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From Crude Oil To Computer Chips

How Technology Is Changing the Texas Economy

"I think there is a world market for maybe five computers."

—Thomas Watson, chairman of IBM, 1943

"I have traveled the length and breadth of this country and talked with the best people, and I can assure you that data processing is a fad that won't last out the year."

—The editor in charge of business books for Prentice Hall, 1957

"There is no reason anyone would want a computer in their home."

—Ken Olson, president, chairman and founder of Digital Equipment Corp., 1977

Technological innovations are rapidly changing the way people live. Computers, fax machines, mobile phones and online computer services allow people to work faster and more efficiently, with ever-expanding access to information. With each new generation of machine, high-tech products become more pervasive household fixtures. No longer is it only the wealthy who can afford to own a VCR or cellular phone. New products are being developed every day to meet consumers' voracious appetites for faster, more efficient ways to conduct business and enhance leisure time.

Thanks to the acceptance and affordability of new technologies, certain high-tech industries have grown into a rapidly expanding segment of the economy. In Texas, employment at high-tech firms has grown twice as fast as the state's overall economy during the past 10 years.[1]

Although Texas' economic roots are grounded in agriculture and oil, the state has pioneered many technological innovations. Dallas' Texas Instruments (TI) was among the first companies to mass produce transistors, and a TI engineer, Jack Kilby, developed the integrated circuit. Another Dallas company—Electronic Data Systems Corp. (EDS)—was among the first firms to offer data processing services. And Dell Computer Corp., headquartered in Austin, is the fifth largest maker of personal computers in the world and is one of the fastest growing U.S. corporations.

Despite recent lean years for the defense industry, Texas defense giants—including LTV, Bell Helicopter and Lockheed (formerly General Dynamics)—have been important catalysts for high-tech advancement. As such firms moved to Texas during the World War II buildup, they brought scientists and engineers. Other workers became skilled in electronics, telecommunications, and weapons and aerospace manufacturing. Now, even as employment in the defense industry wanes, the private sector is making use of defense-related technological advances.

How Much High-Tech in Texas?

The Texas economy, once driven by resource-based industries such as farming, ranching and oil production, is evolving into a more knowledge-based economy. While the oil and gas extraction business is

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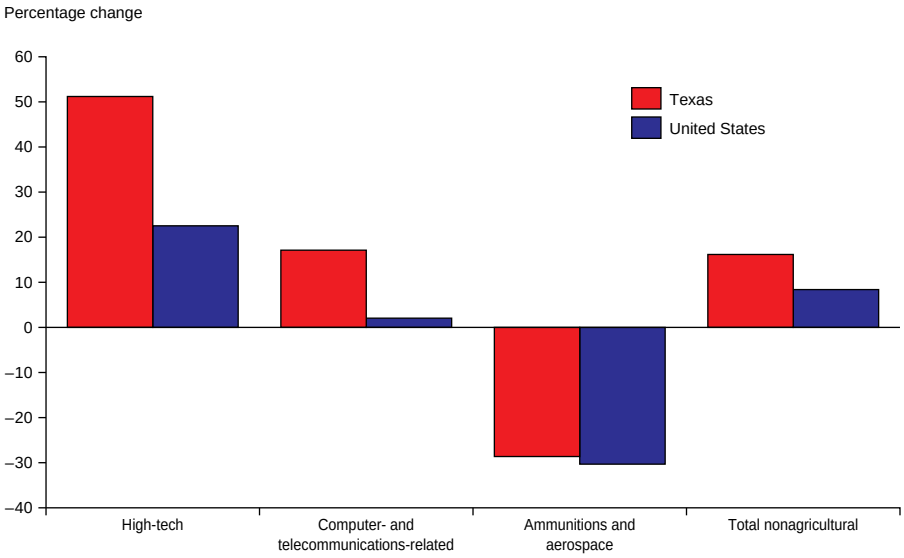
Chart 1
Employment Growth, 1988–94



SOURCE: Bureau of Labor Statistics.

still very important to the state's economy, its share of total employment fell from its early 1980s peak of 5 percent to about 2 percent in 1994.[2] In contrast, the share of Texas employment in high-tech industries rose from about 2 percent in the mid-1970s to 3.4 percent in 1994.[3]

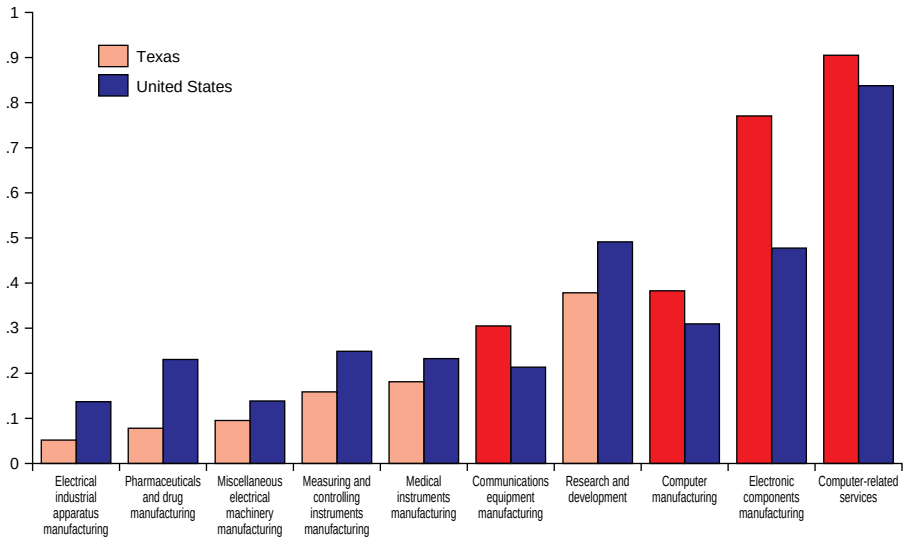
As Chart 1 shows, high-tech employment grew more than twice as fast in Texas than in the nation as a whole during 1988–94.[4] Texas' strongest performance relative to the nation's has come in computer- and telecommunications-related industries.[5] This category includes firms that make computers, computer chips and cellular phones and firms that provide programming or data processing services. Since 1988, employment in Texas computer- and telecommunications-related industries has grown more than eight times the national rate. Currently, the share of computer-related and telecommunications-related employment to total employment is 2.5 percent in Texas and 2.1 percent in the United States.

