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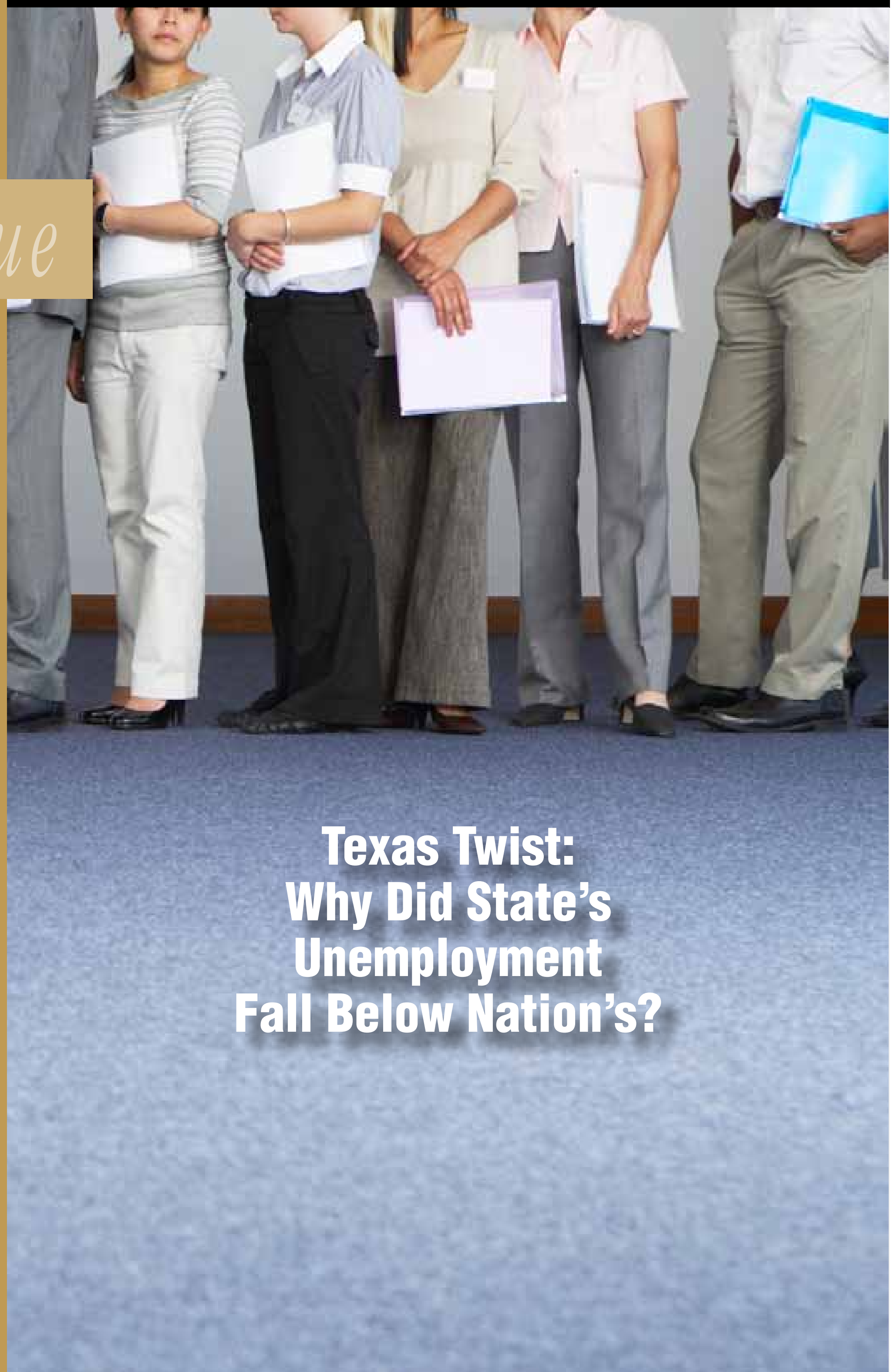
FEDERAL RESERVE BANK OF DALLAS

In This Issue



President's Perspective

To more effectively gauge the health of our economy at the regional and national levels, it's critical that we keep close tabs on our manufacturing industry.

The Eleventh District of the Federal Reserve System—which includes Texas, southern New Mexico and northern Louisiana—accounts for just over 10 percent of the nation's manufacturing output. Add in the Atlanta, Chicago and San Francisco districts and you account for more than 50 percent.

In Texas, manufacturing output grew at more than twice the rate it did nationally in the decade before our recent economic crisis. Texas alone was responsible for nearly $160 billion in manufactured goods in 2008—second only to California.

Texas churns out roughly one-fifth of the country's petroleum and coal manufactured goods—a reflection of our powerful energy industry. And the state is responsible for well over 10 percent of the country's computer and electronics production—a reflection of our strong presence in high tech. Such industries endow our regional manufacturing with a distinctive composition.

TMOS is an important research tool that empowers us at the Dallas Fed with a better understanding of economic conditions in the Eleventh District and the nation.

In 2004, the Dallas Fed began collecting data for the Texas Manufacturing Outlook Survey to track this valuable sector. TMOS, as it's referred to around our office, is a business tendency survey that collects on-the-ground intelligence directly from the private-sector operators powering our economy. Once a month, we ask manufacturers across the state about changes in their Texas operations. We aggregate the responses to create indexes of production, general business activity, price pressures and growth expectations. These indexes have proven quite accurate at predicting economic activity and employment for our region's manufacturing industry. They also contribute to our understanding of the national economy.

TMOS doesn't stand alone. Our sister Banks in Philadelphia, Richmond, New York and Kansas City conduct their own manufacturing surveys. The other major manufacturing districts—Atlanta, Chicago and San Francisco—do not.

Like other things Texan, TMOS is unique. Released at the end of the month in which responses are collected, it is the first regional survey on the scene with timely manufacturing data. And special questions allow us to assess the real-time economic impact of regional events, such as the Gulf oil spill.

TMOS is an important research tool that empowers us at the Dallas Fed with a better understanding of economic conditions in the Eleventh District and—taken together with other indicators—the nation. In this issue of *Southwest Economy*, readers get a closer peek at our latest assessments of this survey's effectiveness.

Richard W. Fisher
President and CEO
Federal Reserve Bank of Dallas

Texas Twist: Why Did State's Unemployment Fall Below Nation's?

By Anil Kumar

State policymakers may gain valuable insights by determining how this remarkable 1.4 percentage point gap emerged in the U.S. unemployment rate minus the Texas rate.

Symbolic of Texas' relative economic health during the recent recession, the unemployment rate has trailed U.S. joblessness by an average of 1 percentage point since January 2007. This marks a reversal of a trend from the 1990s through 2006, when the state averaged 0.4 percentage point more unemployment than the nation (*Chart 1*).

No one feature seems responsible for the shift. Institutional factors such as less unionization and a lower minimum wage than most other large states may account for reduced Texas unemployment but cannot explain the recent reversal.

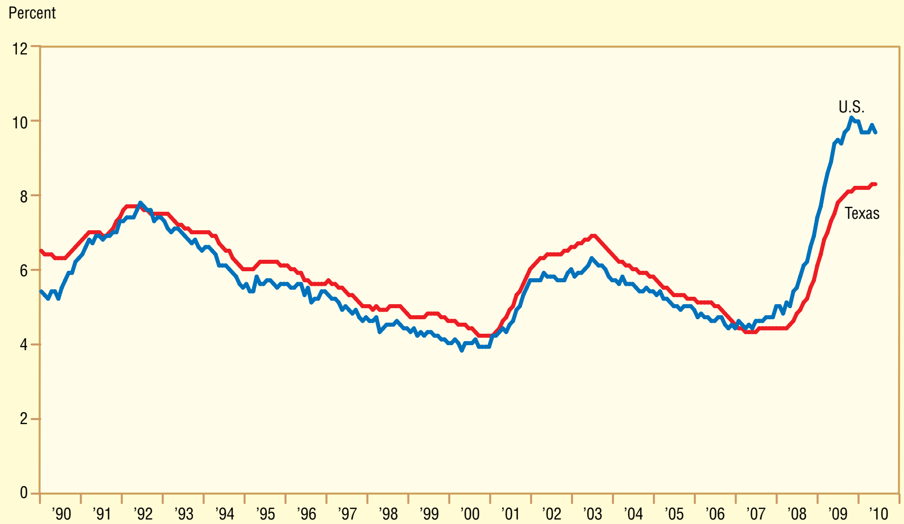
Business-cycle factors contribute to the gap as well. Texas and U.S. recessions don't always overlap, and even when they do, the intensity differs. The smaller impact of the housing bubble in Texas has helped keep the unemployment rate lower in the current housing-led recession.

A part of the gap may also be due to Census Bureau undercounting of undocumented individuals in the Current Population Survey. Not accounting for the undocumented will probably lead to underestimating joblessness in a recession.

The Texas industrial mix is also different, with a lower share of manufacturing in total employment relative to the U.S. Rising oil and gas prices tend to benefit the state, though the unemployment rate gap seems to have evolved independently of energy sector volatility after 2007. Additionally, the economy is aided by a more than 1 percentage point lead over the nation in average job growth over the past 10 years.

