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Economic Letter

Global, National Business Cycles and Energy Explain Texas Metro Growth

by Alexander Chudik, Janet Koech and Mark A. Wynne

ABSTRACT: A mix of global, national and state-specific shocks help drive employment fluctuations between U.S. states. Econometric modeling shows such differences among metropolitan areas also reflect a mix of shocks. Texas cities strongly tied to oil and gas activity appear more affected by energy-sector shocks than other metros in the state.

The Texas economy has enjoyed robust job growth over the past 25 years, surpassing employment expansion in the nation for most of that time. Job gains in the state averaged 2.1 percent on an annual basis from 1990 to 2016, compared with 1.2 percent for the nation as a whole.

Contributing to this performance is an abundance of large cities and favorable economic factors. With five metropolitan areas of 1 million or more residents, Texas has more big cities per capita than the other large U.S. states, except for Florida and Ohio.

The Dallas–Fort Worth–Arlington metro area (DFW) and the Houston–Woodlands–Sugar Land metro area (Houston) rank among the top five metropolitan areas in the U.S. in terms of population and economic output.[1]

Employment growth varies considerably among the state's 25 metro areas that collectively account for more than 92 percent of Texas employment (*Chart 1*). The Austin–Round Rock metro area achieved the fastest job growth in 2016 over the previous year, 3.8 percent, while Odessa's employment declined 7.8 percent.

In the 1990–2016 period, the gap between metro areas with the fastest and slowest yearly job growth varied from a high of 29.8 percentage points in first quarter 1990 to a low of 3.4 percentage points in second quarter 2010.

The rate of employment growth in metro areas is driven by a variety of factors related to the area's economic structure, including: industry mix; population growth; geographic location and access to air, sea and land ports; proximity to Mexico (Texas' largest trading partner); and Texas' endowment of oil and gas deposits. Additionally, developments in the overall U.S. economy and economic activity in the rest of the world affect individual metros' economic and employment growth.

Texas has become more integrated with the global economy, as revealed by an increase in exports. Texas exported more than $230 billion worth of goods to the rest of the world in 2016, compared with $129 billion in 2005. These exports are an aggregation of goods produced in regions within the state that engage in different economic activities.

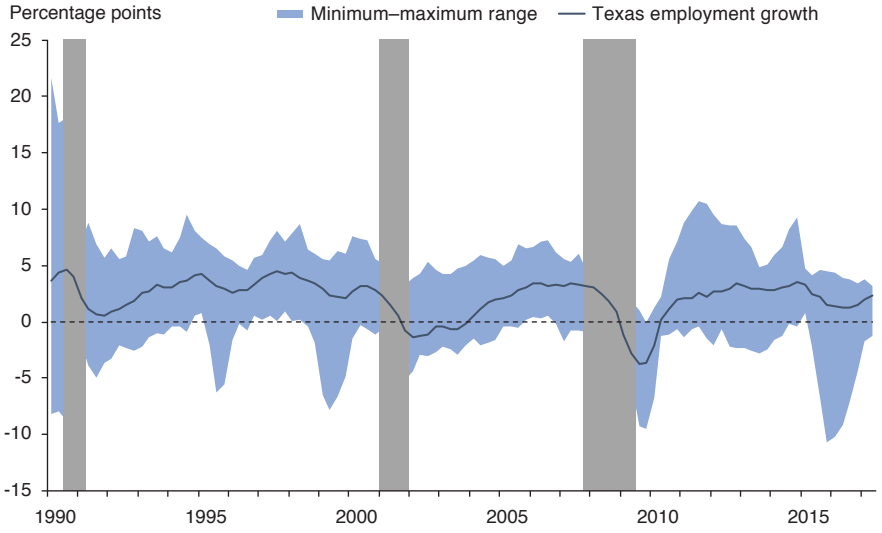
Integration of the state economy with the global economy, apparent at the state level, is also evident at the individual city and metro-area level. The Houston metro area, for instance, exported $84 billion worth of goods to foreign countries in 2016,

accounting for 41.5 percent of total state exports, while the DFW metro area contributed 13.4 percent to total state exports.[2]

Of the exports in 2016 from the Houston metro area, 52.9 percent went to Asia Pacific Economic Cooperation countries, while 28.5 percent went to North America Free Trade Agreement countries, Canada and Mexico. Thus, the integration of Texas metro areas with foreign economies makes them dependent on economic developments in those distant regions.

A previous *Economic Letter* used econometric techniques to evaluate the relative contributions of global, national and state-level shocks to employment fluctuations among individual U.S. states.[3] The analysis is extended here to estimate the relative importance of global, national and metro-area-specific shocks to explain employment fluctuations for individual metro areas within Texas.

