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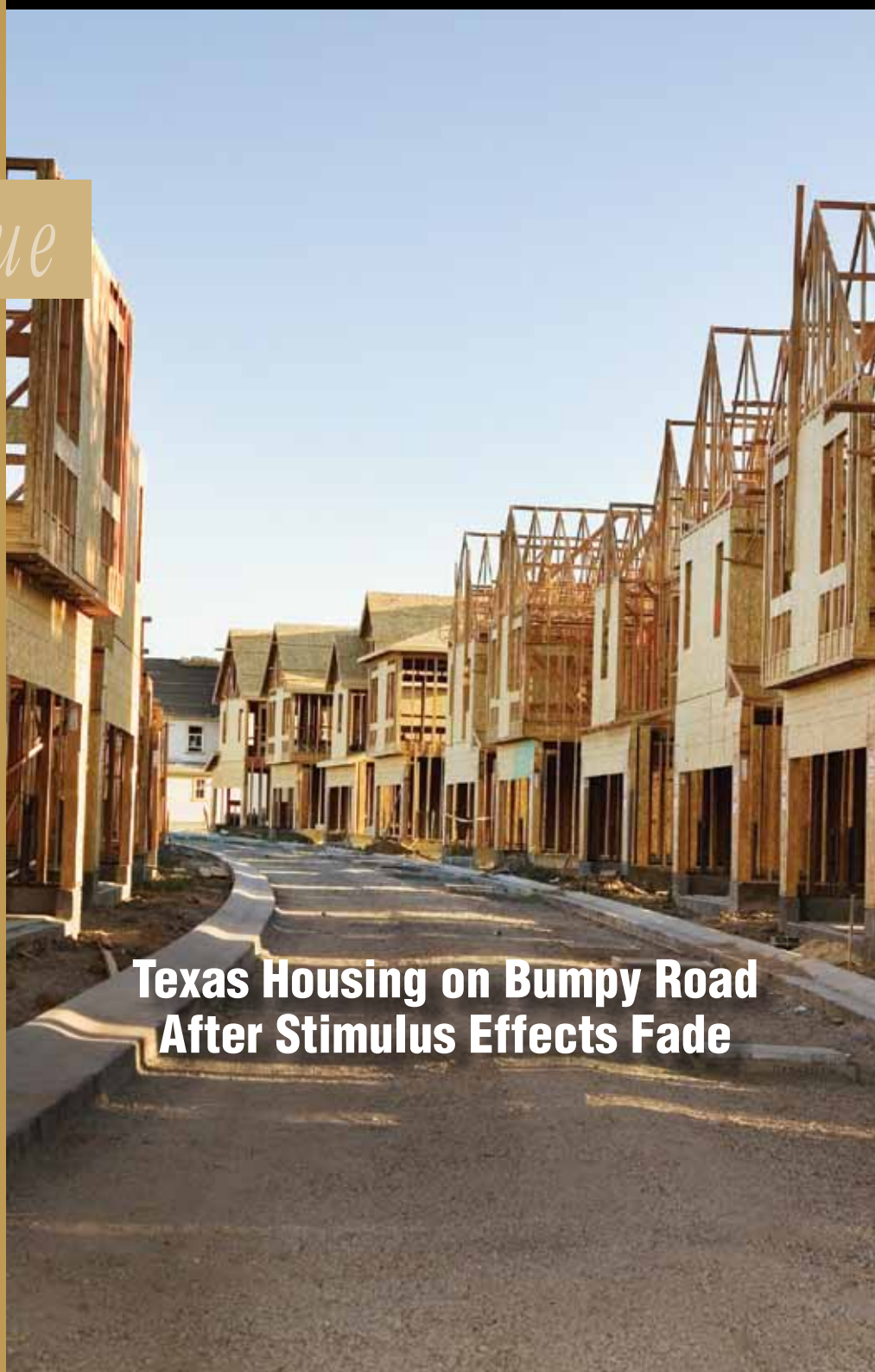
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President's Perspective



*In an increasingly
globalized world,
geography still matters,
and to keep tabs on the
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study and nurture
our ties to Mexico.*

I have a special fondness for Mexico and its people. I spent several of my formative years there, learning the nation's history, culture and language. During my career, I have maintained ties to our southern neighbor. From 1997 to 2001, I served as deputy U.S. trade representative, working closely with the Mexican government to help realize the benefits of the North American Free Trade Agreement (NAFTA).

U.S.-Mexico trade surged in the wake of NAFTA, which took effect in January 1994, and much of that growth has benefited Texas. Mexico is Texas' largest trading partner, responsible for 34 percent of the state's exports. Laredo and El Paso handle 57 percent of all U.S.-Mexico land-based trade. In an increasingly globalized world, geography still matters, and to keep tabs on the Texas economy, we must study and nurture our ties to Mexico.

To that end, the Federal Reserve Bank of Dallas has developed and maintained a long-standing relationship with our partners at Banco de México. Through regional meetings, informal exchanges, conferences and shared research interests, we help contribute to the Federal Reserve

System's knowledge of the Mexican economy and to the Dallas Fed's regional perspective. Guillermo Ortiz, former governor of Banco de México and Mexican secretary of finance, serves on the advisory board of the Dallas Fed's Globalization and Monetary Policy Institute.

Earlier this year, we were fortunate to host Banco de México Governor Agustín Carstens to discuss economic growth, trade and monetary policy. In a conversation with Governor Carstens in this issue of *Southwest Economy*, readers will gain a greater understanding of how Mexico's fiscal, monetary and banking reforms helped our neighbor's economy rebound quickly from the recent recession.

Needless to say, Mexico has come a long way since my childhood years in Mexico City. Macroeconomic growth and stability, established after the 1994 peso crisis, have allowed Mexico to pursue reforms essential to improving the lives of its citizens. That we now compare Mexico to other developed economies is a tremendous achievement and reflects the work of diligent and dedicated public servants such as Governor Carstens.

A handwritten signature in gold ink that reads "Richard W. Fisher".

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



Texas Housing on Bumpy Road After Stimulus Effects Fade

By D'Ann Petersen and Adam Swadley

For a large proportion of Texas buyers, the tax credits were not the deciding factor but a perk of buying sooner—a shift that tended to diminish sales following the programs' expiration and weaken the market.

Texas' housing sector remains in the doldrums following demand spikes in 2009 and 2010 aided by the homebuyer tax-credit program. When the federal government first offered the incentive in mid-2008, Texas home sales and construction were in a rapid descent that began with the U.S. housing crisis and accelerated when the state joined the nation in recession. As part of broader housing measures, a series of three homebuyer tax credits sought to reduce bloated inventories and arrest free-falling home values—a condition felt more profoundly at the national level than in Texas.

How effective were the tax credits at stabilizing the troubled housing market? National housing experts have offered wide-ranging estimates of the number of sales the credits spurred, but no such figures exist at the state level. We attempt to measure roughly how many Texas sales occurred as a direct result of the tax credits—and what proportion would have occurred anyway but were accelerated to take advantage of the program. Assuming the shift in purchases was substantial—and we believe it was—we consider how long subsequent sales might be diminished and whether current weakness can be attributed to it.

Our analysis reveals that the homebuyer tax credits, by bringing homeownership more within reach, likely induced a modest share of Texas sales that would not have otherwise occurred. However, a larger proportion of transactions involved buyers already planning to purchase who moved ahead to take advantage of the credits. Of course, some sales would have taken place regardless of the credits in response to relatively low mortgage rates and affordable prices or personal circumstances.

Texas' relatively strong economy may have contributed to sales as well. The state had just entered recession when the first credit was enacted, half a year after the U.S. economy turned down in December 2007. For a large proportion of Texas buyers, the

tax credits were not the deciding factor but a perk of buying sooner—a shift that tended to diminish sales following the programs' expiration and weaken the market.

By the time the first credit was enacted in July 2008, house prices had tumbled in some of the hardest-hit states, including California, down 19.1 percent from the national peak in 2006–07; Arizona, off 11.1 percent; and Nevada, down 15 percent.¹ Texas prices actually increased a modest 1.3 percent over the period.²

Texas boasts a large supply of land and has fewer building regulations. Thus, it has larger swings in construction during booms and busts—and less price volatility—than many other states. Although Texas prices held up relatively well, sales and construction were severely affected in the housing bust's initial years. Would-be Texas homebuyers—spooked by spiraling home values nationally and reduced household wealth from the U.S. financial crisis—put purchasing a home at the bottom of their to-do lists. As in the nation, the homeownership rate in Texas edged down and inventories swelled.

A Brief Look at Homebuyer Tax Credits

Table 1 provides a synopsis of the three homebuyer credits covering home purchases from April 2008 to September 2010.³ The Housing and Economic Recovery Act of 2008 (HERA) tax credit allowed first-time purchasers a tax credit of up to \$7,500 and required them to repay the credit over 15 years. The second version, under the American Recovery and Reinvestment Act of 2009 (ARRA), removed the repayment requirement and changed the credit to 10 percent of a home's price, up to a maximum of \$8,000. The final version, under the Worker, Homeownership, and Business Assistance Act of 2009 (WHBAA), was more inclusive, extending the time frame for the ARRA credit for first-time homebuyers and also allowing repeat homebuyers a credit of up to \$6,500. The final version also boosted income limits.

Table 1

Homebuyer Tax Credit Programs Summarized

	HERA (July 2008)	ARRA (February 2009)	WHBAA (November 2009)
First-time buyers only	Yes	Yes	No
Maximum credit	\$7,500	\$8,000	\$8,000/\$6,500
Income phase-out range	Single: \$75,000 to \$95,000 Joint: \$150,000 to \$170,000	Single: \$75,000 to \$95,000 Joint: \$150,000 to \$170,000	Single: \$150,000 to \$175,000 Joint: \$225,000 to \$245,000
Repayable	Yes	No	No
Refundable	Yes	Yes	Yes
Applicable dates	4/9/2008–12/31/2008	1/1/2009–11/6/2009	11/7/2009–9/30/2010
Maximum purchase price	No	No	\$800,000

NOTES: HERA=Housing and Economic Recovery Act of 2008; ARRA=American Recovery and Reinvestment Act of 2009; WHBAA=Worker, Homeownership, and Business Assistance Act of 2009.