While the lower unemployment rate in Texas has received much media attention, specific causes of the transition to lower joblessness than in the nation have been much less explored. Is it due to changes in demographics, industrial mix or state policy? Perhaps it's the result of a change in data collection and analysis? State policymakers may gain valuable insights by determining how this remarkable 1.4 percentage point gap emerged in the U.S. unemployment rate mi-

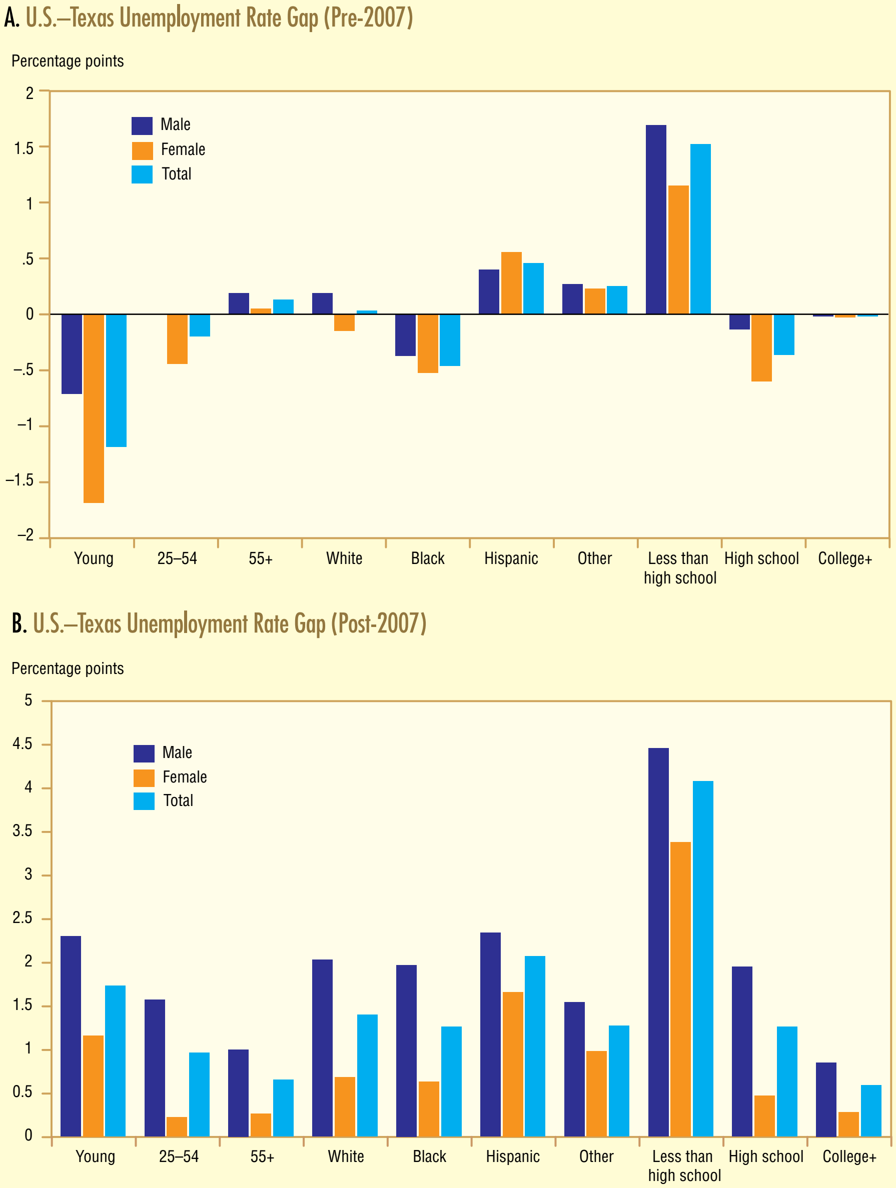
Chart 1
Texas Unemployment Rate Dips Below U.S. Rate Before Recent Recession



SOURCES: Haver Analytics; Bureau of Labor Statistics.

Demographics account for a small portion of the approximately 1 percentage point higher U.S. unemployment.

Chart 2
U.S.–Texas Jobless Gap Reverses Among Key Groups



NOTE: Bars reflect the difference between U.S. and Texas unemployment rates (in percentage points).

SOURCES: Current Population Survey, January 1998–December 2009, Bureau of Labor Statistics; author's calculations.

nus the Texas rate, from pre-2007 (1998–2006) to post-2007 (2007–09).[1]

To be sure, demographics would suggest more, not less, unemployment in Texas, with its higher-than-the-nation percentage of young people, minorities and workers without a college degree—all categories with an above-average jobless rate. The difference in jobless rates by group is plotted in Chart 2. Before 2007, higher Texas unemployment (the negative numbers) was primarily driven by younger people, prime-age workers (25–54 years old), blacks and workers with a high school diploma (*Chart 2A*). After 2007 and the onset of the U.S. recession, the picture is vastly different. U.S. joblessness currently surpasses Texas' among all key groups (*Chart 2B*). For example, workers nationally without a high school diploma have an unemployment rate 4 percentage points above those in Texas post-2007, compared with 1.5 percentage points pre-2007.

Data collection methods can't account for the overall shift, and how unemployment is calculated hasn't changed since 2007 (*see box, "Data-Related Explanations"*). The change in the U.S.–Texas unemployment rate gap largely reflects improved labor mar-

Data-Related Explanations

The unemployment rate is calculated from the Current Population Survey, a household-based telephone survey that's subject to sampling variability and low response rates among certain demographic groups. To make the sample representative of U.S. and state populations, the Bureau of Labor Statistics uses population-weighted responses to calculate the jobless figure and other measures of labor market activity. Every January, the population weights are revised to reflect new Census Bureau estimates for each demographic segment. As a result, there are two possible data-related explanations for divergence of the U.S.–Texas unemployment rate gap since 2007.

In some years, revising the population count of a particular group can produce significant changes in the demographic composition of Texas relative to the nation. For example, in January 2008, the estimated Hispanic population was revised lower because of Census Bureau methodology changes used to calculate international migration. While the total civilian, noninstitutional population fell by 745,000 in the U.S., the estimate of people with Hispanic and Latino ethnicity declined by 349,000. The Hispanic population reduction disproportionately affected Texas, likely trimming Texas' unemployment rate relative to the nation because of that demographic group's higher-than-average unemployment rate.

To assess the impact of population adjustments, the weights in December 2007 were used to estimate the unemployment rate for all subsequent months. Holding weights fixed had little impact on the pattern of the gap.

A second possible source of difference is the Bureau of Labor Statistics' use of alternative methodologies for estimating the unemployment rates for states. To circumvent imprecision resulting from states' smaller sample sizes, official unemployment rates aren't estimated from direct counts of the jobless as a percentage of the labor force in the Current Population Survey—the way the national figure is calculated. Instead, the bureau uses model-based estimation for the states. This difference in methodology of the national and the state unemployment rates hasn't changed since 2007 and, therefore, probably played no role in the U.S.–Texas gap becoming positive.[1]

[1] The Bureau of Labor Statistics last revised the methodology for calculating state unemployment rates in 2005, but the revisions were applied to all previous years to maintain comparability.

The comparatively larger proportion of people looking for work nationally at a time of decreasing employment widened the unemployment rate gap with Texas, leaving the state in a relatively better position.

ket prospects in the state versus the nation, with a broad-based shift for all demographic groups after January 2007.

Role of Demographics

Texas has a relatively larger share of teens, Hispanics and high school dropouts and fewer college graduates—all correlated with the unemployment rate. But did that mix change much after 2007?

Demographics evolve slowly, and it is unlikely that they shifted enough in a decade to contribute significantly to lowering Texas joblessness vis-à-vis the nation. In Chart 3, the U.S.–Texas unemployment gap is divided into parts: a portion explained by differences in demographic composition such as sex, age, race and education and a part attributable to other factors, such as industrial composition of the workforce and business cycles.[2] The gap is shown for either side of the 2007 turning point.

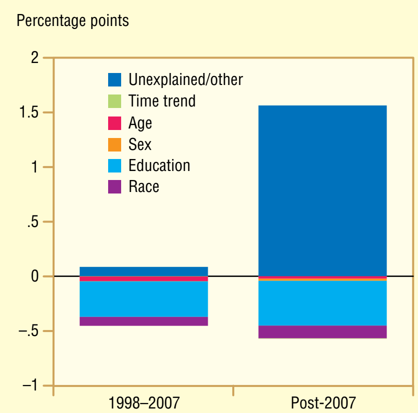
The pre-2007 gap can largely be explained by variation in demographic composition, especially differences in education and race. Post-2007 is very different. Demographics account for a small portion of the approximately 1 percentage point higher U.S. unemployment. A comparison of pre- and post-2007 suggests that demographics, as expected, had little to do with the gap's reversal; rather, the increase in the contribution of other factors dominates.

Seeking Work vs. Employed

Two indicators that help explain the unemployment rate could provide clues to why Texas' joblessness dipped below the nation's. The labor force participation rate is the proportion of the adult population working or looking for work, and the employment/population ratio is the proportion actually on the job. The difference between them approximates the unemployment rate.[3] Declining joblessness might be due to fewer people seeking work or a higher proportion of employed individuals.

A falling unemployment rate because discouraged workers left the labor force isn't desirable and reflects economic weakness. Conversely, a larger proportion of employed people indicates labor-market strength. During the past decade, Texas' labor force participation rate was consistently higher than the nation's, though it sharply dropped to the U.S. rate as the recession took hold (*Chart 4*).

Chart 3
Demographic Factors Fail to Account for U.S.–Texas Jobless Rate Gap after 2007
(Contribution to U.S.–Texas unemployment rate gap)



SOURCES: Current Population Survey, January 1998–December 2009, Bureau of Labor Statistics; author's calculations.

Construction's share of total employment rose sharply in Texas relative to the nation, where housing led the recession.

During the downturn, the proportion of Texans in the labor force began stabilizing, while nationally it declined.

Meanwhile, the state's share of people employed followed the nation until the recession, when it fell, though less precipitously than across the country (*Chart 5*).

The comparatively larger proportion of people looking for work nationally at a time of decreasing employment widened the unemployment rate gap with Texas, leaving the state in a relatively better position.

