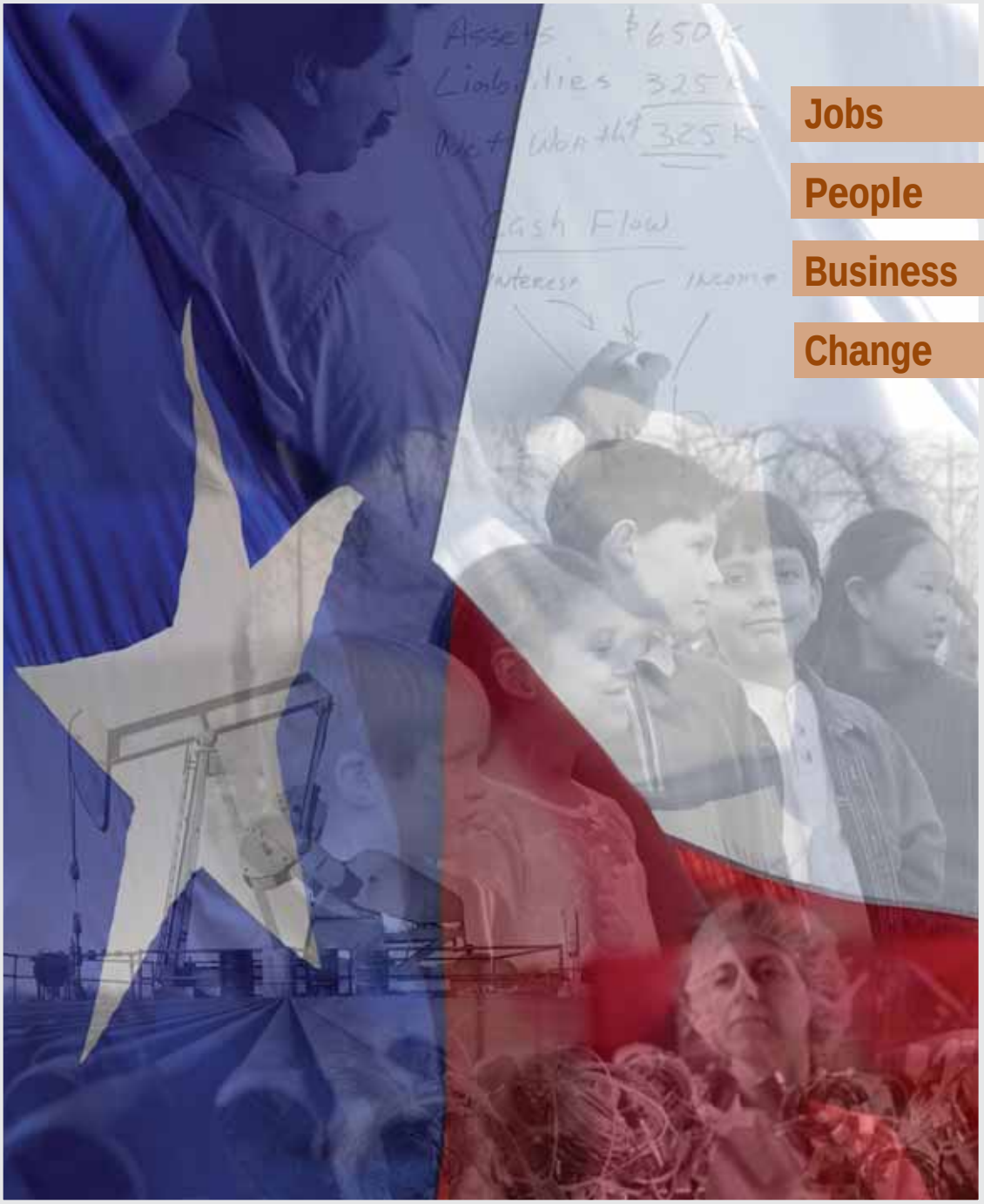
The Face of Texas



FEDERAL RESERVE BANK OF DALLAS • OCTOBER 2005

The Face of Texas

Jobs, People, Business, Change

The only constant is change itself. A Greek philosopher wrote those words more than two millennia ago, at a time when events probably didn't move as rapidly as they do today. Accepting the inevitability of change still leaves us the task of understanding the often bewildering world around us. Most of us need help in deciphering the meaning of the changes we can see and identifying the changes we can't see. That is the purpose of this collection of essays — to give our readers solid, useful perspectives that will assist in understanding the changing Texas economy.

The new century finds Texas in transition — no longer booming on high oil prices, finally rebounding from the late 1990s technology bust and still looking for the next economic driver. Our times are complex. Texas' economy is being reshaped not only by what's happening in the state and nation but also by a globalizing world, an important part of which lies just over the Rio Grande.

These essays explain the recent past, give a textured picture of the current landscape and offer a glimpse of what changes may be over the horizon. Our goal is straightforward: We want to promote a fuller understanding of Texas' evolving economy, so the state's citizens will be better equipped to take advantage of opportunities that lie ahead.

Harvey Rosenblum
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Introduction

Mine Yücel

The economic landscape of Texas is changing. The state lost more than 200,000 jobs during the tech bust and recent recession. A majority of these jobs were in the high-tech sector, which was the main driver of the Texas economy in the 1990s. With the decimation of the tech sector, which industry will be the driver of the Texas economy in the future? This monograph doesn't attempt to answer that question, but we explore some of the ways the Texas economy has been changing and some of the current issues facing it.

The state has gone through boom and bust cycles before, but each downturn has been followed by a stronger and more diverse economy. The oil bust was particular to Texas and hurt the state's economy, while low oil prices helped the rest of the nation. The tech bust, on the other hand, was experienced similarly in Texas and the nation. Texas bore a larger brunt because it had a higher share of high-tech manufacturing and service industries than the nation.

While the drivers of the economy may change, one constant is the close relationship the state has with the Mexican economy. The interconnection is crucial to the border economies and is a big factor in the changing demographics of Texas.

Structural Change

The articles in this publication discuss some of the changes in the economic landscape of our state. Mine Yücel looks at the Texas economy's performance during the most recent recession and explains why it was different from previous recessions. She argues that unlike previous recessions, the most recent recession was primarily due to a high-tech bust rather than an oil price shock. Although oil prices were relatively high during the recession, they did not benefit Texas as much as in the past because the state has diversified away from oil. In addition, she shows that the high-tech sector grew very fast in Texas in the 1990s, to a share higher than the national average. Texas' higher share of industries that were hit hard in this recession was a major factor in the state's prolonged downturn.

Pia Orrenius, Jason Saving and Priscilla Caputo survey the weak jobless recovery after the most recent recession and suggest that it may be caused by structural change in the Texas labor market. They note that structural change is not new to Texas. The state went through structural change in the 1980s after the oil bust and may be going through another one now. They show that the high-tech and apparel industries are undergoing structural losses, while the health care, education and government sectors are undergoing structural gains. But, just as the oil industry decline paved the way for the diversification and growth of the Texas economy a decade later, the structural change going on today will pave the way for a more dynamic and prosperous Texas.

Oil's Impact

The oil industry has been undergoing change for the past 20 years, shrinking while other sectors of the Texas economy have grown. The Texas economy's diversification away from energy and the energy sector's declining importance prompt Stephen Brown and Mine Yücel to ask whether high oil prices are still a benefit to the Texas economy. They show that higher energy prices still benefit the state—even though it is by less than in the boom years of the 1970s and early '80s. They also find evidence that the Texas economy has become less sensitive to fluctuations in oil prices than it was in the '70s and '80s. First, oilfield activity has become less sensitive to fluctuations in energy prices. Second, the energy industry makes up a smaller share of the Texas economy than it used to. Together these factors mean that Texas output is about 15 percent as sensitive to oil price fluctuations as it was from 1970 to 1988. Texas employment no longer seems to be positively affected by oil price fluctuations.

Business Mix

Laila Assanie and Mine Yücel outline the importance of industry agglomeration to an economic growth. They highlight the key clusters in Texas and its six major metropolitan areas through economic base analysis. They find that oil and gas extraction and its support activities, pipelines, natural gas distribution, refining and oil-

Texas' population is faster growing, younger and more ethnically diverse than the nation's. The Hispanic population will be the dominant force in Texas by 2020.

field-machinery manufacturing are still agglomerated in Texas. However, high-tech and transportation industries have been added to this mix. Computers, telecommunication services, semiconductors and air transportation firms now have a larger presence in Texas than in the nation as a whole.

Bill Gilmer analyzes per capita income growth in various regions of the Texas economy. He shows that the state economy has been growing rapidly since 1969, either matching or exceeding the nation's growth. But the Texas Triangle cities of Houston, Dallas/Fort Worth, Austin and San Antonio grew faster than average. Outside the Texas Triangle, income growth was much slower, although population growth was not. Especially after 1989, the Texas Triangle cities contributed three-fourths of the state's income growth. Gilmer notes that the Mexican border area represents a challenge to state economic development because the border cities' average per capita income is only 50 to 60 percent of the national average. The border saw explosive gains in the '90s following the passage of NAFTA and the growth of the maquiladora industry, but high population growth and high in-migration rates kept income per capita low in this area. The article also explains that the growth in wages and salaries after 1989 came through a change in industry mix as the economy shed low-wage jobs and replaced them with better-paying ones.

Border Influence

Texas border cities are a unique blend of U.S. and Mexican cultures, languages and customs and follow the ups and downs of the Mexican and U.S. economies. Keith Phillips and Roberto Coronado look at how border cities on the Texas side benefit from cross-border traffic by consumers from their sister cities on the Mexican side. They estimate retail sales in four metro areas along the Texas–Mexico border. They find that in 2001, retail sales to Mexican nationals accounted for nearly 20 percent of retail sales in border metros. Laredo had the highest share, with 41 percent of its retail sales going to consumers from across the border. Phillips and Coronado also show that unexpected changes in the peso's real value affected these border metros because retail sales strength varied closely with peso strength, especially in Laredo and McAllen.

Another perspective on border cities is presented by Jesus Cañas, Roberto Coronado and Bill Gilmer. They show how expansions and contractions of the maquiladora industry have affected Texas border cities. NAFTA's passage and the peso devaluation in the early '90s led to maquiladora growth and the relocation of component parts and material suppliers to Texas cities along the border. Texas border cities developed rapidly in the '90s as part of this supply chain. Cañas, Coronado and Gilmer observe that proximity to the U.S. market becomes a crucial advantage for the maquiladoras when there is a short inventory cycle, when the weight-to-value ratio of goods is high, when there is frequent retooling, when quality is more important than price and when intellectual property rights are critical. However, they note that the state is unlikely to repeat the banner performance of the '90s as foreign competition slows the growth of Texas border-city suppliers to the maquiladora industry. Hence, Texas may see less stimulus in the future from maquiladora expansion.

Population Shift

Finally, D'Ann Petersen and Laila Assanie discuss Texas' changing demographic makeup and how it will shape the economy. Texas' population is faster growing, younger and more ethnically diverse than the nation's. The Hispanic population will be the dominant force in Texas by 2020. The authors demonstrate that there are large disparities between ethnic groups in income and education. Such disparities may imply a decline in real income and a lower-skilled and less-educated labor force in Texas compared with the nation. On the other hand, the young and fast-growing population also means Texas' housing market may continue to be vibrant even as the baby boomers age. Texas' challenge is to reduce the disparities and make our differences work for us.

Yücel is a senior economist and vice president in the Research Department of the Federal Reserve Bank of Dallas.

Texas in the Most Recent Recession and Recovery

Mine Yücel

What are the reasons for Texas' prolonged downturn? Why did the state lose its edge?

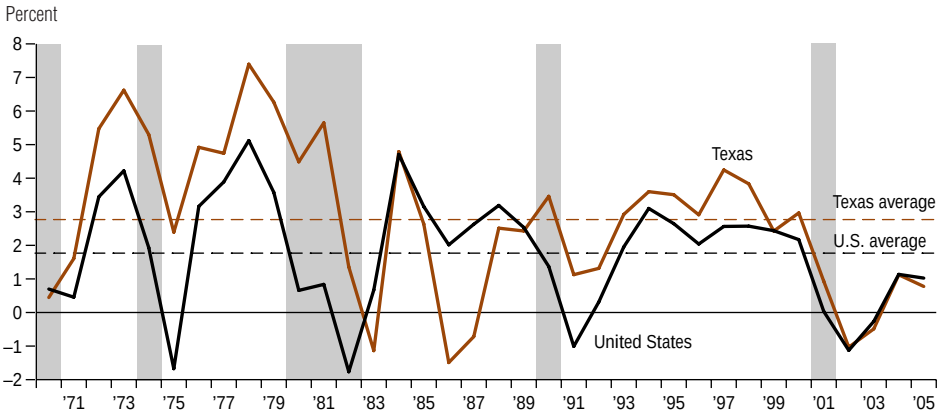
After decades of faring better than the rest of the country, Texas' economic growth has lagged both the nation's and its own past performance for almost three years.

The most recent U.S. recession was short-lived, beginning in March 2001 and ending that November, according to the National Bureau of Economic Research. It took Texas another 20 months—until July 2003—to bottom out, based on the Texas Coincident Index.[1] Employment growth picked up in Texas in 2004. But while the 1.7 percent increase put Texas on par with the nation, it still left the state below its historical pace. What are the reasons for Texas' prolonged downturn? Why did the state lose its edge?

Past Performance

Texas employment growth, on average, exceeded the nation's from 1970 through 2004, with a 2.8 percent rate to the country's 1.8 percent (*Chart 1*). The

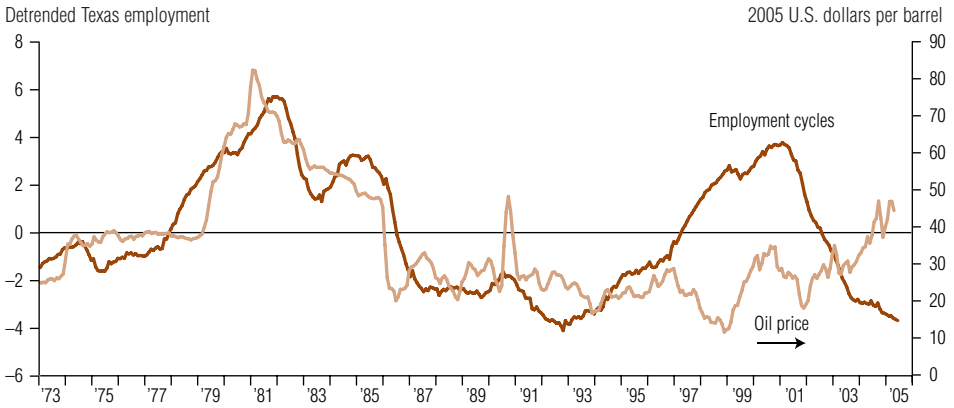
Chart 1
Texas Bests U.S. Employment Growth for More Than 30 Years



NOTES: Data are year-over-year, seasonally adjusted, annualized rates. Shaded bars signify national recessions.

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

Chart 2
Texas Economy Follows Oil Prices



NOTE: Employment data are seasonally adjusted and have had the time trend removed.

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

After oil prices crashed, Texas diversified and the industry became a much smaller share of the state's economy.

state's ability to dodge national recessions is one reason Texas has done so much better. Eight of the 10 post–World War II recessions followed oil price shocks. And unlike the nation as a whole, Texas benefited from high oil prices, especially in the 1970s through early 1990s. As can be seen in Chart 2, the Texas economy followed changes in oil prices fairly closely, with employment rising and falling with the oil price. The Texas employment cycle started diverging from oil-price movements in the 1990s as the economy diversified away from oil and gas.

High oil prices were a boon to the Texas economy and helped it grow, even during national recessions, as seen in Chart 3. Oil prices that nearly tripled from $4 to above $10 per barrel (refiners' acquisition cost) sent the United States into recession in December 1973 but boosted output and employment in Texas (*Chart 3a*). Oil prices started creeping up again in the late 1970s and rose from around $12 per barrel in 1978 to almost $30 when Iraq invaded Iran in September 1980. The U.S. economy went into recession—again, without Texas (*Chart 3b*).

But just as high oil prices helped Texas, low ones hurt it. The nation went into recession again in August 1981, and Texas followed 10 months later, the result of oil prices that began falling from record highs in March 1982 and the pull of the national downturn (*Chart 3c*).

Texas had its own recession in 1986, when oil prices collapsed and the real estate boom cratered. Low oil prices benefited the national economy but sent Texas into a steep decline. However, Texas skirted the national recession again in 1990, when West Texas Intermediate crude spiked to $45 per barrel with the Iraqi invasion of Kuwait (*Chart 3d*).

This Time Around

Texas looked much more like the nation in the 2001 recession than it did in past downturns, for two reasons (*Chart 4*). First, although oil prices were high, this recession was primarily due to a high-tech bust, not an oil price shock. Second, high oil prices do not help the Texas economy as much as they have in the past.

The collapse of high tech in the recent recession was greatly felt in Texas. The state had a larger share of high-tech employment than the U.S. average, so job losses in those industries were relatively higher. From March 2001 through July 2003 (the Texas recession), 39 percent of the jobs lost nationwide were in high tech—426,800 of them in manufacturing and 610,000 in services. Fifty-one percent of the 208,900 jobs lost in Texas were in high tech—51,900 of them in manufacturing and 55,500 in services.

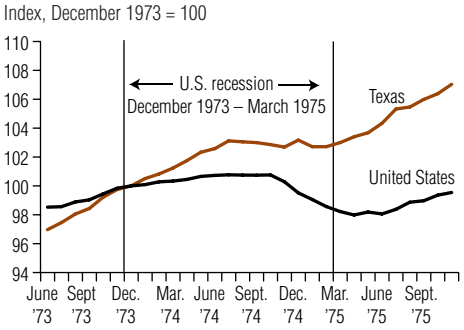
The events of September 11 also contributed to Texas' steep downturn. The transportation industry is important to the state's economy and has a larger share of total employment than in the nation. Transportation was especially hard-hit by fallout from the terrorist attacks, with the sector losing 280,000 jobs nationwide from March 2001 to July 2003. These job losses plus those in high tech constituted 50 percent of the total U.S. employment decline. Texas lost 21,200 transportation jobs, which, combined with its high-tech losses, accounted for 62 percent of the state's total.[2]

Chart 5 illustrates Texas' high-tech roller coaster. California is included as a comparison, along with the United States. High tech grew very fast in the 1990s but came back down just as fast. High-tech production in Texas grew six times as fast as the state's overall output. During the recession, Texas high-tech manufacturing lost 107,400 jobs, nearly a third of its employment. Even though California started with a higher base and therefore grew less in percentage terms, more jobs were created in Texas. During the build-up, total high-tech manufacturing jobs increased by 47,000 in Texas, while they rose by only 17,000 in California. In semiconductors, for example, California added 22,000 jobs, while Texas added 35,000. Texas also grew faster than the nation in telecom services, adding 50,000 jobs during the '90s, then losing 30,000 during the recession.

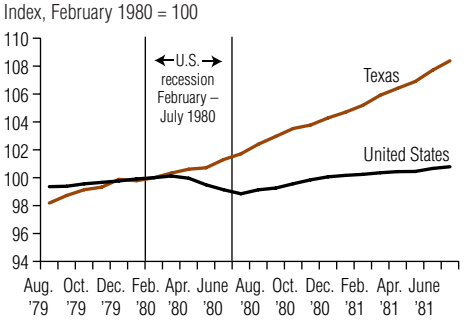
Elsewhere in this publication, "Do Higher Oil Prices Still Benefit Texas?" discusses how the relationship between oil and the Texas economy has evolved. When the industry was a larger share of the Texas economy, higher oil prices were always a net benefit to the state. That

Chart 3
Texas and U.S. Economies in Previous Recessions

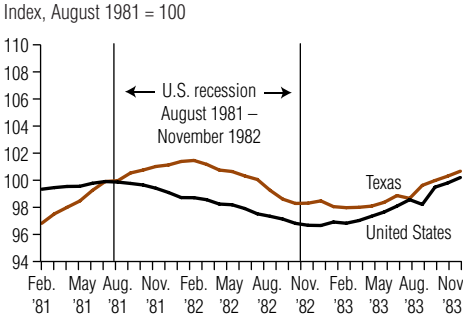
a. Texas Skirts Recession in the 1970s…
(Total nonfarm employment)



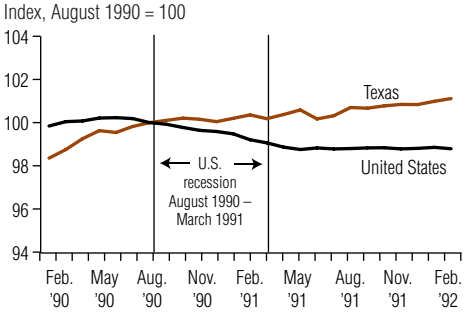
b. …and Again in 1980
(Total nonfarm employment)



c. Texas Follows Nation into Recession in 1981…
(Total nonfarm employment)



d. …but Dodges the 1990 Downturn
(Total nonfarm employment)



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

changed in the late 1980s, when volatile energy prices helped erode the prominence of energy-intensive and energy-producing industries.

After oil prices crashed, Texas diversified and the industry became a much smaller share of the state's economy. For example, oil and gas output, which accounted for nearly 20 percent of total Texas output in 1981, accounts for only about 6 percent today. Similarly, oil and gas jobs account for only 2 percent of Texas employment, down from a high of about 5 percent in 1982. The upshot is that rising oil prices benefit Texas much less now than they did in the past.

Texas is still a large producer and exporter of oil and gas, and when prices go up, it helps producers, royalty owners and the state through increased severance taxes. So, unlike the rest of the country, Texas gets an offset. But that offset is much less now than it was 25 years ago.

In sum, Texas' economic performance has been below par the past three years. Unlike other downturns, the 2001 recession was primarily due to a high-tech bust, not an oil price shock. And although oil prices were relatively high, they did not benefit Texas as much as in the past because the state economy has diversified. In addition, high tech grew very fast in Texas in the 1990s, to a share that was higher than the national average. Texas' higher share of industries that were hard-hit in the recent recession was a major factor in the state's prolonged downturn.

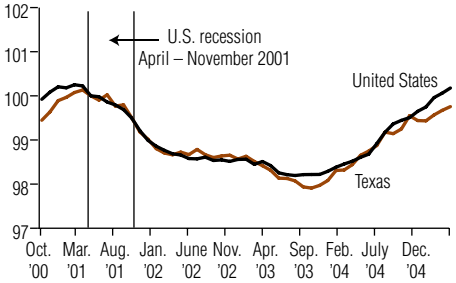
Yücel is a senior economist and vice president in the Research Department of the Federal Reserve Bank of Dallas.

Notes

[1] The Texas Coincident Index aggregates the movements of key regional indicators—employment growth, the unemployment rate and gross state product—to gauge the state's overall economic direction.

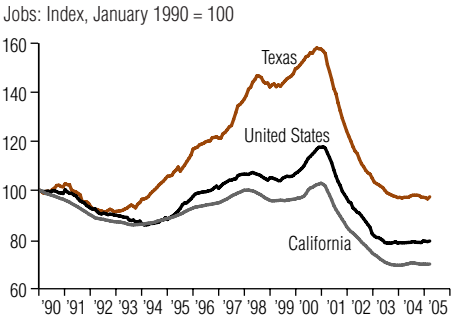
[2] One point to note is that both high-tech and transportation employment were falling even before the onset of the recession. The two sectors were responsible for 73 percent of all job losses in Texas from December 2000 to July 2003.

Chart 4
Texas Looks More Like the Nation
(Total nonfarm employment)

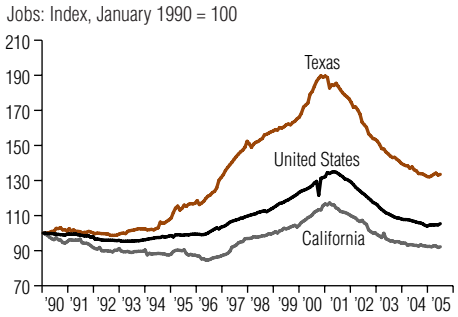


SOURCES: Bureau of Labor Statistics; Federal Reserve Bank of Dallas; National Bureau of Economic Research.

Chart 5
The Boom and Bust of High-Tech Manufacturing…



…and Telecom Services



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

Why Did Texas Have a Jobless Recovery?

Pia M. Orrenius, Jason L. Saving and Priscilla Caputo

In early 2001, the U.S. and Texas economies fell into recession. While the National Bureau of Economic Research Business Cycle Dating Committee declared the U.S. recession over in November of that year, job growth did not resume until June 2003. Texas job growth broke into positive territory two months later, and there is evidence that, like the nation, economic activity in the state picked up long before that.

Following a typical recession, employment begins to rise at about the same time output does. But in the two years after the 2001 recession, U.S. real output growth averaged 2.5 percent, while employment growth was essentially zero. The divergence between output and employment was even more pronounced in Texas, where real output—as measured by gross state product—grew faster than the nation's, but employment fell at an average annual rate of 0.2 percent. Clearly, something was different this time.