SOURCE: "An Economic Analysis of the Homebuyer Tax Credit," by Mark P. Keightley, Congressional Research Service, December 2009.

(–0.7 percent for new-home permits and –5.5 percent for existing-home sales), following much larger reductions in the prior years (Table 2). It's difficult to separate whether the leveling off in housing activity resulted from the government's tax-relief efforts or the improving state economy in late 2009. Either way, it was welcome news for an industry entering its fifth down year.

Incentive Prompts Some Texas Sales

The temporary Texas housing activity pickup coincided with the last two tax-credit programs—the ARRA and WHBAA plans, which likely produced a greater impact than the first credit, requiring buyer repayment. Several government and private-sector analysts have estimated the number of additional sales nationally attributable to the ARRA and WHBAA; we extend these estimates by looking specifically at Texas.

We closely followed the approach used in a Congressional Research Service (CRS) report that examined the impact of the tax credits on U.S. housing demand.⁴ As a starting point, we reproduced U.S. estimates using the CRS methodology and achieved comparable results.⁵

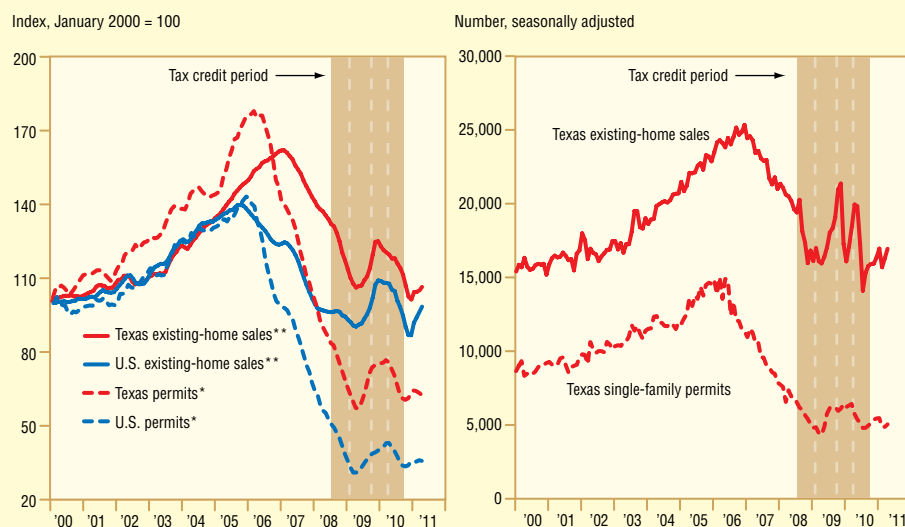
For our first look at the incentives' effect in Texas, we adhere to CRS's methodology exactly as it was applied in its U.S. review but use Texas seasonally adjusted existing-home sales data and Texas single-family home permits as a proxy for new-home sales (Table 3, Scenario 1).⁶ Three sets of transactions are calculated, reflecting a range of price elasticities for housing.⁷ The elasticities estimate the sensitivity of home sales given a change in price.⁸ We then adapt the analysis under two additional scenarios, each assuming different month-over-month sales growth rates.

In the first of the two additional views (Scenario 2), we consider a situation in which Texas home sales continue slipping as they did in 2008 by assuming that the month-over-month sales growth rates are the same as in 2008. In the next exercise (Scenario 3), we assume that home sales return to a more normal pattern, in which month-over-month sales growth rates equal their average from 2000 to 2008. The Texas estimations using our assumptions (Scenarios 2 and 3) are slightly more conservative than those produced using the CRS methodologies (Scenario 1 in Table 3) but are still very similar.

We looked separately at Texas home sales from February 2009 to September 2010, the final closing date for the tax credit program. According to our estimates, total sales

Chart 1

Home Sales, Construction Spike During Tax-Credit Period



NOTES: Vertical dashed lines represent tax credit expiration dates; shaded areas extend to closing dates.

SOURCES: Census Bureau; National Association of Realtors; Texas A&M Real Estate Center; seasonal adjustment by the Federal Reserve Bank of Dallas.

Activity Spikes in Tax-Credit Period

The homebuyer tax credits appear to have helped Texas' housing industry, even if only temporarily. Monthly data show existing-home sales and new-home construction spiked with the tax-credit programs (Chart 1). New-home sales data are not available at the state level; single-family construction permits serve as a good proxy. During the first years

of the national housing crisis, Texas builders cut back sharply. By the time the tax credits were instituted, new-home inventories were relatively low, unlike existing inventories, which were elevated. Thus, the tax incentives spurred activity as builders added inventory to meet increased buyer traffic.

Annual data for Texas show a decelerating pace of sector decline from 2009 to 2010

Table 2

Texas Construction, Sales Fall at Slower Pace in 2009 and 2010

Year	Permits	Percent change	Existing-home sales	Percent change
2004	142,153	8.0	239,111	10.8
2005	162,414	14.3	267,130	11.7
2006	159,822	-1.6	293,268	9.8
2007	116,758	-26.9	275,347	-6.1
2008	77,625	-33.5	231,450	-15.9
2009	65,845	-15.2	213,644	-7.7
2010	65,376	-0.7	201,936	-5.5

SOURCES: Census Bureau; National Association of Realtors; Texas A&M Real Estate Center; seasonal adjustment by the Federal Reserve Bank of Dallas.

Table 3

Estimated Additional Texas Home Sales Due to Tax Credits

Scenario	Elasticity	ARRA (02/09-10/09)	WHBAA (11/09-09/10)
1. Number of sales equal to 2008 levels (Congressional Research Service)	-0.5	2,881	5,160
	-1.0	5,762	10,320
	-1.5	8,643	15,479
2. Sales continue to slump at 2008 monthly growth rates	-0.5	1,898	3,980
	-1.0	3,797	7,960
	-1.5	5,695	11,941
3. Sales return to "normal" pace of 2000-08 average monthly growth rates	-0.5	1,944	4,706
	-1.0	3,887	9,411
	-1.5	5,831	14,117

NOTE: An elasticity of -0.5 implies that a 1 percent reduction in price leads to a 0.5 percent increase in quantity of homes demanded. Other elasticities are interpreted similarly.

SOURCE: Authors' calculations.

Table 4

Estimated Share of Sales Induced by ARRA and WHBAA

Scenario	Elasticity	Texas (percent)	U.S. (percent)
2. Sales continue to slump at 2008 monthly growth rates	-0.5	4.7	7.7
	-1.0	9.3	15.3
	-1.5	14.0	23.0
3. Sales return to "normal" pace of 2000-08 average monthly growth rates	-0.5	7.1	10.8
	-1.0	14.2	21.7
	-1.5	21.3	32.5

NOTE: An elasticity of -0.5 implies that a 1 percent reduction in price leads to a 0.5 percent increase in quantity of homes demanded. Other elasticities are interpreted similarly.

SOURCE: Authors' calculations.

exceeded what would have been achieved at 2008 month-over-month growth rates (*Scenario 2*) by 126,275 units and surpassed what would have been achieved at 2000-08 average month-over-month growth rates (*Scenario 3*) by 92,251 units.

Combining these figures with the sum of estimates in Table 3 suggests that if sales occurred at the 2008 rate, 5 to 14 percent of additional Texas sales over that 20-month period could be attributed exclusively to the tax credits' impact on improved home affordability. That leaves 86 to 95 percent of additional sales attributable to buyers who shifted forward their planned purchase in order to take advantage of the tax credit.

Similarly, assuming 2000-08 sales activity, 7 to 21 percent of induced purchases can be attributed to the tax credits. This implies that the remaining 79 to 93 percent were buyers already in the market, anticipating a purchase (*Table 4*).

The large sales drop immediately following expiration of the final tax credit supports the idea that many purchasers simply changed their timing. We estimate conservatively that the negative effects of shifted demand on Texas home sales and construction will trail off between now and the end of 2011.⁹ This is consistent with the views of housing-sector contacts in the Federal Reserve Bank of Dallas' Beige Book, who expect to see market improvement in the latter half of 2011 or early 2012.¹⁰

Price Recovery Elusive

When the tax credits were approved, Texas home values hadn't eroded as they had elsewhere in the U.S. (*Chart 2*). However, Texas home prices fell in 2008 and were largely unchanged during the tax-credit period, according to the Federal Housing Finance Agency (FHFA) purchase-only home price index.¹¹

The median price for an existing home in Texas was \$150,527 at the end of the program last September, virtually unchanged from \$150,947 in June 2008, before the first version was enacted.¹²

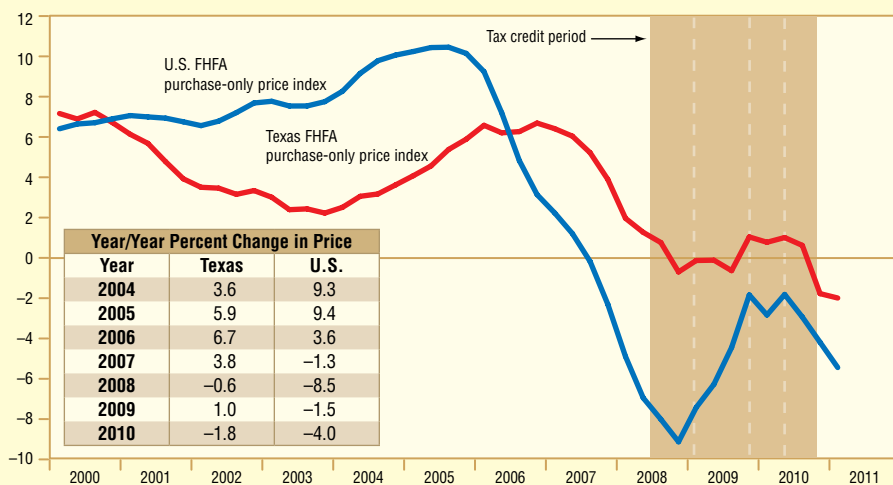
Since the expiration, however, Texas and national home prices have slipped. Texas values dropped 2 percent in first quarter 2011 from the prior year, with seasonally adjusted quarterly changes slightly negative in fourth quarter 2010 and first quarter 2011, FHFA data show.