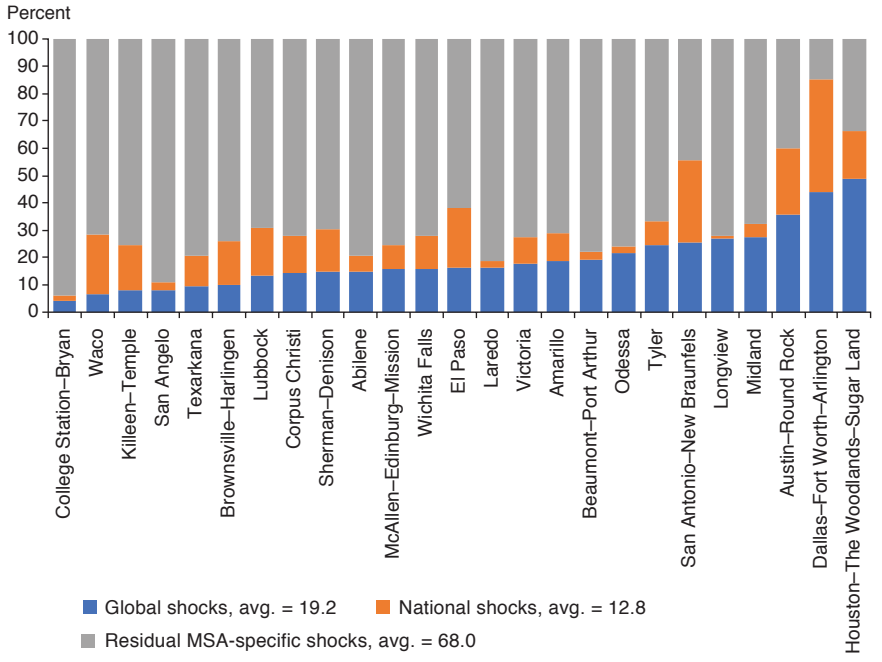
CHART 1 Texas Employment Growth Varies Across Metro Areas



NOTES: Employment fluctuations are computed as year-over-year growth in quarterly nonfarm payroll employment. Shaded bars indicate U.S. recessions.

SOURCES: Bureau of Labor Statistics; Texas Workforce Commission; Haver Analytics; authors' calculations.

CHART 2 Global, National and Residual Shock Impact Varies Among Metros



NOTE: MSA is metropolitan statistical area.

SOURCE: Authors' calculations.

Measuring Shocks

Identifying shocks is a challenge in empirical research and requires some assumptions. Shocks to global output are identified as shocks to the growth rate of real (inflation-adjusted) gross domestic product (GDP) in an aggregate of 21 foreign economies.[4] This grouping includes a mix of developed and emerging economies that collectively accounted for half of global GDP in 2016.

National shocks are identified as shocks to U.S. national employment and output growth that cannot be accounted for by global shocks. Metro-area employment fluctuations not accounted for by the global and national shocks are attributed to shocks specific to the metros and other residual shocks.

An econometric model known as the global vector autoregression (GVAR) is used to quantify the impact of these shocks.[5] The model is estimated using quarterly data from first quarter 1990 to fourth quarter 2016.

Employment Fluctuations

Global and national shocks together are estimated to account for about 32 percent of employment fluctuations in Texas metro areas, on average. The remaining 68 percent of the metro-area employment fluctuation is not explained by global or national business cycles and, thus, can be largely attributed to factors specific to the individual metro areas. However, large differences exist among metro areas (*Chart 2*).

For example, global output shocks explain 49 percent and 44 percent, respectively, of employment fluctuations in the Houston and DFW metro areas, while College Station and Waco are least affected by the global business cycle, which only explains 4.2 percent and 6.8 percent of their respective total employment changes.

The importance of the global business

cycle for employment fluctuations in Houston is perhaps not surprising, given that it is a large seaport. What is perhaps more surprising is that the global business cycle is so important for employment fluctuations in landlocked DFW.

DFW was most affected by national shocks, accounting for 41 percent of employment fluctuations, followed by San Antonio, 30 percent, and Austin–Round Rock, 24 percent. Conversely, national shocks play essentially no role in explaining employment fluctuations in Longview, College Station–Bryan and Laredo metro areas. In these metros, residual metro-specific shocks explain the bulk of the employment changes.

