factors: central location, rich oil and gas deposits, well-placed sea and land ports, proximity to Mexico, rapid population growth, low cost of living and business-friendly climate. With so many advantages, it is no surprise that employment grows a percentage point faster in Texas than the nation on average and that state gross domestic product growth was more than twice that of the nation in the recent economic recovery.³



While the Texas economy slowed notably in 2015 due to the collapse of oil prices and related drilling, metros will continue to play a key role in the state's economic expansion. Those with a more diversified industrial base, such as Dallas and Austin, will have to offset some of the downturn playing out in Houston, Midland–Odessa and the other energy-producing regions in the state.

This Federal Reserve Bank of Dallas special report details the historical, economic and demographic profiles of eight of Texas' most important cities: Austin, Dallas, El Paso, Fort Worth, Houston, McAllen, Midland–Odessa and San Antonio. Together, the eight accounted for 73 percent of the state's population, 76 percent of its employment and 82 percent of its economic output in 2014.

While such an aggregate view tells part of the story, the industrial clusters of each area define a metro's distinctive place in the state's economy and explain its returns to agglomeration, in terms of both job growth and income gains. Accordingly, the state as a whole provides useful context with which to look at the individual metros.

Dominant Clusters Power Texas

Characteristics such as location, natural resources and labor force contribute to an area's long-run economic performance. Another important factor is industry agglomeration, or clusters, which are geographically concentrated groups of firms linked by the technologies they employ, the markets they serve, the goods and services they produce and the labor skills they require. Clusters are important because they provide their participants (firms) with access to specialized knowledge and/or resources, enhancing productivity, spurring innovation and attracting new business and investment in the area.⁴

An area typically has an economic base that consists of several dominant industry clusters. These clusters exceed the national average in their share of employment, output or earnings. Location quotients (LQs), which compare the relative concentration of various industry clusters locally and nationally, are one way of assessing these key drivers in an economy.

We use annual employment data from the Quarterly Census of Employment and Wages to compute location quotients. These data are readily available at the three-digit-or-higher North American Industry Classification System (NAICS) level by metropolitan area, facilitating



analysis. Industry cluster definitions are taken from StatsAmerica, with some modifications that are detailed in the Appendix. Clusters generally comprise multiple interdependent or interrelated industries or NAICS classifications. The entertainment cluster in Los Angeles and the auto manufacturing cluster in Detroit are examples of such broad groupings that include the main industry and its suppliers and service providers.

An LQ exceeding 1 indicates that a specific industry cluster is more dominant locally than nationally. Industry cluster growth is measured by the percentage-point change in its share of local employment between 2006 and 2014.⁵