Little 2011 Texas home price data are currently available. Inflation-adjusted Realtor median price figures have fallen 4.2 percent

Prices—nationally and in Texas—will not recover fully until excess inventory is eliminated. While the Texas foreclosure rate is lower than the nation's, foreclosures are a significant portion of supply.

Chart 2
Prices Slump Following Tax-Credit Expiration

Year/year percent change, seasonally adjusted

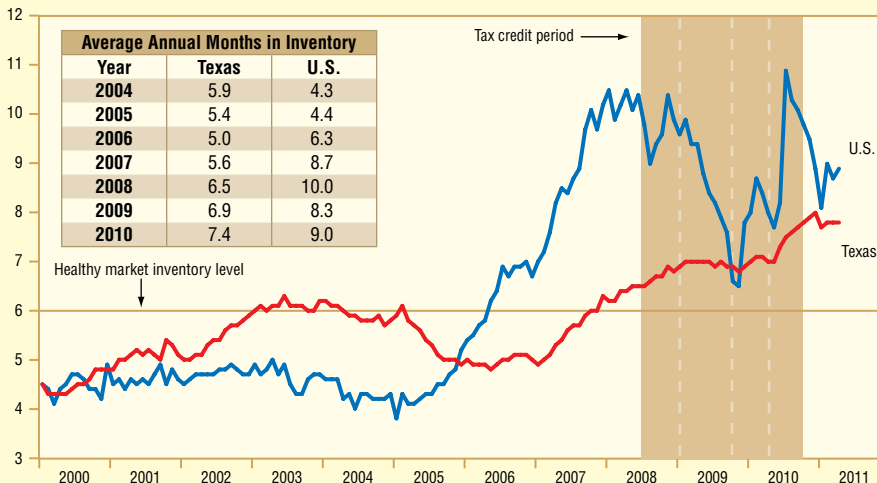


NOTES: Vertical dashed lines represent tax credit expiration dates; shaded areas extend to closing dates.

SOURCE: Federal Housing Finance Agency.

Chart 3
Home Inventories Remain Elevated

Months in inventory



NOTES: Vertical dashed lines represent tax credit expiration dates; shaded areas extend to closing dates.

SOURCES: Texas A&M Real Estate Center; seasonal adjustment by the Federal Reserve Bank of Dallas.

year to date, while the S&P/Case-Shiller Price Index for Dallas–Fort Worth as of March was down 2.5 percent from the same period in 2010. Even so, the tax credits appear to have eased the U.S. home slide for a while.

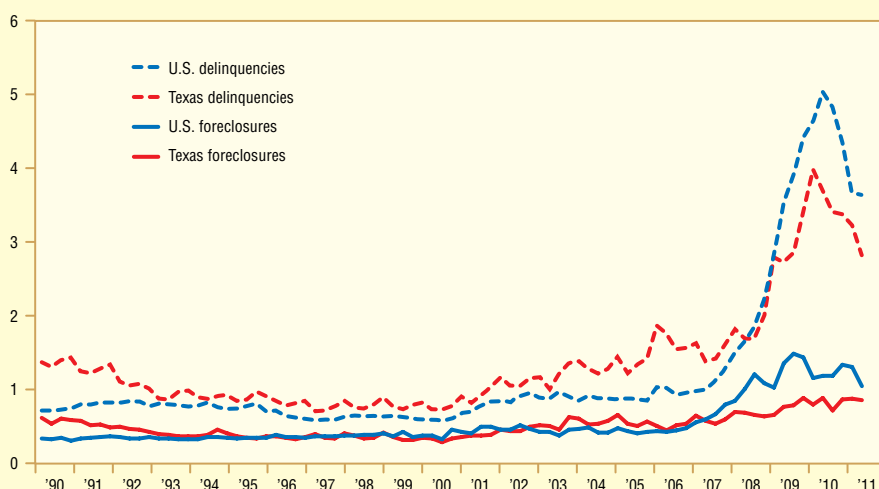
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significant portion of supply.¹³ Texas existing-home inventories edged up in the latter half of 2010 and, as of April 2011, stood at 7.8 months of supply based on the current sales pace (Chart 3). Though the supply is less than the national average of 8.6 months, it's still more than the six-month threshold the industry regards as a balanced market and above the point at which prices tend to increase.

Chart 4 Delinquencies and Foreclosures Declining

Percent of loans, seasonally adjusted



SOURCES: Mortgage Bankers Association; seasonal adjustment by the Federal Reserve Bank of Dallas.

While indications are that the Texas housing market may have bottomed out, challenges remain.

Texas Outlook: Positive Points

The national and Texas economies are growing again. Still, a housing recovery remains elusive despite several government measures, including the homebuyer tax credits.

While indications are that the Texas housing market may have bottomed out, challenges remain.

A higher share of foreclosures in 2009 and 2010 has contributed to elevated home inventory, deflating prices. Relatively tighter credit, partially reflecting lessons learned in the housing bust, may also trim demand. Dallas Fed housing contacts say many would-be first-time homebuyers do not have the credit scores or down payment now required to get a mortgage. Finally, a reduction in homeownership rates both nationally and in Texas may suggest that consumers are rethinking spending habits following the recession and financial crisis and may be postponing homeownership.

On a positive note, state foreclosure rates dipped in first quarter 2011 and remain below the national average (*Chart 4*). Moreover, the share of households behind on mortgage payments (delinquencies) has declined significantly in Texas and the U.S. since the peak in fourth quarter 2009.

With a strong state job growth forecast of more than 3 percent in 2011, Texas housing is poised to perform better than the national average, even if the market lacks the vigor seen in past recoveries.¹⁴

Petersen is a business economist and Swadley is a research assistant in the Research Department at the Federal Reserve Bank of Dallas.

Notes

¹ The U.S. market peaked in second quarter 2007, according to the Federal Housing Finance Agency purchase-only price index. S&P Case-Shiller data show the peak in 2006.

² While the Housing and Economic Recovery Act was signed into law in July 2008, the tax credit applied retroactively to sales made from April 9, 2008, through Dec. 31, 2008.

³ The Worker, Homeownership, and Business Assistance Act of 2009 included contracts signed by April 30, 2010, but extended the qualifying closing date to Sept. 30, 2010.

⁴ See "An Economic Analysis of the Homebuyer Tax Credit," by Mark P. Keightley, CRS Report for Congress, Congressional Research Service, Dec. 1, 2009.

⁵ The CRS methodology used the number of sales occurring in 2008 as a baseline of what would have transpired in the absence of the tax credit. The number of purchases induced by the credit was calculated using a range of price elasticities for housing. See the appendix of the paper cited in footnote 4 for full details.

⁶ New-home sales statistics are not available for Texas. Single-family building permits should be a good proxy for sales, although the data may overestimate sales figures slightly.

⁷ Elasticity is a measure of consumer responsiveness to a change in price. Formally, elasticity=(percent change in quantity demanded) / (percent change in price).

⁸ For housing elasticity estimates, the CRS report mentioned in footnote 4 cites: "Housing Subsidies: Effects on Housing Decisions, Efficiency, and Equity," by Harvey S. Rosen, National Bureau of Economic Research Working Paper no. 1161, June 1983, and "Urban Housing Demand," by Todd

Sinai, in *The New Palgrave Dictionary of Economics*, Second Edition, ed. Steven N. Durlauf and Lawrence E. Blume, Basingstroke, England: Palgrave Macmillan, 2008.

⁹ This estimate assumes that all additional sales occurring during the tax period that are not attributable to the tax credit are "shifted demand." It does not account for sales induced by mortgage rates and low prices alone. Further, it assumes that the tax-credit-shifted demand effect is the only thing depressing sales after the expiration of the credit. To the extent that broader economic phenomena continue to depress home sales and that sales are induced by price and mortgage rate differences from our scenario assumptions, this estimate will overstate negative effects on sales following the tax-credit expiration and thus provide a conservative upper bound of the time frame.

¹⁰ See the Dallas Fed Beige Book at www.dallasfed.org/research/beige/2011/bb110413.html.

¹¹ Other indexes are more volatile but give similar results: The Freddie Mac Price Index looks most similar to the FHFA series, and the S&P/Case-Shiller Index and the Texas inflation-adjusted median price series show more of a drop prior to the credits but overall flatness (despite volatility) since.

¹² Data are from the National Association of Realtors, seasonally adjusted by the Federal Reserve Bank of Dallas.

¹³ See "Texas Dodges Worst of Foreclosure Woes," by D'Ann Petersen and Laila Assanie, *Southwest Economy*, Fourth Quarter, 2009.

¹⁴ Federal Reserve Bank of Dallas employment growth forecast as of April 2011.

Mexico's Economic Reforms Propel Postrecession Rebound

Dr. Carstens has led Mexico's central bank since January 2010, after serving as the government's secretary of finance and as deputy managing director for the International Monetary Fund. He holds a PhD in economics from the University of Chicago and received his undergraduate degree from Mexico's Autonomous Institute of Technology. Carstens recently visited the Federal Reserve Bank of Dallas and met with a group of the Bank's economists.

Q. What is the outlook for 2011 growth, and what are Banco de México's biggest challenges ahead?

A. Since 2010, Mexico has experienced a very strong recovery. Inflation went from 3.5 percent in 2009 to 4.4 percent in 2010, and the increase included the impact of a higher value-added tax. Right now, inflation is back at 3.7 percent. The economy grew very fast in 2010, and it is very likely that it will grow soundly in 2011.