Many explanations have been offered for the unusually weak labor market performance, including problems with measuring employment, high productivity growth, widespread uncertainty in the wake of 9/11 and corporate scandals, and structural change in the economy. While much has been written on the nation's experience during this period, there is little information on what caused the jobless recovery in Texas. For this reason, it's important to examine these explanations to see which of them can shed light on the state's experience.

Employment Statistics?

Two Bureau of Labor Statistics (BLS) surveys are the primary source for national and state employment data. The establishment, or payroll, measure—officially, Current Employment Statistics—surveys about 400,000 work sites each month. Critics contend this survey understates job creation at economic turning points because it misses employment in the new firms created during a recovery's initial stages. The alternative, household-based Current Population Survey contacts individuals directly about their employment status. According to this survey, there has been little jobless about the recovery: Jobs have grown each year since the 2001 recession.[1]

The household survey might seem sounder than the payroll survey because it is not limited to wage and salary workers on firm payrolls. However, the household survey has a much smaller sample size and depends on population estimates that are not always reliable, mainly because of uncertainty about immigration rates. Given these weaknesses and the adoption of a statistical method to compensate for missed job growth in start-up firms, most experts—and the BLS—consider the payroll survey the better gauge of employment.

Productivity Growth or Uncertainty?

If the data are sound and the country did experience a jobless recovery in 2002 and 2003, could high productivity growth or substantial uncertainty have been the cause?

U.S. productivity growth averaged 4.3 percent during this period, and some experts believe that increase—well above the post–World War II average of about 2 percent—enabled companies to step up production without hiring more workers. Others believe the uncertain environment that followed various corporate accounting scandals and the 9/11 attacks led to a wait-and-see approach by employers.

These factors likely played an important role in the jobless recovery. But job growth in 2002–03 was far below what Texas and the nation saw in earlier periods of relatively high productivity growth, such as the late 1990s, and substantial uncertainty, such as the late 1970s. So there is more to the story.

Structural Change?

A widely read article from the Federal Reserve Bank of New York offers another explanation for the jobless recovery.[2] Erica Groshen and Simon Potter consider two types of effects that could shake up labor markets: (1) short-term cyclical adjustments that vary with the business cycle, and (2) longer term structural changes, in which some industries decline while others grow.

The economists contend that an unusually large amount of structural change in the labor market, as opposed to temporary cyclical adjustments, hindered the resumption of employment growth in 2002 and 2003. When jobs shift across industries, new positions have to be created and filled, which takes far more time than simply recalling workers to their jobs, as might occur with cyclical change. So if structural change is on the rise, it could explain the jobless recovery.

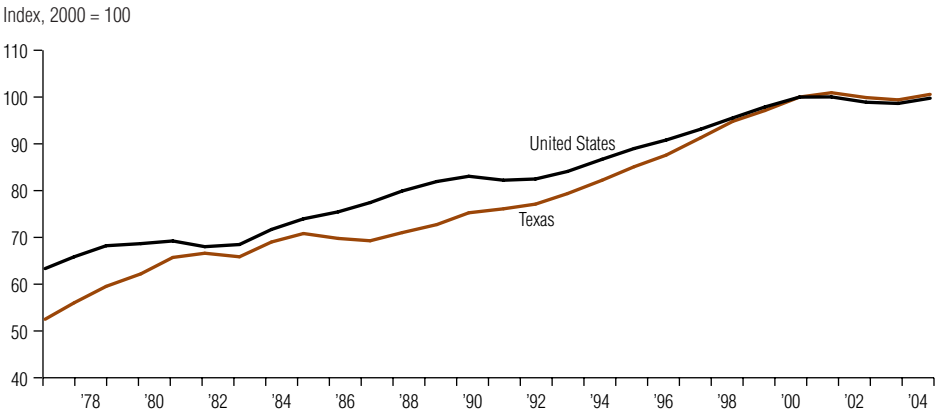
The kind of structural change Groshen and Potter consider can result from a myriad of factors that cause some industries to decline as others grow. These factors include technological and demographic change, reorganization of production, trade and outsourcing—any one of which can permanently alter a state's or nation's industrial mix. Cyclical job losses, by contrast, move with the business cycle. As the economy enters a recession, jobs are temporarily lost in response to softening demand. They are added back as the economy picks up again.

Looking at job growth by industry, Groshen and Potter find that structural factors played a much greater role in the United States during 2001–02 than in earlier U.S. recoveries. They attribute this to a changing labor market in which cyclical job losses have been minimized and structural changes are more pervasive.

This conclusion has important implications for public policy. The traditional safety net in the United States, with such elements as unemployment insurance, is largely designed around the needs of the cyclically unemployed—people who need short-term help with income sustenance while they search for a job. The system is generally not designed to provide longer term retraining for displaced workers whose sectors permanently shrink. Public job-training programs are becoming more common, however. Lawmakers recognized the effects of structural change in the labor market in passing such bills as the Workforce Investment Act of 1998 and the Trade Adjustment Assistance Reform Act of 2002.

Assuming structural change has accelerated at the national level, can the same be said for Texas? Taking the Groshen–Potter approach, we compare recent patterns to earlier recessions to see if structural change has increased in Texas and, if so, whether it helps explain the state's recent experience.

Chart 1
Texas Employment Tracks the Nation's in 2001 and After



NOTE: Data show total nonfarm employment.

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

Measuring Structural Change

To measure structural job change, Groshen and Potter compare employment growth in the recession and the recovery.[3] They make this comparison for each major industry over the length of the recession as designated by the National Bureau of Economic Research (NBER)—March 2001 to November 2001.[4] The recovery is defined as the 12 months following the business cycle's trough in November.

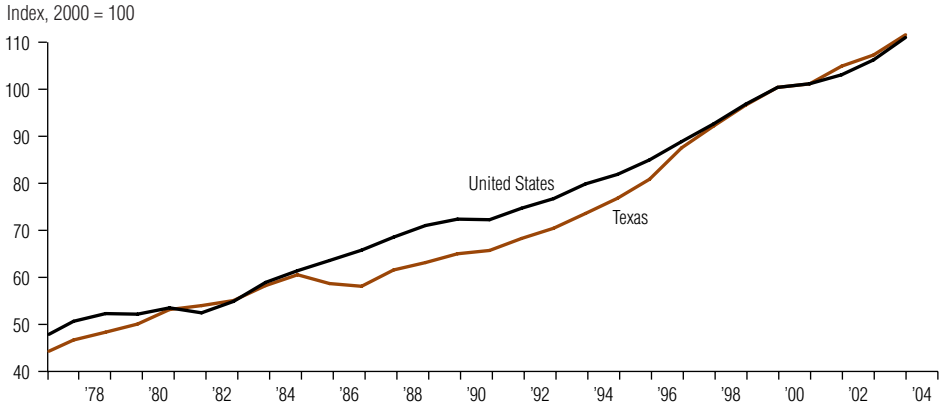
Pinpointing recession dates for Texas is more complicated. Economic analysts often look to payroll employment growth to date state recessions because this is the most timely and reliable data available at the state level. In a jobless recovery, however, the traditional relationship between employment growth and overall economic activity breaks down. This means payroll employment data may not have accurately reflected the state's overall economic health during 2002–03, making it impossible to date the Texas recession using those numbers.

The NBER solves this conundrum for the nation by using several variables in addition to employment—such as industrial production and, especially, gross domestic product—to date U.S. business cycles.[5] Most of these numbers are not available in a timely fashion at the state level, and they are not available at all on a quarterly or monthly basis, which would be needed to date the Texas recession.

We use the national dates for a baseline analysis of Texas. After all, Texas employment closely tracked the nation's in 2001 and thereafter, suggesting that similar factors drove both economies into recession (*Chart 1*). Texas output also tracked the nation's reasonably well in 2001 and 2002 (*Chart 2*). That said, estimates of real output at the state level are subject to a higher degree of uncertainty than at the national level, and there is anecdotal evidence Texas emerged from the recession after the nation. To check the validity of our findings, we repeat the analysis using an end date of March 2003 rather than November 2001.[6]

Chart 3 shows how Texas job growth fared during the 2001 recession and the 12-month recovery for each one-digit industry, the broadest category in the

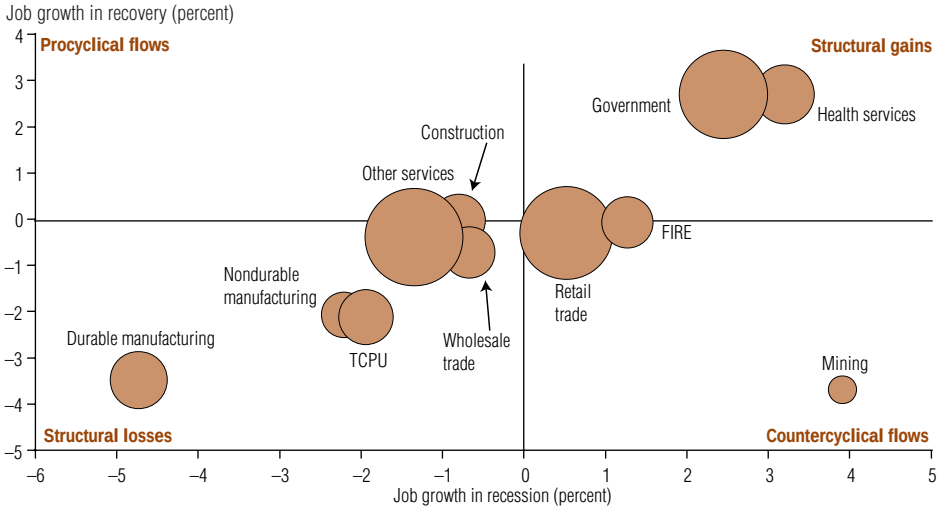
Chart 2
Texas Real Output Tracks the Nation's in 2001 and After



NOTE: Data show real U.S. gross domestic product and Texas gross state product.

SOURCES: Bureau of Economic Analysis; Federal Reserve Bank of Dallas.

Chart 3
Structural Change Prevalent Among Texas Industries in 2001–02



NOTES: TCPU is transportation, communications and public utilities. FIRE is finance, insurance and real estate. The recession is dated March to November 2001; the recovery is dated December 2001 to November 2002.

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

Standard Industrial Classification (SIC) system.[7] All growth rates are relative to the average for total Texas employment during the relevant period. For example, if an industry grew 5 pecent slower than the Texas economy as a whole during the recession, its growth rate is –5 percent. Likewise, if an industry grew 5 percent faster than the Texas economy during the recovery, its growth rate is 5 percent.

The horizontal axis on Chart 3 measures the relative growth rate during the recession; the vertical axis measures the relative growth rate during the recovery. If an industry grew slower than the statewide average in each of the two periods, it falls in the southwest portion of the chart, labeled "structural losses" because these industries lose jobs regardless of overall economic conditions. If an industry grew more rapidly than the statewide average during both intervals, it is in the northeast portion of the chart, labeled "structural gains" because such industries gain jobs regardless of the overall economy.

The remaining quadrants deal with industries that rise and fall with the business cycle. Industries that grew slower than the statewide average during the recession but faster during the recovery are in the procyclical flows quadrant because they move with changes in the business cycle. Industries that grew faster than the statewide average during the recession but slower during the recovery are in the countercyclical flows quadrant because they tend to add jobs when the rest of the economy declines but lose jobs when the rest of the economy does well.

The size of each industry's bubble on the chart represents its share of total Texas employment in March 2001, when the recession began. The larger the bubble, the larger the industry's share of the state's workforce at that time.

The results suggest that the recent business cycle has been dominated by structural gains and losses, as most major industries fall into the structural change quadrants in Chart 3. Manufacturing of both durable and nondurable goods suffered the largest structural losses, whereas health services and government had the biggest structural gains. Overall, about 75 percent of March 2001 employment was concentrated in industries that subsequently underwent structural change. The next section breaks down these major industries to take a closer look at job adjustments.

Industries with Structural Loss. Industries in Chart 4 are classified according to subsectors in the North American Industry Classification System (three-digit NAICS codes). The southwest portion of Chart 4 includes a number of high-tech sectors, among them computer and electronic product manufacturing (includes semiconductors); electrical equipment, appliance and component manufacturing; telecommunications; and Internet service providers (ISPs), search portals and data processing services. High tech's presence in the structural loss quadrant is not surprising, since the 2001 recession kicked off a prolonged retrenchment and restructuring for the sector in Texas, a process from which the state has not fully emerged.

Apparel manufacturing also falls in the structural loss quadrant. In contrast to high tech, the apparel industry has been declining in the United States and Texas for many years. Indeed, apparel experienced the largest job losses in percentage

terms during both the recession and the recovery.

The northeast quadrant of Chart 4 shows the industries that grew faster than total Texas employment during the recession and recovery. This quadrant consists mainly of sectors related to the provision of health care and education, including local government.

Given recent policy and demographic developments, this trend is understandable. Rapid advances in medical technology, coupled with an aging population, are producing an increased emphasis on health care, regardless of the business cycle.

The rise in the economic return to education, the burgeoning youth population and renewed public attention to educational quality have produced an increased emphasis on education that doesn't ebb and flow with economic conditions, either. Since local government is the largest provider of K–12 education, it's not surprising that employment in this sector rose during the recession, as well as the recovery.

Countercyclical Industries. The southeast corner of Chart 4 consists mainly of industries in the energy sector. Rising energy prices were a contributing factor to the 2001 recession.[8] As home to a major share of the U.S. energy industry, Texas benefits from high oil prices (although to a lesser extent than when the industry constituted a much larger part of the state's economy).

Since energy prices were higher during the 2001 recession than during the 2002–03 recovery, it makes sense that energy is categorized as countercyclical for this period.[9] Natural resource and mining industries in this quadrant include oil and gas extraction and mining support activities.

One notable countercyclical industry that doesn't fit into the natural resource category is real estate. What high oil prices did for natural resource industries during the recession, low-interest loans likely did for homebuyers.

Procyclical Dating. Despite expectations of "normal" cyclical losses, few industries fall into the procyclical category during and after the 2001 recession. The northwest quadrant of Chart 4 consists of only about 9 percent of total employment. Among the industries in this quadrant are retail, transportation-related sectors and accommodations.

It may be surprising that so few industries fall into the cyclical category, but it's important to remember that we are comparing each industry to the overall state economy. If an industry's employment fell slightly during the recession and rose slightly during the recovery, it's categorized as countercyclical because its employment fell by less than the state average during the recession and rose by less than the average during the recovery.

Recession Dating. What if the Texas recession was longer than the nation's and did not end in November 2001? If so, the analysis so far biases the findings toward structural change by attributing 2002 job losses to the recovery instead of to what may have been a continuing recession. To check our results, we repeat the exercise under the assumption that Texas emerged from the recession in March 2003—much later than the nation and about four months before employment growth resumed in the state.

A few industries move from one quadrant to another, but the overall picture is one in which structural change still dominates cyclical change (*Chart 5*). About two-thirds of employment is concentrated in industries undergoing structural change, compared with three-fourths when November 2001 is used as the end date.

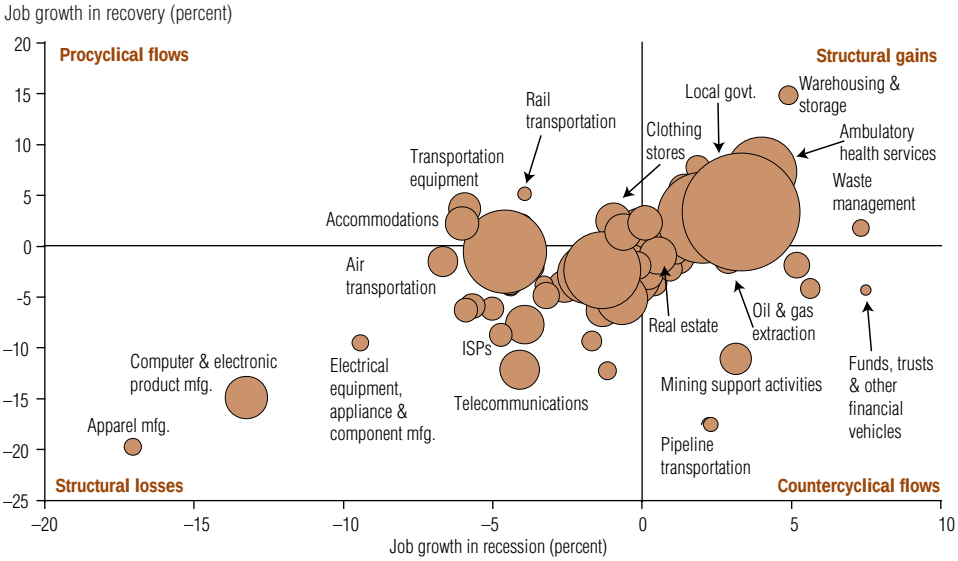
Comparing Texas Recessions

Is structural change a bigger factor today than in the past?

Groshen and Potter conclude that for the United States as a whole, it is. More industries in the recent recession fell into the structural-change quadrants, compared with earlier recessions. They find that 79 percent of U.S. employment was in industries affected more by structural than cyclical shifts in the 2001 recession, up from about 50 percent in previous downturns.

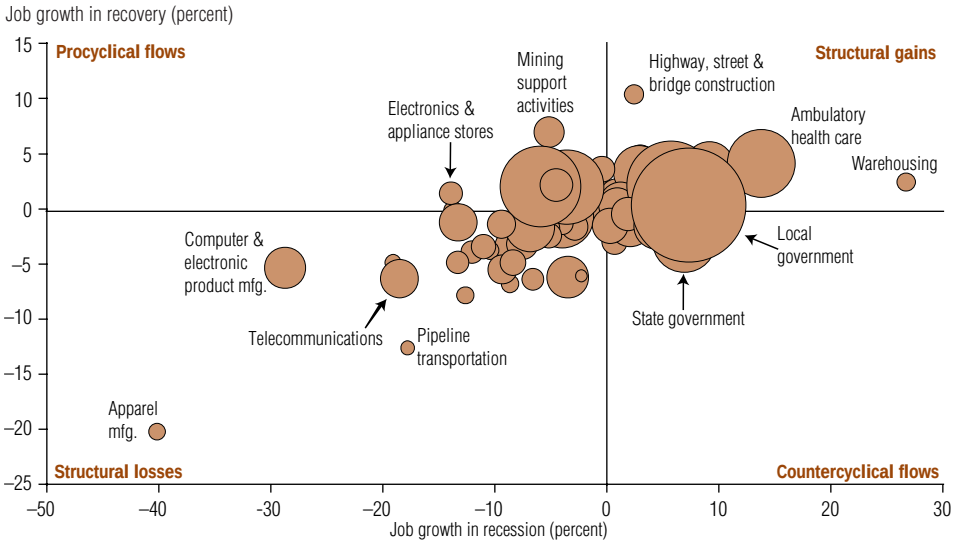
It's a somewhat different story for Texas. Chart 6 shows job adjustments by major industry during the recession and recovery of the early 1980s.[10] That recession was more severe than the recent one, with several large industries—such as durable manufacturing and mining—experiencing double-digit job losses. Nevertheless, except for government, education and health services, the losses were fairly concentrated in the structural categories. In fact, Texans were about as likely to work in structural-change sectors in the 1982–83 recession as they were in 2001. The share of structural job losses was about 72 percent during the earlier period, compared with 76 percent in the 2001 recession. While the relationship can be seen a bit more easily in Chart 3 than in Chart 6, the two graphs confirm that

Chart 4
Structural Change Prevalent in 2001–02: A Look at More Detailed Industries



NOTES: The recession is dated March to November 2001; the recovery is dated December 2001 to November 2002. Educational services is behind local government in the northeast quadrant.
SOURCES: Bureau of Labor Statistics; Federal Reserve Bank of Dallas.

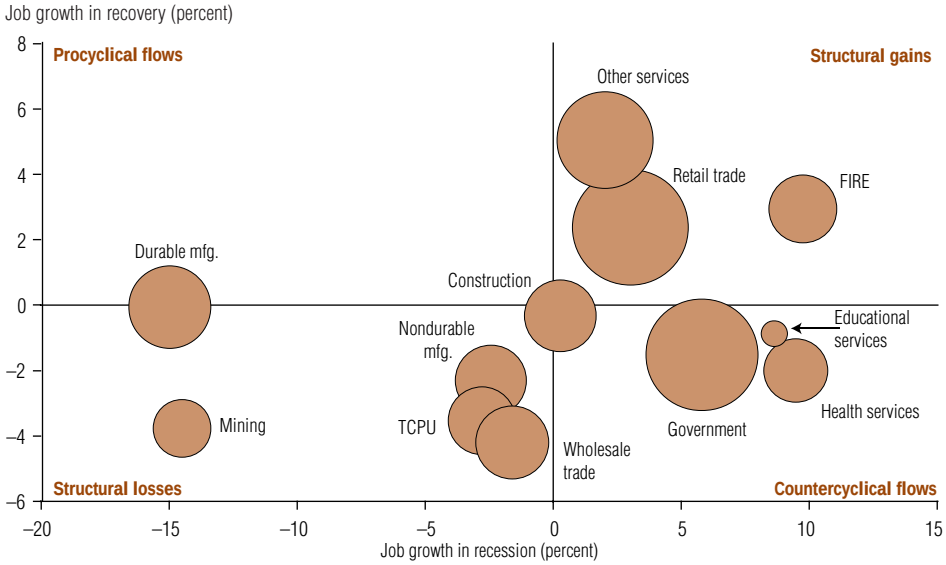
Chart 5
Structural Change Prevalent with Alternate Recession End Date



NOTES: The recession is dated March 2001 to March 2003; the recovery is dated April 2003 to March 2004.

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

Chart 6
Structural Change a Major Factor in 1982–84



NOTES: TCPU is transportation, communications and public utilities. FIRE is finance, insurance and real estate. The recession is dated March 1982 to March 1983; the recovery is dated April 1983 to March 1984.

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

structural change, as defined by Groshen and Potter, is not new to Texas.

More Sectors Undergo Structural Change

Several explanations have been offered for the growing role of structural change in the U.S. economy, including technological change and increasing international trade. A decline in the role of cyclical change, meanwhile, has been linked to factors such as improved monetary policy, which appears to have lessened the duration and severity of U.S. business cycles.[11] Better supply chain management has also allowed firms to respond more quickly to changes in demand and avoid sudden large swings in inventory, production and employment. Additional contributing factors are a decline over time in the severity of energy and food supply shocks and the deregulation of financial markets.

But does structural change really explain the jobless recovery? Structural change, as measured here, was about as prevalent in Texas in the 2001 recession and ensuing recovery as in the early 1980s recession and recovery. The difference between the two periods is the severity of the change. Job losses were much deeper in the 1982–83 downturn (and worse yet in 1986). Nevertheless, employment rebounded with a short lag, and there was nothing like the jobless recovery experienced post-2001.

Another possibility is that the investment bust that characterized the 2001 recession and its aftermath may have driven both structural losses in the labor market and the jobless recovery. The investment bust followed the investment boom that had characterized certain fast-growing industries—led by high tech—during the 1990s. In Texas, for example, post-2001 venture capital commitments fell sharply to about 20 percent of their 2000 levels. The investment bust likely delayed employment growth during the recovery in the sectors that had been booming. If this was the case, sectors that were fast-growing before the recession would fall into the structural loss category in our analysis. These industries may or may not belong there, depending on whether they will eventually resume above-average job growth.

The data suggest that the investment bust played an important role in Texas during the recent business cycle. In fact, of the state's 16 fastest-growing industries in the 1990s, 10 appear in the structural-loss quadrant of Chart 4, meaning they shed jobs both during and after the 2001 recession. Groshen and Potter show that for the nation, seven of the 18 fastest-growing industries fall into the structural loss category.

It is likely that as these industries' expansion fell short of expectations, investment dried up and employment declined. The industries include several high-tech subsectors, such as telecommunications and ISPs, search portals and data processing services. Not all fast-growing industries fall into the structural

loss quadrant, however. Three of Texas' fastest-growing industries in the 1990s are in the structural gain category—warehousing and storage, ambulatory health services and social assistance.

Little New About Structural Change

The Texas economy has undergone fundamental restructuring as the state has diversified away from agriculture and energy and become more like the nation. These trends began in earnest in the 1970s and intensified in the 1980s with the drop in oil prices and collapse of the banking sector. The 1990s saw tremendous growth of the state's high-tech industries and further consolidation in the energy sector. In both the 1970s and again in the 1990s, Texas' economic growth was characterized by large inflows of workers who brought different skills and education with them and contributed to the state's economic transformation.

The decline of industries paves the way for diversification and the growth of new sectors as workers, capital and know-how are freed up to pursue better ends. For example, at one time, 90 percent of the U.S. labor force was engaged in farming. Today, that number is a mere 3 percent.

While this transformation is clearly beneficial in the long run, in the short to medium term, this type of change is not without its critics. People may primarily see the negative connotations of structural change, without seeing the benefits. This may be because certain advances in trade and technological change have large benefits that are spread across many people, such as all U.S. consumers, while the costs of such advances can be small but concentrated on a select few (such as laid-off textile workers).