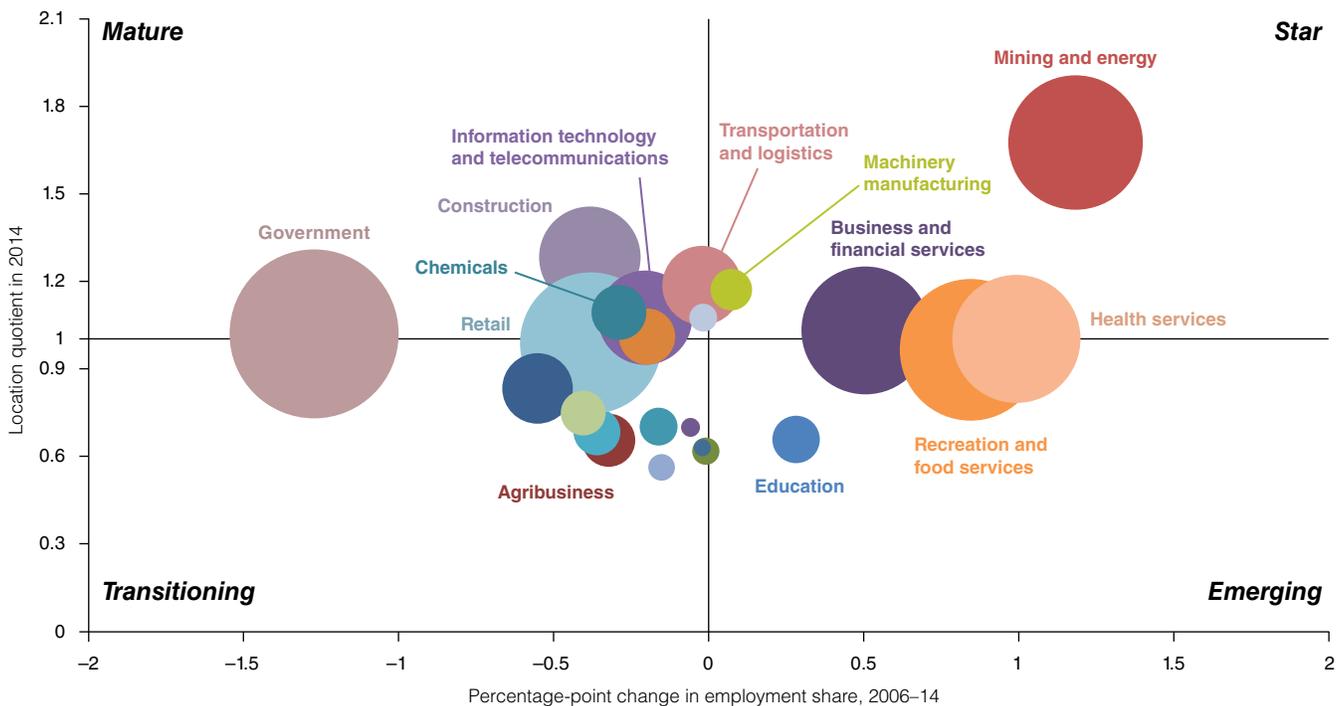
Chart O.1 plots industry cluster LQs and growth for Texas. Clusters in the top half of the chart, such as mining and energy, construction, and transportation and logistics, are referred to as base clusters. They have a larger share of state employment relative to the nation and, thus, an LQ exceeding 1. A base cluster is usually vital to an area's economy and can be expanding rapidly (star) or growing slowly (mature). Those in the bottom half are less dominant locally than nationally. They generally produce services or goods for local consumption

and, hence, have an LQ below 1. "Emerging" clusters, such as education, are fast growing, while those growing slowly are termed "transitioning." Clusters comprise only private sector employment, with the exception of the government cluster, which includes public school teachers and staff.

Texas has several dominant clusters. An abundance of oil and gas has traditionally made mining and energy and related industries a major cluster—employing nearly 10 percent of the state's workforce. Texas' geological makeup includes four shale formations—the Permian Basin, Barnett, Haynesville and Eagle Ford—helping make the state the No. 1 producer of oil and gas in the nation. Texas produces 37 percent of all U.S. crude oil and 28 percent of U.S. natural gas and employs nearly 14 percent of the workers in the nation's mining and energy cluster. The employment share of this cluster expanded from 2006 to 2014, with the head count up 30 percent—the second-fastest increase among the clusters covered in this report (*Chart O.2*). This remarkable expansion came as Texas oil production tripled from 2008 to 2014.