We have been operating under an inflation targeting scheme since 2001 and have been perfecting it over the years. Banco de México has a permanent inflation target of 3 percent and has established a tolerance bound or interval of plus or minus 1 percent. Basically, our policy instrument is the equivalent of the Fed's federal funds rate.

Core inflation [excluding food and energy] has behaved very well. We expect it to be 3 percent at the end of 2011. Noncore inflation is very volatile because it is composed of agricultural prices and government-regulated prices, which in Mexico are important. The price of gasoline, for example, is regulated by the government—sometimes with lags and sometimes with leads relative to its international reference prices. For the last few years, it has been subject to a very rapid rate of adjustment of more than 10 percent per year.

From the point of view of monetary policy management, the main challenge we face is how to deal with noncore inflation: how much of it we can tolerate and how much we need to fight. There is always the consideration that as noncore inflation feeds into core inflation and inflation expectations, the central bank needs to do something about it. Right now, the main challenge we face is the current sharp increase in commodity prices: Is it a one-time relative price change, or is



it something that has a dynamic component that will feed into core inflation?

Another very important dilemma that we face is the influence of U.S. monetary policy on Mexico's monetary policy and how much our stance needs to be judged independently of or in relative proportion to the U.S. In practice, as U.S. monetary policy has become more lax, Mexico's monetary policy has become tighter, without us adjusting the reference rate. This has attracted capital inflows. Thus, the appreciation of the peso versus the dollar has been an important factor in keeping core inflation low.

This certainly implies that when the U.S. starts unwinding its monetary policy stance, our exchange rate will probably be affected in some way. At that point, we might have to make other types of decisions. The two decisions we have to make now are how to react to commodity price increases and how we should adjust or calibrate our monetary policy in terms of the changes in U.S. monetary policy.

Q. How did the Mexican economy handle the global financial crisis?

A. I remember when, as a finance secretary, we prepared the budget for 2009. The macro framework we presented in September 2008 was based on an expected GDP [gross domestic product] growth of 3 percent for 2009. And that was basically the consensus forecast. We were deeply affected when the financial crisis erupted, and Mexico's GDP fell 6.1 percent in 2009. Trade collapsed dramatically after the fall of Lehman Brothers [in September 2008].

In the midst of this turmoil, when all the countries around the world were talking about how they were going to expand fiscal policy, we looked at the worsening public finances and agreed on the need to raise the value-added tax. That kept public finances under control. Partly as a result, we had a very strong rebound in the economy, and that is why we expect GDP to grow between 4.5 and 5 percent in 2011.

Q. What accounted for Mexico's resiliency following the recession?

A. Mexico had two lost decades in terms of growth and development, mostly due to poor macroeconomic management. We had major crises in 1976, 1982 and 1987 and then a financial crisis in 1994, which cost 18 percent of GDP. All of this led to some important institutional changes in banking supervision and regulation, in terms of the central bank and fiscal policy.

Our 1994 banking crisis not only made us put the banking system back into shape, but forced us to take some additional steps. What is happening now is that the world is catching up with Mexico. Since we experienced the banking crisis before other countries, we were more resilient this time around. Our banking system was left unscathed by the recent financial crisis. Mexico is a country that in the near future can rely on the financial sector to support its economic growth.

The other important reforms have been in monetary policy and monetary policy making. Two major steps were taken around

“Since we experienced the banking crisis before other countries, we were more resilient this time around. Our banking system was left unscathed.”



1993–94 and in 1995. Before that, monetary policy making was clearly under fiscal dominance. The central bank was financing the public deficit, and that led to very stubborn inflation and to an unsustainable fixed-exchange-rate regime. Obviously, the effect of high inflation was extremely detrimental to the Mexican economy and society. Following the reforms, we moved to a floating exchange rate regime and the central bank gained its autonomy. Today, Banco de México has one of the strongest autonomy mandates in the world.

We also have a single monetary policy mandate: the pursuit of price stability.

Compared to other countries, we do not have a mandate of pursuing growth, which I would say, for the most part, is a relief. Our mandate also states that, at the constitutional level, no authority can dictate the central bank's credit policy. It specifies very clearly that we cannot grant any financing to the government. This was a major breakthrough.

The last institutional development has involved fiscal discipline. Before our credit crisis in 1994, there was a lot of creative accounting and very blurry records of public finances with periodic “surprises.” Things have cleared up as time has passed. Now, Mexico is completely transparent in its fiscal accounts and, I would say, has developed a very deeply ingrained responsibility in both the federal government and, over the years, in Congress. This has been institutionalized, as it is now set by law. Unless there is an important underlying reason, the budget needs to be balanced. There are some exceptions—in case of a natural disaster or another clear reason to deviate. In those circumstances, the government has to explain to Congress why it is necessary to deviate from the balanced-budget goal and also present a plan to bring the budget back into balance.

Q. What was the significance of adopting a floating exchange rate?

A. In the early 1990s, there was a major problem with policy coordination in a way similar to what Europe is currently experiencing. When you have a fixed exchange rate, you need to have sufficient policy co-

ordination in order to make the rest of the macroeconomic framework consistent with the exchange rate. At that time, Mexico had a relatively lax fiscal policy. We also had problems in the banking sector, and significant capital inflows. At some point, it became obvious that the exchange rate was not consistent with the macroeconomic framework. We began to experience speculative attacks on the peso. All hell broke loose. We had a combination of a balance-of-payments and banking crisis. At that point, we made a very important decision: We got rid of the fixed exchange rate.

Mexico operated under a sort of fixed exchange rate for decades. In the early 1990s, not only Mexico but many emerging countries were under the veil of an economics doctrine, which established that in a small, open economy, a floating exchange rate would never work because it would be extremely volatile and lead to poor economic performance.

Since then, many countries have gradually shifted from fixed to floating exchange rate regimes. I believe these measures have been extremely useful. Moving to flexible rate regimes has really made emerging markets far more resilient. In Mexico, the combination of a flexible exchange rate regime with a strong mandate for the monetary authority has transformed the monetary policy framework established by the central bank into a really solid anchor. This framework certainly proved to have worked well during the most recent global financial crisis.

Q. Mexican banks held up well during the global financial crisis. What accounts for their superior performance? Are there changes planned to comply with Basel III, the international bank regulatory update approved last year?

A. After our crisis in 1994, a major boost was given not only to upgrade our supervisory capacity and our regulatory instruments but, to some extent, to be ahead of the curve. As a matter of fact, many of the standards that

are now being addressed and created as part of Basel III are in the process of being implemented in Mexico.

Mexico will implement Basel III in the coming months. Why? Well, because, basically, we are already there. For example, a major advance in Basel III is how much core capital [equity and cash reserve funding] must comprise basic capital. There were many aspects of the capital definition that were weak before—for instance, the provisions for deferred taxes. Liquidity provisions, we have already taken care of.

The Mexican banking system was very resilient to the recent real shock to the economy. Banks continue to be profitable. They have only reduced the rate of credit granting as a precautionary measure, in response to how their operations were unfolding in the rest of the world. To counteract tightening credit—and this was the only important countercyclical measure implemented—authorities used the development bank network to assume part of the credit risk from certain transactions and induce banks to take more risk. These actions turned out very well. Moreover, the program has not cost the Mexican government a cent because there was no intrinsic risk in those transactions.

Bank Profits Rebound as Loss Set-Asides Ease

By Kelly Klemme and Kenneth J. Robinson

Last year, the banking industry both nationally and regionally recorded its highest net income since 2007.

Banks across the U.S., including the Eleventh Federal Reserve District, appear to be recovering from the financial crisis that began in mid-2007.¹ The news is welcome because a healthy banking sector spurs economic growth by providing financing for businesses to expand investment spending and for consumers to purchase goods and services.

Data for 2010 show strong profit growth, with banks across the nation rebounding from a net loss in 2009 and those in the Dallas-based Eleventh District almost doubling their profits. There was also good news regarding asset quality: Problem loans are starting to moderate. And there are indications that the banking industry has grown more efficient, supporting more operations at lower cost.

However, concerns linger about the sustainability of profits because the recent improvement can be attributed almost entirely to a reduction in what banks set aside to cover future loan losses. Banks refer to this as their provision expense, and it usually falls as asset quality improves. But there is a limit to how far it can decline and contribute to profitability.

Improved Profitability in 2010

Last year, the banking industry both nationally and regionally recorded its highest net income since 2007. Return on average assets (ROAA) also reached a three-year peak in 2010—0.66 percent for banks nationally and 0.93 percent for those in the Eleventh District. The better performance regionally reflects the relative strength of the area's economy and general absence of a major housing bubble.

Asset-quality problems also appeared to abate. Nationally, noncurrent loans reached a record high of 5.5 percent at the end of 2009.² Since then, asset quality has steadily improved. A similar picture emerges in the district, although the noncurrent loan rate peaked at only 2.7 percent in 2010.³

Profits in banking and other industries are defined as the difference between revenues and expenses. One major source of bank revenue is net interest income, or the difference between the interest earned on loans and securities and the interest paid on deposits and other funding. Another important revenue source is noninterest income, sometimes referred to as fee income. It includes earnings from service charges, trading revenue, asset sales and investment advice.