Texas has not been immune to the forces of trade and outsourcing. Semiconductor production has moved out of Austin and Dallas to Asia, for example, and major computer companies have concentrated their software development in India, outsourcing thousands of jobs there. Big retailers and national banks continue to expand in the state, often displacing or absorbing local businesses in the process.

At the same time, the state's economy has many strengths. Workers and investors continue to flock to Texas, home construction is at record levels, freed-up capital and labor are moving into sectors—such as education and health—where structural growth is most pronounced. Exports to China are booming, and the border economy is thriving as a result of freer trade with Mexico.

Summary

The aftermath of the 2001 recession is often described as a jobless recovery. It took Texas and U.S. employment almost four years to reach their respective prerecession levels, which they finally did in January 2005. Many factors contributed to labor market weakness in 2002 and early 2003, including high productivity growth, the war on terror and corporate scandals.

In their New York Fed article, Groshen and Potter highlight another potential source of labor market weakness—structural change. The economists imply that because new industries are replacing old ones, jobs are being created and filled at a slower rate than in past business cycles, in which workers were simply laid off and rehired by the same or similar employers.

Applying the Groshen–Potter methodology to Texas, we find that structural change also dominated cyclical change in the state during the last business cycle. We do not find, however, that the amount of structural change has increased over time, as Groshen and Potter argue is the case for the nation.

Structural change is an enduring feature of the state's economy. But while Texas labor markets experienced structural change in earlier recessions, they did not experience drawn-out weakness once a recovery was under way. In other words, the recent jobless recovery remains a bit of a mystery. The investment boom and subsequent bust may have had something to do with it. Many of the 1990s' fastest-growing industries ended up with the largest relative and most persistent job losses. The extent of the state's high-tech investment boom and subsequent bust may help explain why the effect on Texas employment growth was so significant and lasting.

Orrenius and Saving are senior economists in the Research Department of the Federal Reserve Bank of Dallas. Caputo worked on this article while an economic analyst at the Bank.

Notes

1. Annual household employment was lower in 2002 than 2001, but yearly job growth is calculated December-over-December and was 0.26 percent in 2002.
2. "Has Structural Change Contributed to a Jobless Recovery?" by Erica L. Groshen and Simon Potter, Federal Reserve Bank of New York *Current Issues in Economics and Finance*, August 2003.
3. Alternative measures of structural change are discussed at length in "Can Sectoral Reallocation Explain the Jobless Recovery?" by Daniel Aaronson, Ellen R. Rissman and Daniel G. Sullivan, Federal Reserve Bank of Chicago *Economic Perspectives*, Second Quarter 2004.
4. Groshen and Potter compare employment growth in the recession and the recovery for two-digit industries as defined by the Standard Industrial Classification (SIC) system. SIC codes were replaced by the North American Industry Classification System (NAICS) in 2002.
5. In a statement announcing the dating of the 2001 recession, the NBER called real GDP "the single best measure of 'aggregate economic activity.'" See www.nber.com/cycles/recessions.pdf.
6. Texas payroll employment began to grow in August 2003, while retail sales began to grow in September 2002. As a compromise, we selected March 2003 as an alternative end date for the state recession. Eleventh District Beige Book accounts also suggest the second quarter of 2003 may have been the turning point for Texas.
7. SIC codes are used in Charts 3 and 6 so that employment by industry can be compared over time. The newer, three-digit NAICS codes are used in Charts 4 and 5.
8. See "Do Energy Prices Threaten the Recovery?" by Stephen P. A. Brown, Federal Reserve Bank of Dallas *Southwest Economy*, May/June 2004.
9. In 2004, oil prices rose again, and they are currently higher than they were during the 2001 recession. Natural gas prices have also remained high.
10. The 1982–83 Texas recession is assumed to have lasted from March 1982 to March 1983. This period roughly corresponds to the downturn in both state output and employment.
11. See "New Economy, New Recession?" by Evan F. Koenig, Thomas F. Siems and Mark A. Wynne, Federal Reserve Bank of Dallas *Southwest Economy*, March/April 2002.

Industry Clusters in Texas

Laila Assanie and Mine Yücel

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

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

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

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

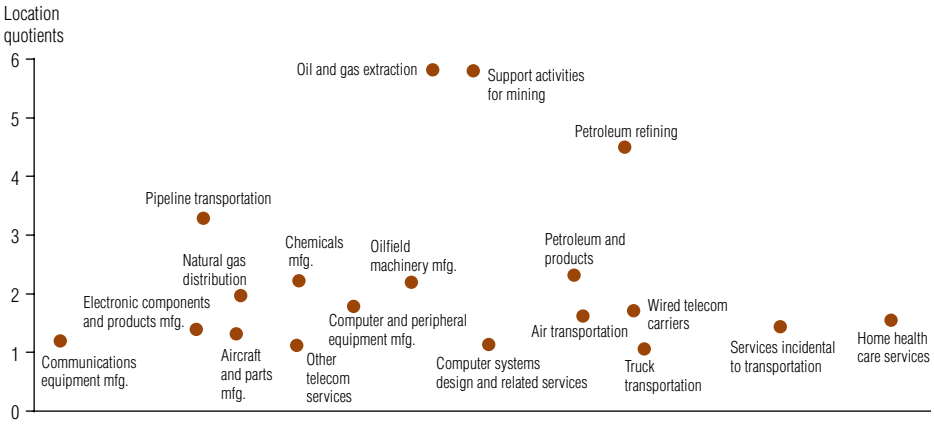
To determine which goods and services produced in Texas and its major metropolitan areas are basic, or exportable, we use location quotients (LQ), a tool commonly used to analyze the economic base of a region. Location quotients compare the local economy with a reference economy (for example, the Dallas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

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

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

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

Chart 1
Texas Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

How Texas Compares With the United States

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

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

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

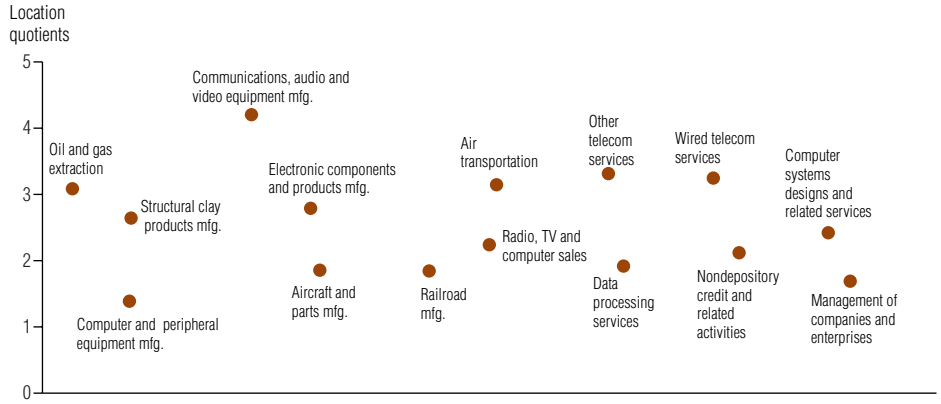
Since higher concentration indicates the presence of clusters, or specialization, these industries are the central drivers of the Texas economy. The prominence of these industries—high tech, telecommunication services and air transportation—helps to explain why the state's economy fared worse than the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

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

Texas Major Metros

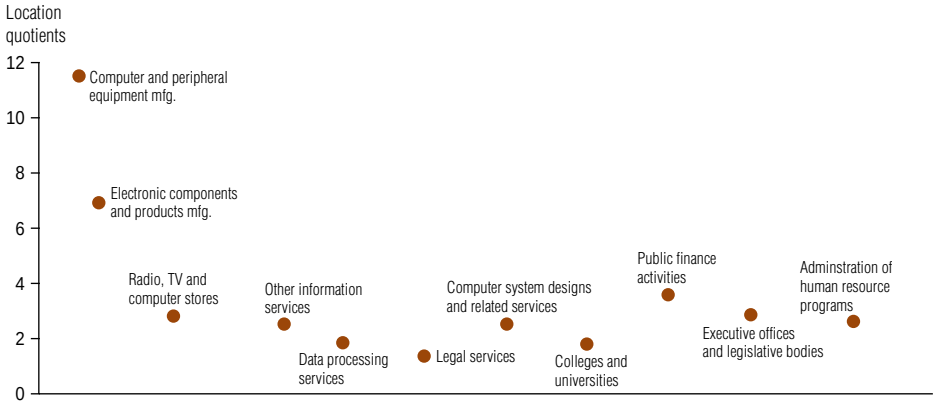
The major metropolitan areas in Texas account for more than two-thirds of the state's employment, so the sectors that lead these metro economies determine the state's overall economic base. The composition of economic activity varies significantly among Texas' major metros.

Chart 2
Dallas Compared with the United States



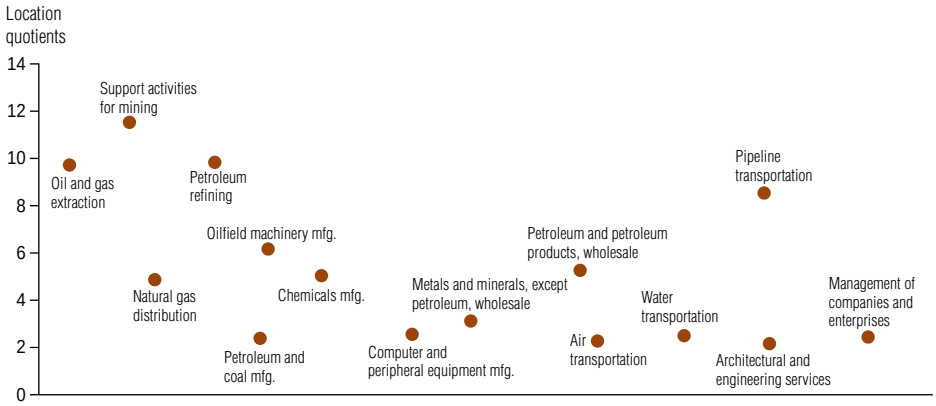
SOURCE: 2000 Census IPUMS data; authors' calculations.

Chart 3
Austin Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

Chart 4
Houston Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

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

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

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

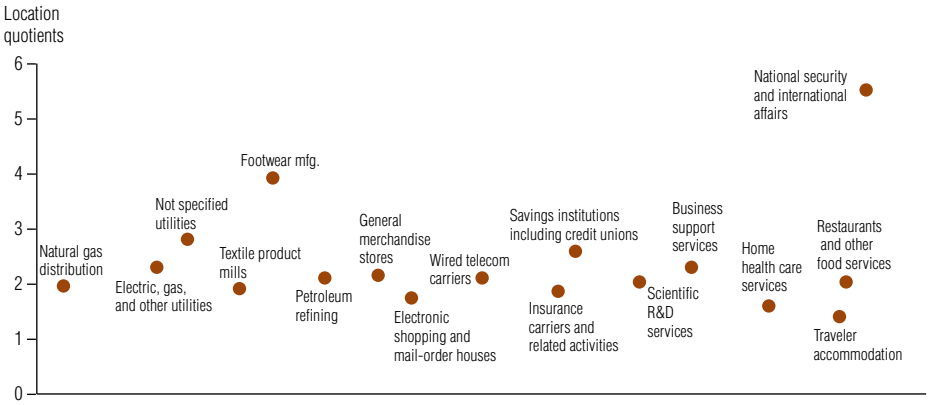
Houston. Houston is Texas' oil and gas capital and home to the sixth largest seaport in the world. Not surprisingly, the location quotients convey a similar story. Five of the 10 most geographically concentrated industries compared with the

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

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

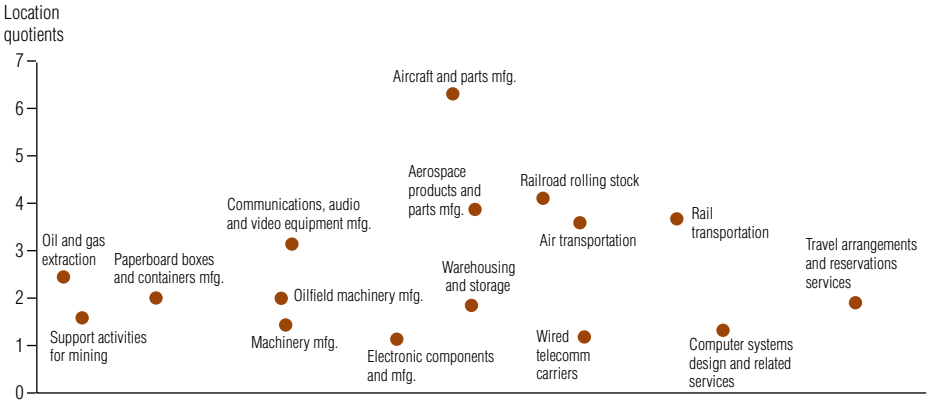
Fort Worth–Arlington. Fort Worth–Arlington is a major air and rail transportation hub in Texas with historic ties to oil, aircraft and aerospace product manufacturers. Fort Worth's employment shares in aircraft, aerospace products and parts manufacturing, communications equipment manufacturing as well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

Chart 5
San Antonio Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

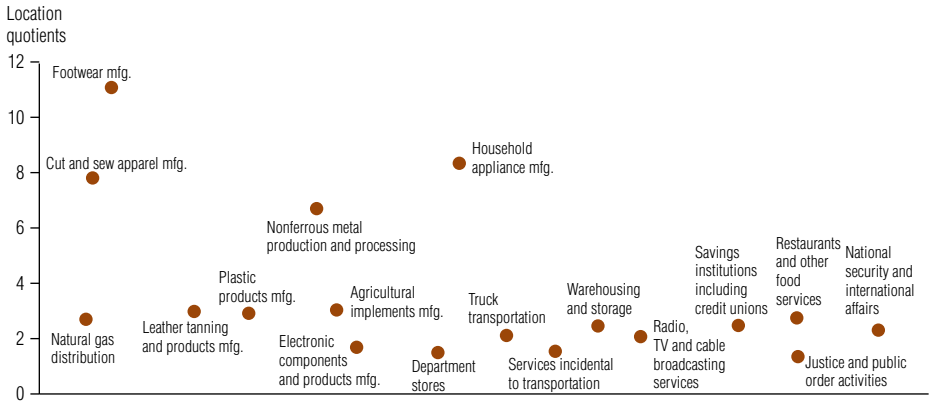
Chart 6
Fort Worth Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

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

Chart 7
El Paso Compared with the United States



SOURCE: 2000 Census IPUMS data; authors' calculations.

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

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

Conclusion

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

Assanie is an assistant economist and Yücel is a senior economist and vice president in the Research Department of the Federal Reserve Bank of Dallas.

Notes

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

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

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

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

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

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

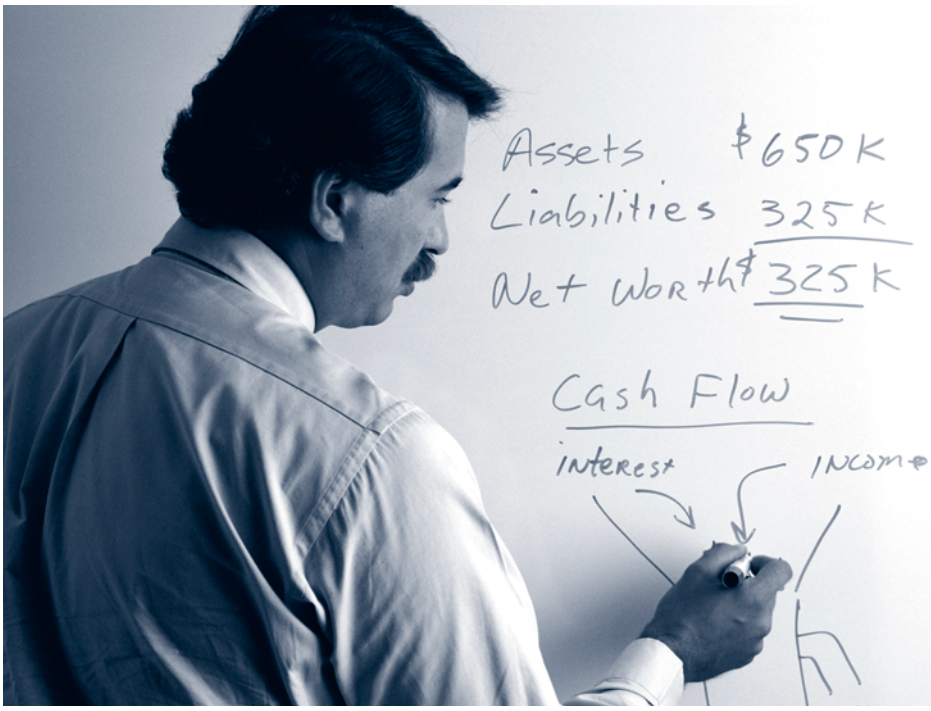
[6] For Texas and all its major metropolitan areas, industries with high location quotients, which have been referenced in the text as key contributors of their respective economic bases, were also the largest employers in the state and its major metros, unless otherwise noted.

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

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

Economic Progress in the Texas Economy

Robert W. Gilmer



Since 1969, the Texas economy has grown rapidly, consistently matching or exceeding the growth of the national economy from one decade to the next. Real personal income growth rates in Texas matched the U.S. rates even during the oil bust years of 1979–89 and exceeded U.S. rates in 1969–79 and 1989–2001 (*Table 1*). Measured by total population, growth in Texas was substantially greater in all periods.

The state's largest metropolitan areas—Dallas–Fort Worth, Houston, Austin and San Antonio, which together make up what is known as the Texas Triangle—have contributed the largest part of this growth, especially since 1979. Outside the Texas Triangle cities, real income growth has failed to match U.S. growth since 1979, although population has expanded somewhat faster.

This growth has improved Texas' economic position relative to the rest of the United States. Texas moved from the nation's fourth most populous state in 1969 to second in 2001, trailing California but ahead of New York and Florida. In terms of personal income, Texas has moved from the sixth largest state economy in 1969 to the third largest today, behind California and New York.

The state's large metropolitan areas have similarly moved up the ranking of the nation's largest cities.[1] Dallas–Fort Worth, Houston and San Antonio made most of their climb through these rank-

In terms of personal income, Texas has moved from the sixth largest state economy in 1969 to the third largest today, behind California and New York.

Table 1
Growth of Population and Personal Income in Texas and the United States
(Average percent per year)

	Population		
	1969–1979	**1979–1989**	**1989–2001**
United States	1.1	1.0	1.2
Texas	2.3	1.9	2.0
Dallas–Fort Worth	2.4	3.0	2.6
Houston	3.4	1.9	2.3
Austin	4.1	3.8	3.9
San Antonio	1.9	2.1	1.8
Texas Triangle	2.8	2.5	2.5
Rest of Texas	1.7	1.2	1.3

	Personal Income		
	1969–1979	**1979–1989**	**1989–2001**
United States	3.7	3.0	2.9
Texas	6.0	3.0	4.3
Dallas–Fort Worth	5.4	4.7	4.7
Houston	8.0	2.4	5.1
Austin	2.3	5.6	8.3
San Antonio	4.7	4.2	4.0
Texas Triangle	6.5	3.8	5.0
Rest of Texas	5.2	1.7	2.9

NOTE: Based on 1999 metropolitan area definitions of the Office of Management and Budget. Dallas–Fort Worth and Houston use the consolidated metro area definition.

SOURCES: Bureau of Economic Analysis; author's calculations.

Table 2
Rank of Texas Triangle Metro Areas in United States by Population and Personal Income

	Population			
	1969	1979	1989	2001
Dallas–Fort Worth	12	9	9	8
Houston	13	10	10	9
Austin	75	63	63	39
San Antonio	37	33	33	32
Texas Triangle	4	4	4	3

	Personal Income			
	1969	1979	1989	2001
Dallas–Fort Worth	13	10	9	8
Houston	16	9	10	9
Austin	86	69	55	37
San Antonio	45	39	38	35
Texas Triangle	9	4	3	3

SOURCES: Bureau of Economic Analysis; author's calculations.

Table 3
Contribution to Texas Personal Income Growth

	Percent				
	1969–1979	1979–1989	1989–1999	1989–2000	1989–2001
Texas	100.0	100.0	100.0	100.0	100.0
Dallas–Fort Worth	23.6	31.9	30.7	31.3	30.6
Houston	28.5	23.8	28.2	28.6	29.7
Austin	4.1	6.0	8.7	8.6	8.3
San Antonio	6.3	8.1	7.1	6.9	7.0
Texas Triangle	62.6	69.8	74.6	75.4	75.5
Rest of Texas	37.4	30.2	25.4	24.6	24.5

SOURCES: Bureau of Economic Analysis; author's calculations.

ings between 1969 and 1979 (*Table 2*).[2] Since 1979, Dallas–Fort Worth and Houston have shared the eighth through tenth spots in population and personal income, while San Antonio moved slowly upward to 32nd in population and 35th in personal income.

Austin, however, made steady and dramatic gains. In 1969, at No. 75 in population, Austin was the size of Canton, Ohio, or Fort Wayne, Ind. But by 2001, at 39th, Austin's population compared favorably with that of Nashville or New Orleans. During the same period, Austin surged from 86th to 37th in personal income.

Table 3 summarizes the contribution of these different metro areas to Texas' personal income growth. Except for the oil bust years, Houston contributed nearly 30 percent of growth, and Dallas–Fort Worth's growth exceeded Houston's by the late 1970s. San Antonio's growth contribution held steady at 6 to 8 percent, while Austin's doubled from 4.1 percent to 8.3 percent. The combined metro areas, collectively designated the Texas Triangle in the table, accounted for three-fourths of the state's income growth between 1989 and 2001.

In this article, we will measure the success of the Texas economy not by its size, growth rates or ranking, but by the state's ability to improve the welfare of its citizens. In particular, we will look at the state's ability to raise its per capita income levels to those of the nation—to join and perhaps outperform the nation's mainstream. Income per person presents a number of flaws as a measure of general welfare, but it serves here as a widely recognized and useful summary of the standard of living.[3]

Texas Per Capita Income

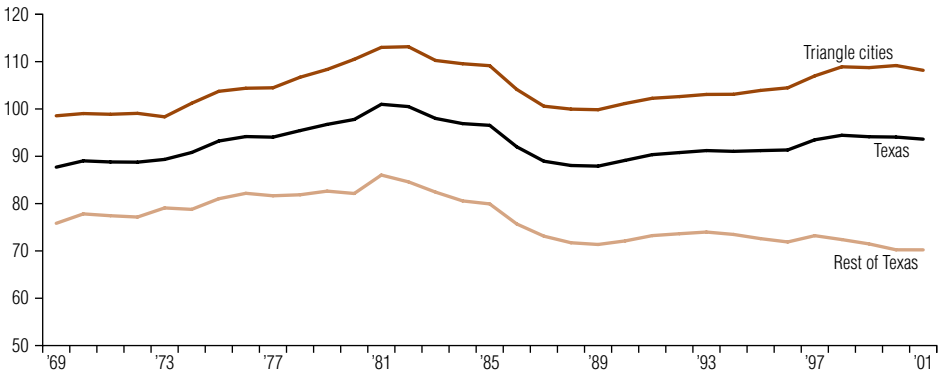
In 1969, per capita income in Texas was $3,373, or 87.7 percent of the U.S. level. Fueled by the oil boom after 1973, Texas' per capita income grew rapidly to briefly exceed that of the United States by 1981–82 (*Chart 1*). The 1980s oil, banking and real estate bust quickly erased these gains, and by the end of the decade, state per capita income had returned to 87.9 percent of the U.S. level.

The 1990s brought new advances relative to the nation as oil, high tech and a free trade- and maquiladora-inspired boom along the Texas–Mexico border produced another burst of Texas economic growth. By 1998, Texas per capita income returned to 94.4 percent of U.S. levels and made no further progress through 2001.

We can examine Texas per capita income growth both geographically and by the components of income—wages and salaries, proprietor's income, property income, transfers and other sources. By component, the most interesting

Chart 1
Convergence of Texas to U.S. Per Capita Income Levels

Index: U.S. per capita income = 100



SOURCE: Bureau of Economic Analysis.

results come from the growth of wages and salaries and proprietor's income. The geographic designation focuses largely on the Texas Triangle cities, which have fueled both the state's growth and most of its recent convergence to U.S. per capita income levels.

Framework for Analysis

The general framework used here is shown in Table 4, which summarizes per capita income growth in Texas by component of income, geographic area and time period from 1969 to 2001.[4] The data are presented as percentage point contributions to average annual real per capita income growth in each region and time period.[5]

For example, the growth of per capita income in Texas from 1969 to 1979 averaged 3.6 percent per year, with most of the growth (3 percent per year) coming from wages and salaries per capita and smaller contributions from property income (0.2 percent), transfer payments (0.2) and other per capita income (0.4). Proprietor's income per capita grew more slowly than other components, reducing the growth rate by 0.2 percent.