Collectively, global and national shocks explain more than half the employment fluctuations in DFW, Houston, Austin and San Antonio, the state's largest metro areas. A correlation of the shares of employment fluctuations attributed to these two shocks with the size of the metro areas (measured by employment shares relative to total state employment) shows that the size of the metro area alone explains about 77 percent of global and national shock-driven employment fluctuations (*Chart 3A*).

Large metros are generally more diversified than smaller ones and have a mix of sectors that make them co-move more with aggregate economic developments outside the metros' geographic boundaries. Economic activities in these large metro areas tend to co-move with the national and global business cycles. Adding a measure of industry mix to the previous correlation, the size of a metro area and its industry mix jointly explain about 82 percent of the global and national shocks impacting individual regions (*Chart 3B*).

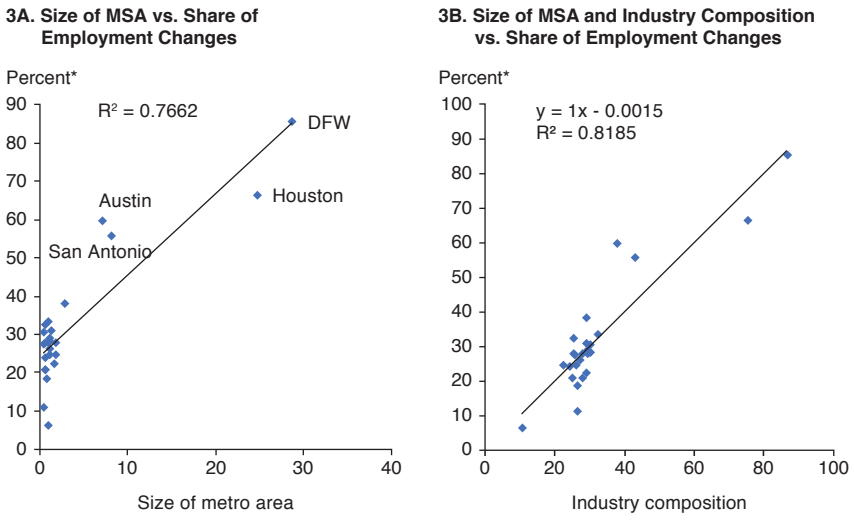
Role of Energy Sector

Texas is the nation's largest producer of oil and gas. Sector employment in the state accounts for more than half of total nationwide employment in these industries. Developments in energy industries should, to some degree, affect overall state and metro area employment growth. Residual employment fluctuations are decomposed across metro areas (the 68 percent portion not explained by global and national shocks) into those that can be explained by energy-related indicators.

How well crude oil price changes correspond to employment changes in the energy sector at the state level provides an initial measure.[6] Over the 1990–2016 period, changes in oil prices and employment growth in Texas have a low positive correlation.[7] Changes in total state employment, however, are more correlated with energy-sector employment changes, accounting for about 41 percent of year-over-year state employment movements.

Crude oil price fluctuations alone do not provide a complete picture of the impact

CHART 3 Metro Area Size, Industry Mix Help Explain Employment Fluctuations Attributed to Global and National Shocks

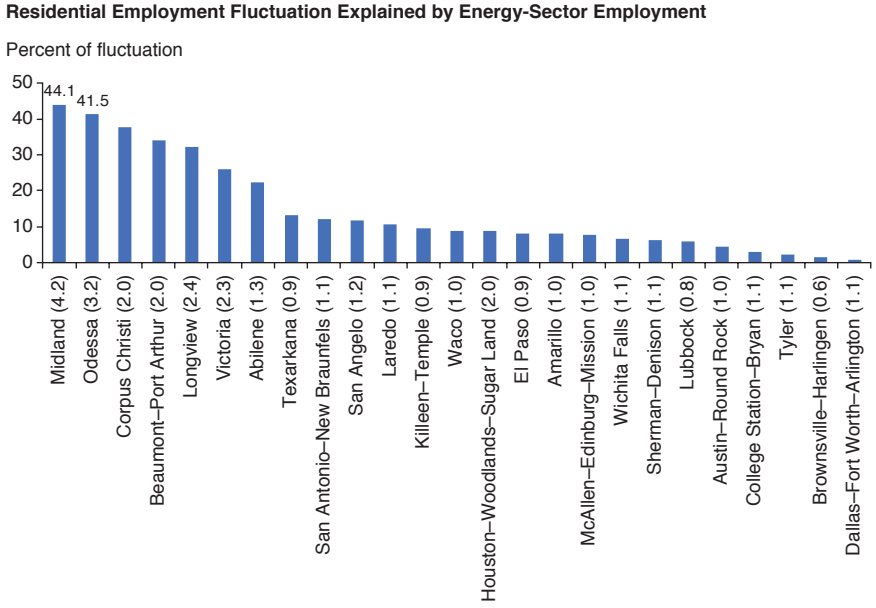


*Employment fluctuations explained by national and global shocks.