Fewer Jobs, Still Looking

Comparing before and after 2007, the relative difference in the percentage of U.S. and Texas populations working or willing to work narrowed across most demographic categories (*Table 1*). Overall, the national and state labor force participation rates each declined during the pre-2007 period. But the Texas rate fell faster as population growth outstripped labor force expansion.

Before 2007, Texas labor force participation exceeded that of the U.S. for all groups except Hispanics, younger workers, those 25–54 years old and females. Texans with less than a high school diploma were comparatively more likely to seek work or be employed—their participation exceeded the nation's by more than 5 percentage points.

In the post-2007 period, Texas' diminishing labor force participation rate and slowly falling employment rates dampened rising joblessness in the state. The trend was mirrored among key Texas demographic segments (*Table 2*). Meanwhile, U.S. joblessness grew faster, reflecting an overall greater proportion of the population willing to work amid a paucity of positions. As more people across the country sought fewer jobs, the unemployment rate gap swung in favor of Texas (*Chart 6*).

The bottom line: The national unemployment rate increased 1.6 percentage points while Texas joblessness rose 0.2 percentage point from pre- to post-2007, leading to the gap in average unemployment between the two periods of 1.4 percentage points.

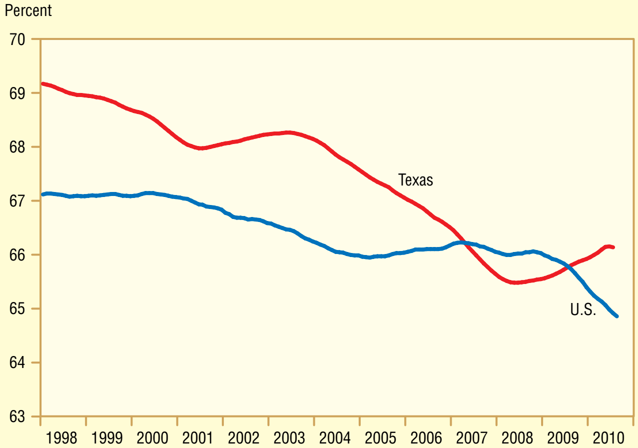
Other Structural Factors

Other structural factors may hold the unemployment rate down, but they were present both before and after 2007. They include differences in union coverage, minimum wage laws, trends in real wages and the relative generosity of the unemployment insurance system across states.

Changes in the industrial structure of Texas employment compared with that of the U.S. might explain the unemployment rate gap. While the relative share of manufacturing and services remained roughly stable after 1998, the share of construction rose dramatically in Texas after the nationwide housing meltdown, which disproportionately affected the rest of the nation. Rising oil and natural gas prices also tend to benefit Texas while hurting the rest of the nation. But energy prices rose sharply and then

Chart 4

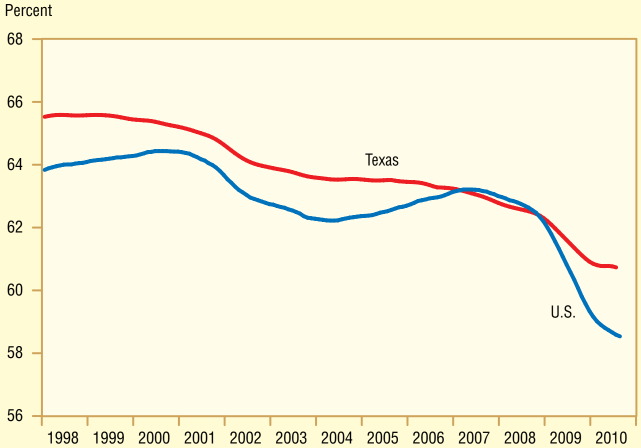
Labor Force Participation Rate Declines Faster in Texas Than in U.S. Through 2007



SOURCES: Current Population Survey, January 1998–July 2010, Bureau of Labor Statistics; author's calculations.

Chart 5

Employment/Population Ratio Falls More Steeply in U.S. Than in Texas Post-2007



SOURCES: Current Population Survey, January 1998–July 2010, Bureau of Labor Statistics; author's calculations.

Table 1

Labor Force Participation Rate

	Texas			U.S.		
	Pre-2007 (percent)	Post-2007 (percent)	Percentage point change*	Pre-2007 (percent)	Post-2007 (percent)	Percentage point change*
Male	77	75	–2	74	73	–1
Female	59	57	–2	60	59	0
Young	61	56	–6	63	58	–5
25–54	83	81	–1	83	83	0
55+	37	40	3	35	39	5
White	68	65	–3	67	66	–1
Black	69	65	–4	65	63	–2
Hispanic	67	66	–1	68	68	0
Other	68	68	0	66	66	0
Less than h.s.	49	47	–2	44	42	–1
High school	71	68	–3	69	67	–2
College+	80	78	–2	79	78	–1

*Change reflects rounding.

SOURCES: Current Population Survey, January 1998–December 2009, Bureau of Labor Statistics; author's calculations.

Table 2

Employment/Population Ratio

	Texas			U.S.		
	Pre-2007 (percent)	Post-2007 (percent)	Percentage point change	Pre-2007 (percent)	Post-2007 (percent)	Percentage point change
Male	73	71	–2	70	68	–3
Female	56	54	–2	57	56	–1
Young	54	49	–5	56	50	–6
25–54	79	78	–2	80	78	–2
55+	36	38	2	33	38	4
White	66	63	–3	64	62	–2
Black	62	58	–4	59	56	–3
Hispanic	63	62	–1	64	63	–1
Other	65	65	0	63	62	–1
Less than h.s.	45	42	–2	39	36	–2
High school	67	64	–3	65	62	–3
College+	78	76	–2	77	75	–2

*Change reflects rounding.

SOURCES: Current Population Survey, January 1998–December 2009, Bureau of Labor Statistics; author's calculations.

plummeted precipitously during 2007–09 even as the U.S.–Texas unemployment rate gap widened in favor of Texas.

Conclusion

Prior to the recession, the number of people in the Texas labor force rose faster than in the nation, but the population grew even more quickly—producing a large decline in the proportion of people in the labor force. Meanwhile, in the U.S., labor force participation fell less rapidly and greater unemployment occurred.

Texas' home prices remained relatively stable. Construction's share of total employment rose sharply relative to the nation, where housing led the recession. The sturdiness of the construction sector and the reversal in the unemployment rate gap after 2007 suggest a possible relationship.

In the coming months, it is very likely that the gap will narrow, although it may not disappear any time soon.

Three reasons help explain this probable narrowing of the gap. Texas' labor force participation rate has shown signs of stabilizing since 2008. Second, there appear to be no structural explanations for the difference to persist. Finally, the U.S.–Texas gap tends to creep up before each national recession and then narrow. It happened in 2001 when both the U.S. and Texas entered the recession, just as in 2008, although the primary drivers of the two downturns were different.

Kumar is a senior research economist and advisor in the Research Department at the Federal Reserve Bank of Dallas.

Notes

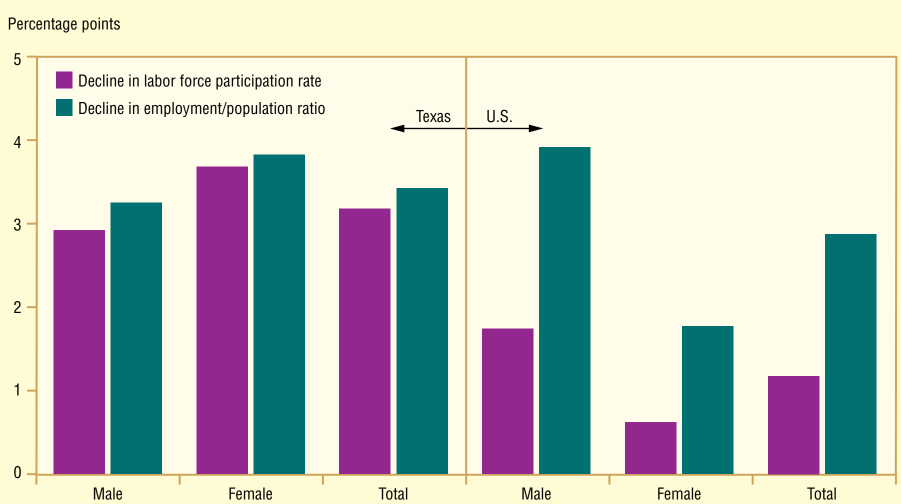
[1] Throughout the article, unless otherwise stated, "the unemployment rate gap" or "the gap" refers to the unemployment rate of the U.S. minus the unemployment rate of Texas; pre-2007 refers to 1998–2006, and post-2007 refers to 2007–09. For the sake of enhanced comparability, the unemployment rate and other labor market indicators for Texas are calculated directly using the Current Population Survey data, similar to how they're used for the national estimates. The data in this article are from the Current Population Survey from January 1998 through December 2009. To deal with the imprecision problem of smaller state samples and the seasonality of the monthly labor force statistics, a 12-month moving average is used whenever appropriate.

[2] This analysis is performed using the well-known Blinder–Oaxaca decomposition. See "Wage Discrimination: Reduced Form and Structural Estimates," by Alan Blinder, *Journal of Human Resources*, vol. 8, no. 4, 1973, pp. 436-55, and "Male-Female Wage Differentials in Urban Labor Markets," by Ronald Oaxaca, *International Economic Review*, vol. 14, no. 3, 1973, pp. 693–709.

[3] For a detailed discussion, see "The Labor Market in the Great Recession," by Michael Elsby, Bart Hobijn and Aysegül Sahin, Brookings Papers on Economic Activity, Spring 2010, pp. 1–48.

Chart 6

Decomposing the Rising Unemployment Rate, Post-2007



SOURCES: Current Population Survey, January 1998–December 2009, Bureau of Labor Statistics; author's calculations.