Banks' major expense categories are noninterest expense, which includes items such as labor costs and building maintenance, and provision expense, for reserves set aside to cover loan defaults. In a deteriorating economy, defaults become more likely and banks increase their loan-loss reserves by increasing their provision expense. Conversely, as economic conditions improve, banks are able to set aside less, reducing their provision expense.⁴

Table 1 shows the major components of profitability for U.S. and Eleventh District banks and their contribution to earnings in 2009 and 2010. Among banks nationally, the 76-basis-point improvement in profitability, as measured by ROAA, can be traced almost entirely to a drop in provision expense. A basis point equals one one-hundredth of

Table 1

Contributions to Bank Profitability

	U.S.				Eleventh District			
	Percent of average assets		Difference (basis points)**	Effect on ROAA	Percent of average assets		Difference (basis points)**	Effect on ROAA
	2009	2010			2009	2010		
Revenue								
Net interest income	3.06	3.26	20	+	3.57	3.49	-8	-
Noninterest income	2.07	1.81	-26	-	1.61	1.21	-40	-
Expense								
Noninterest expense	3.18	2.98	-20	+	3.39	2.89	-50	+
Provision expense	1.96	1.21	-75	+	1.17	0.68	-49	+
Taxes	0.03	0.28	25	-	0.19	0.26	7	-
Other items*	-0.05	0.06	11	+	0.09	0.06	-3	-
Net income (ROAA)	-0.10	0.66	76		0.52	0.93	41	

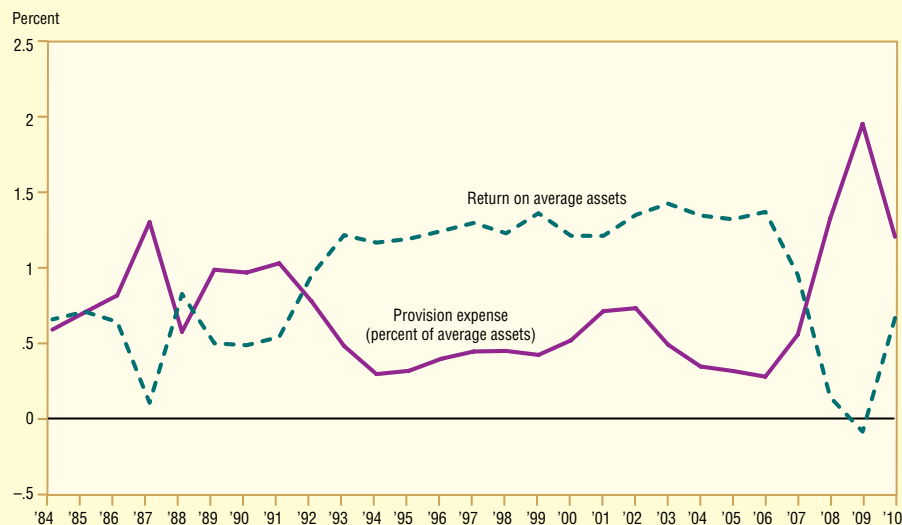
* "Other items" includes securities gains/losses and extraordinary items.

** A basis point equals one one-hundredth of a percentage point.

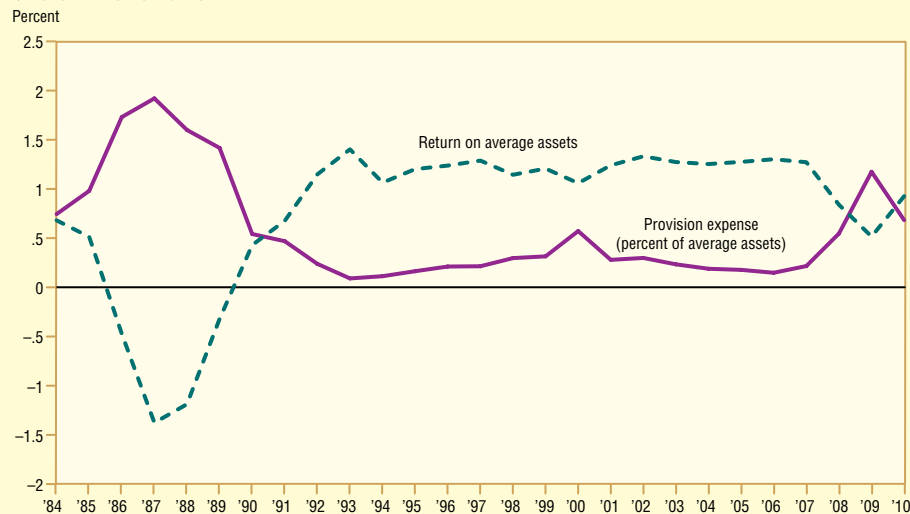
SOURCE: Quarterly Reports of Condition and Income, Federal Financial Institutions Examination Council.

Chart 1 Movements in Profitability Driven by Changes in Provision Expense

A. U.S. Banks



B. Eleventh District Banks



SOURCE: Quarterly Reports of Condition and Income, Federal Financial Institutions Examination Council.

a percentage point. For the district, profitability increased 41 basis points despite less revenue. For these banks, lower revenue was more than offset by declines of about 50 basis points in both noninterest expense and provision expense.

Earnings Sustainability

Banks' improved profitability has been characterized as "a drastic reversal from 2009, when the prospect of widespread loan defaults forced them to set aside billions of dollars to cover losses."⁵ Interpreted this way, the upturn may seem less resilient. Lower provision expense means banks are setting aside less money for future loan losses. As the overall economy improves and asset-quality prob-

lems diminish, such a reduction is expected.

Given that there is a limit to how much provision expense can fall and thus contribute to profitability, and that revenue has recently increased little, if any, is bank profitability stagnating? Or will increased revenue, or perhaps efficiency gains, help sustain bank profitability?

Provision Expense and Return on Assets

Some historical perspective might shed light on these questions. While declining provision expense is a big contributor to recent bank profitability, that development is neither new nor unusual. Historically, provision expense changes have been important factors affecting movements in bank profitability.

In periods of relative banking prosperity, such as the 1990s, provision expense and profitability are fairly constant. But during times of stress, when banks must set aside additional funds to cover possible loan defaults, the associated provision expense increase coincides with declining bank profitability. This was true for U.S. banks in the recent financial crisis (*Chart 1A*), and it was also true for Eleventh District banks in the late 1980s, when the industry experienced severe difficulties (*Chart 1B*).⁶

For U.S. banks, provision expense increased 169 basis points from 2006 to 2009 (*Chart 2*). This coincided with a decline in profitability of 147 basis points. In the district, provision expense increased 118 basis points in the mid-1980s. During this period, ROAA fell 206 basis points. Provision expense in both downturns was the single-biggest contributor to profitability movement, far outpacing other components.

During periods of recovery, though, this trend is reversed. As *Chart 1* reveals, we are beginning to see a decline in provision expense at banks nationwide as the recovery takes hold. Similarly, provision expense fell sharply in the district in the late 1980s after banking difficulties subsided.

Weakness in Revenue

If banks are showing weakness in revenue measures, as seen in *Table 1*, how durable can the recent profitability upturn be? Again, historical perspective is useful. Revenue measures at both U.S. and district banks rose fairly steadily until peaking in the mid-to-late 1990s (*Chart 3*).

Since then, overall revenue has trended lower. Revenue sources differ somewhat, with banks in the district deriving a greater proportion of revenue from net interest income than banks nationally, and banks nationwide deriving a relatively larger proportion of revenue from noninterest income. However, despite this revenue decline, banks were able to earn a healthy return on assets of 1 percent or more, at least until the onset of the financial crisis. So a lack of recent revenue growth is not necessarily cause for concern. An increasingly competitive marketplace tends to pressure revenue and overall profitability.⁷ Yet, banks have earned robust profits even in the face of a sustained revenue decline.

Maintaining Profitability

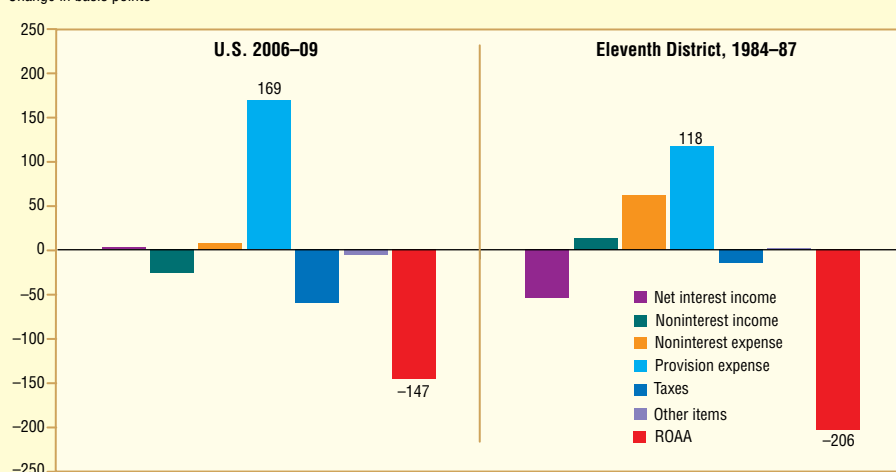
The banking industry has confronted significant competitive issues over the past

Lower provision expense means banks are setting aside less money for future loan losses. As the overall economy improves and asset-quality problems diminish, such a reduction is expected.

Chart 2

Higher Provision Expense Biggest Contributor to Declining Profitability

Change in basis points



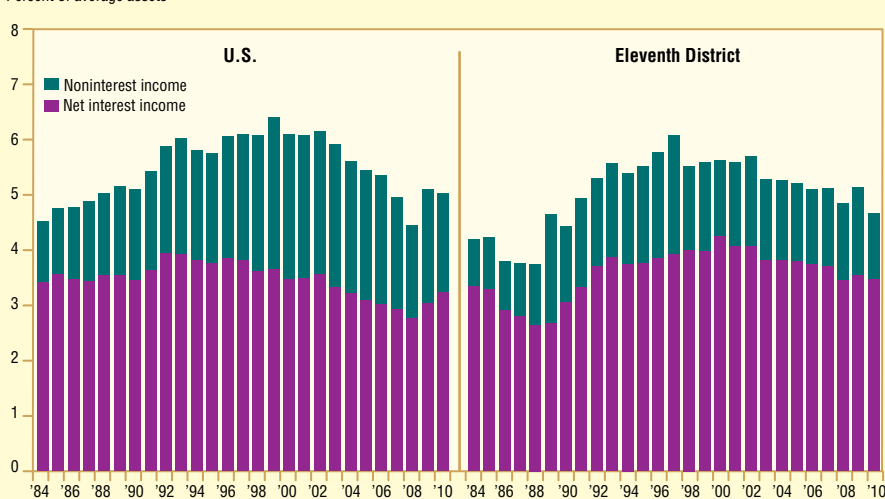
NOTE: Components of return on average assets (ROAA) are calculated as a percent of average assets.