The components of income definitions follow standard conventions for accounting for personal income in the national income and product accounts. The definitions are fairly obvious: nonfarm wages and salaries; farm and nonfarm proprietor's income earned by sole proprietorships, partnerships and tax-exempt corporations; property income from dividends, rent and interest; and transfer payments for no current services rendered. The "other income" category is a residual made up mainly of benefits paid to wage and salary workers, but it also includes a residence adjustment for workers who live and work in different areas.

The rationale for the geographic focus on the Texas Triangle has partly been discussed above, primarily because three-fourths of the region's personal income growth came from these metro areas after 1989. Also, most of the forces driving income convergence have come from the Triangle cities. While per capita income levels were, on average, well above national norms and rising through the 1990s within the Triangle, they were falling back to near 70 percent outside of it.

Table 4
Growth Rate of Real Per Capita Personal Income and Factors Contributing to Its Growth
(Average percent per year)

	Component Percentage Point Contribution Per Capita					
	Personal income	Nonfarm wages and salaries	Proprietor's income	Property income	Transfer payments	Other income
1969–1979						
United States	2.6	1.6	–.1	.3	.4	.4
Texas	3.6	3.0	–.2	.2	.2	.4
Dallas–Fort Worth	2.9	2.1	.1	.2	.2	.4
Houston	4.4	4.2	–.1	–.1	.1	.3
Austin	3.4	2.7	–.1	.3	.1	.5
San Antonio	2.7	1.3	.1	.3	.4	.6
El Paso	1.4	.9	.2	.3	.6	–.6
Texas Triangle	3.5	2.9	0	.1	.1	.4
Rest of Texas	3.4	2.8	–.5	.4	.3	.4
1979–1989						
United States	2.0	1.4	0	.7	.1	–.1
Texas	1.1	.2	0	.7	.2	0
Dallas–Fort Worth	1.6	1.1	.1	.4	0	–.1
Houston	.5	–.8	.5	.6	.2	0
Austin	1.9	1.7	–.6	.6	0	.1
San Antonio	2.0	1.1	.1	.7	.1	.1
El Paso	1.7	.2	–.2	.7	.1	.9
Texas Triangle	1.2	.3	.2	.6	.1	0
Rest of Texas	.6	–.6	–.5	1.1	.4	.2
1989–2001						
United States	1.7	1.8	.1	–.1	.2	–.2
Texas	2.2	2.4	.4	–.4	.1	–.3
Dallas–Fort Worth	2.0	2.4	.2	–.3	.1	–.3
Houston	2.7	2.3	1.0	–.6	.1	–.2
Austin	2.9	4.2	.1	–.7	–.1	–.6
San Antonio	2.2	2.1	.7	–.3	.2	–.5
El Paso	1.7	.9	.8	–.2	.5	–.3
Texas Triangle	2.4	2.5	.5	–.4	.1	–.3
Rest of Texas	1.6	1.5	0	–.4	.4	0

SOURCES: Bureau of Economic Analysis; author's calculations.

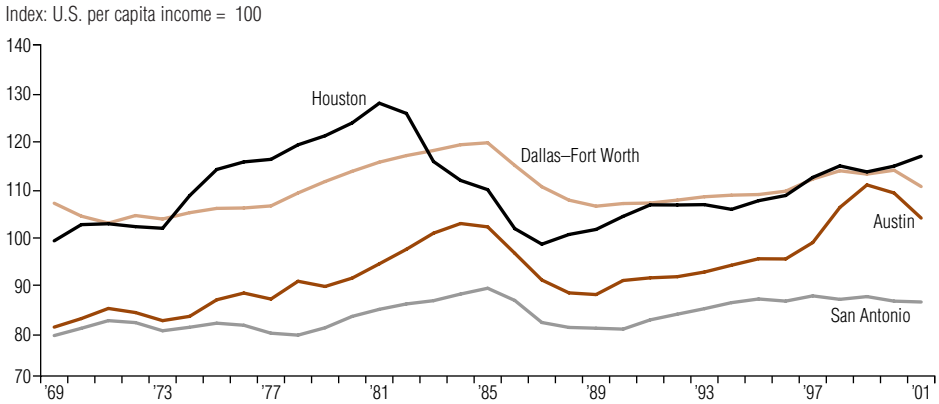
Chart 2 shows the path of the four cities since 1969 in terms of income growth relative to the nation's. The gains and losses of the boom and bust in oil and real estate are visible in all four cities, but most notably in Houston and Austin. All cities made gains in the 1990s, especially Austin. San Antonio made the least progress, despite beginning from the lowest per capita base. The two high-tech metros began losing ground in relation to the United States well before the national recession began in 2001, with Austin peaking at 110 percent of U.S. levels in 1999 and Dallas–Fort Worth at 112 percent in 2000. Houston reached 115 percent of U.S. per capita income in 2001. San Antonio stood at 88 percent.

The fact that the four cities have such different income levels and very different behavior over time might seem surprising in light of their geographic proximity. But, in fact, it may be this very proximity that guarantees their different personalities. Because no pair of cities in the Texas Triangle is more than 240 miles apart, each has assumed a role in the state economy that sets it apart and makes it distinct from the others.[6]

Dallas–Fort Worth. Dallas–Fort Worth is a major inland transportation hub and distribution center for Texas, Louisiana, Arkansas and Oklahoma and claims the world's fifth busiest airport. Following the oil bust, Dallas emerged as the state's banking and financial center. Dallas and Fort Worth also have a significant presence of oil-related activity, notable on any standard except that set by Houston. High-technology industries, especially telecommunications, became a major center of growth in the 1990s.

Houston. Houston's bread and butter remains oil and natural gas, with oil pro-

Chart 2
Convergence of Texas Triangle Cities to U.S. Per Capita Income Levels



SOURCE: Bureau of Economic Analysis.

The fact that the four Texas Triangle cities have such different income levels and very different behavior over time might seem surprising in light of their geographic proximity.

ducers, oil services and machinery companies, refineries and petrochemicals directly or indirectly accounting for half the metro area's jobs. The Texas Medical Center and Johnson Space Center, along with companies such as Continental Airlines, American General Insurance and HP/Compaq, help define the non-oil part of Houston's economy. Houston is the state's major deepwater port—the second largest in the country based on tonnage—and home to the state's international business community.

Austin. Because it is the state capital and site of the University of Texas' main campus, Austin's major strength has historically been a robust government sector. Beginning in the late 1960s, Austin began developing a significant presence in high technology: IBM in 1967, Texas Instruments in 1969 and Motorola in 1974. The arrival of chipmaker-consortium Sematech in 1988 provided the momentum for the 1990s. Today, about 120,000 employees—25 to 30 percent of the local workforce—are tied to technology industries, and Dell Inc. has emerged as the city's most important technology employer. Austin is also renowned for its music industry. Billed as the "Live Music Capital of the World," the city sponsors a number of festivals and conventions based on music.

San Antonio. San Antonio's historic role has been as the distribution point for South Texas and northern Mexico, a role that has grown with the rapid expansion of the maquiladora industry and the implementation of the North American Free Trade Agreement. Tourism is a major industry, with such features as Fiesta Texas, SeaWorld, the River Walk, El Mercado and others. Lackland Air Force Base, Fort Sam Houston and Randolph Air Force Base provide a major military presence.

One could speculate that if Texas' geography had been only slightly different—with navigable rivers or a saltwater inlet that cut into the heart of the state—the four cities could easily have been one. The port, the inland distribution point and the political capital would all have been colocated. Because the four Triangle cities play such different economic roles, adding up their current populations produces a not far-fetched approximation of what might have been a single metro area. The combined ranking of the Triangle cities (bottom of Table 2) shows that such a combination would rank third among all U.S. consolidated metro areas—behind New York and Los Angeles but ahead of Chicago—in both personal income and population in the 1990s.

It is difficult to generalize about the area outside the Triangle, or to easily characterize an area that includes cities as different as El Paso, Amarillo, Texarkana and Beaumont. The decline of agriculture throughout the second half of the 20th century played a large role in the region's poor performance.

In addition, the Texas–Mexico border acts as a drag on any measure of economic progress or welfare in the state, including per capita income. Gilmer, Gurch and Wang have already examined the Texas border cities using the same framework employed here.[7] The border cities' average per capita income is only 50 to 60 percent of the national average and has only occasionally matched or exceeded the state's overall growth rate (such as Laredo in the 1990s). El Paso, by far the largest Texas–Mexico border city, saw its per capita income fall from 73 percent of the U.S. average in 1969 to 63 percent in 2001. Although the border saw gains in income and jobs in the 1990s, rapid population growth due to high birthrates and in-migration meant living standards did not improve nearly as much as overall growth statistics might indicate.

How Income Grew in Texas

Except for the oil bust years, Texas' per capita income outgrew the nation's by

a significant margin (see Table 4). The difference was a full percentage point from 1969 to 1979 (3.6 versus 2.6) and by half a percentage point from 1989 to 2001 (2.2 versus 1.7). With the oil bust and recovery factored in, however, the difference in favor of Texas narrows to 0.2 percent (2.3 versus 2.1 over the 32-year period), and per capita income rises from 88 percent to 94 percent of the national average.

Also except for the oil bust years, most of the growth in Texas' real per capita income came from increases in real wages and salaries per capita—83 percent from 1969 to 1979 and 109 percent from 1989 to 2001. Only during the years of the oil and banking crisis did real wages and salaries fail to contribute strongly to income growth; only 17 percent of growth came from that source from 1979 to 1989. Growth in property income (most probably in the first half of the 1980s) was the major factor contributing to income growth during the decade of the downturn.

Proprietor's income makes its largest contribution from 1989 to 2001. Houston has the strongest contribution from the self-employed in this period (1 percent) and during the previous period as well (0.5 percent). In 16 cities in Texas and Louisiana, all with strong ties to oil, the first result of the oil bust was a large number of new "proprietors," presumably new businesses started by people unemployed by the downturn.[8] This forced entrepreneurship was followed in the late 1980s and early 1990s by rapidly growing proprietor's income, the fruit of the businesses that succeeded. The often-used analogy of a forest fire leaving behind the seeds for the forest's regeneration seems to apply to Texas in recent years, with entrepreneurship sowing the seeds. On average, proprietor's income contributed 0.5 percent to per capita income growth in Texas Triangle cities in the 1990s.

Property income (dividends, rent and interest) was the biggest contributor to per capita income growth during the oil bust and recovery years. The 1980s saw a large run-up in property values, which fell back slowly late in the decade but drove up rental values, and a sharp hike in interest rates due to inflation and tight monetary policy increased income from interest-earning sources. The contribution of property income is small from 1969 to 1979 and negative from 1989 to 2001.

Other income per capita makes its largest contribution from 1969 to 1979, is neglible from 1979 to 1989 and turns slightly negative in the most recent period.

Table 5
Impact on Per Capita Income of Industry Mix, Differential Regional Earnings and Jobs Per Capita

	Percentage Point Contribution to Annual Growth Rate			
	Wages and salaries per worker	Industry mix	Differential regional earnings	Jobs per capita
1969–1979				
Texas	1.5	1.3	.2	1.5
Dallas–Fort Worth	.8	1.1	–.2	1.3
Houston	1.9	1.1	.8	2.3
Austin	1.2	1.2	0	1.4
San Antonio	1.2	1.5	–.3	.2
Texas Triangle	1.4	1.2	.2	1.5
Rest of Texas	1.5	1.5	0	1.2
1979–1989				
Texas	.3	.8	–.5	–.1
Dallas–Fort Worth	.9	.9	.1	.2
Houston	–.2	.7	–.8	–.6
Austin	1.2	1.2	0	.5
San Antonio	.5	.8	–.3	.6
Texas Triangle	.4	.8	–.4	–.1
Rest of Texas	–.3	.8	–1.0	–.4
1989–2000*				
Texas	1.8	1.4	.4	.8
Dallas–Fort Worth	2.1	1.3	.8	.7
Houston	1.9	1.5	.3	.5
Austin	3.7	1.3	2.4	1.5
San Antonio	1.2	1.4	–.2	1.1
Texas Triangle	2.1	1.4	.6	.8
Rest of Texas	.7	1.0	–.3	.8

* Data extend only to 2000 due to a change in the distribution of jobs from the Standard Industrial Classification to North American Industry Classification System in 2000, making it impossible to compare 1989 with 2001.

NOTE: Differences due to rounding error.

SOURCES: Bureau of Economic Analysis; author's calculations.

A Closer Look at Wage and Salary Growth

Because wages and salary growth per capita account for such a large share of Texas per capita income, we will examine it more closely. We can divide wages and salaries per capita (WS/P) into two parts: wages and salaries per employee (WS/E) and the employment population ratio (E/P).

$$WS/P = WS/E \times E/P$$

Further, we can offer two reasons for the growth of wages and salaries per employee: (1) improvements in the industry mix that allow more workers to move into higher-paying industries, or (2) specific advantages the region offers in resources, labor supply, infrastructure or other local factors. This region-specific advantage is called differential regional earnings.[9]

$$WS/P = WS/E \times E/P = \text{industry mix} \times \text{differential regional earnings} \times E/P$$

Table 5 summarizes the contribution of each of these elements to real per capita income.[10] The first column is wages and salaries per worker; the second and third columns divide this category into two parts. The fourth column is the employment population ratio, or jobs per capita.

Industry mix was a significant factor in all areas and in every period. Texas was clearly shedding low-wage jobs and replacing them with better-paying jobs throughout the entire period.

We also see gains from differential regional earnings in the two periods of rapid growth. In the 1990s the Texas Triangle cities added 0.6 percent per year to per capita income thanks to these advantages. The measure highlights the

During the two decades of strong growth, Texas generated jobs faster than the rate of population growth, despite rapid in-migration.

Table 6
Employment and Population Growth, 1969–2001

	Job Growth*		
	1969–1979	**1979–1989**	**1989–2001**
United States	2.2	1.8	1.5
Texas	3.8	1.8	2.7
Dallas–Fort Worth	3.6	3.2	3.0
Houston	5.8	1.3	2.7
Austin	5.5	4.4	4.9
San Antonio	2.0	2.6	2.7
Texas Triangle	4.3	2.5	3.0
Rest of Texas	3.0	.8	2.0
	Population Growth*		
	1969–1979	**1979–1989**	**1989–2001**
United States	1.1	.9	1.2
Texas	2.3	1.9	2.0
Dallas–Fort Worth	2.3	3.0	2.6
Houston	3.4	1.9	2.3
Austin	4.1	3.8	3.9
San Antonio	1.9	2.1	1.8
Texas Triangle	2.8	2.5	2.5
Rest of Texas	1.7	1.2	1.3
	Jobs Per Capita*		
	1969–1979	**1979–1989**	**1989–2001**
United States	1.1	.8	.3
Texas	1.5	–.1	.7
Dallas–Fort Worth	1.3	.2	.4
Houston	2.3	–.6	.4
Austin	1.4	.5	1.0
San Antonio	.2	.6	.9
Texas Triangle	1.5	–.1	.5
Rest of Texas	1.2	–.4	.7

* Annualized growth rates.

SOURCES: Bureau of Economic Analysis; author's calculations.

state's booms and busts: Houston added 0.8 percent per year from 1969 to 1979, which turned to –0.8 percent the following decade. Large regional differentials in Austin (2.4 percent) and Dallas–Fort Worth (0.8 percent) mark the 1990s tech boom. A look back at Chart 2 shows that these cities were already giving back some of their tech gains by 2001.

During the two decades of strong growth, the state generated jobs faster than the rate of population growth, despite rapid in-migration (*Table 6*). Per capita job growth has occurred inside and outside the Triangle cities despite the fact, as mentioned above, that the border cities were unable to attain job growth much faster than population growth. This contributed 1.5 percent per year to Texas per capita income growth (as seen in column 4 of Table 5) from 1969 to 1979 and 0.8 percent from 1989 to 2000. The slight decline in the 1980s (–0.1 percent) was primarily due to slower job growth in Houston and areas outside the Triangle.

Summary and Conclusions

Measured by standards of population, employment and income growth, the Texas economy has outperformed the U.S. economy since 1969. As shown in Table 7, by 2001 the state as a whole had raised its per capita income to 94 percent of the national average, up from 88 percent in 1969. Over the same period, the average annual growth rate of per capita income was 2.3 percent for Texas versus 2.1 percent for the United States.

Economic progress has been uneven over time. The oil boom briefly pushed Texas per capita income above the nation's in 1981–82. In the subsequent collapse of oil, banking and real estate, Texas fell back to almost its 1969 position relative to the United States. Most subsequent progress has come since 1989, and it primarily can be attributed to more jobs available to the general population and an improving mix of jobs with higher salaries.

Table 7 also indicates the uneven geographic progress. In fact, the forces of convergence to U.S. levels have mostly come from the Texas Triangle metropolitan areas of Dallas–Fort Worth, Houston, Austin and San Antonio. All these cities have outperformed the United States since 1969, with the most dramatic gains

coming out of Austin. The addition of a large high-technology workforce to a stable, if less-well-paid, government and university base fueled both rapid growth and rising per capita income in the state capital. Except for San Antonio, all the cities enjoy living standards above the U.S. average.

The uneven nature of Texas' economic history makes it difficult to predict future progress. The geographic concentration of growth seems unlikely to change, but the state's advantages relative to the rest of the nation (as measured by differential regional earnings) were dominated by the oil boom from 1969 to 1979 and to some extent by the high-tech expansion of 1989–2001. Advantages were concentrated first in Houston, then in Austin and Dallas–Fort Worth. Predicting the source or location of the next great round of expansion is impossible.

However, since 1969 Texas' cost advantages, tax advantages, climate and lifestyle have prepared the ground for further growth and development, including periodic excesses. These Sunbelt advantages should persist, making renewed economic expansion in Texas and continued progress in raising the state's living standards simply a matter of time.

Gilmer is a vice president at the Federal Reserve Bank of Dallas.

Table 7
Performance of Regions of the Texas Economy

	2001 per capita income (dollars)	Percent of U.S. level	Annual growth rate 1969–2001 (percent per year)
United States	30,413	100	2.1
Texas	28,472	94	2.3
Dallas–Fort Worth	33,247	109	2.2
Houston	34,916	115	2.5
Austin	31,511	104	2.8
San Antonio	26,887	88	2.3
Texas Triangle	32,897	108	2.4
Rest of Texas	21,357	70	1.8

SOURCES: Bureau of Economic Analysis; author's calculations.

Notes

1. The statistics for Dallas–Fort Worth and Houston use their consolidated metropolitan statistical area definition throughout this article. The ranking of metro areas includes consolidated metropolitan statistical areas (CMSAs) but then excludes all the parts of these CMSAs (metropolitan and primary metropolitan statistical areas) in the subsequent ranking process.
2. The end years used here—1969,1979,1989 and 2001—are all peak years in the U.S. business cycle. Although Texas and its metro areas did not always follow the U.S. cycle, particularly in the 1980s, these years were typically times of economic expansion for Texas, making comparisons to the U.S. economy appropriate.
3. The most notable flaw in the use of per capita income as a measure of welfare is that it tells us nothing about the size distribution of income among the population. However, this article divides per capita income into enough categories by component and geography to give some insight into how income growth is affected by regional wage levels, job growth, population growth and the locational advantages of the state's largest metro areas.
4. The framework was developed by Daniel H. Garnick. See "Accounting for Regional Differences in Per Capita Personal Income Growth, 1929–79," by Daniel H. Garnick, *Survey of Current Business*, vol. 62, September 1982, pp. 24–34, and "Accounting for Regional Differences in Per Capita Income Growth: An Update and an Extension," by Daniel H. Garnick and Howard L. Friedenberg, *Survey of Current Business*, vol. 70, January 1990, pp. 29–40.
5. Constant dollars are obtained by deflating with the personal consumption expenditure deflator (1996 = 100) for all areas.
6. "The Simple Economics of the Texas Triangle" (January 2004) and "The Texas Triangle as Megalopolis" (April 2004), both by Robert W. Gilmer, in *Houston Business*, Federal Reserve Bank of Dallas.
7. "Texas Border Cities: An Income Growth Perspective," by Robert W. Gilmer, Matthew Gurch and Thomas Wang, *The Border Economy*, Federal Reserve Bank of Dallas, June 2001, pp. 2–5.
8. "Finding New Ways to Grow: Recovery in the Oil Patch," by Robert W. Gilmer, *Houston Business*, Federal Reserve Bank of Dallas, July 1996.
9. The actual calculation of industry mix and differential regional earnings is spelled out carefully in Garnick and Friedenberg (1990). The calculation depends on the definition of hypothetical income (H), total wages and salaries that would have been earned in Texas if compensation were paid at the national rate in each industry. Hypothetical income was calculated using the wage and salary employment categories in the Bureau of Economic Analysis's Regional Economic Information System, essentially a one-digit definition in the Standard Industrial Classification. Using this definition,

   WS/P = industry mix × differential regional earnings × $E/P = H/E \times WS/H \times E/P$.
10. The data in Table 5 extend only to 2000 because of the change in the industrial classification system from the Standard Industrial Classification to the North American Industry Classification System, beginning in 2001. This made it impossible to compare the distribution of jobs and income by industry in 1989 and 2001.

Texas Border Benefits from Retail Sales to Mexican Nationals

Keith R. Phillips and Roberto Coronado

Over the past 10 years, trade between the United States and Mexico has boomed, partly because of the significant reduction in tariffs from NAFTA and the strong growth in the maquiladora industry. Along with the expansion in trade, there has been strong population growth along the northern border of Mexico. Generally, the population in Mexican border cities is significantly larger than in the corresponding U.S. sister cities. Moreover, the South Texas border metros are a short drive from the industrial city of Monterrey, which had a population of 3.8 million in 2000. The large and growing population on the Mexican side of the border represents an important consumer base for retail stores in U.S. border towns.

While commercial trade between the United States and Mexico is well documented, less is known about the size of the nations' cross-border retail trade. Though small in comparison with commercial trade, this retail trade is a significant part of many border city economies. In 2003 alone, there were more than 38 million noncommercial crossings at the bridges along the Texas–Mexico border. Many of these individuals were coming to purchase goods to take back to their home country. Due to differences in national policies such as environmental laws, taxes and consumer safety regulations, people cross daily to purchase goods and services on both sides of the border.

Since most of the retail trade conducted on the U.S. side of the border is done in cash, it is difficult to document the share of retail spending by Mexican nationals. In this article, we use a simple consumption function to estimate the amount of retail spending that is essentially exported to Mexico via cross-border shoppers.[1] Since the true amount spent by Mexican nationals is not known, it is difficult to estimate the accuracy of our measures. Theory tells us, however, that metro areas having the biggest share of their retail sales going to Mexican nationals will be impacted the most by large swings in the value of the peso. We thus check that our estimates are consistent with the effects on local retail sales of movements in the real dollar/peso exchange rate.

El Paso Convention & Visitors Bureau

Previous Research on Border Retail

Traditionally, the border has been a region of fast population and job growth compared with the rest of the United States and Mexico. The Border Industrialization Program—enacted in 1965 by the Mexican government after the United States ended the Bracero Program—gave birth to the maquiladora industry, which in turn intensified the border region's growth, not only in Mexico but also on the U.S. side due to increasing border interlinkages. The maquiladora industry has been the main economic growth driver along the Texas–Mexico border.

Several studies have addressed the issue of cross-border retail trade as part of a larger question of the maquiladora industry's impact on the regional economies of U.S. border cities. The first studies on the subject date back to the early 1970s and indicate that a significant portion of maquiladora salaries was spent on the U.S. side of the border, mainly on food and clothing. More specifically, one study estimates that a 10 percent increase in maquiladora employment translates into a 23 percent increase in retail sales in Brownsville, a 13 percent increase in Laredo, an 11 percent increase in El Paso and a 7 percent increase in McAllen.[2]

Perhaps the first researcher to study the impact of the maquiladoras along the Texas border in a comprehensive manner was J. Michael Patrick.[3] His main conclusion regarding cross-border retail trade activity is that growth in the maquiladora industry in Mexico stimulates U.S. border job growth mostly in the retail and service sectors, not in the manufacturing sector as commonly perceived.

One of the first studies to quantify the impact of Mexican nationals on retail trade on the U.S. side of the border was done by the San Diego Chamber of Commerce in 1979.[4] Through surveys, the study estimated that 7.5 percent of San Diego's retail sales ($407 million) could be attributed to Mexican nationals. In 1993, according to a study by the San Diego Dialogue, about 42 percent of the people who crossed into San Diego were Mexican nationals with the main purpose of shopping. They accounted for $2.8 billion in retail sales.[5]

More recently, in 2002, Charney and Pavlakovich-Kochi estimated the eco-

nomic impact of Mexican visitors to the economy of Arizona. They found that Mexican visitors spent $962 million, with the vast majority in department stores (41 percent) and grocery stores (25 percent), mostly in border counties.[6] Similarly, on the Texas–Mexico border, the Center for Border Economic Studies at the University of Texas–Pan American estimated that total expenditures by Mexican visitors in the lower Rio Grande Valley amounted to $1.4 billion in 2003.[7]

Other studies have focused on the impact of exchange rate fluctuations on U.S. border retail sales. For instance, Diehl concludes that the 1982 Mexican economic crisis that triggered peso devaluation stunned South Texas retailers by cutting retail sales as much as 80 to 90 percent in many border businesses.[8] Similarly, Patrick and Renforth estimate, through the use of almost 4,000 surveys, that the 1994 peso devaluation resulted in a strong 41.8 percent decline in retail sales, but the results varied by city, store type, distance from the border and relative domestic market size.[9] Gerber documents the relationship between peso value fluctuations and total taxable sales in San Diego and Imperial counties, where he finds that an unanticipated 10 percent decline in the value of the peso depresses total taxable sales by approximately 1 percent in San Diego County and 2.22 percent in Imperial County.[10]

Many of the studies, however, are region- and time-specific, making comparisons across regions and over time difficult. Also, many of the studies were done using time-consuming, labor-intensive, and thus expensive, survey techniques that would be difficult to perform consistently over time and across regions. To overcome these limitations, we use a simple consumption function approach that produces a consistent annual time series of exported retail sales for the four metropolitan statistical areas (MSAs) on the Texas–Mexico border.