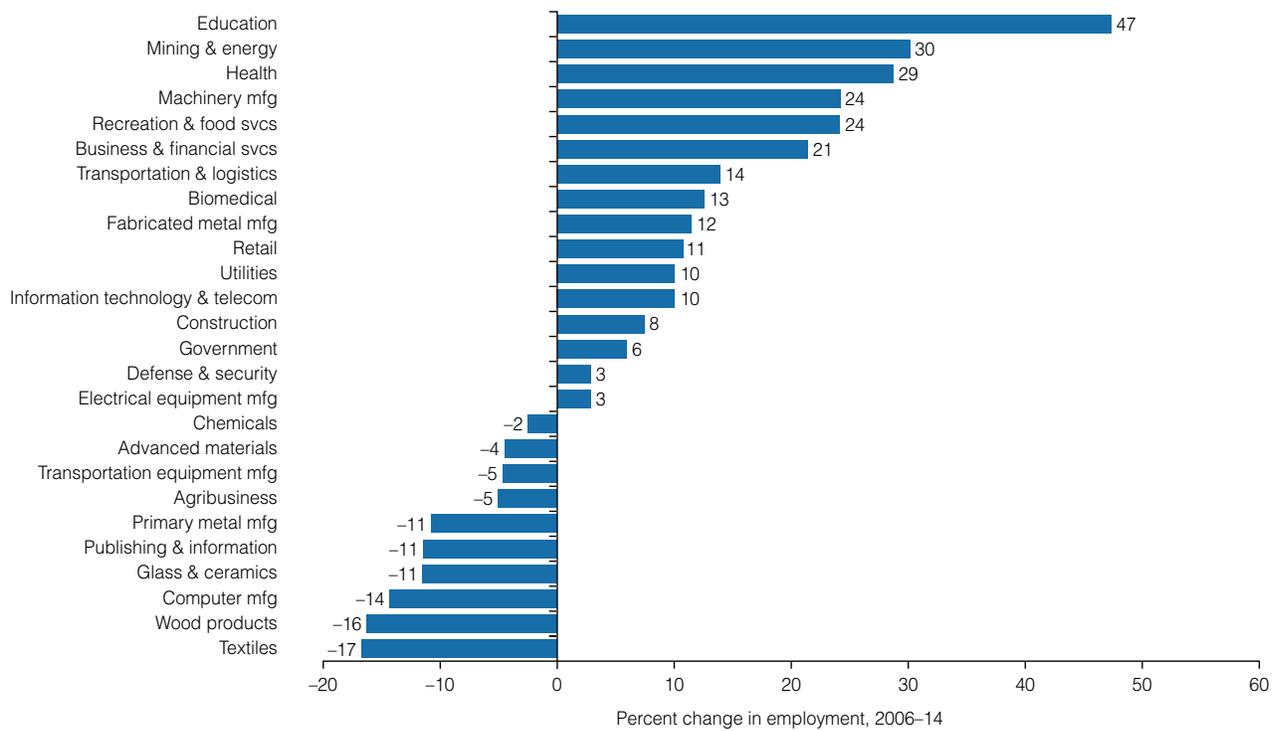
Tied to oil and gas exploration is machinery manufacturing, a cluster with 1.2 times the U.S. concentration.

Chart O.1: Energy and Information Technology Help Set Texas Apart from Nation



NOTE: Bubble size represents cluster share of metropolitan statistical area employment.
 SOURCES: Texas Workforce Commission; Bureau of Labor Statistics; authors' calculations.

Chart O.2: Mining and Energy the Second-Fastest Growing Cluster in the State



SOURCES: Texas Workforce Commission; authors' calculations.

Employment in the cluster expanded 24 percent from 2006 to 2014. Employment in construction and fabricated metal manufacturing—both sectors with an LQ exceeding 1—grew over the same period. This growth was supported by a booming energy sector and overall strong economic performance that increased demand for office, industrial and residential space. The chemical industry also plays a meaningful role in Texas, not surprising given the significant presence of refineries and petrochemical plants near the Gulf Coast.

Texas has evolved into a major high-tech hub (LQ of 1.1 in 2014). The industry took off after World War II as Dallas-based Texas Instruments and other military-electronics manufacturers branched into civil electronics. Texas also flourished during the high-tech boom, when the information technology and telecommunications industries took off in Austin and Dallas. Employment in the IT and telecom cluster grew about 10 percent in 2006–14 and now represents 5 percent of the state’s workforce.

The energy and high-tech clusters dominate, but Texas’ central U.S. location and its border with Mexico

also boosted the concentration of the transportation and logistics industry (LQ of 1.2). The state is home to two large commercial airlines, a major railroad and two of the nation’s busiest ports—Houston and Laredo. Government also has a slightly higher-than-average presence in the state, likely due to the number of major military bases in the state.

Several of Texas’ dominant clusters, such as mining and energy and computer manufacturing, boast high pay (*Table O.1*). In fact, Texas’ dominant clusters—those with an LQ exceeding 1—pay about 1.9 times more than the industries that are less concentrated in the state. Also, while real average earnings in clusters with an LQ below 1 dipped during 2006–14, real earnings in Texas’ dominant clusters increased 6.7 percent.

In Texas and its metros, clusters with an LQ exceeding 1 generally pay more than ones that aren’t as geographically concentrated. However, dominant clusters don’t necessarily have faster inflation-adjusted earnings growth; performance depends on the underlying industries.