NOTES: Size of metro area is computed as the share of employment in each metro area in total state employment. Industry composition is computed as shares of employment in mining, manufacturing, services and government in total state employment in the respective sectors. R^2 is the coefficient of determination and measures statistical fit. 1.0 is a perfect fit. MSA is metropolitan statistical area.

SOURCES: Bureau of Labor Statistics; Texas Workforce Commission; Haver Analytics; authors' calculations.

CHART 4 Impact of Energy Sector Employment Varies Among Texas Metros



NOTES: Numbers in parentheses are energy-sector location quotients computed as the ratio of energy employment in each metropolitan statistical area (MSA) as a share of total employment in the MSA relative to energy employment in the nation as a share of total employment in the nation. Numbers over 1 mean that energy-sector employment is more concentrated in those regions relative to the nation. Higher numbers indicate greater sector concentration.

SOURCE: Authors' calculations.

of oil-market developments on employment in the broader energy sector. When oil prices fall and remain below a breakeven price—a price that affects the profitability of drilling—companies lay off workers, most likely at a faster pace than the number of workers they will add when oil prices increase and remain relatively high for a sustained period.

For instance, a $10 change in per-barrel oil prices, from say, $80 to $70, may lead to some employment losses, but not to the same extent as a similar-sized price decline from $50 to $40, a price possibly below the breakeven threshold for a large number of drilling activities in Texas.

Oil prices alone don't fully explain energy-sector-related employment fluctuations because of prices' potentially nonlinear impact. Additionally, recent technological innovations in oil extraction that markedly increased the extractable supply of oil occurred somewhat independently of oil-price fluctuations.

Thus, estimating the portion of total metro-area employment fluctuations unexplained by global and national shocks and possibly attributable to energy-sector developments prompts the question: Can the residual employment fluctuations be explained by what is happening to employment in the energy-specific sectors as opposed to oil prices?

It appears that energy-sector employment fluctuations explain a large share of otherwise unexplained swings in employment in energy-intensive metro areas and relatively little in those metro areas with few ties to the energy sector (*Chart 4*). More than 40 percent of the employment variations in Midland and Odessa unexplained by global and national shocks can be attributed to changes in energy-sector employment.

On the other hand, fluctuations in energy employment play almost no role in explaining employment changes in areas with little or no oil-related activity, such as the Brownsville and DFW metro areas.

Varying Impact Across Metros

Just as employment fluctuations at the level of individual states are driven by a mix of global, national and state-specific shocks, so, too, are employment fluctuations at the level of metropolitan areas within the states.

The relative importance of the different shocks depends on the metros' economic structure and their exposure to global, national or region-specific shocks through intranational and international trade. Global and national business cycles together can explain, on average, an estimated 32 percent of total metro area employment fluctuations within Texas.

Larger metro areas are generally more sensitive to developments in overall U.S. and international economies, while areas with a lot of oil and gas activity are impacted more by shocks specific to the energy sector and less by developments in national and global economies.

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Notes

[1] See, "At the Heart of Texas: Cities' Industry Clusters Drive Growth," a special report of the Federal Reserve Bank of Dallas, February 2016, www.dallasfed.org/research/~/media/Documents/research/heart/heartoftexas.pdf.

[2] Data are from the International Trade Administration.

[3] See, "Global and National Shocks Explain a Large Share of State Job Growth," by Alexander Chudik, Janet Koech and Mark A. Wynne, Federal Reserve Bank of Dallas *Economic Letter*, vol. 12, no. 10, October 2017, www.dallasfed.org/~/media/documents/research/eclett/2017/el1710.pdf.

[4] Real gross domestic product for the following countries was included in the estimation of the global output shock: Argentina, Australia, Austria, Belgium, Canada, China, Colombia, France, Germany, Italy, Japan, Korea, Mexico, Netherlands, Peru, Portugal, South Africa, Spain, Sweden, Switzerland and the United Kingdom.

[5] An overview of the Global Vector Autoregressive model is provided by "Theory and Practice of GVAR Modelling," by Alexander Chudik and M. Hashem Pesaran, *Journal of Economic Surveys*, vol. 30, no.1, 2016, pp. 165–97.

[6] Energy-sector employment includes employment in the mining, logging and construction industries.

[7] The correlation of year-over-year crude oil price fluctuations with year-over-year employment changes in the energy sector is 0.12 over this period.

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