OnTheRecord

A Conversation with **retired U.S. Coast Guard Capt. Bill Diehl**

Texas Well-Positioned as Panama Canal Expands

Capt. Diehl, president of the Greater Houston Port Bureau, was U.S. Coast Guard liaison officer to the Panama Canal Authority from 2004 to 2006. A maritime safety, security and environmental response expert, he served on the operational managers board, charged with moving up to 14,000 vessels safely through the canal each year.

Q. What are the history and economic significance of the Panama Canal?

A. When it opened in 1914, the Panama Canal revolutionized shipping in the Americas by shortening the ocean route between the East and West coasts by 8,000 miles. The United States built the canal for economic and trade reasons, and President Teddy Roosevelt saw it as a military necessity. Before becoming president, Roosevelt served as assistant secretary of the Navy and was particularly concerned that it took the naval fleet—our defenses—60 days to travel across the country via Cape Horn at the tip of South America.

Once the U.S. decided to build the canal, the project overcame enormous natural barriers. Not only did the Americans wipe out malaria and yellow fever (diseases that defeated the French), they also solved rain forest water-flow problems. They dug through the continental divide, creating the largest artificial lake of its time with the largest dam in the world (until the Hoover Dam was built), and built the largest locks ever imagined. Those locks are located at both ends of the 50-mile system, and involve a series of three chambers through which ships are elevated 85 feet to the level of Gatun Lake so they can cross Panama.

The United States ran the canal until Dec. 31, 1999, when Panama assumed full responsibility for it. The canal figures in 15 percent of all U.S. oceangoing cargo and serves as a vital link in world supply chains.

Q. The Panama Canal Expansion Project, a $5.25 billion undertaking funded in 2006, is scheduled for completion in 2014. Why did Panama decide to expand the canal, and what does expansion entail structurally?

A. Since the 1970s, by mixing vessel sizes and setting the order of movement, about 38 vessels per day pass through the canal, its practical capacity. Over the years, the size of ships using the waterway has grown, more than doubling in just the past 15 years, primarily because of increasing containerized cargo shipments.

Transpacific trade between Asia and the U.S. East Coast accounts for more than half of canal traffic. By 2020, post-Panamax ships (vessels larger than the current locks) are projected to comprise 30 percent of the global fleet. To attract this maritime trade, the canal seeks to double capacity by adding a third set of locks. This entails construction of two complexes of locks—one on the Atlantic side, the other on the Pacific. These three-level locks will have water-saving basins that allow the canal to reuse a portion of the freshwater that would otherwise be released from Gatun Lake to the open sea. The project also involves construction of approach lanes to the new locks and widening/deepening of the existing navigational channels.

The canal is expanding so it can remain competitive, ensuring that Asia–U.S. East Coast trade routes do not shift west from Asia through the Suez Canal [in Egypt]. On average, the Suez route involves an extra day, rendering it less efficient. But, at the moment, it is the only ocean-bridging canal with lanes wide enough for the post-Panamax ships. Panama must meet the challenges of moving the larger vessels, and the expansion is a major step toward enhancing its position in international supply chains.

Q. In assisting with planning and preparation for the expansion, what did you perceive was the project's biggest challenge and how was it overcome?

A. I was not on the canal expansion team but knew of some of the issues it worked through. I think the design of the new lock chambers was the biggest decision. The authorities made an excellent choice, going with the European-designed rolling gates, which slide into the side of the lock when opened. By using sets of two of them at each end of the locks, they have provided redundancy, allowing canal personnel to perform maintenance and be more responsive if damage occurs. Each lock chamber also will have three water-saving basins, which will reuse 60 percent of the water in each transit. This makes the expansion environmentally sustainable by diminishing water loss and by preserving freshwater resources.

Q. How will the expansion affect U.S. container trade with Asia?

A. In 1999, about 86 percent of eastbound containers coming from Asia were unloaded at a West Coast port and shipped by train

"The fastest-growing market for Houston regional ports is East Asia. We eagerly anticipate further steady growth with the opening of the canal's new locks."

across the country to the East Coast. Eleven percent went by an all-water route through the Panama Canal. By 2004—when I arrived in Panama—the canal's market share had risen to 38 percent. That's the sheer volume of goods moving from Asia to the East Coast by skipping a West Coast port. Once the canal expansion is completed in 2014, the size of container ships able to cross will go to 12,600 TEU (twenty-foot equivalency units) from the current 4,800-TEU capacity. This will ensure that the canal can handle the next few generations of container vessels.

There are many variables at play when trying to figure out how larger ship movements will affect the East Coast ports and how rapidly change will come. I predict a slight surge in shipping traffic in 2015, but consumer demand is the major component to watch. Once the expanded canal settles into operation, cargo volumes will grow 2 to 3 percent annually over the longer term. The canal, the fleet and the ports can support this growth—though ancillary port equipment, labor, productivity and operating practices must work to keep pace.

What will be interesting to watch is the toll rate: How fast will the canal raise tolls to recover expansion expenses? Most likely, canal operators will limit growth to 2 to 3 percent per year by using the fees. For example, if there is a particularly high-volume year, they can raise tolls to slow growth, much the same way that the Federal Open Market Committee uses interest rates to keep inflation inside a targeted range. Conversely, operators can maintain their current tariff structure if they need to encourage more movement. This pricing approach lets the canal system expand operations gradually without being compelled to bring on new staff and equipment immediately.

Q. Gulf ports process mostly bulk cargo and petrochemicals and relatively little container trade. Will they still be impacted by the canal expansion? How can Texas ports such as Houston expect to be affected? What preparations are being made?

A. The fastest-growing market for Houston regional ports is East Asia, with total tonnage increasing more than 30 percent in the last three years. We eagerly anticipate further steady growth with the opening of the new locks.

When it comes to moving cargo to the end consumer, Houston has an advantage: While East Coast ports will compete with each other for market share in the eastern U.S., Houston is the logical gateway into the middle of the country and the northern Mexico market. We have 20 million people living within 500 miles of the port, and our population in this area is growing at three times the national rate. Why is that important? Having a port so close to your customers means your cargo can go from a ship to a truck, as opposed to a West Coast port, where cargo must move to the customer in three steps—ship to rail to truck.

Infrastructure is key: On the land side, local ports are gearing up for increased traffic. For example, the Port of Houston Authority is building new facilities to accommodate cargo growth. The authority is tripling the design capacity of its container yards with the build-out of the Bayport container facility as well as improving access to road and rail hubs in the region.

One area of concern is maintaining dredging of our ship channels. Currently, only 52 percent of the revenue generated from a nationwide harbor maintenance tax is spent to keep our channels deep and wide. This underspending will be a serious problem as larger ships arrive.

Q. What are the projections for the canal expansion's overall impact in a decade or two?

A. As the ships and the market grow into the larger locks, we must adjust our supply chains. The larger ports will become hubs where—just like oil supertankers transferring crude oil to smaller ships—large ships will dock, unload their cargo and then move on to the next hub. This will create growth in short-sea shipping as smaller vessels move up and down the coast from the hub, delivering their part of the load.

We've already seen Panama gearing up by adding massive container yards on both sides of the canal and the corresponding construction of heavy, double-tracked short-line railroad capacity to enable ships to come to the canal, drop their containers off, then turn around as another ship pulls up on the opposite coast to take the containers from a railcar and move them to their port of destination.

I think we will see steady growth, regulated by the Panama Canal Authority, of 2 to 3 percent a year that allows all the players involved to increase their cargo handled while keeping congestion to an acceptable minimum.

Natural Gas from Shale: Texas Revolution Goes Global

By Robert W. Gilmer and Emily Kerr

The Texas experiment in the Barnett Shale proved the technical feasibility of shale gas development and brought costs within bounds that promise to give shale gas an important role in global energy supplies.

Natural gas extraction is experiencing what has been called a quiet revolution.

The industry historically viewed natural gas as trapped in reservoirs, where it collects over thousands of years after exiting source rock. Though hard to find, the reservoirs easily give up large amounts of their holdings when penetrated by drilling.

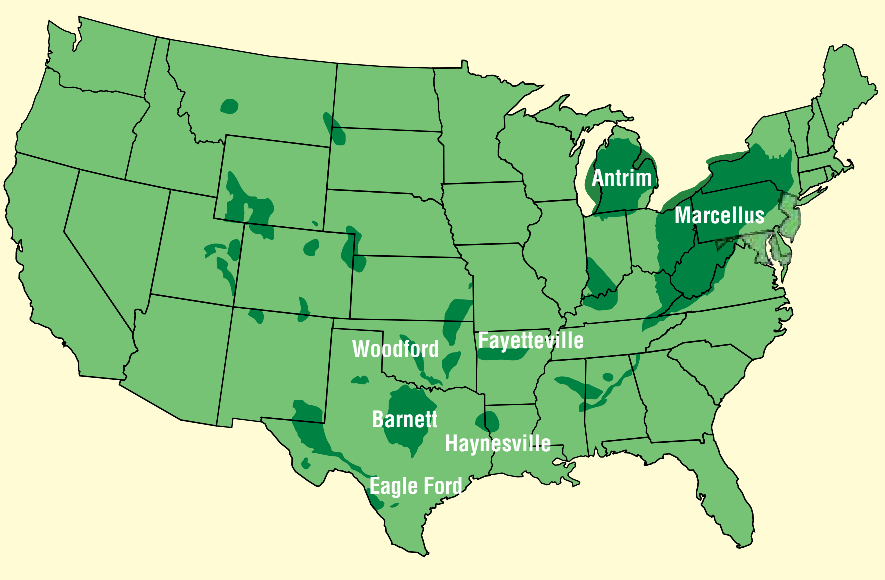
But what if natural gas could be extracted directly from source rock, such as common and easily found shale?