SOURCE: Quarterly Reports of Condition and Income, Federal Financial Institutions Examination Council.

Chart 3

Bank Revenue Trending Downward

Percent of average assets



SOURCE: Quarterly Reports of Condition and Income, Federal Financial Institutions Examination Council.

two decades. Interstate branching restrictions were eliminated with the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994, increasing industry consolidation. And entities such as hedge funds and money market funds lured customers away from banks.

Despite the pressures on revenue, banks were able to maintain profitability. One possible explanation may be that increased efficiency offset declining revenue, thus mitigating the pressure on profitability.

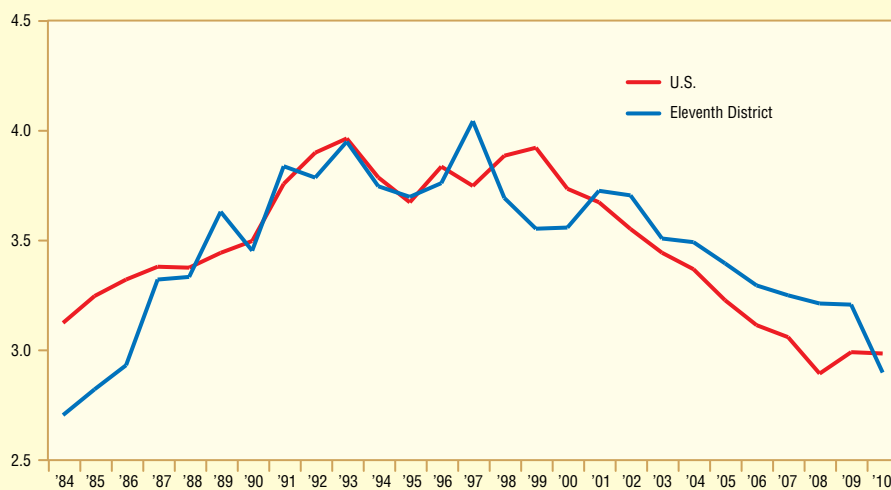
Noninterest expense, as a percent of average assets, can be used as a rough measure of bank efficiency.

Noninterest expense is a broad category that includes employee salaries and benefits, facility and equipment expenses, advertising and marketing costs and other types of overhead. If bank efficiency is improving, it is expected that noninterest expense would decline relative to assets. That ratio, after increasing fairly steadily, peaked in the mid-to-late 1990s at U.S. and Elev-

Chart 4

Lower Noninterest Expense Points to Improved Efficiency

Percent of average assets



SOURCE: Quarterly Reports of Condition and Income, Federal Financial Institutions Examination Council.

Recent data suggest that the banking industry, with improved profitability and fewer problem assets, is in the early stages of recovery.

enth District banks and has since trended downward (*Chart 4*).

For banks in the U.S. and the district, falling salary and premises expense relative to assets accounted for roughly half of the overall decline. In other words, banks are now able to support more assets at a lower cost. That may reflect recent advances in information technology.⁸

Rebuilding Balance Sheets

Recent data suggest that the banking industry, with improved profitability and fewer problem assets, is in the early stages of recovery from the worst financial crisis since the Great Depression. Adjustments continue as banks strive to rebuild their balance sheets and position themselves for the future. These changes, coupled with declining revenue, could be contributing to a spate of mergers and acquisitions. In 2010, for example, 172 bank mergers were announced. Of this total, more than three-fourths involved sellers with fewer than \$1 billion in assets. So far this year, 44 deals have been announced, and almost all involve sellers with assets below \$1 billion.⁹

Concerns remain about the source of the industry's profits, but these may be misplaced. Put in historical context, the recent rebound in profitability that has been driven almost entirely by a drop in provision expense is both welcome and expected. As the economic recovery advances and asset quality improves, the upturn in profitability should continue.

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Notes

¹ The Eleventh Federal Reserve District consists of Texas, northern Louisiana and southern New Mexico.

² Noncurrent loans are those 90 days or more past due or those with nonaccrual status (the stated interest rate was not being paid).

³ Data were obtained from the Federal Financial Institutions Examination Council's Reports of Condition and Income. Data for the Eleventh District banking industry have been adjusted for structural changes involving recent relocations of banks into the district.

⁴ Technically, the loan-loss reserve is known as the Allowance for Loan and Lease Losses (ALLL). There are no formal numerical requirements for banks' ALLL. However, banks are responsible for "developing, maintaining, and documenting a comprehensive, systematic, and consistently applied process for determining the amounts of the ALLL." See Board of Governors of the Federal Reserve System, SR 06-17, Dec. 13, 2006, www.federalreserve.gov/boarddocs/srletters/2006/SR0617.htm.

⁵ See "Banks' Underlying Problem is Revenue," by Eric Dash, *New York Times*, Jan. 18, 2011.

⁶ For more on the 1980s banking difficulties in the Eleventh District and how district banks have fared relatively better in the current crisis, see "Eleventh District Banking Industry Weathers Financial Storms," by Kenneth J. Robinson, *Southwest Economy*, Second Quarter 2010.

⁷ See "The Competitive Dynamics of Geographic Deregulation in Banking: Implications for Productive Efficiency," by Douglas D. Evanoff and Evren Ors, *Journal of Money, Credit and Banking*, vol. 40, no. 5, August 2008, pp. 897–928.

Product restrictions were also relaxed. See "The Impact of the Gramm–Leach–Bliley Act on the Financial Services Industry," by Abdullah Al Mamun, M. Kabir Hassan and Van Son Lai, *Journal of Economics and Finance*, vol. 28, no. 3, Fall 2004, pp. 333–47.

⁸ See "The Economic Effects of Technological Progress: Evidence from the Banking Industry," by Allen N. Berger, *Journal of Money, Credit and Banking*, vol. 35, no. 2, April 2003, pp. 141–76.

⁹ See "Merged Banks Could Become Future Bait for Bigger Banks," by Rachel Witkowski, *American Banker*, March 29, 2011. Data on mergers are from SNL Securities as of April 28, 2011.

QUOTABLE: *"The regional economic outlook is quite positive. Broad-based hiring in every sector from energy to construction to services reflects the confidence employers have that the region is poised for sustained expansion."*

—Pia Orrenius, Research Officer and Senior Economist

DEMOGRAPHICS: Hispanic Population Exceeds Pre-Census Estimates

The Hispanic population's growth the last decade proved more significant than previous estimates had suggested.

The 2010 census showed that the nation's Hispanic population rose 43 percent to more than 50 million. The increase accounted for just over half of total U.S. population growth. About one in six people in the U.S. identified themselves as Hispanic. Texas had 9.5 million Hispanic residents, amounting to 37.6 percent of its population. There were 1 million Hispanics (46.3 percent of the population) in New Mexico and nearly 200,000 (4.2 percent) in Louisiana.

The national Hispanic count exceeded the official Census Bureau estimate by 1.9 percent, or about 1 million, according to the Pew Hispanic Center, a Washington think tank. Pew extrapolated from the 2009 estimate to determine a comparative

2010 figure. It also found the Hispanic population was higher than the estimate by 86,000 in Texas and by more than 20,000 each in New Mexico and Louisiana.

During the decade between official counts, Census Bureau estimates are updated based on birth and death records and official immigration data. Estimates were much closer to the true population in the most recent census than in previous decennial counts. In 2000, overall population estimates were off by 6.9 million, including 3.1 million Hispanics.

Reasons for the latest discrepancy haven't been analyzed, but the Census Bureau said the 2000 underestimate was likely related to unauthorized immigration and undercounting in prior censuses.

—Yingda Bi

NATURAL GAS: Louisiana's Haynesville May Have Overtaken Barnett

Louisiana's Haynesville Shale may have become the nation's most productive natural gas field in February, surpassing the Barnett Shale formation in North Texas, which had held the title since 2008.

Pipeline flows data from energy analytics firm Bentek Energy LLC suggest the Louisiana portion of the Haynesville Shale moved ahead Feb. 12, even after Barnett rebounded from winter well freeze-offs. While few argue that Haynesville is on a faster production track, confirmation of the timing of its Barnett takeover won't come until lagged well production numbers are released. Both fields are in the Federal Reserve Eleventh District.

Advances in horizontal drilling technology and lessons learned from Barnett helped boost Haynesville production.

The first Haynesville well was completed in 2008, with production exceeding 5 billion cubic feet (Bcf) per day in less than three years. It took Barnett almost 10 years to achieve that level, government data show. Haynesville production stood at 5.3 Bcf on Feb. 12, compared with Barnett's 5.2 Bcf, according to estimates based on flows. The figures rose to 5.5 Bcf at Haynesville and 5.3 Bcf at Barnett by month's end.

Haynesville offers economic benefits to northwestern Louisiana. Since January 2007, energy employment in the Shreveport-Bossier City area has increased 78 percent, compared with 4 percent in Louisiana and 12.1 percent in Texas. Haynesville has also lifted Louisiana state and local tax revenues and boosted household earnings.

—Adam Swadley

ELECTRIC POWER: February's Rolling Blackouts Chill Much of Texas

The North American Electric Reliability Corp. (NERC), which oversees bulk power system reliability throughout the U.S. and much of Canada, had anticipated a warmer-than-average Texas winter.

Instead, a record cold snap hit Texas in early February, and rolling blackouts affected most of the state Feb. 2 when weather-related mechanical issues knocked out 102 power-generation units that provide about 7,000 megawatts (MW) of capacity. The Electric Reliability Council of Texas (ERCOT), an independent operator in the NERC system that manages service to more than 22 million customers, coordinated the rolling blackouts. Such planned outages are designed to conserve power and prevent total blackouts.