Texas Outperforms Nation; Slower Growth Ahead

Texas on average has grown faster than the nation, with job gains in the state averaging 1.9 percent per year from December 2005 to December 2014, compared with 0.4 percent for the nation. Similarly, Texas output expanded at 3.5 times the U.S. pace from 2006 to 2014.

Texas weathered the Great Recession better than the nation, and its economy rebounded strongly. The state surpassed its 2008 employment peak in 40 months (by December 2011)—a little over half the time it took the U.S. Texas ranked third among the states in job growth in 2012, eighth in 2013 and third again in 2014. The state's eight major metropolitan areas also experienced the expansion and contraction, albeit at different paces.

Employment declines during the Great Recession were steepest in Midland–Odessa, followed by Dallas and Fort Worth (*Chart O.3*). As the depth of decline varied, so did the pace of recovery. Despite major employment losses, Midland–Odessa achieved faster postrecession growth than all other metros in this re-

port thanks to the shale oil boom. Meanwhile, the pace of recovery in Dallas was relatively slow because of its large construction and business and financial services sectors, which were hit hard during the recession.

Though the rates of job loss in Austin, El Paso and San Antonio were comparable, Austin bounced back, paced by its large and fast-growing high-tech sector.

The state's rapid recovery from the recession reflected the shale oil and gas boom, but it was also due to the notable absence of a housing bust that weighed significantly on other large states such as California and Florida.

The downstream energy industry also came to play a very important role in the Texas recovery. Petroleum product exports such as gasoline and diesel ballooned, and the petrochemical producers became highly competitive internationally when the price of the natural gas used as an input declined as the price of the oil used by competitors abroad rose in the months after the economic downturn.

For a few years during the recovery, Texas was the only large state adding jobs. This growth, combined

Table O.1: Annual Earnings in Texas Exceed Nation in Most Dominant Clusters

Cluster	Texas					U.S.
	2006	2008	2010	2012	2014	2014
Mining and energy	86,086	87,081	89,239	92,530	93,260	76,815
Construction	52,317	53,882	53,454	55,934	58,639	55,041
Transportation and logistics	55,401	54,937	57,548	60,067	59,956	51,043
Fabricated metal manufacturing	54,490	57,026	56,590	58,468	59,210	53,130
Machinery manufacturing	73,401	74,418	78,646	82,375	84,134	66,715
Glass and ceramics	51,256	53,116	49,738	52,086	55,759	51,073
Computer manufacturing	115,743	101,443	107,555	110,404	110,490	105,968
Chemicals	74,466	75,289	77,843	80,802	82,901	69,856
Information technology and telecommunications	91,046	87,933	90,288	92,034	92,434	96,631
Utilities	96,333	97,463	97,617	101,886	100,414	98,149
Business and financial services	81,973	82,511	83,207	84,674	87,090	92,957
Government	45,149	46,303	47,693	46,834	47,835	51,726
Defense and security	61,874	58,117	60,119	59,420	59,989	59,588
Health services	49,325	49,406	50,454	49,777	50,341	56,055
Clusters with location quotient >1	64,367	64,802	65,391	67,186	68,700	–
Clusters with location quotient <1	38,281	37,011	37,111	37,133	37,085	–
Average earnings (total)	49,827	50,526	50,975	52,152	53,220	51,361