Using a Different Approach

Phillips and Manzanares propose a simple model in which it is assumed that individuals spend a fixed proportion of their income on consumption, or in this case, retail sales.[11] For instance, they find that from 1986 to 1998 retail sales as a fraction of personal income in Texas averaged 46 percent. For each of the four border MSAs, they multiplied 0.46 by total personal income to get an estimate of retail sales purchased by the local population and then subtracted sales to locals from total sales to get net exported retail sales. If the value of net exported retail sales is negative, that means more local income is spent outside the local economy than income spent by outsiders in the local community. While it is evident that many Mexican nationals cross the border to shop, U.S. citizens also cross into Mexico to dine at restaurants and to buy local handicrafts, medicines, liquor, dental services and other products and services. Border residents also vacation and shop at other destinations in the United States. Remittances to family members in Mexico can also reduce the amount of local income spent on local retail goods and thus reduce net exported retail sales.

Using a constant fraction of local personal income to estimate the amount that locals spend on retail—and using this amount to estimate net exported retail—produces reasonable results. However, we can further refine the model by decomposing personal income into three components, allowing the coefficient on each component to differ. The border region has a low employment-to-population ratio due to its young labor force and high unemployment rates. It also has persistently low per capita personal income yet strong job growth rates. If these factors play differing roles in retail spending, it is important to separate them out. We divide personal income (Y) as follows:

$$Y = \left(\frac{Y}{POP}\right) \times \left(\frac{POP}{EMP}\right) \times EMP,$$

where POP is population and thus Y/POP is per capita income, POP/EMP is the inverse of the employment-to-population ratio and EMP is total employment. We then try to estimate the impact of the three components of personal income on retail sales across the 23 non-border Texas MSAs. We use quarterly retail sales data at the metro level from 1978 to 2001, available from the Texas comptroller's office. Annual personal income for metro areas (less contributions for social insurance) from 1978 to 2001 is available from the Commerce Department's Bureau of Economic Analysis.

Table 1
Border Exported Retail Sales, 1978–2001

	Average share (percent)
Brownsville	25.7
El Paso	11.3
Laredo	51.1
McAllen	35.6

SOURCE: Authors' calculations.

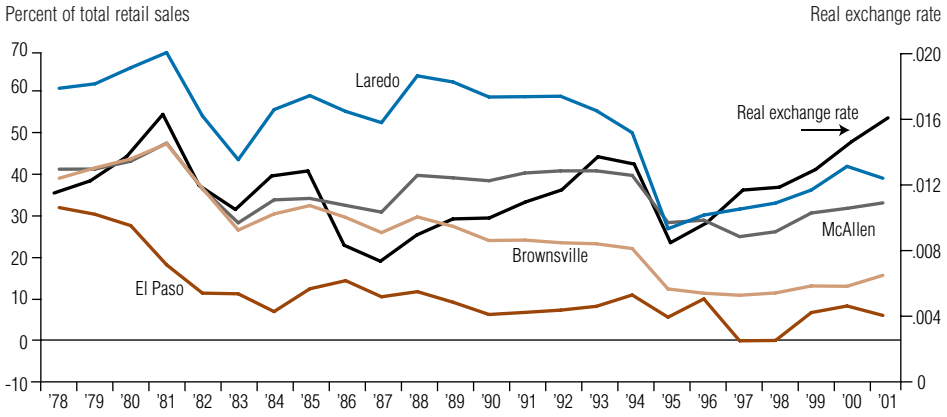
We use the results from the model to estimate exported retail sales for the four Texas border MSAs. Table 1 reports the average share of exported retail sales for these four areas during our estimation period. According to our results, in 2001, Mexican shoppers accounted for more than $2 billion in retail sales, representing 0.75 percent of total retail sales in Texas. In 2001, McAllen was the biggest net exporter of retail sales to Mexicans, with almost $1 billion in sales, representing 33 percent of its total local retail trade activity. Laredo came in second with $540 million in exported retail sales, or 39 percent of total retail sales. Brownsville registered $256 million (16 percent of total retail sales), while El Paso, the biggest of the four cities in terms of population, exported only $215 million (6 percent) to Mexican nationals. El Paso's figure is well below its average exported retail sales of 11.3 percent and is primarily due to the contracted maquiladora activity south of the border. Ciudad Juárez registered its worst maquiladora performance in 2001 and 2002, with employment declining almost 25 percent.

On average over the 1978–2001 period, Mexican nationals accounted for 1.6 percent of Texas retail sales, or $5.1 million on a daily basis. Chart 1 shows that over time Laredo has the highest share of exported retail sales to actual total sales, followed by McAllen, Brownsville and El Paso.

Sensitivity to Exchange Rate Swings

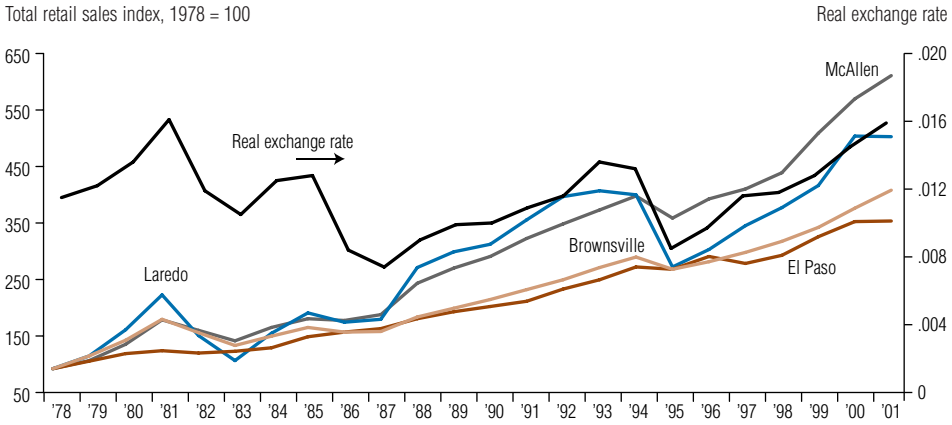
Although there is no straightforward way to determine the accuracy of our results, retail sales from Mexican nationals should be sensitive to swings in the value of the peso. These swings represent price shocks for Mexican nationals shopping on the U.S. side, and border retailers know that sharp declines in the peso's

Chart 1
Exported Retail Sales Shares



SOURCES: Authors' calculations; Federal Reserve Bank of Dallas.

Chart 2
Border Retail Sales Are Closely Related to Real Exchange Rate



SOURCES: Authors' calculations with data from Texas Comptroller of Public Accounts and Banco de México.

value result in a sharp drop in Mexican shoppers. Under our model, exported retail sales seem to be responsive to changes in exchange rate (see Chart 1).

If exported retail sales represents a significant portion of total retail sales, changes in the value of the peso should have statistically significant impacts on total retail sales. To asses this, we perform some statistical tests on the sensitivity of overall retail sales to changes in the value of the peso. Results show that, in all MSAs but El Paso, changes in the real exchange rate have statistically significant impacts on total local retail sales. The magnitude of the impact was the largest in Laredo. Since our results show that El Paso had the smallest share of its retail sales going to Mexican nationals and Laredo had the largest, these results are consistent with our previous findings (Chart 2).

Outlook

In mid-2005 the real value of the peso was above its 20-year average and the maquiladora industry was continuing to bounce back from its downturn in 2001–03. Both of these factors should continue to stimulate growth along the Texas side of the border. Looking to 2006, Mexico is hoping to have its second consecutive presidential election without a peso devaluation. The Texas border community is hoping for the same, as its economy ebbs and flows with the movements in the value of the peso and the accompanying waves of Mexican shoppers.

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Notes

1. For a more detailed version of this article, please see "Exported Retail Sales along the Texas–Mexico Border," by Keith R. Phillips and Roberto Coronado, Federal Reserve Bank of Dallas working paper (forthcoming).
2. See "Maquiladoras along the Texas–Mexico Border: An Econometric Evaluation of Employment and Retail Sales Effect on Four Texas Border SMSAs," by Richard J. Holden, Texas Department of Community Affairs, Regional Economic Development Division, February 1984.
3. See "The Economic Impact of Maquiladoras on Border Development: A Rio Grande Valley Case Study—Some Preliminary Findings," by J. Michael Patrick and Roland S. Arriola, paper presented at the Western Social Science Association meeting, El Paso, Texas, 1987; "The Employment Impact of Maquiladoras along the U.S. Border," by J. Michael Patrick, in *The Maquiladora Industry: Economic Solution or Problem?*, ed. Khosrow Fatemi, New York: Praeger Publishers, 1990, pp. 31–35; and "The Impact of NAFTA on Border Maquiladora and Industrial Activity," by J. Michael Patrick, Technical Report, Center for Entrepreneurship and Economic Development, University of Texas–Pan American, 1991.
4. "Mexican Impacts on Retail Sales," San Diego Chamber of Commerce, *San Diego Economic Bulletin*, vol. 27, no. 6, 1979.
5. "Who Crosses the Border: A View of the San Diego/Tijuana Metropolitan Region," Technical Report, San Diego Dialogue, University of California, San Diego, 1993.
6. "The Economic Impacts of Mexican Visitors to Arizona: 2001," by Alberta H. Charney and Vera K. Pavlakovich-Kochi, Research Studies, Economic and Business Research Program, University of Arizona, July 2002.
7. "The Economic Impact of Mexican Visitors to the Lower Rio Grande Valley 2003," by Suad Ghaddar, Chad Richardson and Cynthia J. Brown, Technical Report, Center for Border Economic Studies, University of Texas–Pan American, 2004.
8. "The Effect of the Peso Devaluation on Texas Border Cities," by Philip N. Diehl, *Texas Business Review*, vol. 57, May/June 1983, pp. 120–25.
9. "The Effects of the Peso Devaluation on Cross-Border Retailing," by J. Michael Patrick and William Renforth, *Journal of Borderlands Studies*, vol. 11, Spring 1996, pp. 25–41.
10. "The Effects of a Depreciation of the Peso on Cross Border Retail Sales in San Diego and Imperial Counties," by James Gerber, working paper, San Diego State University, June 1999.
11. "Transportation Infrastructure and the Border Economy," by Keith R. Phillips and Carlos Manzanares, *The Border Economy*, Federal Reserve Bank of Dallas, June 2001.

Texas Border

Employment and Maquiladora Growth

Jesus Cañas, Roberto Coronado and Robert W. Gilmer

Courtesy of Mexico*Now* magazine

In the 1990s, the Texas economy exceeded even the remarkable performance of its U.S. counterpart. State job growth averaged 2.9 percent per year from 1990 to 2000, well ahead of the 1.8 percent annual increases in the United States. Three engines drove the Texas economy forward in the 1990s: the oil sector, high tech (especially in Austin and Dallas) and a boom in border-city employment. Employment growth in the four largest Texas border cities topped that of the nation, and the three south Texas cities outperformed the state by a wide margin (*Table 1*).[1]

The accelerated job growth along the Texas–Mexico border was the result of several factors: a quick Mexican recovery after the 1994–95 financial crisis; tight labor markets in the United States that attracted employers to the border in search of the region's surplus labor; a strong peso for much of the period, which increased retail sales in U.S. border cities; and rapid expansion of the maquiladora industry.

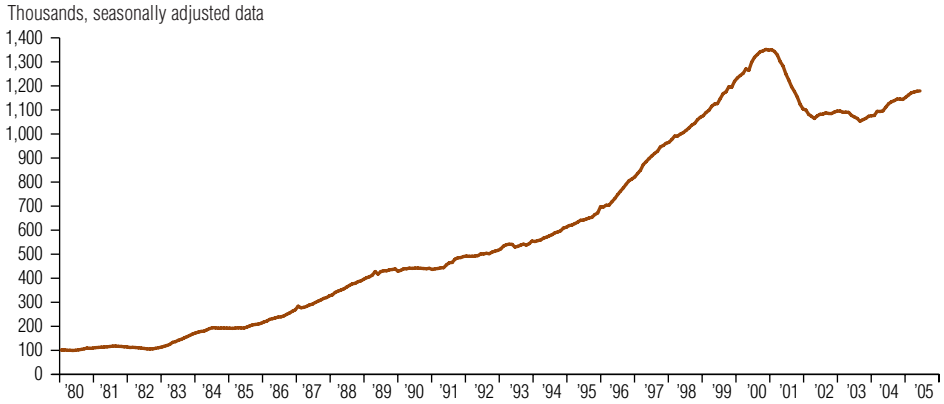
Maquiladora expansion came on the heels of NAFTA implementation and the 1994–95 peso devaluation. In recent years, however, this part of the border boom has turned to bust. After watching the industry lose 290,000 jobs between October 2000 and July 2003, many observers are questioning the industry's future. Recession, rising wages in Mexico, low-wage competition from countries such as China and Mexico's inability to deal with growing problems in its competitive environment have all contributed to

Table 1
Percent Job Growth Along the Texas–Mexico Border

	Texas	El Paso	Laredo	Brownsville	McAllen
1991	.7	2.3	4.3	2.0	1.5
1992	1.9	3.6	8.7	4.8	5.3
1993	3.3	2.2	3.6	4.4	4.5
1994	4.3	3.9	7.2	6.0	7.3
1995	2.9	0	–5.5	.4	2.7
1996	3.2	2.0	5.1	2.8	3.3
1997	4.4	2.7	7.6	3.0	3.8
1998	3.6	1.1	2.7	2.3	5.6
1999	2.2	2.0	5.3	5.8	6.5
2000	2.8	1.5	3.0	5.1	5.1
1990–2000	2.9	2.1	4.1	3.7	4.6

SOURCE: Federal Reserve Bank of Dallas, El Paso Branch, with data from the Texas Workforce Commission.

Chart 1
Maquiladora Employment Growth



SOURCES: Federal Reserve Bank of Dallas, El Paso Branch, with data from INEGI.

the recent downturn.

This article looks at the maquiladora's role in today's Texas economy, especially how it affects Texas border cities. We also assess the industry's future and the prospects for the maquiladora to again be a significant factor in job growth in Texas and Mexico.

Growth and Decline

The maquiladora industry began in 1965 and experienced slow but steady growth under the Border Industrialization Program. The canceled Bracero Program had used Mexican labor in agriculture, and the replacement maquiladora was designed to relieve the resulting high unemployment rates in northern Mexico. The new program used low-wage Mexican labor as a lure to draw U.S. manufacturing to the region, allowing companies to move production machinery and unassembled parts into Mexico without tariff consequences, as long as the assembled product was returned to the United States for final sale.

Chart 1 shows the elevenfold increase in maquiladora employment between 1980 and its peak in 2000, from 120,000 workers to 1.3 million. In 1980, about 94 percent of maquiladora employment was in the border states of northern Mexico.[2] Today, the share has slipped to 76 percent, but the northern states still dominate. In 2004, 2,810 operating plants accounted for about 9 percent of formal employment in Mexico, or 3 percent of the total labor force. The companies operating under the maquiladora program are a who's who of U.S. industry, including Delphi, Mattel, Tyco, General Electric and ITT.

The maquiladora industry has been highly cyclical since its inception, falling into its first recession in 1974 with an 11.5 percent decline in employment. Table 2 shows the uneven effects of the latest maquiladora downturn on Mexican border cities. Maquiladora employment in Ciudad Juárez was higher than in all the other cities combined when the recession began, and it has sustained the largest percentage losses from peak to trough (27.7 percent). Piedras Negras, Nuevo Laredo and Matamoros also suffered large percentage losses, all in excess of 24 percent. Ciudad Acuña and Reynosa were exceptions to the deep recession, with Ciudad Acuña declining only 10.6 percent and Reynosa continuing to grow throughout the downturn. Newer plants, a better industry mix and a business-friendly environment account for their better performance.

The cyclical nature of the maquiladora industry is not surprising, given its close ties to U.S. manufacturing (*Chart 2*). Throughout the latest recession and slow recovery, manufacturing was the hardest hit part of the U.S. economy, and maquiladora output and employment generally followed the lead of U.S. industrial production. In mid-2003, however, strong U.S. industrial growth finally returned, and as Table 2 shows, maquiladora employment has returned to recovery as well. Job growth remains uneven among the Mexican border cities, however, with Ciudad Acuña, Matamoros and Piedras Negras recovering more slowly.

How Do Maquladoras Affect the Texas Border Economy?

The original vision for maquiladoras was the "twin plant," with capital-intensive operations located a few miles inside the U.S. border and low-wage, labor-intensive operations close by on the Mexican side. However, the bulk of U.S. manufacturing was already established in the Midwest, and trucking deregulation would make transportation links between the border and the Midwest both easier and cheaper in the 1970s and '80s. The twin-plant vision was never realized along the border. Instead, the maquiladora supply chain remained concentrated in states such as Illinois, Michigan and Ohio.

What economic impact would a new maquiladora in Mexico have on a neighboring U.S. city? The list might run as follows. To select and develop a site, U.S. legal, engineering and financial assistance would be used. Once established, the new plant would rely on U.S.-based businesses for customs, brokerage, warehousing and transportation services. The plant would also purchase a variety of office, packaging and industrial supplies. Corporate management, engineers and quality spe-

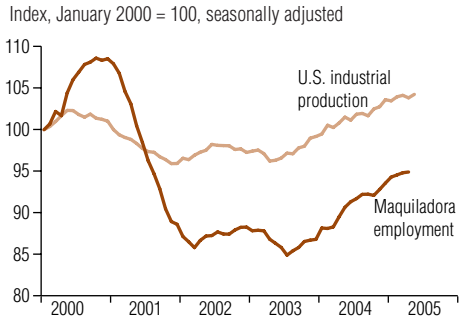
Table 2
Texas–Mexico Maquiladora Border Employment

	Peak		Trough		
	Jobs	Date	Jobs	Date	April 2005
Ciudad Juárez	262,550	October 2000	189,930	June 2003	213,389
Ciudad Acuña	37,512	November 2002	33,541	February 2005	33,674
Piedras Negras	15,222	February 2000	10,939	December 2004	11,187
Nuevo Laredo	22,915	February 2000	17,171	April 2003	22,233
Reynosa	86,925	April 2005	N/A	N/A	N/A
Matamoros	68,413	October 2000	51,900	August 2003	53,002

NOTES: Seasonally adjusted data; border twin cities are as follows: Ciudad Juárez–El Paso, Ciudad Acuña–Del Rio, Piedras Negras–Eagle Pass, Nuevo Laredo–Laredo, Reynosa–McAllen and Matamoros–Brownsville.

SOURCE: Federal Reserve Bank of Dallas, El Paso Branch, with data from INEGI.

Chart 2
Maquiladora Ties to U.S. Industrial Sector



SOURCES: Federal Reserve Bank of Dallas, El Paso Branch, with data from INEGI; Federal Reserve Board.

cialists would be drawn to the border to visit this plant, and they would spend money on food and lodging.[3] Maquiladora employees draw their salary in Mexico but do a significant share of their shopping in the United States, stimulating employment in local retail and service sectors.

These impacts on the U.S. border have been recognized for some time, and a number of studies were conducted in the 1970s and '80s to quantify them. For instance, in 1972, Ladman and Poulsen found that Agua Prieta, Sonora, maquiladora workers spent 40 percent of their wages in Arizona.[4] Ayer and Layton estimated the maquiladoras' impact on value added and population, using an input–output model for the Arizona–Mexico border economy. They concluded that Mexicans' expenditures due to the growing presence of twin plants increased value added by 14 percent and population by 11 percent on the U.S. side of the border.[5]

In a 1984 study of the Texas border, Holden estimated that maquiladora employment had a large impact on employment in the border communities of El Paso, Laredo, McAllen and Brownsville. For instance, a 10 percent increase in maquiladora payroll results in a 2 to 3 percent increase in employment in El Paso and McAllen as well as a 3 to 4 percent increase in Laredo and Brownsville.[6]

In another study, Sprinkle found that during the early 1980s Ciudad Juárez maquiladoras accounted for one of five jobs created in El Paso, and these new jobs were concentrated in the service sector.[7] Silvers and Pavlakovich assessed the relative magnitude of employment gains and losses across U.S. border regions due to maquiladora industry activity. Their research suggests that U.S. border states—with the exception of Arizona, where job losses ranged from negligible to small—gained jobs as a result of growth in the maquiladora industry.[8]

A more recent development has been the arrival of component parts and material suppliers in U.S. border cities. Specific examples can be found in El Paso, neighbor to Ciudad Juárez, which is home to the largest number of maquiladora employees along the U.S. border. Over the past decade, an increasing number of rubber and plastics, electronics and electrical equipment, and metal fabricating plants have begun to operate in El Paso to serve as suppliers to the maquiladora industry (*Chart 3*).

Components supplied include computer housings, electrical wiring harnesses, special dies and tools, and electrical switches. About 26 plastic-injection molding plants can be identified, 31 metal stamping companies, and 12 electric- and electronic-related companies. Together, these companies employed 4,000 workers in 2004. The manufacturing sectors that supply the maquiladoras paid about 40 percent more in hourly wages than the low-wage apparel, textile and leather industries that traditionally operated in El Paso.

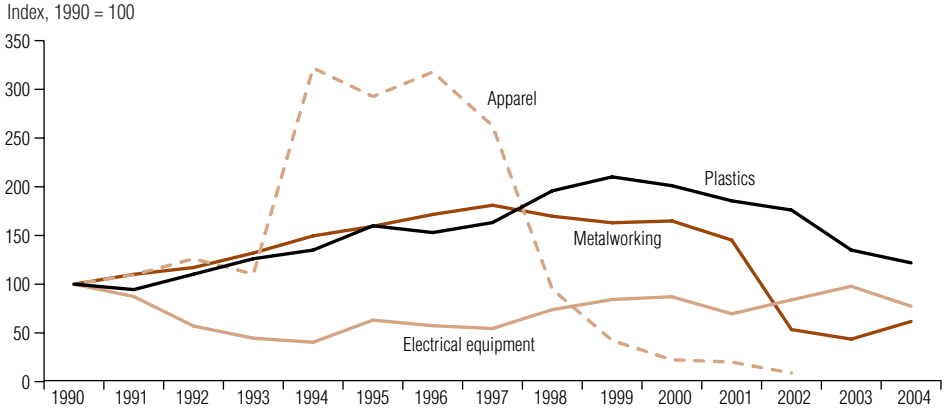
Maquila manufacturing in Mexico also positively influences El Paso's employment in transportation, real estate, and legal and accounting services (*Chart 4*). Given the rapid increase in trade flows after 1993, transportation and warehousing employment accelerated quickly. Business service employment, especially personnel supply services, computer programming and data processing, grew 45 percent from 1990 to 2004. El Paso's maquiladora-related businesses rely heavily on temporary staffing agencies to hire additional personnel to meet rising demand. Computer programming and data service workers help minimize the burden of paperwork required by customs agencies to export or import components. Legal employment grew 20 percent over the same period. Similar results can be found up and down the U.S. border.

The definitive study on the linkages between maquiladoras and the border economy, by Gordon Hanson, takes all these factors into account.[9] Hanson estimates that a 10 percent increase in maquiladora output in a Mexican border city will increase employment in its U.S. city pair by 1.1 to 2 percent. He provides more specifics by estimating that this same 10 percent increase in output would increase wholesale trade employment in the U.S. city by 2.1 to 2.7 percent, transportation services by 1.7 to 2.7 percent, manufacturing by 1.2 to 2.1 percent and retail trade by 1 to 1.8 percent.

The Role of Recession

The recent recession has played an important role in the latest downturn of the highly cyclical maquiladora industry. At the same time, maquiladoras have long served as a low-wage platform for U.S.