The industry's perspective changed when a few small, independent oil producers from Texas developed a method to economically extract natural gas from shale. Focusing on the source rock, they discovered how to force the more rapid release of natural gas. The feat, representing 10 years of work for George Mitchell and Mitchell Energy, was achieved in the Barnett Shale near Fort Worth.[1] By the late 1990s, their solution was in place, and subsequent technological advances and rising natural gas prices enabled natural gas produced from shale to become profitable.

The innovation involved hydraulic fracturing—injecting a mix of water, sand and chemicals into a well to stimulate production from shale formations. Horizontal drilling, a technique exposing more of the well bore to the source rock, further boosted output and was applied to the Barnett in 2002. Other independent producers took notice. From experimental output levels in 2000, the Barnett produced 380 billion cubic feet of natural gas in 2004 and 1.8 trillion cubic feet by 2009—almost a month's worth of average U.S. natural gas output.[2]

The quiet revolution in Texas has now stepped onto the national and global stage. The technology has moved to other U.S. shale basins (*see map*), notably the Haynesville in East Texas and Louisiana, the Fayetteville in Arkansas, and the Marcellus in New York,

U.S. Shale Plays Boost Natural Gas Supplies



SOURCE: Energy Information Administration.

Pennsylvania, Ohio and West Virginia. The Potential Gas Committee, official arbiter of the U.S. natural gas resource base, recently expanded its estimate of technically recoverable U.S. natural gas by more than one-third—virtually all of the increase due to new shale technology.[3] The newfound supply will likely lower the price outlook and price volatility of natural gas while improving its competitiveness with other energy options.

The technology also spurred investment from the largest producers, such as Exxon Mobil, BP and Shell, which purchased major stakes in the pioneering independents, partly to learn more. A long list of companies from abroad also arrived: Mitsui from Japan, Statoil from Norway, BG Group from Britain, Total from France and Reliance Industries from India. Statoil, for example, hopes to carry the technology to countries such as Hungary, Poland, Austria and China.

Texas Leads Production

Texas leads the nation in natural gas production, and its position is unlikely to be eclipsed any time soon. The state accounted for more than 70 percent of U.S. shale output in 2008.[4] Shale gas makes up 20 percent of the U.S. supply, up from 1 percent in 2000. Some believe it could exceed 50 percent by 2030.[5] States such as Pennsylvania and New York have become viable energy producers because of their shale resources and proximity to major northeastern markets.

The Barnett Shale in Texas is the nation's largest natural-gas-producing area—though the state has other important shale plays, such as Eagle Ford in South Texas and Haynesville, which are rapidly developing into major fields and bringing billions of dollars of household earnings and tens of thousands of new jobs through direct expenditures on drilling and related multipliers.

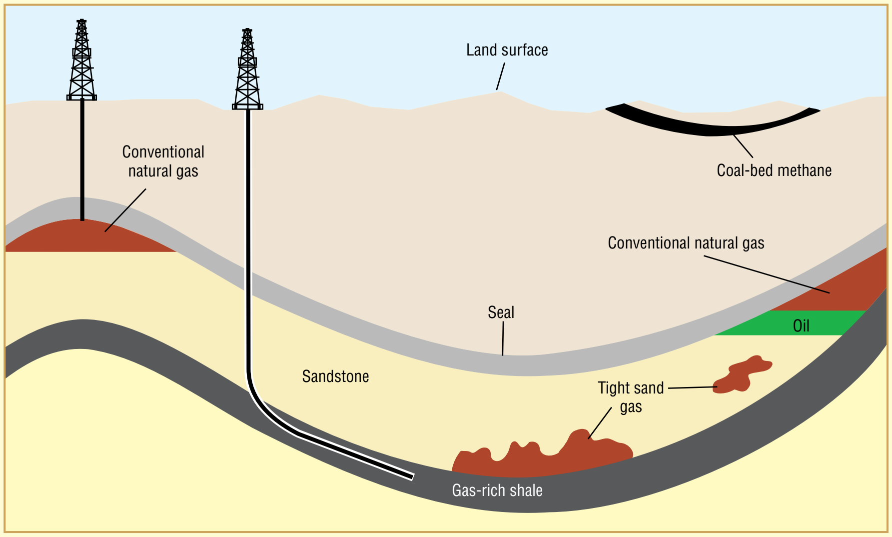
Unconventional Reserves Climb

Natural gas occurs over time and can become locked in structural traps or in the earth's strata, where sealed rock creates a reservoir for hydrocarbons (*Figure 1*). This conventional natural gas flows easily to the surface once drilling penetrates the pocket.

Unconventional resources, such as tight sands, coal-bed methane and gas shales, are more difficult to exploit. Natural gas in tight sands is trapped in sandstone and limestone, which have low permeability. Production often depends on using natural fissures in the rock. Coal-bed methane can be exploited specifically for this natural gas because coal is a weak, already highly fractured rock. Additional stimulation by hydraulic fracturing creates a rapid flow of gas from the coal that can be captured. Shale is a soft, impermeable rock that is easily

Conventional natural gas flows easily to the surface once drilling penetrates the pocket. Unconventional resources, such as tight sands, coal-bed methane and gas shales, are more difficult to exploit.

Figure 1
Natural Gas Now Extracted from Earth's Deeper Layers



SOURCE: Energy Information Administration.

U.S. shale gas reserves rose from almost zero in 2000 to 32.8 trillion cubic feet (Tcf) in 2008, and Texas contributed 21.6 Tcf, virtually all from the Barnett.

broken, but freeing the natural gas from it is more difficult. The use of hydraulic fracturing combined with horizontal drilling has reduced extraction costs, greatly enhancing natural gas recovery.

U.S. proven reserves—or the supply of natural gas that can be produced at current prices—increased 38 percent from 2000 to 2008, with more than half of that addition coming from unconventional resources. U.S. shale gas reserves rose from almost zero in 2000 to 32.8 trillion cubic feet (Tcf) in 2008, and Texas contributed 21.6 Tcf, virtually all from the Barnett. Outside the state, shale reserves were concentrated in Oklahoma (Woodford), Arkansas (Fayetteville) and Michigan (Antrim).

The 2008 reserve estimates illustrate how fast shale's prospects are changing. Two years ago, there were no significant reserves in south Texas, where the Eagle Ford Shale recently blossomed, and there were small reserves in the Haynesville Shale. Extraordinary leasing activity and initial drilling have occurred over the past two years in the Marcellus Shale in the Appalachian region, though 2008 estimates show no reserves in the area. Large additions to the calculation are likely as the numbers are updated.

Calculating Exploration Costs

Whether the cost of recovering natural gas from shale can be justified is a subject of debate. Shale drilling is very different from conventional exploration. It's costlier because of horizontal drilling and additional fracturing, but the high initial expense is offset by an absence of exploration risk. There is no hit-or-miss drilling for a reservoir; shale deposits are well-defined and easily located.

Delivering natural gas to the wellhead usually costs $4 to $8 per thousand cubic feet (Mcf). Engineers have tried to narrow this generally accepted range but have run into complications. One is evolving technology. Most shale production has been in the Barnett, and it is unclear how well tools developed there will travel elsewhere. Another is uncertainty about volumes and the timing of delivery. Shale wells yield very high volumes at first, but production rates fall rapidly during the first year and stabilize in the following years. This initial decline rate varies from 50 percent in the Barnett to 80 percent in the Fayetteville.

Nevertheless, the industry has recently seen large increases in drilling amid depressed natural gas prices. The recession curtailed demand for natural gas from all sources and cut its price. But by July 2009, producers resumed drilling, with new activity mostly involving shale. Last April, 283 additional rigs were searching for gas in the U.S., with 257 of them drilling horizontally, mostly in shale.[6]

What stimulated this shale activity? The average wellhead price of natural gas during this period was $3.98 per Mcf, compared with the $6.02 average that prevailed in the five-year period before the latest recession. A sharp increase in shale-directed drilling at a price below $4 does not necessarily indicate that natural gas can be produced from shale this inexpensively. The price was probably too low to reflect the full cost of production including leasing, drilling and transportation.

Much of this drilling was based on hedges that locked in the higher prices of the previous winter. Further, many producers in the Haynesville and Marcellus recently bought expensive leases that needed to be secured by drilling. This cycle's resiliency is illustrated by the fact that gas production never fell during the recession (*Chart 1*). Despite the sharp decline in overall drilling, producers brought on one high-volume shale well after another, responding to incentives perhaps not well-reflected in the market price.

Environmental Reviews Under Way

Several environmental issues complicate shale gas production, with possible drinking water contamination perhaps the most compelling. There is concern that the fluid used in hydraulic fracturing—typically a mixture of 99 percent water and sand and 1 percent chemicals—is toxic and could seep into underground aquifers or contaminate surface water.

Risks are mitigated by well construction requirements calling for steel piping to be cemented into place with multiple casings to ensure groundwater is protected during all phases of operations. Shale is found far underground (7,000 feet in the Barnett, 10,000 feet in the Haynesville and 4,000 feet in the Marcellus), providing thousands of feet of impermeable rock between freshwater aquifers and the fracturing process. Most drilling fluid is recovered before production begins and, depending on its composition, disposed of via surface discharge, commercial facilities or disposal wells.

States such as Texas, Louisiana and Oklahoma have long been home to oil and natural gas exploration, and hydraulic fracturing has been used since the 1940s. According to the American Petroleum Institute, fracturing has been safely employed in the U.S. more than a million times. However, as the technology spreads beyond the oil patch, states including Pennsylvania and New York have questioned the environmental impact of drilling and natural gas production—in particular, hydraulic fracturing in shale.