The rolling blackouts largely took place over an eight-

hour period as demand reached 56,334 MW, taxing the impaired system. Texas electricity use peaks in the air conditioning-cooled summer; the ERCOT record of 65,776 MW occurred last Aug. 23. Heading into winter, NERC predicted peak demand of 48,066 MW in ERCOT's service area. Such forecasts help utilities meet demand for electricity, a product that's difficult to store.

The arctic front swept as far south as the Rio Grande Valley, producing the longest and coldest winter streak in Texas in over 20 years. The Valley's citrus crops survived, but Dallas pre-Super Bowl events and work schedules were disrupted as wind chills fell below zero. El Paso, outside of ERCOT's area, also endured rolling blackouts during the cold snap.

—Michael Weiss

The service sector drives the Texas economy, accounting for 59 percent of private-sector output and employing close to 7 million workers. Despite the service sector's prominence, there are no timely state-level gauges of its activity. To fill this regional data gap, the Federal Reserve Bank of Dallas began assembling the Texas Service Sector Outlook Survey (TSSOS) in 2007. After a four-year collection period, the data have been seasonally adjusted, with public release June 1.¹

About 230 firms participate in the survey monthly. Executives are asked about changes to business indicators such as revenue, employment, prices and general business activity. Responses are aggregated into balance indexes, similar to the Dallas Fed's popular Texas Manufacturing Outlook Survey (TMOS), where positive values indicate growth or improvement while negative ones show contraction or worsening conditions.² TSSOS has a breakout for the retail and wholesale sectors, called the Texas Retail Outlook Survey (TROS).³

The recent recession and ongoing economic recovery provide good variation on which to test how well key TSSOS indexes—revenue, employment and general business activity—reflect changing economic conditions. The negative readings of the TSSOS indexes are in line with declining economic

activity in Texas in late 2008 and 2009 (*Chart 1*). The general business activity index was the first to enter negative territory, most likely reflecting respondents' perception that national business conditions were worsening before those in Texas. The key TSSOS indexes turned positive in late 2009, coinciding with the economic recovery taking hold.

Business tendency surveys such as TSSOS and TMOS are particularly valuable because they're timely. Like the influential national PMI index (formerly known as the Purchasing Managers Index), these Texas measures come out before other data, such as employment, and provide crucial early clues about the direction of economic activity.⁴ The most important gauge of their value is whether the indexes are correlated with the economic activity they are intended to measure. To formally test the explanatory power of TSSOS and TROS indexes, we ran statistical regressions on state service sector employment, retail employment and retail sales.

The results suggest the survey indexes are a good fit for employment and other regional data—that is, statistically speaking, they help explain what's taking place. Explanatory power is captured in the statistical measure R-squared, which calculates how much of the variation in the dependent variable (for ex-

ample, employment) is accounted for by variation in the included variables (survey indexes). The first row in Table 1 shows the result of including two lagged values of the dependent variable—the predictive power of past performance—absent the survey variables. When survey variables are added to the model, the R-squared rises in all cases, signifying that the survey index provides additional explanatory power for the dependent variable.⁵

—Jesus Cañas and Emily Kerr

Notes

¹ Information regarding the Texas business outlook surveys can be found at www.dallasfed.org/research/surveys.

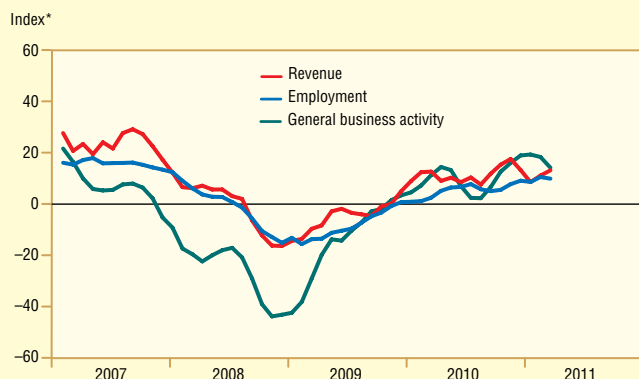
² Each index is calculated by subtracting the percentage of respondents reporting a decrease from the percentage reporting an increase.

³ Retailers and wholesalers make up 12 percent of Texas output and account for 1.6 million jobs.

⁴ See "Texas Manufacturing Survey Offers Advance Look at State and National Economies," by Franklin D. Berger, Federal Reserve Bank of Dallas *Southwest Economy*, Third Quarter, 2010.

⁵ An R-squared reading of zero means no explanatory power, while a 1 indicates complete explanatory power. A second-order, autoregressive distributed lag model was estimated. Because no autocorrelations were found, the model was estimated with ordinary least squares. We report adjusted R-squared, which corrects for the fact that R-squared will always increase as independent variables are added.

Chart 1
Texas Service Sector Outlook Survey Reflects Recent Recession, Ongoing Recovery



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

Table 1
TSSOS Indexes Help Explain Regional Economy
(Quality of fit, adjusted R-squared)*

	Private service employment	Retail sales	Retail employment
Lagged dependent variables only	0.39	0.65	0.42
with TSSOS employment	0.54**	—	—
with TSSOS revenue	0.53**	—	—
with TSSOS business activity	0.54**	—	—
with TROS employment	—	0.68**	0.61**
with TROS revenue/net sales	—	0.69**	0.48**
with TROS business activity	—	0.66	0.53**

* An R-squared reading of zero means no explanatory power, while a 1 indicates complete explanatory power.

** Indicates the survey variable is statistically significant with 95 percent confidence.

SOURCES: Bureau of Labor Statistics; Federal Reserve Bank of Dallas; authors' calculations. Seasonal and other adjustments by the Federal Reserve Bank of Dallas.

Sizing Up Nanoelectronics: Gauging the Potential for New Productivity Wave

By Keith Phillips, Adam Swadley, Jackson Thies and Mine Yücel

The long-term impact of new technologies and innovation extends beyond economic effects, creating social and cultural benefits.

The Federal Reserve Bank of Dallas, in cooperation with the Semiconductor Industry Association (SIA), hosted a conference on nanoelectronics and the economy in Austin on Dec. 3, 2010. Economists and scientists explored how information technology has affected U.S. productivity and output growth and prospects for the future. A summary of conference highlights follows. Presenters' papers and presentations are available on the Dallas Fed website at www.dallasfed.org/news/research/2010/10nano.cfm.

Moore's law, the technology axiom holding that the number of transistors on a semiconductor chip doubles every two years, has led U.S. productivity growth over the past three decades. Many scientists expect this advancement to reach its limits within 20 years. As transistors approach their physical size minimums, potentially ending Moore's law, nanoelectronics may hold the key to further reducing size, leading to enhanced productivity and growth.

While nanoelectronics' potential economic benefits are large, numerous challenges exist, presenters at the Austin conference said. To remain a leader in the field, the U.S. must stay competitive in the research, development and manufacture of nanotechnology, which involves manipulating matter on an atomic and molecular scale. There must also be cooperation between governments, industry and educational institutions to ensure necessary physical and human capital.

George Scalise, SIA president emeritus, drew parallels between the emerging field and semiconductors. He noted that while government and industry were the initial mainstay semiconductor purchasers, consumers—with their personal computers, cell phones and other electronic products—now account for 55 percent of demand.

Companies headquartered in the U.S.

represent more than half of world semiconductor production (*Chart 1*), Scalise said. Historically, research and development and manufacturing went hand-in-hand to create jobs in the U.S., though increasingly manufacturing is shifting overseas. To encourage industry growth in the U.S., the SIA established the collaborative Nanotechnology Research Initiative (NRI) in 2005. Its goal is development of a successor to today's semiconductor technology by 2020. Membership includes U.S. semiconductor companies, 30 universities and federal, state and local governments.

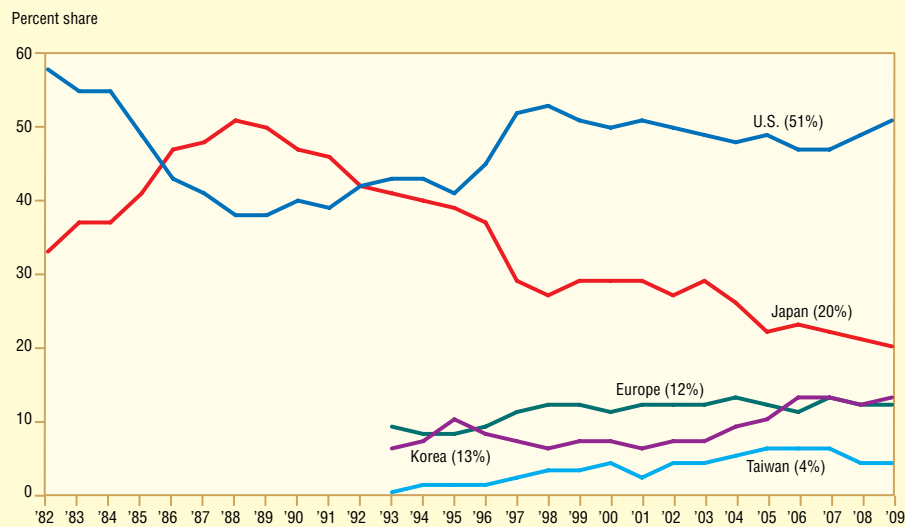
Scalise expressed unease that the U.S. regulatory and tax environment has put the nation's semiconductor factories at a competitive disadvantage to overseas plants. He proposed four goals to lead the U.S. into the "nano era": (1) maintaining market leadership, (2) retaining technology leadership, (3) keeping the semiconductor industry's No. 1 position in production, (4) creating U.S.-based jobs at all levels, from research to manufacturing.