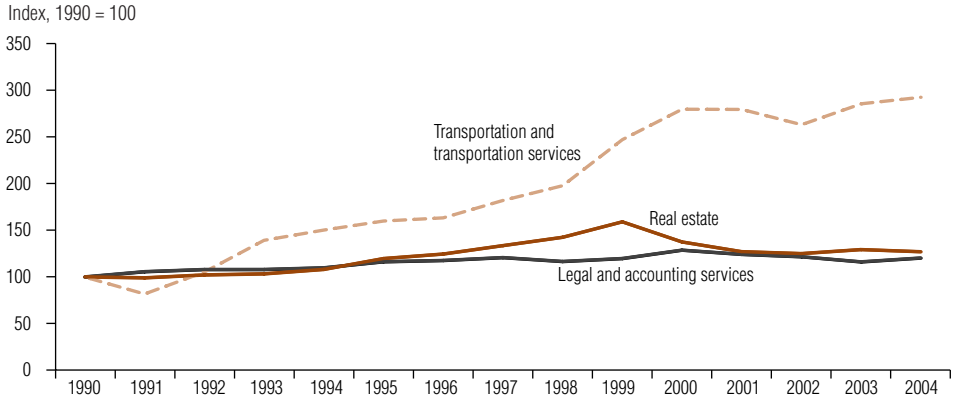
Chart 3
Maquiladora Suppliers in El Paso



NOTE: North American Industry Classification System (NAICS) codes used in the chart were 3327, 3329, 3328, 3332, 3335, 3159, 3261 and 3344.

SOURCE: Federal Reserve Bank of Dallas, El Paso Branch, with data from Bureau of Labor Statistics.

Chart 4
Service Employment in El Paso



NOTE: North American Industry Classification System (NAICS) codes used in the chart were 4889, 5311, 5312, 5313, 5411 and 5412.

SOURCE: Federal Reserve Bank of Dallas, El Paso Branch, with data from Bureau of Labor Statistics.

manufacturing, and the rise of new low-wage alternatives such as China, India and Vietnam has broadened U.S. options for manufacturing. These very low-wage competitors, plus rising real Mexican wages, have become a factor in pushing some maquiladora activity abroad. Mexico generally has looked at the loss of the lowest wage jobs as an inevitable price of progress, because increasing domestic wage levels must be seen as a positive aspect of economic development. The government has expressed reluctance to enter into subsidy programs to retain or attract these industries, considering such action as poor fiscal policy and a violation of Organization for Economic Cooperation and Development and World Trade Organization rules.

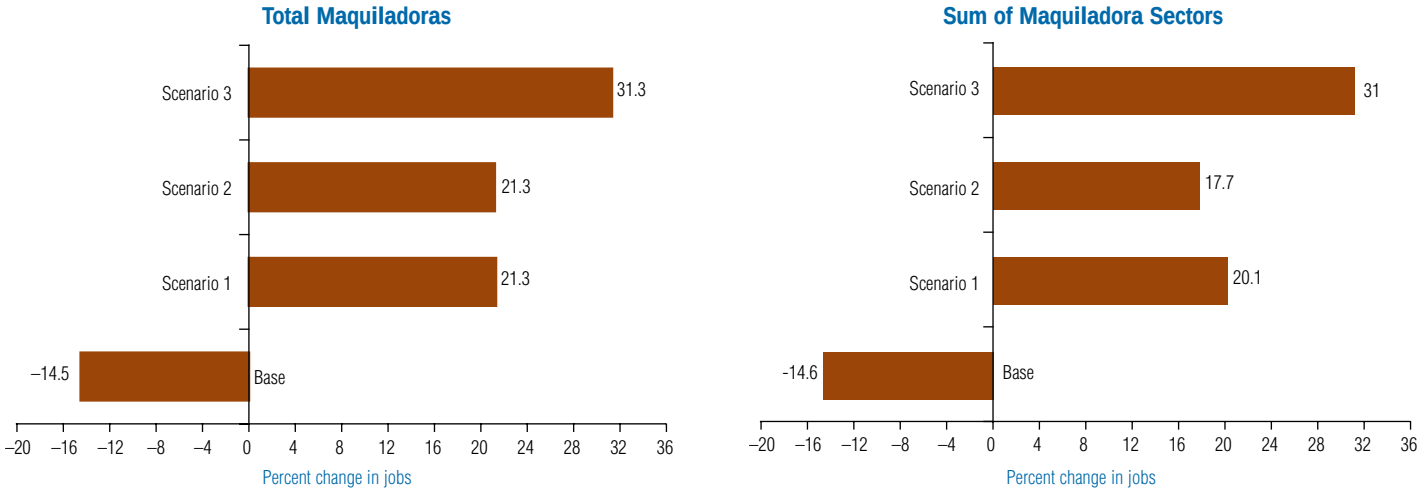
To focus on the question of how maquiladoras will respond to economic recovery and which sectors would benefit, we developed some econometric estimates. As in other models, our methodology confirmed that past maquiladora employment has primarily been driven by the business cycle and relative real wages.[10] Trends and dummy shift variables were included to account for structural change, particularly testing for breaks with the 1994 implementation of NAFTA and the 1994–95 financial crisis in Mexico. The general methodology follows several papers by Branson and Love, and detailed results are reported elsewhere.[11]

To examine the future of the industry under various assumptions, we simulated maquiladora employment following its second quarter 2000 peak. The base case was the actual outcome through 2002, a decline of 14.5 percent for the industry as a whole. Scenario 1 (S1) assumed no recession and that the U.S. unemployment rate held firm at a historically low 4 percent through the end of the period. Real relative wages rose in this scenario, just as in the base case. Scenario 2 (S2) assumed the recession occurred but that real relative maquiladora wages fell 6.1 percent after second quarter 2000 instead of rising 16.8 percent. And scenario 3 (S3) assumed the best of both worlds for maquiladora managers, falling real relative wages and no recession.

Chart 5 shows the results for all maquiladoras combined. This can be computed two ways: as the result of a single estimate based on the sum of all maquiladora employment or as the sum of the simulation results for 10 maquiladora sectors. Fortunately, they agree quite closely. Eliminating the U.S. recession in S1 would provide an increase of approximately 20 percent in employment in the simulation period, replacing a decline of about 14.5 percent in the base case. The percentage turnaround for S2 is similar, and the combined effect in S3 is a 31 percent increase.

Four individual sectors do not

Chart 5
Simulation Results



NOTE: The base cases in the two calculations are slightly different because the chemicals sector was excluded from the sum of regression results. There was a break in the data for this sector.

SOURCE: Authors' calculations.

Table 3
Maquiladora Sectors That Are Unresponsive to a U.S. Economic Rebound
(Percent change in jobs)

	Leather	Toys	Furniture	Not classified
Base	–25.6	–31.5	–8.7	–4.9
S1	–7.8	–21.0	–8.9	–2.1
S2	–6.8	–34.7	17.3	–22.1
S3	–7.4	–5.1	4.4	5.8

SOURCE: Authors' calculations.

respond to an upturn in the U.S. economy: leather, toys, furniture and a group of other, unclassified maquiladoras. Their simulation results are summarized in Table 3. Combined, these maquiladoras accounted for 226,782 jobs at the second quarter 2000 peak, or 18.1 percent of the total. These sectors are unlikely to return to growth with U.S. economic recovery.

The three largest maquiladora sectors, together accounting for 76.1 percent of the peak employment, all respond positively to economic recovery in the simulations. In S1, electrical machinery records an 18.2 percent increase, in place of a 26.1 percent decline. Textiles turn around to record a 63.2 percent gain in S1, and transportation equipment (which did not decline after second quarter 2000) grows by another 4.5 percent in this scenario.

In conclusion, less than 20 percent of maquiladora employment is in sectors that are unresponsive to economic recovery in the United States, and overall growth seems likely to continue. However, even those sectors that continue to grow in simulations are going to be influenced by foreign competition. The effect of foreign competition is often couched in terms of a product cycle, in which product development and testing occur in the United States, initial long production runs take place in Mexico and ultimately product commoditization happens in China or another low-wage competitor. The more quickly and easily a product is commoditized, the quicker it will move to China. Leather, toy and furniture sectors are often cited as no longer competitive in Mexico. But even within the most advanced sectors, we may find individual products susceptible to being lost to lower wage countries in exactly the same way—computers, cell phones, modems, printers and disk drives, for example. Hence, the rise of foreign competition means even sectors returning to positive growth with economic recovery may experience slower job growth than in the recent past, as some products within the sector are commoditized.

In assessing Mexico's competitive prospects, the nation retains crucial advantages over the rest of the world, even as domestic wages rise. The most important factor is proximity to the U.S. market. For example, bulky items that have a high ratio of weight to value, such as large-screen televisions or major appliances, will remain competitive. Proximity also matters if the inventory cycle is short, if there are constant design changes or if there must be frequent retooling. Mexico will also be competitive when quality is more important than price, such as with medical equipment or when intellectual property rights are critical.[12]

Texas-Based Suppliers

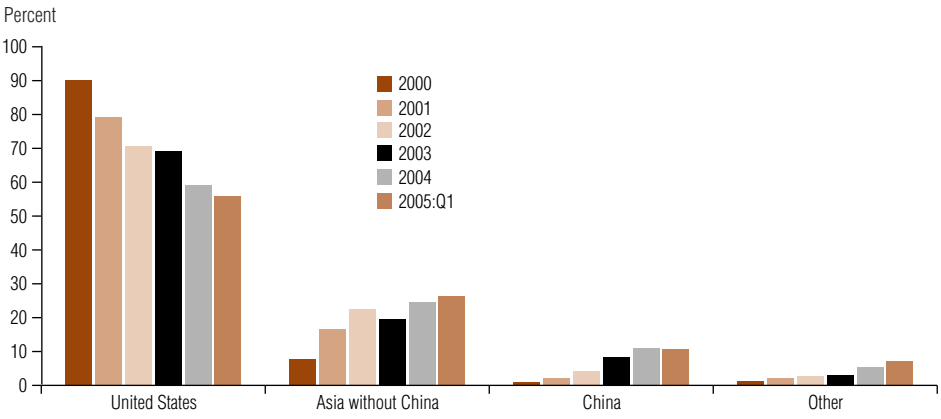
The maquiladoras' contribution to U.S. border city growth in the 1990s stemmed from (1) the spillovers from rapid maquiladora expansion in neighboring Mexican cities and (2) the shift of many maquiladora suppliers to border cities from their base in the Midwest. We have already shown how foreign competition and rising real wages in Mexico have reduced the prospects for maquiladora growth, but foreign competition is also making significant inroads into the maquiladora supply chain. This raises the possibility of slowing, or even reversing, the increase of U.S. border-city suppliers to the maquiladora industry.

Throughout the 1990s, the United States supplied the vast majority of maquiladora industry inputs. In 2000, 90 percent of maquiladora inputs were from the United States and 9 percent were from Asia, with China contributing only 1 percent (*Chart 6*). By 2004, 59 percent came from the United States and 35.7 percent from Asia, including 11.1 percent from China. The United States remains the majority supplier, but this rapidly moving trend continued to run in favor of Asia into 2005.

The vehicle for entry of foreign inputs to Mexico is 20 sectoral promotion programs, or PROSECs, created by the Mexican government in December 2000. They were created in response to implementation of NAFTA Article 303, which in January 2001 eliminated duty-free imports of maquiladora inputs from non-NAFTA countries. The PROSECs protect the entry to Mexico of non-NAFTA components that are not readily available in the domestic market, allowing them to enter under reduced tariffs of zero to 5 percent. Despite the paperwork and the need to track the origin of thousands of parts to comply with PROSECs, maquiladoras have apparently fully embraced the programs.

Data are not available on exactly which inputs are being displaced, making it difficult to assess the impact on Texas border communities. For example, if the 1990s shift of suppliers to the border from the Midwest was based on just-in-time inventory needs, it may be difficult for Asian suppliers to take their place. However, given the extent and pace at which

Chart 6
Mexican Maquiladora Imports by Country of Origin



SOURCE: Federal Reserve Bank of Dallas, El Paso Branch, with data from Banco de México.

Mexico retains important competitive advantages over many of its low-wage rivals, based on proximity to the United States, political and financial stability, and the rule of law.

Asian suppliers have taken market share, it would be hard to argue that the maquiladora market share of Texas-based suppliers has not been reduced. Future expansion of Texas-based suppliers is likely to slow as well.

Conclusion

Mexico's maquiladora jobs are growing once more, beginning with the resumption of U.S. industrial expansion in mid-2003. Mexico retains important competitive advantages over many of its low-wage rivals, based on proximity to the United States, political and financial stability, and the rule of law. The maquiladora industry is stable, competitive and growing again.

It is unlikely, however, to repeat the banner performance of the 1990s, at least not in the near future. There were elements of unique, one-time stimulus in the 1990s, with the collapse of the peso in 1994–95 and the implementation of NAFTA in 1994. Further, foreign competition appears to have taken away the potential for any growth in several low-wage sectors and probably has reduced the growth potential of a number of other sectors as well.

Rising real wages in Mexico have accelerated the transfer of low-wage jobs to other countries, and the Mexican government has argued that this must be seen as a highly desirable result of successful economic development and Mexico's move up the product cycle. The next generation of maquiladoras should not be judged by the ability to generate low-wage jobs, but by productivity, value added or rising wages. Critics, at the same time, claim Mexico simply has not done an adequate job of preparing the way for more sophisticated manufacturing. To illustrate this point, many observers cite the failure (so far) of proposed reforms in energy, labor law, taxes and telecommunications. These and other reforms are badly needed to prepare Mexico for a fine market economy.

Finally, it is not just the maquiladora industry that is affected by foreign competition, but the U.S.-based supply chain as well. In 2000, 90 percent of inputs to the maquiladoras came from the United States, and four years later that number was only 59 percent. Texas border cities in the 1990s developed rapidly as a critical, new part of this supply chain, with suppliers shifting from the Midwest to the U.S.–Mexico border. We lack industry detail to know exactly how the recent success of foreign suppliers is affecting Texas border cities, but again, declining economic stimulus from maquiladora expansion would seem to be the rule.

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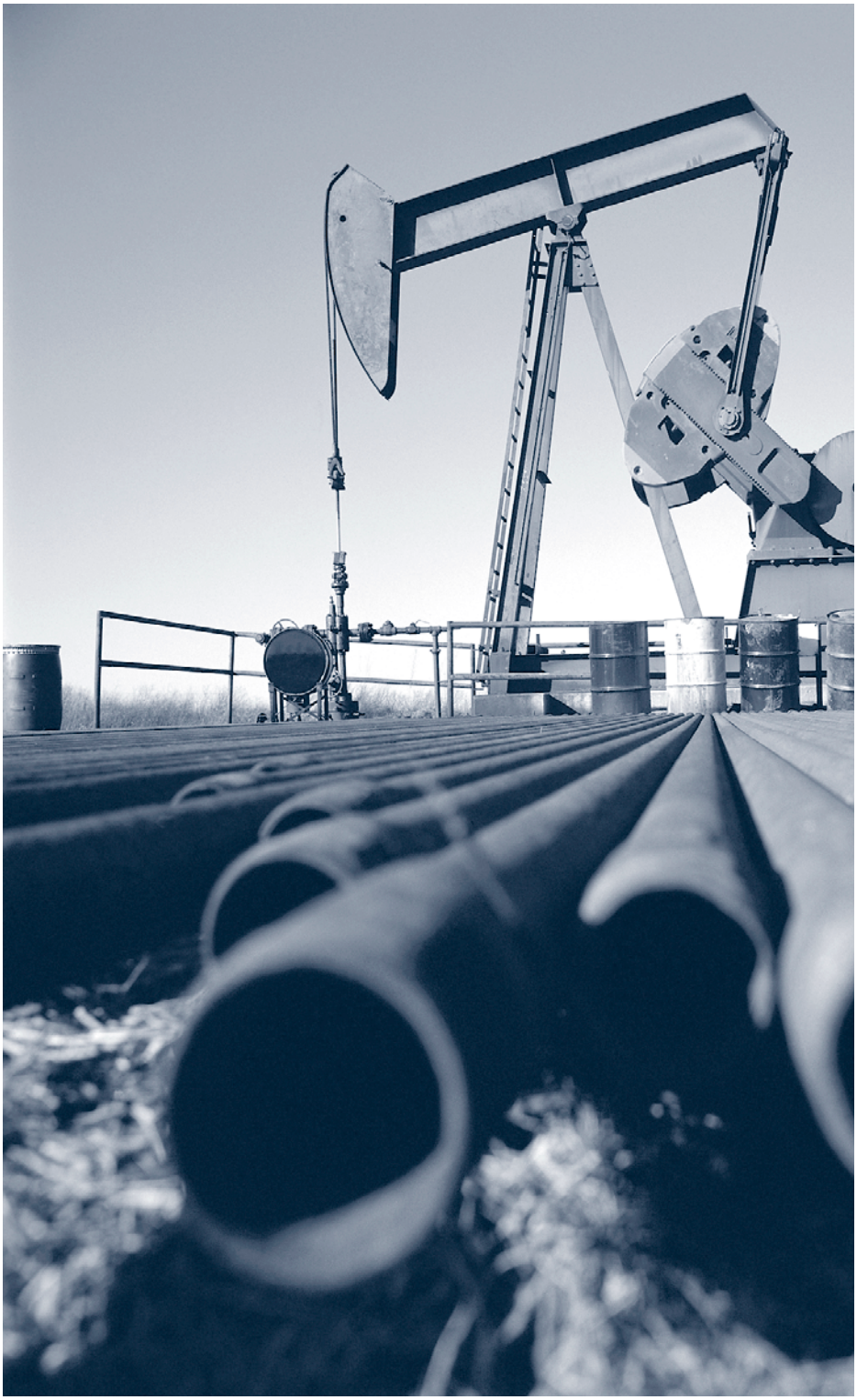
Notes

1. The four border cities contributed 6.8 percent of the 2.3 million jobs generated in Texas from 1990 to 2000, while making up 6.1 percent of Texas employment in 1990.
2. Mexican border states include Baja California, Sonora, Chihuahua, Coahuila and Tamaulipas, excluding Nuevo León.
3. "The Employment Impact of Maquiladoras Along the U.S. Border," by J. Michael Patrick, in *The Maquiladora Industry: Economic Solution or Problem?*, ed. Khosrow Fatemi, New York: Praeger Publishers, 1990, pp. 31–35.
4. "*Economic Impact of the Mexican Border Industrialization Program: Agua Prieta, Sonora*," by Jerry R. Ladman and Mark O. Poulsen, Arizona State University, Center for Latin American Studies, May 1972.
5. "The Border Industry Program and the Impact of Expenditures on a U.S. Border Community," by Harry Ayer and Ross Layton, *Annals of Regional Science*, vol. 8, 1974, pp. 105–17.
6. "*Maquiladoras Along the Texas–Mexico Border: An Econometric Evaluation of Employment and Retail Sales Effect on Four Texas Border SMSAs*," by Richard J. Holden, Texas Department of Community Affairs, Regional Economic Development Division, February 1984.
7. "*Project Link: An Investigation of Employment Linkages Between Cd. Juárez and El Paso*," by Richard Sprinkle, University of Texas at El Paso, December 1986.
8. "Maquila Industry Impacts on the Spatial Redistribution of Employment," by Arthur L. Silvers and Vera K. Pavlakovich, *Journal of Borderlands Studies*, vol. 9, December 1994, pp. 47–64.
9. "U.S.–Mexico Integration and Regional Economies: Evidence from Border-City Pairs," by Gordon Hanson, *Journal of Urban Economics*, vol. 50, September 2001, pp. 259–87.
10. For more information, see the papers from the Dallas Fed conference "Maquiladora Downturn: Structural Change or Cyclical Factors?" available at www.dallasfed.org/news/research/2003/03maquiladora.html. In particular, see the presentations by Everardo Elizondo Almaguer, Banco de México; William C. Gruben, Federal Reserve Bank of Dallas; James Gerber, San Diego State University; and Ernesto Acevedo Fernández, Ministry of Finance and Public Credit.
11. "Maquiladora Downturn: Structural Change or Cyclical Factors?" by Jesus Cañas, Roberto Coronado and Robert W. Gilmer, *International Business and Economics Research Journal*, vol. 3, August 2004; "Dollar Appreciation and Manufacturing Employment and Output," by William H. Branson and James P. Love, National Bureau of Economic Research, Working Paper No. 1972, July 1986; "The Real Exchange Rate and Employment in U.S. Manufacturing: State and Regional Results," by William H. Branson and James P. Love, National Bureau of Economic Research, Working Paper No. 2435, November 1987; "The Real Exchange Rate, Employment and Output in Manufacturing in the U.S. and Japan," by William H. Branson and James P. Love, National Bureau of Economic Research, Working Paper No. 2491, February 1988.
12. See "Maquiladora Downturn: Structural Change or Cyclical Factors?" by Jesus Cañas, Roberto Coronado and Robert W. Gilmer, Federal Reserve Bank of Dallas *Business Frontier*, Issue 2, 2004.

Do Higher Oil Prices Still Benefit Texas?

Stephen P. A. Brown and Mine Yücel



Texas and oil. These two words have gone hand in hand since 1889, when the state started producing oil. Since then, the Texas economy has often been driven by volatile energy prices—suffering with low oil prices and benefiting with high oil prices.

The effects of energy prices on the Texas economy were particularly evident during the 1970s and 1980s (*Chart 1*). As energy prices rose, the Texas economy expanded at a rapid pace, with strong employment and income growth. Although the Texas economy continued to expand until 1986, the oil and gas sector began to slip as energy prices slid from their 1981 heights. The oil price collapse in July 1986 touched off a statewide recession and significant job losses.

Since the early 1980s, however, the Texas energy industry has shrunk and other sectors of the Texas economy have grown. Despite these changes, Texas remains the top oil and natural gas producer in the United States and exports most of its production of these two commodities to other states. Consequently, the energy industry remains an important driver of the state economy.

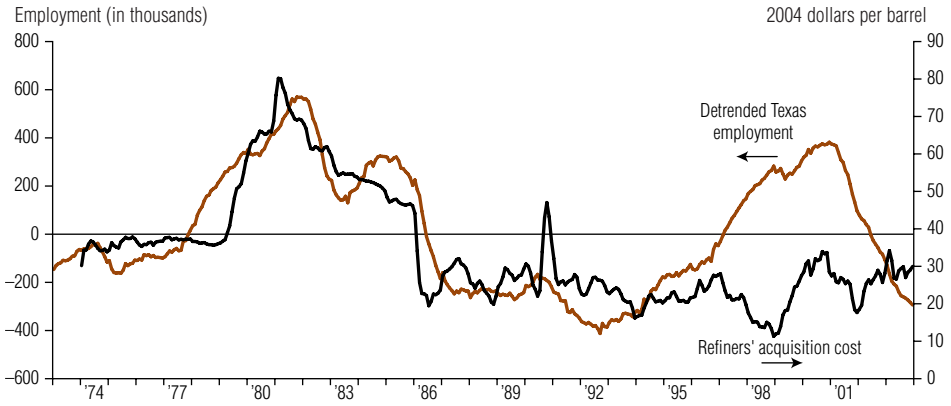
The diversification of the Texas economy away from energy and this sector's continuing importance to the state prompt us to consider: How much do swings in energy prices affect the Texas economy today? How much has that relationship changed since the energy boom years of the 1970s and 1980s?

Oil Production in Texas: A Brief History[1]

The first economically significant oil in Texas was discovered in Corsicana in 1894. Discoveries in Navarro County followed. By 1901 the Spindletop oil field was producing 75,000 barrels per day and had contributed to the first Texas oil boom.

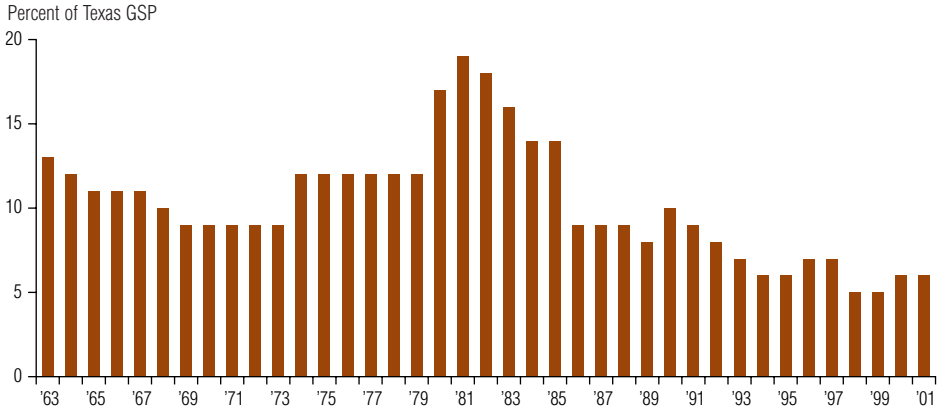
In the early 1900s, Texas produced relatively little oil and gas—crude oil pro-

Chart 1
Texas Employment Tracks Oil Prices in 1970s and 1980s



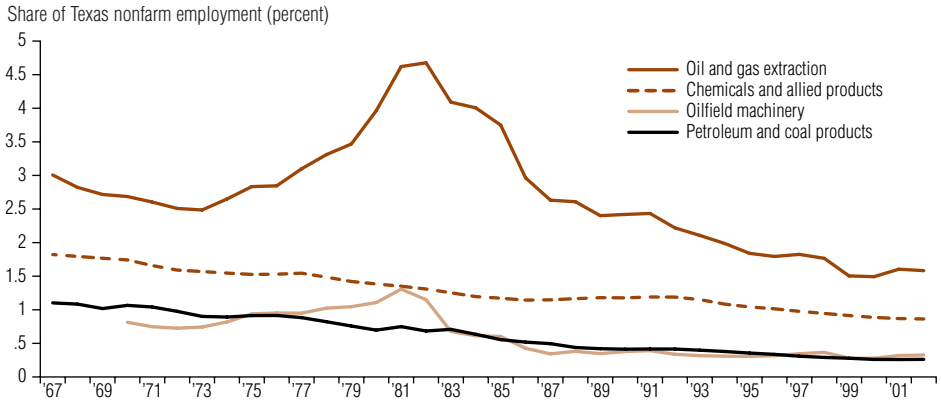
SOURCES: Bureau of Labor Statistics; Federal Reserve Bank of Dallas; Energy Information Administration; authors' estimates.