The massive oil spill from deepwater drilling in the Gulf of Mexico this year demonstrated how a proven and trusted technology can fail, especially if oversight is insufficiently vigilant. In the case of shale, regulation of drilling and fracturing rests with the states, which have stepped in to review existing rules due to concerns about the large amounts of water required for fracturing, potential groundwater pollution and the disposal of recovered liquids. A typical horizontal well might use 3 million gallons of water, and heavy drilling activity can stress some regions' supplies.

Given the likelihood of widely expanded fracturing as shale development proceeds, the federal government has entered the picture, with the Environmental Protection Agency recently announcing a two-year study of hydraulic fracturing.

Additional vigilance and protection of groundwater could change the economics of producing natural gas from shale. More stringent development rules, if imposed, would increase costs and might halt production.

The industry has taken note, and concerns are sufficiently elevated that some recent mergers and acquisitions have been contingent on regulatory acceptance of hydraulic fracturing.

Shale Gas Outlook

The Texas experiment in the Barnett Shale proved the technical feasibility of shale gas development and brought costs within bounds that promise to give shale gas an important role in global energy supplies for decades to come.

Shale gas cost estimates vary widely, partly because of limited experience in a few basins and partly because the technology is evolving. Prices of competing energy sources at levels seen today will likely stimulate continued rapid development of natural gas from shale. However, additional regulations to protect or conserve groundwater could halt or slow development in some states or regions and reduce the projected contribution of shale gas to national energy supplies.

Gilmer is vice president in charge of the El Paso Branch and Kerr is an assistant economist in the Research Department of the Federal Reserve Bank of Dallas.

Notes

[1] "The Father of the Barnett Natural Gas Field: George Mitchell," by Marc Airhart, Geology.com, www.Geology.com/research/Barnett-shale-father.shtml.

[2] Texas Railroad Commission, http://www.rrc.state.tx.us/data/fielddata/barnettshale.pdf

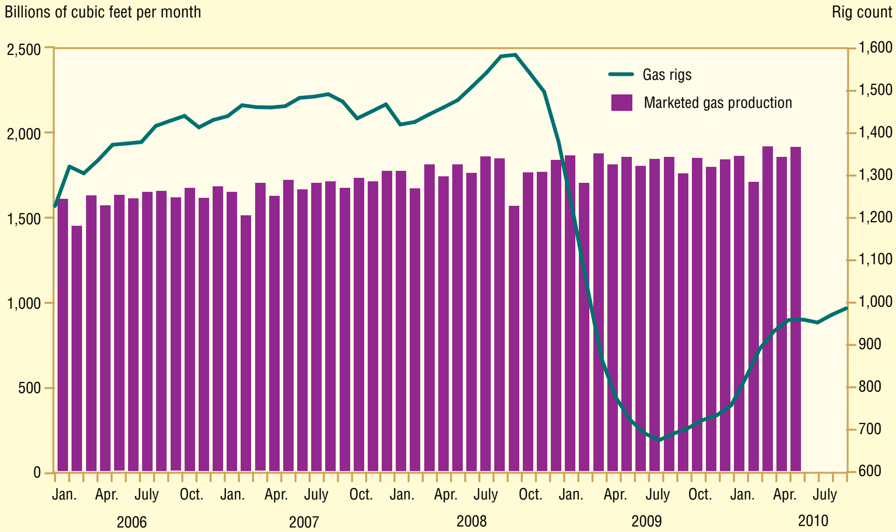
[3] "Potential Supply of Natural Gas in the United States," Potential Gas Committee, Dec. 31, 2008. No time frame or market price is associated with these resource estimates; only technical feasibility of production is inferred.

[4] Energy Information Administration, Office of Oil and Gas, www.eia.gov/dnav/ng/ng_enr_shalegas_s1_a.htm

[5] "Fueling North America's Energy Future: Executive Summary," IHS Cambridge Energy Research Associates, February 2010.

[6] The split between oil- and gas-directed horizontal drilling activity is available periodically on the Baker Hughes website. The latest full month available is April 2010. (See "Total number of horizontal rigs, split by oil and gas," http://blogs.bakerhughes.com/rigcount/2010/06/11/total-number-of-horizontal-rigs-split-by-oil-vs-gas.) New gas-directed drilling after July 2009 was concentrated in the Haynesville and Marcellus basins.

Chart 1
Shale Activity Lifts Gas Production During Downturn



SOURCES: Energy Information Administration; Baker Hughes.

NoteWorthy

QUOTABLE: *"The Texas economy should expand at a pace near the historical average in 2010. Still, the forecast suggests it will be close to year-end 2011 before all the jobs lost during the downturn are recovered."*

—D'Ann Petersen, Business Economist

TRANSPORTATION: Unexpected Demand Drives Up Shipping Rates

Texas exports rose 2.7 percent in real terms in the first six months of the year, fueled by a nascent economic recovery that surprised some shipping companies. Increased demand in the state and nation contributed to spikes in the cost of container, truck and rail freight shipments.

As of Sept. 11, Harper Petersen's HARPEX index of container shipping rates rose 2 percent month over month and 136 percent for the year to date. Maritime shipping companies noted that too few containers were ordered this year to cover the unexpected rapid recovery in demand.

Surging demand earlier this year, along with lean truck inventories, pressured truck freight rates even as tonnage fell slightly in May and June. The American Trucking Association's seasonally adjusted U.S. truck tonnage index rebounded in July, rising 2.8 percent in the first seven months of the year.

Seasonally adjusted freight rail yields, a measure of revenue per ton-mile, advanced 5.4 percent in first quarter 2010. Texas railroads reported increases in shipments through August, while nationally, freight rail traffic rose 8 percent on a seasonally adjusted basis.

Major container shipping lines expected a shortage of containers through third quarter 2010. Truck rates are likely to rise further as supply remains tight, and rail rates may also keep climbing if demand stays strong and contracts continue to renew at higher prices.

—Adam Swadley

POPULATION: Texas Grows Despite Recessionary Doldrums

Texas' population grew robustly in the two years ended July 2009 despite the recession's impact on labor markets. The state added more people than any other—almost 1 million—and expanded at a faster pace than all but Utah and Wyoming.

Most of the growth occurred in Texas' thriving metropolitan areas, recently released Census Bureau data show. Dallas–Fort Worth added 291,000 people over the two-year period, more than any of the nation's metro regions. Houston trailed closely, with 270,000 people. Austin–Round Rock and San Antonio also ranked among the nation's top 15 in population gains.

Texas' urban regions also expanded at a faster pace than many others across the nation. Austin's population rose 6.9 percent over the period, making it the nation's fourth-fastest-growing metro area. All told, seven Texas metros were among the 25 fastest growing. McAllen, Midland, Houston, Dallas–Fort Worth, Laredo and College Station each recorded population increases of at least 4.5 percent, more than double the 1.8 percent national average for such areas.

Texas entered recession later than the nation, which may explain how it supported the population gains. The Texas unemployment rate climbed 3.5 percentage points in the two years ended July 2009, comparing favorably with the nation's 4.8 percentage-point gain. The San Antonio rate rose 2.8 percentage points and Dallas–Fort Worth, Houston and Austin each came in roughly a percentage point below the national figure.

—Mike Nicholson

EMPLOYMENT: Low Job Creation Accelerates in the Downturn

Job creation has declined faster than jobs have been lost in Texas, an ongoing trend since the housing boom's peak, according to Business Employment Dynamics data from the Bureau of Labor Statistics (BLS).

The number of private-sector new jobs as a percent of employment—the gross job gains rate—fell 1.6 percentage points from first quarter 2006 to third quarter 2009. Meanwhile, jobs shed as a share of employment—the gross job loss rate—rose 0.8 percentage points. The data point to similar patterns for the nation.

The fall in gross job gains accelerated during the recent recession. Texas lost 443,210 private-sector jobs, a 5.1 percent reduction, in the first three quarters of 2009.

Unusually large declines in gross job gains in the recession are consistent with other BLS data, suggesting surprisingly low hiring rates compared with past downturns.

Firms may be reluctant to act if available workers lack needed skills or if there is uncertainty about labor costs, a concern cited in July's Beige Book, the Federal Reserve's anecdotal account of regional economic conditions. Job seekers' incentives to find work may be constrained by extended unemployment benefits or by diminished mobility, perhaps due to depressed housing markets that tether property owners.

—Yingda Bi and Barbara Davalos

SpotLight

Imports and Exports

Container Trade Thriving in Texas

Texas has ranked first among the states in exports since 2002. The real value of trade processed through its ports grew at an average annual rate exceeding 8 percent from 1997 to 2009, nearly twice the national pace.

Rapid growth in trade with Asia implies that containerized shipping—the movement of goods by standardized intermodal cargo containers—will play an increasingly prominent role. Growth in twenty-foot-equivalent units (TEUs) processed at Texas ports has outpaced that at other U.S. coastal regions almost every year since 1997 (*Chart 1*).[1]

Inland ports such as Laredo and Dallas–Fort Worth still process most Texas imports and exports, particularly with Canada and Mexico, partners in the North American Free Trade Agreement.

Texas seaports are almost as important, accounting for 42 percent of activity in 2009. What's more, waterborne trade grew at 6.5 times the rate of overland trade on average during 2002–08. The ports of Houston, Galveston and Freeport are the busiest, accounting for two-thirds of the state's seagoing cargo. In terms of foreign trade tonnage, the Port of Houston ranks first in the nation.

While trade in petrochemicals and other bulk commodities is the staple of Texas ports, especially the Port of Houston, the best prospects for expansion lie in container shipping. Texas' overall share of U.S. container trade, although rising rapidly, was a relatively small 5 percent as of 2009 (*Chart 2*).