Technology Aids U.S. Economy

Bart van Ark, senior vice president and chief economist at The Conference Board, noted that information and communications technology (ICT)—as evidenced by the computer, email and cell phone—has accel-

Chart 1

U.S. Companies Lead in Semiconductor Production Share



NOTE: Based on headquarters location of manufacturers.

SOURCE: Semiconductor Industry Association; adapted from a presentation by George Scalise on Dec. 3, 2010.

While nanoelectronics will likely be an economic engine in this century, it must overcome many technological and economic challenges.

erated productivity increases and contributed to economic growth. In the late 1990s, the U.S. experienced a significant increase in output per unit of labor partly because of greater production and utilization of information and communications technologies, he said.

Van Ark was concerned that advances may be shifting from developed countries to emerging economies, such as China and India (Chart 2A). Emerging economies' share of ICT investment as a percentage of global ICT investment increased to 25 percent in 2007 from 10 percent in 2000 (Chart 2B). The long-term impact of new technologies and innovation extends beyond economic effects, creating social and cultural benefits, van Ark said. For example, Facebook became a social phenomenon made possible by ICT advances. He recommended that the U.S. provide incentives for investment in productivity-enhancing endeavors.

Jan Youtie, a Georgia Tech University adjunct professor and principal research associate, said the transition from nanotechnology discovery to application can be measured by the ratio of research publications to patent applications.

She noted that the locations of nanotechnology research and commercialization differ. In Texas, for example, corporate entry into nanotechnology has exceeded research activity because the state's diverse

high-tech companies are well positioned to benefit from knowledge developed and shared by national and local universities.

Nanotechnology has the potential to affect the entire economy and spawn additional technologies, Youtie said. Following 2006, research shifted from passive nanostructures—materials designed to perform one task, such as polymers and aerosols—to active nanostructures, which change or evolve during operation, such as targeted drugs or mechanical actuators (often used to translate a rotary motion into linear motion). This development is expected to become evident in commercialization of active nanotechnologies in the near future.

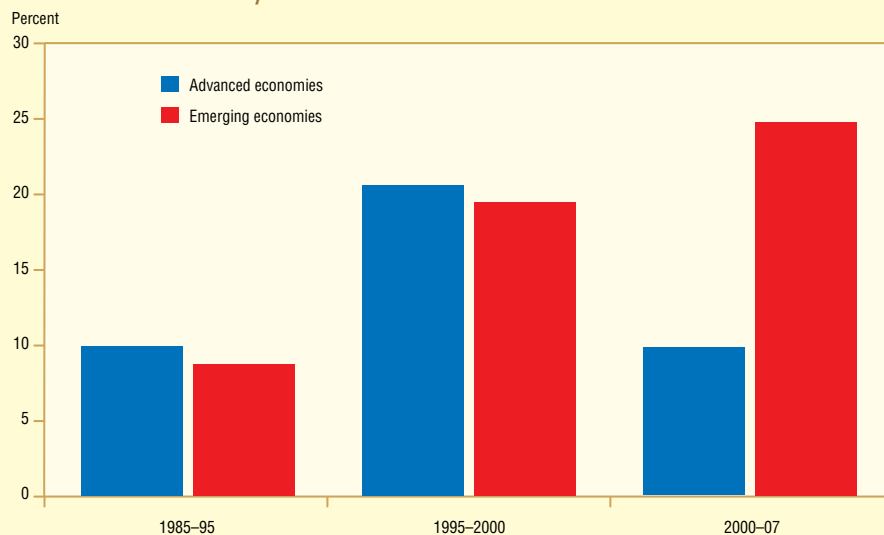
Moving From Microelectronics (Small) to Nanoelectronics (Smaller)

Pushkar Apte, a consultant to the technology consortium Sematech, said that while nanoelectronics will likely be an economic engine in this century, it must overcome many technological and economic challenges. Sematech and semiconductor industry leaders have developed a roadmap to aid creative collaboration and to identify potential problems. The difficulties are too numerous for a single entity to overcome, Apte said, and nanoelectronics' commercial success depends on industry participants working together. Most costs involve infrastructure investment, leaving a relatively small part as labor expense.

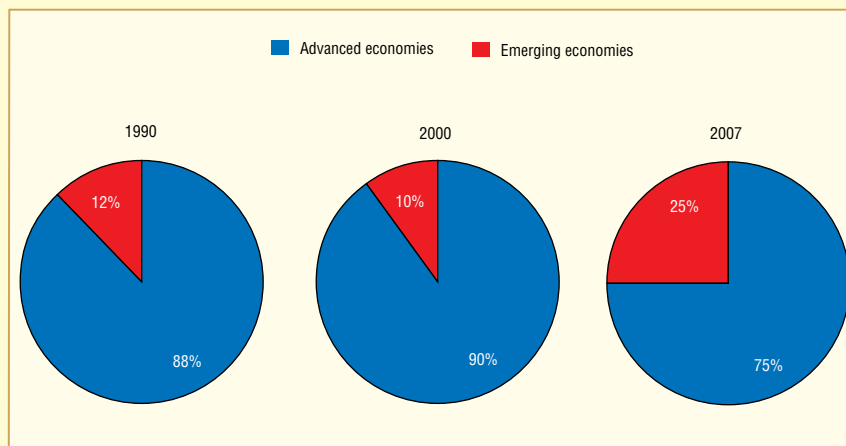
Advances in information and communications technology may be shifting from developed countries to emerging economies, such as China and India.

Chart 2 Emerging Economies Gain in Information and Communications Technology Investment

A. Growth of Total Investment by Period



B. Total Investment Shares



SOURCE: The Conference Board; adapted from a presentation by Bart van Ark on Dec. 3, 2010.

Sanjay Banerjee, director of the Microelectronics Research Center at the University of Texas at Austin, delved into the application side of nanotechnology, noting the rapid advance of information and communications technology over the past 50 years. Some of the most important achievements involve integrated circuits, a large number of semiconductor devices working together. Today, integrated circuits (also called chips or microchips) are a \$300 billion industry and drive a \$1 trillion electronics business. Transistors, used to amplify and switch electronic signals, are imbedded in these microchips. The average person owns more than 100 billion transis-

tors; they are key components of everyday items, from cell phones to cars. Because of technological advancements, 100,000 transistors can fit across a single grain of rice and can cost less than that same rice grain.

Nanotechnology has the potential for greater advances and improvements in weight, size, speed, power consumption and electronic circuit efficiency. As the electronics industry moves from micro- to nanoscale designs, thermal management challenges abound because of increased power densities. Nanotechnology offers promising high-thermal-conductivity, low-contact-resistance materials to solve heat dissipation problems.

Research is moving toward more exciting nanostructures that hold innumerable possibilities, Banerjee said. However, for the U.S. to maintain its dominant position, the nation must ensure its education system is up to the task. The U.S. attracts top talent to its universities, but often loses promising individuals after they graduate. Revising immigration law is critical so those attaining high levels of education remain in this country, Banerjee said.

Nanoelectronics Enhances Other Industries

John A. Laitner, economic and social analysis program director for the American Council for an Energy-Efficient Economy, focused on how nanotechnology can help the economy achieve energy savings.

For example, a significant amount of generated power is lost through electric transmission lines. Nanotechnology could improve such systems, potentially lowering costs and increasing the viability of intermittent energy sources such as wind and solar. Collection sites are often located far from electricity-consuming urban areas. New nanotechnology structures used in high-capacity fuel cells could significantly enhance efficiency and aid storage of energy generated by intermittent energy sources.

Thomas Kenny, a Stanford University professor of mechanical engineering, similarly observed that nanotechnology has numerous applications, from solar cells to chip-cooling applications.

Still, considerable barriers remain, he noted. The industry lacks methods for large-scale manufacturing and integration of distinct technologies. Encouraging further development will require innovative funding. One financial source has been the federal Defense Advanced Research Projects Agency (DARPA), which has various teams working on nanotechnology-related issues. Zyvex Labs, a private Richardson, Texas-based company, has been developing nanotechnology manufacturing. It received funding from DARPA and the Texas Emerging Technology Fund, created by the Texas Legislature in 2005.

Anthony Tether, a former DARPA director, highlighted the importance of nanoelectronics development for the U.S. amid intense global competition. In military applications, for example, nanoelectronics sewn in soldiers' uniforms will act as an electronic interface, monitoring vital signs and other critical information, he said.

Finding Nanoelectronics R&D Funding

John Hardin, executive director of the North Carolina Board of Science and Technology, studied nanotechnology expertise among various North Carolina companies and found that the primary barrier to a broader application of nanotechnology was a lack of access to early-stage capital. A second hindrance was obtaining use of university facilities and equipment, Hardin said during a final panel discussion on methods of funding for companies involved in nanoelectronics research and development. Incentive for public/private partnerships for equipment and facilities sharing, similar to the federal government's National Nanotechnology Initiative, is a possible solution. The national program has invested almost \$14 billion in nanotechnology research and development since 2001.

Clinton Bybee, managing director and cofounder of Arch Venture Partners, said there is a progression of ideas that begin in national research labs and subsequently develop into commercial technology. Commercialization is usually a seven- to 10-year process, costing \$50 million to \$75 million.

Venture capital is typically interested in investing at the early stages, when the potential of the innovation may not be fully understood. Bybee, who has been involved in partnerships with governmental agencies, noted that capital sources must be committed to a long-term investment.

Nanotechnology's prospects to open new frontiers at a time when the U.S. seeks to further assert its global leadership argue for a coordinated strategy, conference participants said. Public and private partnership in the still-developing field may hold the most promise as global competition intensifies. The U.S. economy faces many challenges, including an aging population and mounting government debt. Rising productivity, potentially led by the advancement of nanoelectronics, could provide a catalyst for new avenues of economic expansion.

Phillips is a senior research economist and advisor in the San Antonio Branch, Swadley is a research assistant, Thies is a senior research analyst and Yücel is a vice president and senior economist at the Federal Reserve Bank of Dallas.

Public and private partnership in the still-developing field of nanotechnology may hold the most promise as global competition intensifies.

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