Chart 2
Oil and Gas Extraction's Share of Texas Output Peaks in 1981



SOURCE: Federal Reserve Bank of Dallas.

Chart 3
Energy Sector Employment Declines After Early 1980s



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

duction was only about 1.3 percent of total U.S. production, and natural gas was 0.1 percent of U.S. production. By 1952, Texas' shares of total U.S. crude oil and natural gas production peaked at 45 and 52.2 percent, respectively. Crude oil and natural gas production continued to increase in the state, with the peak for both coming in 1972.

As oil and gas production increased in Texas, so did their importance to the state economy. The creation of OPEC in 1960 and subsequent oil price increases in the 1970s and early 1980s gave rise to a boom in the Texas economy. Oil and gas output became an increasing share of Texas output (*Chart 2*). In 1981, at the height of world oil prices, oil and gas extraction was about 20 percent of total Texas gross state product.

After reaching $38 per barrel in 1981, oil prices began softening. Gradually sliding during the next few years, prices finally collapsed to $11.82 per barrel in July 1986. This led to a recession in Texas that lasted 17 months and had a devastating effect on state employment.

The number employed in the Texas mining industry (which is mostly oil and gas extraction) rose from about 7,000 in 1900—0.7 percent of total state employment—to 90,000 by 1950—a 3.1 percent share. At the oil and gas industry's peak in 1981, Texas employment in oil and gas extraction and oilfield machinery reached 366,200—6 percent of total nonfarm employment in the state (*Chart 3*). By the time the oil industry bottomed out in 1987, 175,000 jobs had been lost in the oil and gas extraction and oilfield machinery sectors.

Refining and Petrochemicals

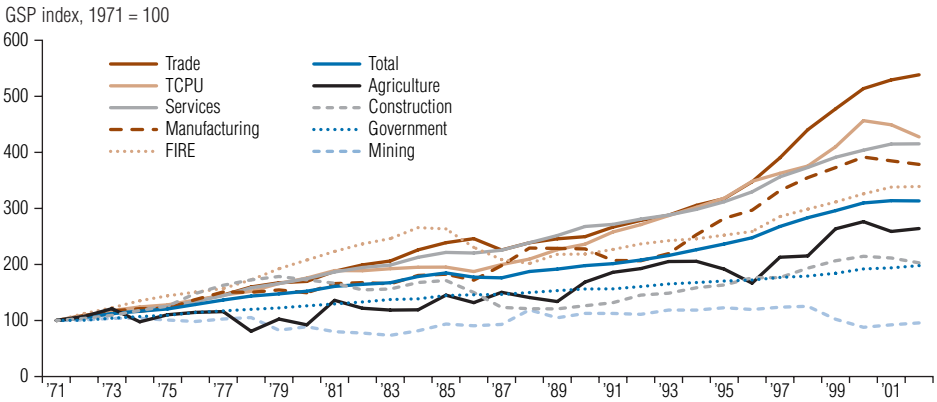
After the first Texas refinery opened in the Corsicana oil field in 1898, the petroleum refining and petrochemical industries flourished in the state. In 1939 (the earliest data available from the U.S. Census of Manufacturers), the chemical industry employed about 6,800 production workers, and the petroleum refining industry employed 19,000 (accounting for 5.5 and 15 percent of total manufacturing employment, respectively). Refining's share of state output was highest in 1939 at 28 percent of total manufactured goods. By 1958, the Texas petroleum refining industry reached its zenith with 43,000

employees.

Today, the refining industry contributes about 11 percent of Texas manufacturing output and 1.5 percent of total Texas output. Employment has also steadily declined to less than 0.3 percent of total Texas employment (*Chart 3*). The petrochemical industry provides about 12 percent of Texas manufacturing output, 1.6 percent of total Texas output and less than 0.9 percent of total Texas employment.

The refining and petrochemical industries provide some counterbalance to the effects of changing energy prices on the Texas economy. These two industries generally are hurt by rising oil and natural gas prices.

Chart 4
Texas Economy Diversifies Away from Mining After Mid-1980s



NOTE: TCPU is transportation, communications and public utilities; FIRE is finance, insurance and real estate.

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

Diversification of the Texas Economy

As output in the Texas mining industry shrank, output in other Texas industries continued to grow after the mid-1980s. Texas saw output gains in manufacturing, construction, agriculture and the service-producing sectors—wholesale and retail trade; transportation, communications and public utilities (TCPU); services; finance, insurance and real estate (FIRE); and government (*Chart 4*). Growing at a faster rate than total Texas gross state product, manufacturing, trade, TCPU, services and FIRE accounted for increasing shares of Texas output. In contrast, agriculture, construction and government posted decreasing shares.

A similar picture emerges for Texas employment since the mid-1980s. Services, construction and trade grew faster than total employment and accounted for increasing shares of Texas nonfarm employment (*Chart 5*). Employment shares for TCPU and FIRE remained relatively constant, while those for manufacturing and government decreased along with mining.

Oil and the Texas Economy

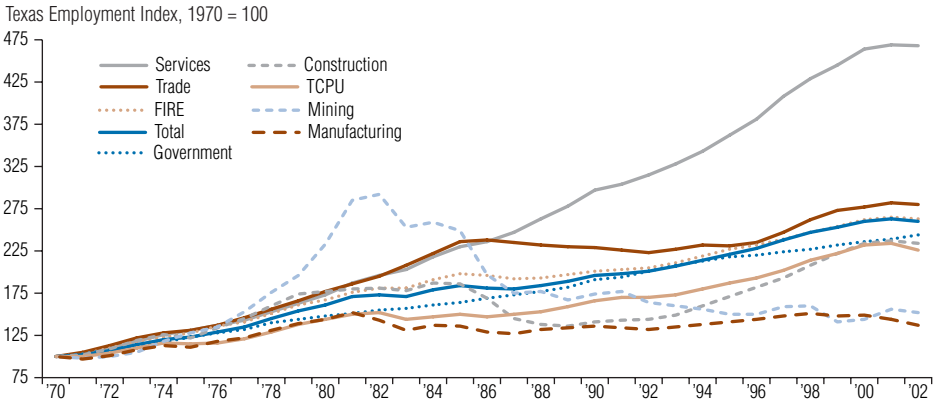
Even without a rigorous analysis, it's evident the relationship between energy prices and the Texas economy has changed since the 1980s. Oil and gas production accounted for 19.4 percent of Texas output in 1981 and only 6 percent in 2002. Similarly, output and employment in energy-related industries, such as oil and gas field machinery, claim a smaller share of the Texas economy today than in the early 1980s.

To examine in more detail how the Texas economy's diversification away from energy-producing industries has affected its response to volatile energy prices, we developed an econometric model that captures the effects of oil price shocks on the Texas economy for the period 1970–2002.[2] We find that the relationship between oil prices and the Texas economy is considerably different today than it was during the oil boom and bust years of the 1970s and 1980s.

Our analysis reveals that the relationship between oil prices and the Texas economy breaks between 1987 and 1988, which indicates that the effects of changing oil prices on the economy were different in 1970–87 than in 1988–2002. To determine just how this relationship differed across the two periods, we analyze the data in two different ways. We examine how much of the actual fluctuation in Texas output and employment arose from oil price shocks and other causes in each of the two periods. We also estimate and compare by how much Texas output and employment would have responded to a 10 percent oil price shock in each of the two periods.

We find changes in oil prices accounted for a much higher percentage of fluctuations in the Texas economy in 1970–87 than in 1988–2002. In the earlier period, nearly half the fluctuation in Texas output (46 percent) arose from changing oil prices. In the latter period, however, less than 10 percent of Texas output fluctuations arose from oil price shocks. In

Chart 5
Texas Employment Shifts Away from Mining After Early 1980s



NOTE: TCPU is transportation, communications and public utilities; FIRE is finance, insurance and real estate.

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

contrast, the fluctuations in U.S. GDP accounted for about 40 percent of the fluctuations in Texas output in the latter period.

The Response to Oil Price Shocks

The Texas economy's response to an oil price shock is significantly different in the two periods (*Table 1*). For 1970–87, we estimate that an oil price increase would have led to sustained gains in both output and employment. In particular, a 10 percent increase in oil prices would have led to a 2.6 percent increase in Texas gross state product and about a 1 percent increase in employment.[3] An oil price increase of 10 percent also would have temporarily boosted the growth rate of the Texas economy, with output growing 1 percent faster during the next few quarters and employment growing 0.1 percent faster over the next three to four months, then a little slower thereafter.

The economy was much less responsive to oil prices in the period 1988–2002, and the nature of the response was different. In the second period, a 10 percent increase in oil prices would have led to only about a 0.4 percent gain in gross state product. The net response of employment to a rise in oil prices is basically nil. The negligible result in employment may arise from the energy sector's greatly muted response to oil price fluctuations in the latter period and the inability or reluctance of oil companies to hire new employees as energy prices rose.

To further examine the channels through which oil price shocks affect the Texas economy, we examined the effects of oil price shocks on the rig count and oil and gas employment in both periods. We found that the rig count responded much more strongly to oil price increases in the first period than in the second. For 1970–87, we estimate that a 10 percent increase in oil prices would have boosted the rig count by 20 percent. In contrast, the same percentage increase in oil prices in 1988–2002 would have yielded only a 6.6 percent increase in the rig count.

Table 1
Effect of a 10 Percent Increase in Oil Prices on Texas Economy

	Texas GSP	Texas nonfarm employment	Rig count	Oil and gas employment
1970–1987	+2.6%	+1.0%	+20%	+9.5%
1988–2002	+0.4%	0	+6.6%	+1.1%

Our estimates confirm the Texas economy has become less sensitive to oil price fluctuations, but it still responds favorably to higher energy prices.

Similarly, oil and gas employment showed a much smaller response in the second period. We estimate that a 10 percent increase in oil prices would have generated a 9.5 percent increase in Texas oil and gas employment for 1970–87 but only a 1.1 percent employment increase in 1988–2002.

One reason for the weaker response in the rig count and employment may be changes in technology. After the 1986 crash in oil prices, companies improved oilfield technology and produced more oil with fewer rigs. Therefore, the same rise in oil prices brings forth fewer rigs and oilfield workers in the latter period. In addition, contacts in the industry say there are fewer prospects for new drilling in Texas, and companies are increasingly shifting their drilling overseas.[4]

Oil Price Effects on the Texas Economy

Over the past 20 years, the Texas energy industry has shrunk while other sectors of the Texas economy have grown. Nonetheless, Texas produces more oil and gas than any other state in the nation. Texas accounts for 20 percent of crude oil and 26 percent of natural gas production in the United States (excluding federal offshore). Texas also exports oil and natural gas to the rest of the nation. Consequently, higher energy prices still benefit the state—even if it is by less than in the boom years of the 1970s and early 1980s.

Our estimates confirm the Texas economy has become less sensitive to oil price fluctuations, but it still responds favorably to higher energy prices. During the 1970–87 period, a 10 percent increase in oil prices would have boosted Texas gross state product by 2.6 percent and employment by 1 percent. During the 1988–2002 period, a 10 percent increase in oil prices would have raised Texas gross state product by 0.4 percent with no significant net effect on employment.

We find evidence for two ways in which the Texas economy has become less sensitive to fluctuations in oil prices than it was in the 1970s and 1980s. The first is that oilfield activity has become less sensitive to fluctuations in energy prices. The second is that the energy industry makes up a smaller share of the Texas economy than it used to. Together these factors have meant that Texas output is about 15 percent as sensitive to oil price fluctuations as it was from 1970 to 1987. Texas nonfarm employment no longer seems to be affected by oil price fluctuations.

Brown is a senior economist and assistant vice president and Yücel is a senior economist and vice president in the Research Department of the Federal Reserve Bank of Dallas.

Notes

This article was previously published under the title "The Effect of High Oil Prices on Today's Texas Economy," in Federal Reserve Bank of Dallas *Southwest Economy*, September/October 2004.

1 See "Oil and Gas Industry," *The Handbook of Texas Online*, www.tsha.utexas.edu/handbook/online.

2 We use a vector-autoregressive model with oil prices, U.S. GDP, Texas gross state product, Texas nonfarm employment, Texas employment in oil and gas extraction, and the Texas rig count as variables.

3 These results are similar to those found in "Energy Prices and State Economic Performance," by Stephen P. A. Brown and Mine K. Yücel, Federal Reserve Bank of Dallas *Economic Review*, Second Quarter 1995. Using input–output analysis, Brown and Yücel estimate that a 10 percent increase in oil prices would have boosted Texas employment by 1.37 percent in 1982 and by 0.3 percent in 2000.

4 Drilling has shifted toward natural gas in the United States and Texas, but because natural gas prices generally moved with oil prices during the estimation periods, the shift may not alter the rig count's weakening response to oil prices.

The Changing Face of Texas

Population Projections and Implications

D'Ann Petersen and Laila Assanie

The key issue facing Texas will be to reduce the economic and educational disparities prevalent among the state's ethnic groups as the population continues to grow and evolve.

Rich natural resources, abundant land, a central location within the United States and a business-friendly environment have long attracted both immigrants and U.S. natives to Texas. As a result, the state's population is faster growing, younger and more diverse than the nation's.

These rapid demographic changes present challenges for the future. As the state's baby boomer population ages, more demands will be placed on housing, health care and social services. Hispanics, already a dominant force in Texas, are expected to become the majority population group by 2020. The significant increase in this population (both immigrant and native) has far-reaching implications for education, housing and the labor force. The key issue facing Texas will be to reduce the economic and educational disparities prevalent among the state's ethnic groups as the population continues to grow and evolve.

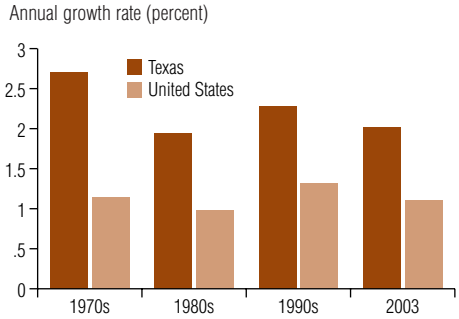
This article looks at population growth and demographic changes of recent decades. Then, with projections from the Texas State Data Center, we examine some sectors of the economy that will be challenged by these demographic forces in the coming decades.

Texas: Big and Getting Bigger

Since the early 1900s, Texas has grown faster than the nation. However, during the Texas oil boom, the state's population growth accelerated. From 1970 to 1980, as oil prices spiraled upward and people flocked to Texas, its population grew by 2.71 percent per year, while the nation's increased at a 1.14 percent pace (*Chart 1*). Even during the 1980s, which witnessed an oil and real estate bust, Texas almost doubled the nation's population growth.

During the 1990s, Texas again exceeded expectations and grew by its largest amount yet, adding almost 3.9 million residents and surpassing New York as the second most populous state. Many immigrants and residents from other

Chart 1
Texas and U.S. Population Growth, 1970–2003



SOURCE: Census Bureau.

Table 1
Total Population and Components of Population Change in Texas, 1950–2003

	Population	Total increase	Natural increase	Net migration	Percent change	Percent change due to: Natural increase	Percent change due to: Net migration
1950	7,711,194						
1960	9,579,677	1,868,483	1,754,652	113,831	24.23	93.91	6.09
1970	11,196,730	1,617,053	1,402,683	214,370	16.88	86.74	13.26
1980	14,229,191	3,032,461	1,260,794	1,771,667	27.08	41.58	58.42
1990	16,986,510	2,757,319	1,815,670	941,649	19.38	65.85	34.15
2000	20,851,820	3,865,310	1,919,281	1,946,029	22.76	49.65	50.35
2003*	22,103,374	1,259,945	699,685	560,260	6.04	55.53	44.47

*Through July 2003.

SOURCE: Census Bureau.

states were drawn to Texas' strong economy and rapidly expanding high-tech centers, such as Austin and Dallas' telecom corridor.

Even with the drastic economic downturn of 2001, which hit Texas much harder than most other areas of the nation, the state gained an additional 1.26 million residents from 2000 through 2003, for a total of 22 million, again growing twice as fast as the nation. Although domestic in-migration—people moving to Texas from other states within the United States—slowed during Texas' hard economic times, the state's high birthrate and a strong pace of immigration kept population growing at a healthy speed. The combination of these factors—higher international immigration, a high Hispanic birthrate and less domestic migration—resulted in Texas' Anglo population dipping below the majority level of 50 percent in 2003 for the first time since the 1800s.

Why the Rapid Growth?

Two major factors are spurring Texas' rapid population growth. One is the state's higher-than-average birthrate. This is partly a result of the state's Hispanic heritage and its ties to Mexico, where total fertility rates were 2.5 percent in 2004, quite a bit higher than the United States' 2.1 percent.[1] In 2000, Texas was second in the country (behind Utah) in state rankings for birth/fertility rates. Because birthrates change slowly over time, Texas will probably continue to see large natural increases in its population despite changes in economic conditions or immigration policies.

Perhaps the most important factor behind Texas' more recent population growth is the strong pace of net migration. Historically, people have been drawn to Texas because of its abundant land and natural resources. In more recent years, people and businesses were drawn by Texas' robust economy and favorable business climate. Net migration, which includes both domestic in-migration and international immigration, was highest during periods of greatest economic expansion—the 1970s oil boom (58.4 percent) and the 1990s high-tech/telecom boom (50.4 percent)—and accounted for a larger share of the state's population growth than natural increase (*Table 1*). Interestingly, even with the state's recession in 2001–03, net migration remained relatively high, thanks to strong international immigration, accounting for 44.5 percent of Texas' population increase.

How Has Immigration Changed the Face of Texas?

The healthy pace of Texas' population growth that began in the 1990s is due in large part to strong international immigration, which surpassed domestic in-migration as a contributor to population growth in six of the nine years during the 1990s.[2] Immigration reached historic proportions as the number of foreign-born in Texas increased by approximately 1.38 million. In addition, immigrants kept Texas population growing during the recent economic downturn and tepid recovery. From April 2000 to July 2003, Texas net migration totaled 560,260, including 430,048 (77 percent) international immigrants (*Table 2*).

Texas is one of the most popular immigrant gateways to the United States.

Table 2
Total Population and Components of Population Change in United States and Texas

Geographic area	Total population change (April 2000–July 2003)	Natural increase: Births	Natural increase: Deaths	Natural increase: Total	Net migration: Net international migration	Net migration: Net internal migration	Net migration: Total	Natural increase: Total (percent)	Net migration: Total change (percent)	Net migration: Net international migration (percent)	Net migration: Net internal migration (percent)
United States	9,364,374	13,098,788	7,843,040	5,255,748	4,108,626	0	4,108,626	56.12	43.88	43.88	0
Texas	1,259,945	1,189,400	489,715	699,685	430,048	130,212	560,260	55.53	44.47	34.13	10.33

SOURCE: Census Bureau.

Chart 2 shows the percentage growth of the foreign-born population in the United States, Texas and the state's six major metros during the 1990s. The foreign-born population share in Texas rose significantly during the decade and in 2000 composed 14 percent of the population compared with 11 percent at the national level.

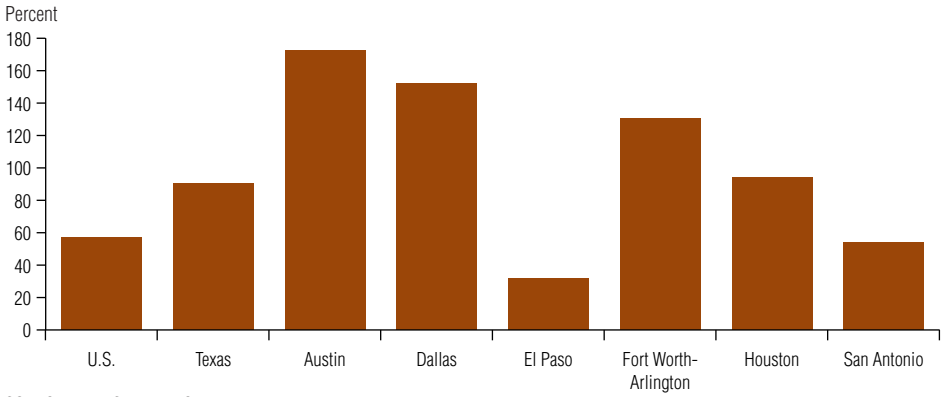
In recent years, growth of the foreign-born has been even more rapid in Texas' major metros than in its border metros. Between 1990 and 2000, the number of foreign-born in the major metros more than doubled (112 percent increase), while that of the border metros increased 51.6 percent, well below the state average of 90.2 percent.[3]

Of Texas' major metros, only El Paso (31.5 percent) and San Antonio (54.3 percent) recorded foreign-born growth rates below the U.S. average (57.4 percent), mostly because many of the immigrants in these metros entered the state in earlier years and their second-generation children now reside there. Austin witnessed the strongest growth in the foreign-born during the 1990s (172 percent), likely due to the booming tech economy there. The share of the foreign-born in Dallas, Fort Worth and Houston grew by 152 percent, 131 percent and 94 percent, respectively. Shares of the foreign-born in the major metros are shown in Chart 3.

This increase in immigration has brought rapid change in the state's ethnic composition. Because of Texas' proximity to Mexico, many of the state's immigrants are of Hispanic origin. Hispanics are by far the fastest growing segment of the population. During the 1990s, Texas' Hispanic population grew at a pace of 54 percent, adding more than 2.3 million people. As a result, Hispanics now make up 35 percent of the state's population, compared with roughly 14 percent at the national level.[4] Among states, Texas has the country's second-highest Hispanic population, behind only California.

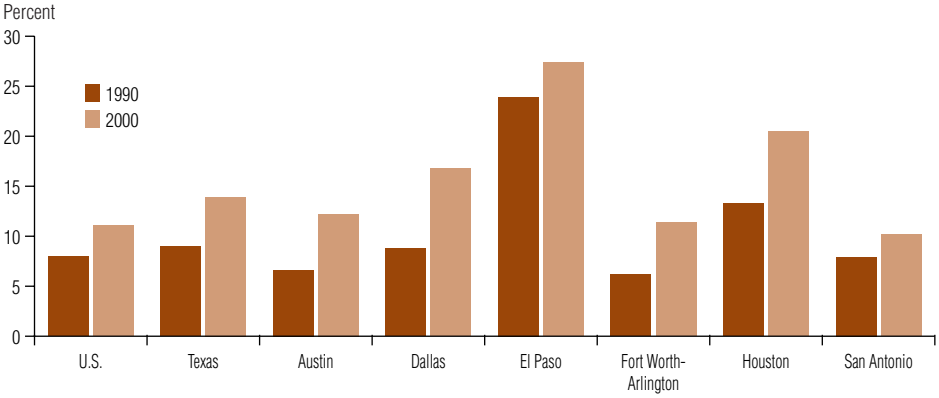
Texas' population has changed in other ways as well. Anglos' share of the total population has fallen—no longer above 50 percent—as their rate of growth slowed in the '90s and the first three years of this decade, while blacks still account for about 11 percent of the state's population (*Chart 4*). The number of people included in the "other" category has doubled since the 1990s.[5]

Chart 2
Growth of Foreign-Born, 1990–2000



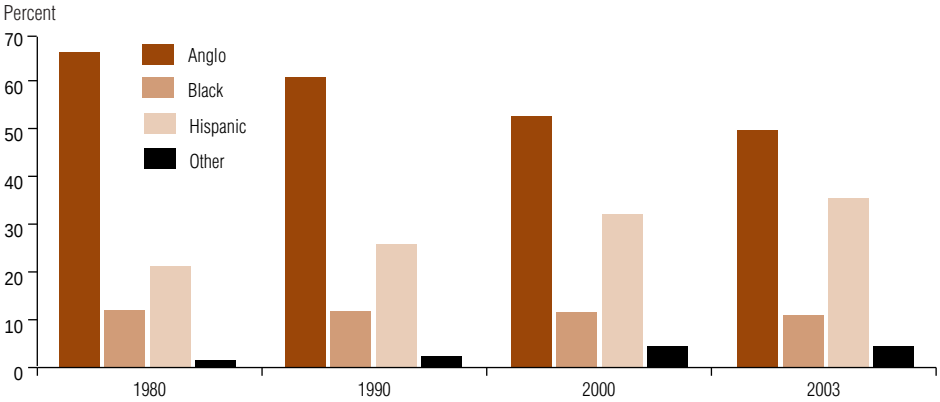
SOURCE: Texas State Data Center.