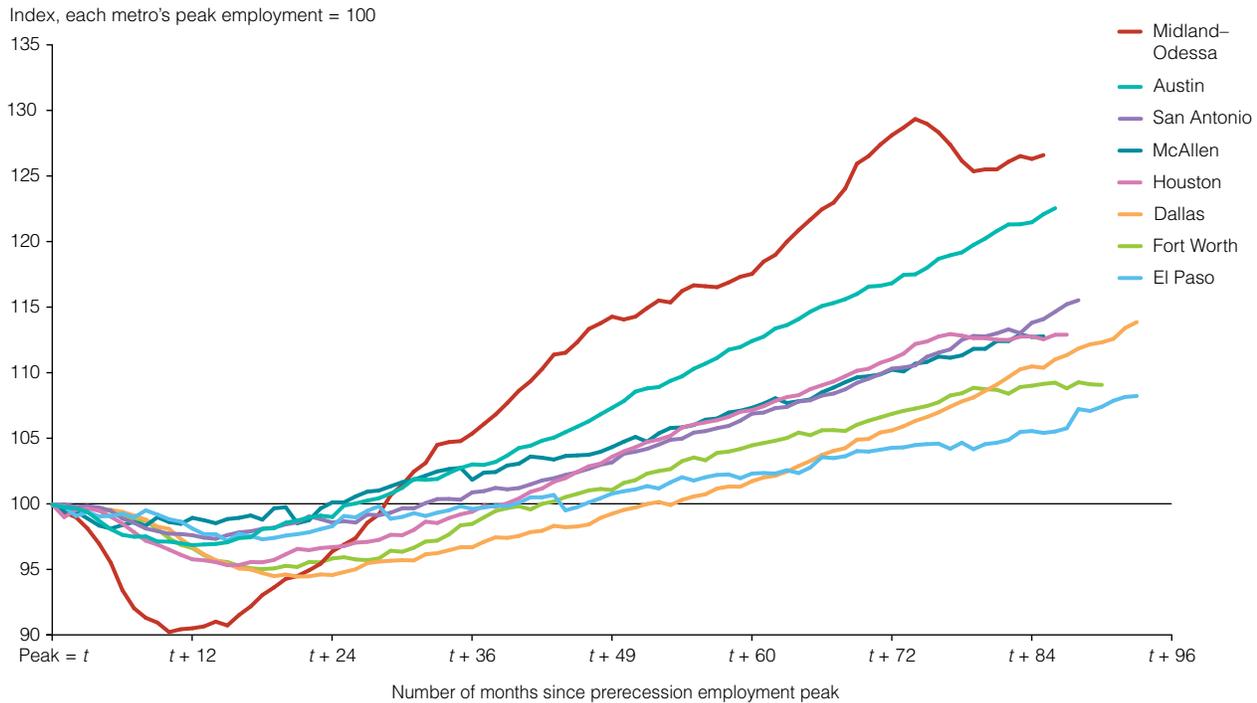
NOTES: Clusters are listed in order of location quotient (LQ); clusters shown are those with LQs greater than 1. Earnings data are in 2014 dollars.
SOURCES: Texas Workforce Commission; Bureau of Labor Statistics; authors' calculations.

with traditional Texas advantages such as a low cost of living and of doing business, prompted record numbers of people and firms to relocate from other states.⁶

With the plunge in oil prices, the economic landscape in the region changed, and employment growth

in 2015 through November slowed to 1.3 percent from 3.6 percent in 2014. Given that energy-related industries are dominant in the state and oil prices have fallen further, employment growth will continue below trend in 2016.

Chart 0.3: Texas Metros' Recovery Reflects Underlying Strengths



SOURCES: Texas Workforce Commission; Federal Reserve Bank of Dallas.

Notes

¹“The Wealth of Cities: Agglomeration Economies and Spatial Equilibrium in the United States,” by Edward L. Glaeser and Joshua D. Gottlieb, National Bureau of Economic Research, NBER Working Paper no. 14806, March 2009.

² *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier*, by Edward Glaeser, New York: Penguin Press, 2011.

³ Texas job growth averaged 2.1 percent per year compared with 1.1 percent for the nation during 1990–2014. State gross domestic product growth averaged 4.9 percent per year compared with 1.7 percent for the U.S. during 2010–14.

⁴ 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. Also, see “Clusters, Convergence, and Economic Performance,” by Mercedes Delgado, Michael Porter and Scott Stern, National Bureau of Economic Research, NBER Working Paper no. 18250, July 2012.

⁵ Individual industry cluster shares add up to more than 100 because some smaller industries at the three-digit-or-higher level in the North American Industry Classification System (NAICS) are included in multiple clusters, while some industries are not part of any of the clusters shown. Clusters include other related industries. For instance, semiconductor manufacturing (NAICS 3344) is included in both the advanced materials and information technology and telecommunications clusters.

⁶ See “Gone to Texas, Immigration and the Transformation of the Texas Economy,” by Pia M. Orrenius, Madeline Zavodny and Melissa LoPalo, Federal Reserve Bank of Dallas Special Report, November 2013.