Container trade traditionally has been focused on the West Coast, particularly Southern California. Following the West Coast ports strike in late 2002, shippers began considering alternatives for cargo destined for the U.S. from Asia. Surging Chinese imports in the years preceding the recent recession, along with increasing Southern California port congestion, further fueled consideration of substitutes. Texas continues to be a likely option for a number of reasons.

First, container trade is largely driven by proximity to population centers and the strength of the local economy—and the Port of Houston fits these criteria with its proximity to Houston and its easy intermodal access to other fast-growing Texas metropolitan areas. Second, the opening of two big-box retail distribution centers near the Port of Houston in the mid-2000s made Texas an attractive West Coast alternative because the facilities import large quantities of containerized cargo from China and distribute well beyond the local area. Third, the Panama Canal's expansion promises to drive more containerized cargo to Texas (*see* "*On the Record*," *page 8*).

As container shipments to Texas increase, the need to transport containerized goods from West Coast ports by rail or truck will decrease. The comparative efficiency of shipping by sea is well noted—one study found an additional 620 miles at sea may be as much as 86 percent cheaper than the same distance by land.[2] Further efficiencies will likely be realized through economies of scale as larger ships pass through the expanded Panama Canal.

These efficiencies are good news not only for Texas but for U.S. consumers. Lower shipping costs should translate into lower consumer goods prices.

—Adam Swadley and Pia Orrenius

Notes

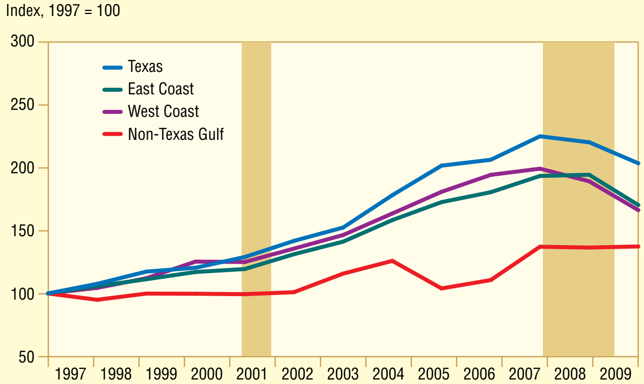
[1] A TEU is the standard nominal measure of volume for shipping containers and container trade. One shipping container is 20 x 8 x 8 feet.

[2] "Infrastructure, Geographical Disadvantage, Transport Costs, and Trade," by Nuno Limão and Anthony Venables, *The World Bank Economic Review*, vol. 15, no. 3, 2001, pp. 451–79. The mileage given here is an approximate conversion from the 1,000-kilometer measure given in the paper.

Chart 1

Texas Container Trade Takes Off from 1997 to 2009

(Waterborne foreign container trade by U.S. coastal region)



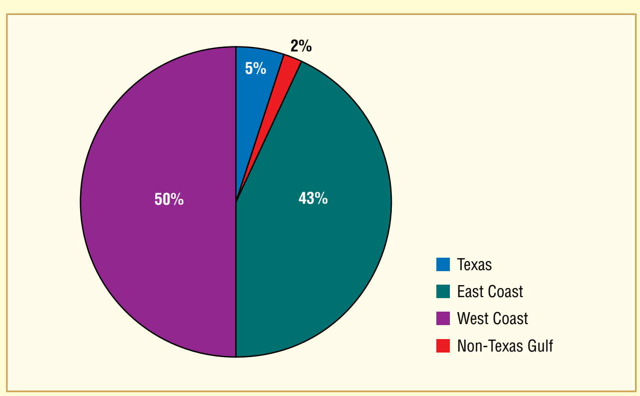
NOTES: Shaded areas indicate U.S. recessions. The East Coast excludes Puerto Rico, and the West Coast excludes Alaska and Hawaii.

SOURCES: U.S. Maritime Administration; authors' calculations.

Chart 2

Texas' Share of Container Trade Still Small in 2009

(Waterborne foreign container trade by U.S. coastal region)



NOTE: The East Coast excludes Puerto Rico, and the West Coast excludes Alaska and Hawaii.

SOURCES: U.S. Maritime Administration; authors' calculations.

Texas Manufacturing Survey Offers Advance Look at State and National Economies

By Franklin D. Berger

Business tendency surveys such as TMOS are increasingly used worldwide to monitor economic activity.

Manufacturing commands special attention because of its size and importance to the economy as well as its strong reflection of the business cycle. The Federal Reserve Bank of Dallas has published its Texas Manufacturing Outlook Survey (TMOS) since fall 2005.[1] Federal Reserve Banks in Philadelphia, New York, Richmond and Kansas City also conduct manufacturing surveys. The Federal Reserve monitors regional economic conditions as part of its monetary policymaking role.

TMOS canvasses manufacturers monthly to learn of changes in activities and attitudes, including ones relating to production, employment, the volume of shipments and new work orders, the cost of raw materials and finished goods prices. The results, seasonally adjusted since August 2009, are presented as "balance indexes"—the difference between the percentage of respondents reporting increased activity and the percentage reporting a decrease. Positive readings indicate business expansion; negative ones, contraction.[2]

Business tendency surveys such as TMOS are increasingly used worldwide to monitor economic activity. The Institute for Supply Management produces the most closely followed national review. Because of a relative dearth of regional data, the Reserve Banks' surveys are particularly valuable and often provide timelier information than headline economic indicators that are prone to revision as data are refined. Business tendency survey responses, because they are a measure of sentiment, aren't revised.

Manufacturing in Texas

Texas manufacturers employed almost a million workers and accounted for nearly 10 percent of U.S. manufacturing output in 2008, the last year for which output data are available. Although contributing a smaller share to the Texas economy than it did 45 years ago, manufacturing remains vital and growing (*Table 1*). As a result of technological change boosting worker productivity, the sector's share of total employment has declined more than its share of overall output even as the amount produced has increased.

TMOS and the Texas Economy

Texas, like the nation, has experienced a sharp recession and nascent recovery. It's interesting to look back on how TMOS measures behaved. Declining economic activity and the subsequent rebound are

Table 1

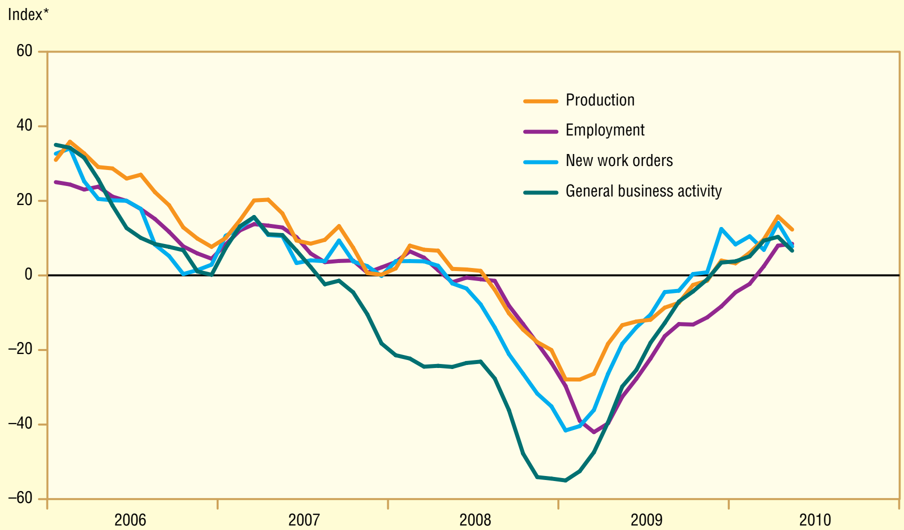
Changes in Texas Manufacturing Output and Employment, 1963 to 2008

	Average annual growth rate (percent)	Manufacturing share of total (percent)	
		1963	2008
Output	4.8	18	13
Employment	1.4	18	9

NOTES: Growth rate of output is based on Texas gross domestic product in constant dollars. Output shares are calculated using nominal data.

SOURCES: Bureau of Economic Analysis (state gross domestic product); Bureau of Labor Statistics (payroll employment); author's calculations.

Chart 1
Texas Manufacturing Outlook Survey Reflects the Recent Recession



*Three-month, centered moving average.
SOURCE: Federal Reserve Bank of Dallas.

clearly reflected in several key indicators (*Chart 1*). The underlying trends are visible in the chart, which uses a three-month moving average to minimize the impact of volatility. Because positive indicator values depict growth and negative values contraction, a positive though declining index indicates growth is still occurring but decelerating. When an index is negative but increasing, the economy continues contracting but at a diminishing rate.

In the recent business cycle, each indicator signaled contraction and subsequent recovery, though the timing varied (*Table 2*).

The business activity index led the other indicators heading into the recession, most likely reflecting respondents' perception that national business conditions were worsening before those in Texas. The Conference Board's Index of Coincident Indicators, a similar national barometer, peaked in November/December 2007 (*Chart 2*). That wasn't long after the TMOS business activity indicator turned negative.[3] The National Bureau of Economic Research, the body that officially dates recessions and expansions, designated the start of the U.S. recession as December 2007

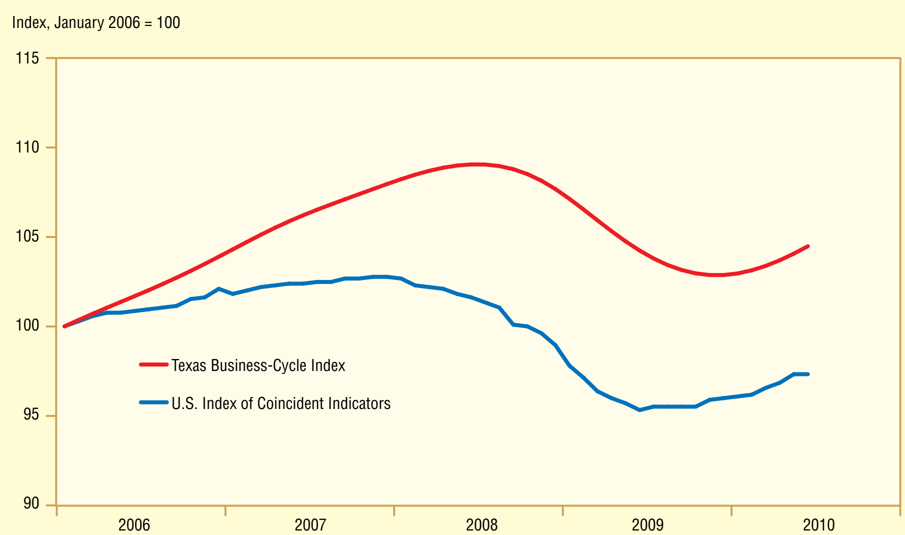
The business activity index led the other indicators heading into the recession, most likely reflecting respondents' perception that national business conditions were worsening before those in Texas.