Chart 3
Share of the Foreign-Born



SOURCE: Census Bureau.

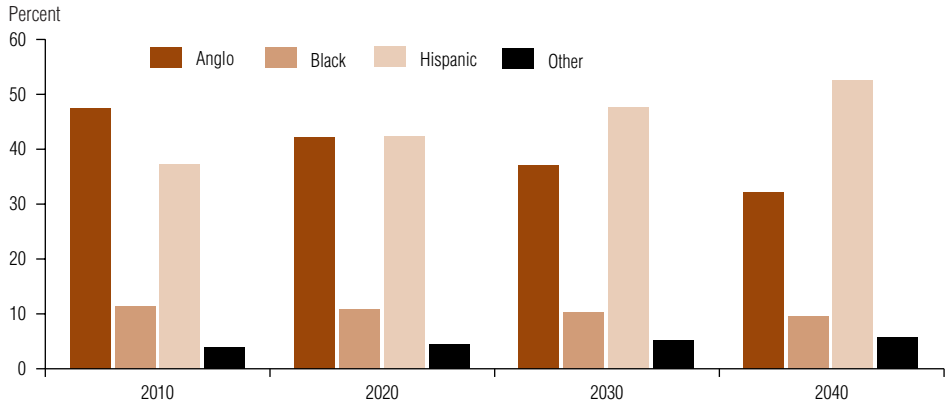
Chart 4
Change in Ethnicity/Race for Texas



SOURCES: Census Bureau; Texas State Data Center.

In recent years, growth of the foreign-born has been even more rapid in Texas' major metros than in its border metros.

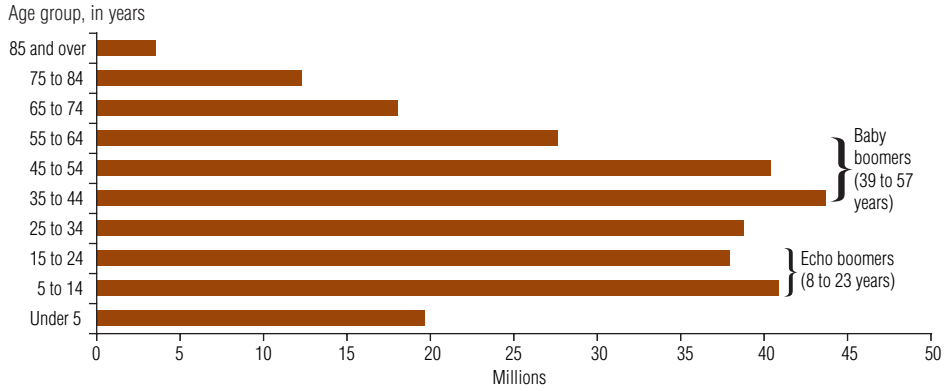
Chart 5
Projected Proportion of Texas Population by Race/Ethnicity



NOTE: Assuming net migration rate is half that of 1990–2000.

SOURCE: Texas State Data Center.

Chart 6
U.S. Population by Age in 2003



SOURCE: Census Bureau, American Community Survey 2003.

The dramatic rise in Texas' Hispanic population (both immigrant and native) has far-reaching implications. Hispanics' higher-than-average birthrate suggests that this demographic segment will continue to grow at a more rapid pace than that of Anglos and blacks, even assuming no immigration. In addition, Hispanics, on average, are younger, which has ramifications for housing, education and the labor force. In 2000, the median age of Hispanics in Texas was 25.5 versus 38 for Texas Anglos. This compares with the median age for all Texans of 32.3 and for the United States of 35.3. Currently, because of its Hispanic heritage, Texas is the second youngest state in the nation, behind Utah.

Population Projections

Texas' population will change in two major ways over the next several decades: in diversity and in age.

Diversity. The Texas State Data Center projects that by 2020, Hispanics will make up the majority of Texas' population, while Anglos will fall to the second-most-populous ethnicity (*Chart 5*). By the year 2040, Hispanics will account for over 50 percent of all Texans, while one-third of the population will be Anglo. Blacks are expected to make up 9.5 percent of Texas' population in 2040, and other races (not Anglo, black or Hispanic) are expected to grow to almost 6 percent of the population.[6]

For Texas' border cities, which already have large Hispanic populations, the changes could be even more dramatic. For instance, El Paso, 78.2 percent Hispanic now, will likely increase to 90.3 percent by 2040. Similarly, San Antonio, with its ties to Mexican heritage, will move from 50 percent Hispanic (in 2000) to 61.1 percent in 2040. Even Austin, where Hispanics make up only 26 percent of the total today, is expected to see a major increase in its Hispanic population by 2040—up to 44 percent.

Currently, large disparities mark socioeconomic conditions among Texas' ethnic groups. Compared with their Anglo counterparts, Texas' Hispanics tend to have lower levels of education, have lower wages and depend more on state services. This is partly a result of immigration—Mexican immigrants tend to have average wages 40 percent below those of natives.[7] These wage differences reflect that the immigrants are young, have scant job experience and speak little English.

While some of the difference between immigrants' and natives' wages is made up after substantial time in the United States, disparities between groups remain. Without changes in socioeconomic conditions, this implies that Texas' future population could be less educated, less competitive, poorer and more in need of state services such as health care and welfare. Texas' challenge is to reduce these socioeconomic differences through increased educational attainment and training, so Texas can compete in the nation's workforce in coming decades.

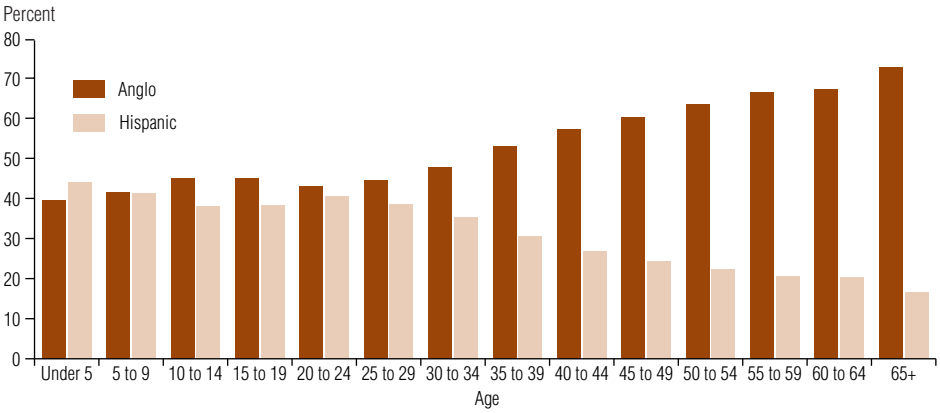
Age. Texas' overall population, like the nation's, is growing older. This aging is a result of the maturing of the baby boom generation, which makes up the largest segment of our population. In 2003, the baby boomers spanned the ages 39 to 57 (*Chart 6*). The youngest of the baby boomers will turn 60 by 2024. As they retire, the baby boomers will put large demands on the Social Security system and other government programs for the elderly, such as Medicare. In addition, the boomers may drive housing demand toward move-up or second homes as well as houses more popular with older adults or combined families.

One factor that may mitigate Texas' aging population is that the fast-growing Hispanic population has a different age structure than the Anglo population. As Chart 7 shows, in 2000 the population in age groups over 35 was predominantly Anglo. For example, in 2000, 66 percent of Texans aged 55–59 were Anglo compared with 20 percent that were Hispanic. Con-

versely, of Texans aged 5 and under, 44 percent were of Hispanic heritage, compared with 39 percent Anglo.

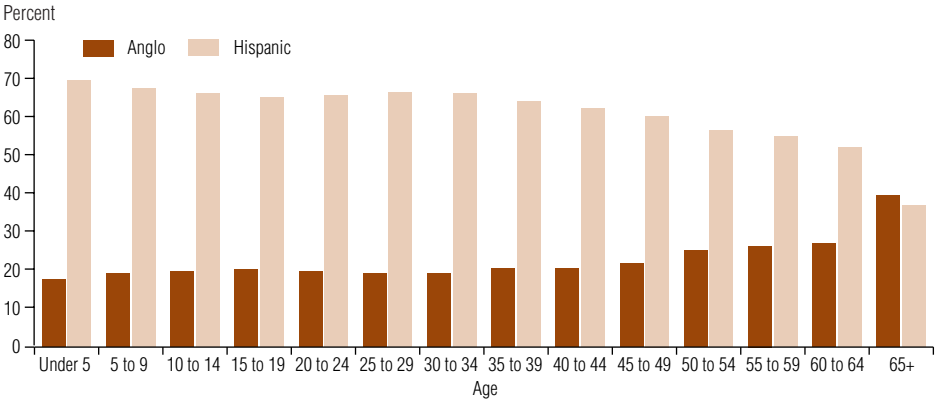
If expectations of rapid growth hold true for Texas' Hispanic population, Hispanics will make up a much higher percentage of most age groups by the year 2040, with only those over 65 being predominantly Anglo (*Chart 8*).[8] The age differential between the Hispanic and Anglo populations has important implications for education, housing and state services.

Chart 7
Texas Population by Age and Ethnicity, 2000



SOURCE: Texas State Data Center.

Chart 8
Texas Population by Age and Ethnicity, 2040



NOTE: Assuming net migration rate to the state is equal to that of 1990–2000.

SOURCE: Texas State Data Center.

Demographics and Poverty

Texas Becoming Poorer? Texas' economy grew faster than the nation's during the 1990s, and all sectors added jobs. Employment in Texas during this period grew at an annualized average rate of 3.3 percent, above the nation's 2.2 percent. Despite this phenomenal growth in employment, Texas has the eighth highest poverty rate in the country and has not yet achieved per capita income parity with the nation.

During the 1990s, Texas per capita income grew rapidly—at an annual average rate of 7.2 percent, which exceeded the nation's 5.7 percent. Consequently, Texas, which began the decade at 89 percent of U.S. per capita income, edged up to 95 percent of the U.S. average by 2000. Moreover, poverty rates in the state declined—from 18.1 percent in 1989 to 15.4 percent in 1999—thanks to a strong economy.

Although Texans' incomes improved during the '90s, succeeding years have seen a reversal of this phenomenon. According to 2003 data, the Texas poverty rate rose to 16.3 percent and Texas nominal per capita income fell to 93 percent ($29,372) of the U.S. average ($31,632) as the Texas economy slumped into the recession that started in 2001 and lasted until mid-2003. The state's higher concentration of high-tech and transportation industries, which were the hardest hit, intensified the recession's impact. Hence, these industries shed a substantial number of high-paying jobs, pushing down the state's per capita income more so than the U.S. average. Also, Texas' recovery from the recession has been unusually weak.[9]

Ethnic Disparities. Among ethnic groups, Hispanics are undoubtedly the largest segment in poverty in Texas. In 1999, more than 1.6 million (25.4 percent) Hispanics in Texas were poor.[10] Their median household income was $29,873, far below the Texas average of $39,927. This is an alarming number, given the importance of this segment to Texas' future.

Blacks had the second-highest poverty rate (23.4 percent) with a median income less than that of Hispanics. Anglos fared best, with the lowest poverty rate (7.8 percent) and the highest median household income ($47,162 in 1999) in Texas.

The disparity among ethnicities when it comes to income and poverty is not surprising. Natives (predominantly Anglo) are far more likely to have a high school diploma and some college education than immigrants (predominantly Hispanic).[11] Less-educated individuals tend to be lower-skilled workers employed in low-paying jobs. In addition, because the non-Anglo population in Texas is far younger than the Anglo population, a large percentage of non-Anglos are in their early earning years, have scant work experience and thus are more likely to have lower incomes.

Implications

If the income differential between Anglos and non-Anglos persists, a larger share of Texans could be drawn into poverty in the future. According to the Texas State Data Center, the share of households with annual incomes of $25,000 or less will increase from 30.7 percent (in 2000) to 37.5 percent by 2040. Moreover, the percentage of families with earnings exceeding $100,000 will fall from 11.5 percent to 8.5 percent. The net impact could be a decline in real

Where the Poor Reside in Texas

The poor live all over the state, but the border metros fare worst, with the highest poverty rates (*see table*). Although poverty rates declined in the border metros during the 1990s as the economy boomed, the share of the population below poverty level remained well above the state average of 15.4 percent in 1999. McAllen, Brownsville and Laredo had more than 30 percent of their population in poverty, while almost one-fourth of those living in El Paso were poor.

The picture for the border metros has not improved much since 1999. According to 2003 census data, Hidalgo County (McAllen MSA), Cameron County (Brownsville MSA) and El Paso County (El Paso MSA) rank among the top four counties in the United States with the highest share of individuals living in poverty.

In contrast, poverty levels in the major metros have rarely been above the state average (*see table*). However, they have been higher than the U.S. average in some major metros. For instance, since 1989, both San Antonio and Houston have recorded poverty rates slightly higher than the U.S. average. In fact, Houston is home to the highest number of poor Texans (623,493). Dallas traditionally has posted lower poverty rates than the nation, but the recent economic downturn pushed its rate slightly above the U.S. average. The higher poverty rates in the Texas border metros and some major metros may be a result of their above-average shares of international immigrants.

Poverty Characteristics of United States, Texas and Its Major and Border Metros

	Individuals below poverty			Percent below poverty		
Place	1989	1999	2003	1989	1999	2003
United States	31,742,864	33,899,812	35,846,289	13.1	12.4	12.7
Texas	3,000,515	3,117,609	3,508,230	18.1	15.4	16.3
Austin	129,942	134,589	171,373	15.9	11.1	12.8
Brownsville	101,362	109,288	130,733	39.7	33.1	36.5
Dallas	322,604	384,146	488,602	12.3	11.1	13.0
El Paso	155,298	158,722	189,596	26.8	23.8	27.4
Fort Worth/Arlington	147,177	171,930	193,427	11.0	10.3	10.7
Houston	494,457	572,410	623,493	15.1	13.9	14.1
Laredo	50,116	59,339	n.a.	38.2	31.2	n.a.
McAllen	159,216	201,865	238,333	41.9	35.9	38.0
San Antonio	252,301	234,478	266,248	19.5	15.1	16.2

NOTE: 1999 poverty data are the latest available for Laredo MSA.

SOURCES: Census Bureau; Texas State Data Center.

income, reduced tax revenue per household and increased burden on the state government to pay for welfare services in Texas. As the state is likely to depend progressively more on non-Anglo Texans for future tax revenues, it is important to lessen the existing wage gap and education differential between ethnic groups.

Education and the Labor Force. One way to reduce the wage gap is through education and training. In fact, according to the Texas comptroller, every dollar invested in Texas' higher education system returns $5 or more to the Texas economy. Hence, it is essential that the education system keep up with the state's changing demographics.

Texas' education record is nothing to brag about. Texas ranks second to last among the 50 states in its share of the population 25 years or older with a high school diploma (only 77.8 percent). Furthermore, in 2003 several Texas cities (Dallas, El Paso, Fort Worth, Houston and San Antonio) ranked in the bottom third among major U.S. cities in shares of high school graduates.[12]

Again, the statistics vary by race. For instance, Anglos in Texas are more likely to be high school graduates (87.2 percent in 2000) than their non-Anglo counterparts, especially Hispanics. In 2000, more than half the Hispanic population in Texas did not have a high school diploma. Anglos are also more likely to attain higher levels of education than non-Anglos, excluding Asians. According to the Pew Hispanic Center, Hispanics are half as likely as Anglos to graduate from college with a bachelor's degree by age 26 (23.2 percent for Hispanics versus 47.3 percent for Anglos). Much of the disparity is due to rapid Hispanic immigration into the state: immigrants' wages and education levels tend to be much lower than natives'.[13]

Hispanics are expected to make up the majority of the labor force in Texas by 2040. If this disparity between Anglo and non-Anglo high school and college graduation rates continues, the Texas economy could face several important challenges.

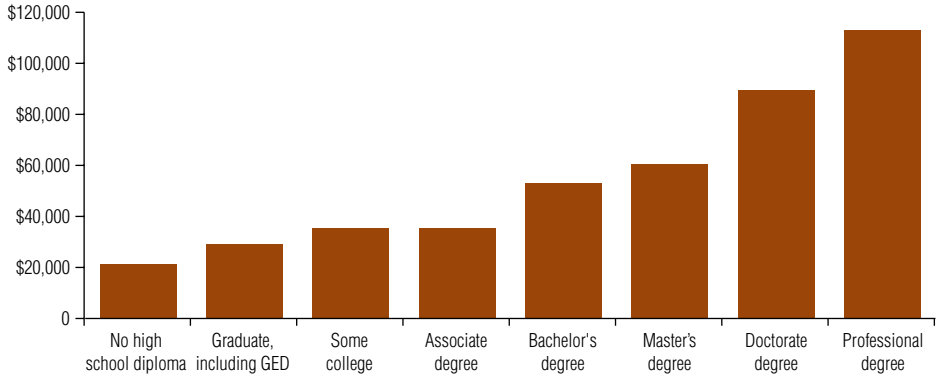
First, according to the Texas State Data Center, by 2040 approximately 30.1 percent of the labor force will not have a high school diploma, up from 18.8 percent in 2000.[14] If that occurs, a higher share of Texas' workforce would be less educated and low skilled, possibly making the Texas economy less competitive.

Second, empirical studies show that low education levels are associated with lower income levels; therefore, failure to complete high school or college negatively impacts average earnings.[15] Earnings data from the Census Bureau demonstrate this point (*Chart 9*). An increasing number of less-educated laborers would reduce the average income of Texans and in turn decrease tax revenues collected by the state.

Third, overall enrollment in public schools is estimated to climb rapidly, growing at about half the state's population growth rate, according to the State Data Center. Most of this increase in student enrollment—Hispanics by almost 100 percent and the "other" category by 71 percent—is expected to result from growth in the non-Anglo population because of its younger age structure.

Thus, state expenditure on public

Chart 9
U.S. Mean Earnings in 2002 by Educational Attainment



SOURCE: Census Bureau, Current Population Survey, 2003.

education as well as the number of students requiring financial assistance could expand rapidly unless socioeconomic differences between races are reduced. Rising education costs coupled with slow growth in tax revenues would adversely impact the state's financial situation.

However, it is naive to assume that the current income differential between Anglos and non-Anglos will persist unchecked. Empirical research shows that second and third generations of immigrants are more likely than their forefathers to have access to higher level education and, therefore, are better equipped with skills required for higher paying jobs. Hence, the wage gap between non-Anglos and Anglos is likely to be reduced in the future.[16]

For the Texas economy to remain robust, it is essential that the state's education system make progress on at least two fronts: (1) investing in resources to improve overall student achievement, and (2) developing programs that help bridge the educational attainment gap between racial and ethnic groups.

Housing. What does the future hold for the housing industry as Texas' population changes over the next several decades? The aging of the overall population, along with the baby boomers, will certainly impact the housing industry in Texas as well as every other state. The youngest baby boomers turn 40 this year, and boomers are turning 50 at the rate of seven every minute and will continue to do so through 2013 (*see Chart 6*). This segment of the population, along with aging seniors, will be among the most potent forces affecting the housing market and home ownership in the coming decades. It remains to be seen what boomers' preferences will be—whether they remain in their current homes, trade up or purchase vacation homes. Most boomers are entering the stage of life when earnings peak—thus, they may choose more affluent homes or ones featuring amenities more popular with empty nesters.

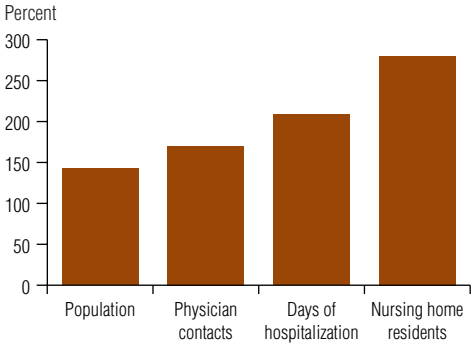
The demographic shift of the baby boom generation leaves fewer households headed by those in the starter home market, ages 25 to 34, which could mean a slowdown in starter home construction. However, immigrants and minorities, who have had historically lower home-ownership rates than Anglos, will likely take up some of the slack. Home ownership is expected to increase dramatically for minority and foreign-born households in the coming decades, especially in areas that have experienced high levels of immigration, like Texas. Because Texas' Hispanic population is younger and faster growing than the overall population, many Hispanic-headed households will move into the prime home-buying age groups in the coming decades, which could give Texas homebuilders a boost.

This has important implications for the apartment market in the short run as well, with Hispanics currently more likely to rent than own. According to census data, in 2002 the U.S. home-ownership rate for Hispanics was 48.2 percent versus 71 percent for Anglos. Thus, Hispanics have the potential to become a much larger segment of the home-buying market.

Home ownership is expected to increase dramatically for minority and foreign-born households in the coming decades, especially in areas that have experienced high levels of immigration, like Texas.

Chart 10

Between 2000 and 2040, Texas' Health Care Costs Could Grow Faster Than Its Population



NOTE: Assuming net migration rate to the state is equal to that of 1990–2000.

SOURCE: Texas State Data Center.

Texas' housing market stands to benefit from its rapidly growing and diverse population and its strong pace of international migration. Real estate firms of the future will be wise to market to both the increasingly older Anglo population and the younger Hispanic population. Additionally, while domestic migration dropped off during the recent economic downturn, a pickup in that segment of the population would benefit Texas housing.

Health Care. The aging of the Texas population plus a rapidly growing population segment with different socioeconomic characteristics than the previous Anglo majority will dramatically affect the health care industry in Texas. The number of instances of diseases and disorders is expected to increase in Texas. Trips to the doctor, days in the hospital and the number of people in nursing care facilities are all expected to rise at rates faster than the population growth rate (*Chart 10*). The health care industry is currently one of the fastest growing sectors of the Texas economy and will likely remain so as the need increases for long-term care facilities and doctors who treat the elderly and a more diverse population.

Outlook

During the 1990s, Texas grew even faster than expected, becoming the second-largest state in the nation. Along with this growth, the population has become older and increasingly diverse, and today it is no longer dominated by an Anglo majority. Hispanics account for the fastest growing segment of Texas' population and will likely make up the majority by the year 2020. Disparities in income and education between Hispanics and other ethnic groups may be a challenge to Texas and its resources. The state could reduce such socioeconomic differences through increased educational attainment and training so that in coming decades, the state's workforce will continue to be one of the most competitive in the nation.

Petersen is an associate economist and Assanie is an assistant economist in the Research Department of the Federal Reserve Bank of Dallas.

Notes

The data used in this article come from two main sources, the Census Bureau and the Texas State Data Center. The two sources differ somewhat in terminology regarding race/ethnicity. Thus, in an attempt to keep the information consistent within the article, the authors use the terminology provided by the Texas State Data Center. For more information regarding the definitions of race/ethnicity, see http://txsdc.utsa.edu/txdata/redistrict/re-report.php and http://www.census.gov/population/www/socdemo/compraceho.html.

1 Census Bureau, International Database. For a definition of total fertility rates, see www.census.gov/ipc/prod/wp02/appE.pdf.

2 See "The Second Great Migration: Economic and Policy Implications," by Pia Orrenius and Alan Viard, Federal Reserve Bank of Dallas *Southwest Economy*, May/June, 2000.

3 Major metros exclude El Paso. The number for El Paso has been included with the other border metros.

4 American Community Survey 2003, Census Bureau, www.census.gov/acs/www/index.html.

5 The term Anglos refers to non-Hispanic whites only. The term blacks refers to non-Hispanic blacks of African as well as non-African origin. The "Other" category includes all people who are not Anglos, not Hispanics and not blacks. Native Americans, Asians and multiracial people are grouped in this category.

6 All projections provided by "The Texas Challenge in the Twenty-First Century: Implications of Population Change for the Future of Texas," by Steve Murdock et al., The Center for Demographic and Socioeconomic Research and Education, December 2002. Projections used in this article assume population growth due to net migration is half that of 1990–2000 unless specified otherwise. See www.txsdc.utsa.edu.

7 See Orrenius and Viard, 2000.

8 Projections are based on the assumption that the net migration rate to the state is equal to that of 1990–2000.

9 Also in 2003, Texas' median household income ($40,674) was below the national average of $43,564, putting Texas 32nd in terms of median household income among the states.

10 The Census Bureau uses a threshold updated every year for inflation to determine the poverty level. If an individual's or family's income before taxes and excluding capital gains or losses falls below the applicable threshold, the individual or family is considered poor. See the Census Bureau's web site (www.census.gov) for poverty threshold schedule.

11 See Orrenius and Viard, 2000.

12 American Community Survey 2003, Census Bureau.

13 See "Immigrant Assimilation: Is the U.S. Still a Melting Pot?" by Pia Orrenius, Federal Reserve Bank of Dallas *Southwest Economy*, May/June 2004.

14 Projection provided by Murdock et al., 2002, assuming net migration rate to the state is equal to that of 1990–2000.

15 "Educational Attainment and Border Income Performance," by Thomas Fullerton, Federal Reserve Bank of Dallas *Economic and Financial Review*, Third Quarter 2001.

16 See Orrenius, 2004.

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