Table 2
Expansion or Contraction?

	Entered contraction	Began expansion
Business activity	August 2007	November 2009
Production	August 2008	November 2009
New work orders	May 2008	September 2009
Employment	May 2008	March 2010

SOURCE: Federal Reserve Bank of Dallas.

Chart 2
Texas and U.S. Have Different Business Cycles



SOURCES: Conference Board; Federal Reserve Bank of Dallas.

Table 3
Quality of Fit for Texas Target Variables
(adjusted R-squared)

	Target variables		
	Manufacturing employment	Manufacturing industrial production	Manufacturing business-cycle index
Lagged dependent variables only	0.76	0.02	0.82
with TMOS employment	0.79*	0.17*	0.85*
with TMOS business activity	0.78*	0.18*	0.84*
with TMOS production	0.78*	0.19*	0.84*
with TMOS new work orders	0.80*	0.23*	0.86*

NOTES: An asterisk next to the R-squared value indicates the survey variable is statistically significant at the 0.05 level. Seasonal and other adjustments by the Federal Reserve Bank of Dallas.

SOURCES: Bureau of Labor Statistics; Federal Reserve Bank of Dallas.

Studies have indicated there exists a significant statistical relationship among the various Federal Reserve tendency surveys and regional and national data.

and the end as June 2009. The Dallas Fed's Texas Business-Cycle Index didn't peak until June 2008, closer to the peaks of the other TMOS indicators, suggesting Texas went into recession about six months after the nation.

The TMOS employment index's behavior around the recession and recovery is consistent with the historical pattern of jobs responding more slowly than output at business-cycle turning points. Employers cautiously hire and fire when demand for their products fluctuates. Firms, uncertain about future conditions, adjust the number of hours worked and vary the number of temporary workers before significantly changing permanent staffing. Decisions to hire or fire occur only when employers decide that demand change seems to be long-lasting.

TMOS Explanatory Power

Studies have indicated there exists a significant statistical relationship among the various Federal Reserve tendency surveys and regional and national data.[4] TMOS, having amassed about six years of data, can now be investigated to see how well it measures economic conditions.

Several Texas and national factors were tested to see if one or more TMOS balance indexes can explain their movements. The factors of interest (or dependent variables) are referred to as "target" variables and the balance indexes as "survey" variables. Target variables are expressed as a percentage change. Survey variables tested were employment, production, new work orders and general business activity.[5]

Statistical analysis can determine if survey variables are significantly related to target variables over and above any ability of the target variables to explain their own behavior. Often a good predictor of what happens this month is what occurred last month. But we are interested in the extent of the survey variables' explanatory power once such forward momentum in the target variables is accounted for.[6] Explanatory power is captured in the statistical measure R-squared,[7] which calculates how much of the variation in the target variable is accounted for by explanatory data. A perfect match would have an R-squared of 1; no power is zero. If a survey variable doesn't explain a significant amount of variation in the target variable, after controlling for lags of the target variable, then the survey variable is ineffective at providing insight.

Three target variables were investigated: manufacturing employment, the manufacturing component of the Texas Industrial Production Index and a specially constructed version of the Texas Business-Cycle Index pertinent to the manufacturing sector.[8]

Limited regional data are available, and payroll employment, published by the Bureau of Labor Statistics, is probably the most closely followed. The Texas Industrial Production Index, produced by the Dallas Fed since 1958, estimates output on the basis of employment, hours worked and some production data. The Texas Business-Cycle Index is produced by the Dallas Fed using methodology similar to what the Conference Board uses in its national Index of Coincident Indicators.

TMOS and Texas Data

In Table 3, the first row shows the result of including two lagged values of the target variable—the predictive power of past performance—without any survey variables included. Low R-squared in manufacturing production reflects that its lagged values poorly explain future movement. High R-squared values in the manufacturing employment and the manufacturing business-cycle index suggest that lagged values are highly correlated with current outcomes. As for the TMOS indexes, new work orders, with the highest R-squared, provides the most explanatory power for each of the target variables. It explains 80 percent, 23 percent and 86 percent of the variation of the target variables, respectively.

All survey variables are statistically significant at the conventional 0.05 threshold, meaning there is at least a 95 percent likelihood each survey variable has explanatory power.

TMOS and National Data

TMOS variables also shed light on the Fed's U.S. manufacturing industrial production data and the Institute for Supply Management's Composite Manufacturing Index (also known as the Purchasing Managers Index), a leading indicator of national manufacturing (*Table 4*).

For U.S. manufacturing production, both the TMOS general business activity and new work orders variables are statistically significant, adding explanatory power over and above what past performance of the national measure explains on its own. Only the TMOS employment variable doesn't improve the fit, though the improvement offered by TMOS production is negligible.

For the Purchasing Managers Index, only the TMOS employment variable fails to add significant explanatory power, and once again, new work orders fits a little better than the other variables.

TMOS Usefulness

Business tendency surveys are designed to provide more timely information on economic conditions than otherwise available. TMOS variables have broad explanatory power for Texas and national economic indicators. TMOS for a given reference month is available up to a month before other Texas data are available. The survey figures appear to measure what they were intended to measure. Moreover, although TMOS was designed for—and is most useful in—understanding the Texas economy, it can also contribute to explaining national developments.

Berger is director of technical support and data analysis in the Research Department of the Federal Reserve Bank of Dallas.

Notes

1 See "A New Barometer for the Texas Economy," by Fiona Sigalla, Franklin D. Berger, Thomas B. Fomby and Keith R. Phillips, Federal Reserve Bank of Dallas *Southwest Economy*, no. 6, 2005.

2 Additional methodological information, a copy of the survey questionnaire, the latest release and historical data for TMOS can be found at www.dallasfed.org/data/outlook/index.cfm.

3 The Conference Board's Index of Coincident Indicators is the principal indicator of the overall performance of the U.S. economy. The Texas Business-Cycle Index is produced by the Dallas Fed using methodology similar to that used by the Conference Board.

4 See the following selected research articles:
"The Predictive Abilities of the New York Fed's Empire State Manufacturing Survey," by Richard Deitz and Charles Steindel, Federal Reserve Bank of New York *Current Issues in Economics and Finance*, Second District Highlights, vol. 11, no. 1, 2005.
"Using Manufacturing Surveys to Assess Economic Conditions," by Matthew Harris, Raymond E. Owens and Pierre-Daniel G. Sartre, Federal Reserve Bank of Richmond *Economic Quarterly*, vol. 90, no. 4, 2004.
"What Can Regional Manufacturing Surveys Tell Us? Lessons from the Tenth District," by William R. Keeton and Michael Verba, Federal Reserve Bank of Kansas City *Economic Review*, Third Quarter, 2004.
"Taking the Measure of Manufacturing," by Timothy Schiller and Michael Trebing, Federal Reserve Bank of Philadelphia *Business Review*, Fourth Quarter, 2003.

5 These are the most closely watched and probably the most useful among the TMOS indicators of economic activity.

6 A second-order autoregressive distributed lag model was estimated. Because no autocorrelations were found, the model was estimated with ordinary least squares.

7 We report adjusted R-squared, which corrects for the fact that R-squared will always increase as independent variables are added.

8 A version of the Texas Business-Cycle Index specific to the manufacturing sector has been calculated. Although unpublished, this series is available on request. For information on the methodology used, see "A New Monthly Index of the Texas Business Cycle," by Keith R. Phillips, Federal Reserve Bank of Dallas, Research Working Paper no. 0401, January 2004. The paper can be found at www.dallasfed.org/research/papers/2004/wp0401.pdf. Optimally, the target variables we choose would represent what the survey variable is designed to measure. For example, if a government agency produced a measure of Texas manufacturing production that was not very timely but measured very accurately, we could use that measure for the period where they both exist to gauge the predictive power of the TMOS production index. Unfortunately, we only have such a measure for manufacturing employment. For the other target variables, we use measures calculated in a fashion different from the survey, but they do not necessarily represent a more accurate measure. This is a weaker, yet still important, method to gauge the usefulness of the survey series.

Table 4
Quality of Fit for U.S. Target Variables
(adjusted R-squared)

	Target variables	
	Manufacturing industrial production	**Purchasing Managers Index**
Lagged dependent variables only	0.27	0.87
with TMOS employment	0.26	0.86
with TMOS business activity	0.33*	0.88*
with TMOS production	0.28	0.88*
with TMOS new work orders	0.31*	0.89*

NOTE: An asterisk next to the R-squared value indicates the survey variable is statistically significant at the 0.05 level.
SOURCES: Federal Reserve System; Institute for Supply Management; Federal Reserve Bank of Dallas.

Federal Reserve Bank of Dallas
P.O. Box 655906
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