Chart 2 shows the 10 largest high-tech industries in Texas. Texas' employment in four of these 10 industries exceeds the national average. These industries (highlighted in bright red) are computer-related services, electronic components manufacturing, computer manufacturing and communications equipment manufacturing—all of which are computer- and telecommunications-related industries.

Computer-related services. As computer and communications technology has become more widely used, the number of service firms has skyrocketed. Thus, it is not surprising that the largest high-tech industry in Texas is service-related. Employment in Texas' computer-related services industry has grown almost 50 percent since 1988, slightly faster than the national average. Included in this category are firms that provide computer programming, data processing, software design, systems design and information retrieval. Plano's EDS, for example, is the nation's largest provider of computer services to business and government.

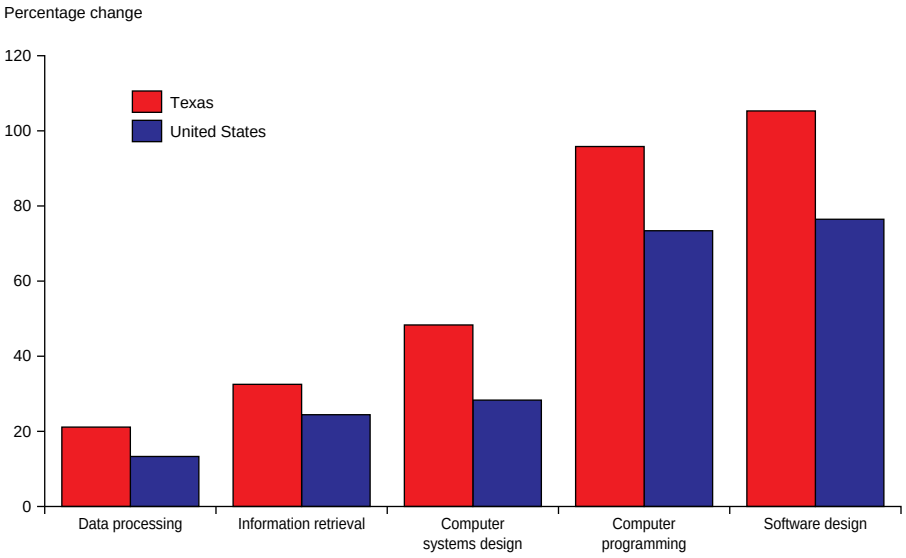
The computer-related services industry accounts for almost 1 percent of total Texas employment, which is roughly the same size as Texas' fabricated metals manufacturing industry. However, employment statistics may drastically underestimate the actual number of computer-related jobs in the Texas economy. Employment statistics count only firms that produce a service, such as programming. Programmers who work for a bank, for instance, are not counted. Because many firms employ their own programmers or systems specialists, total employ-

Chart 2
High-Tech Employment in Texas
(Shares of 1994 Total Nonagricultural Employment
For Largest 10 High-Tech Industries in the State)



SOURCE: Bureau of Labor Statistics.

Chart 3
Employment Growth in Computer-Related Services, 1988–94



SOURCE: Bureau of Labor Statistics.

ment in this sector is probably much higher than the numbers suggest.

The greatest job growth in Texas' computer-related services industry has been from firms that provide software design and computer programming (*Chart 3*). Since 1988, jobs in software production have grown by 105 percent in Texas, compared with 76 percent at the national level. Austin alone has more than 500 software companies. Computer programming employment in Texas has risen 96 percent since 1988, compared with 76 percent nationally.

Electronic components manufacturing. As Chart 2 indicates, the second largest high-tech industry in Texas is electronic components manufacturing. This industry includes firms that produce computer chips and circuit boards, both hot commodities worldwide. Since 1988, circuit board manufacturing employment in Texas has expanded four times faster than in the nation.

Several large companies produce computer chips in Texas, including TI, Motorola, Advanced Micro Devices (AMD), Hitachi, Cyrix and National Semiconductor. Nationally, the computer chip industry has undergone a retrenchment in the last several years. However, announced expansions by Hitachi, Motorola and TI and a worldwide shortage of computer chips suggest that this segment of Texas' high-tech industry has recovered and should see strong growth in the future.

Computer manufacturing. Texas is quickly becoming synonymous with computer production. The Lone Star State is home to Dell, Compaq, TI and AST. Employment at computer makers, while falling nationally, has risen strongly in Texas.[6] Since 1988, Texas employment at computer makers has risen 34 percent, and employment in the computer peripherals industry, which includes printers, has risen by 15 percent. Dell exemplifies this growth; Dell recently announced that it would build a third facility in Austin because its second facility will be at capacity when it comes online in November.

Communications equipment manufacturing. Communications equipment manufacturing includes firms that produce telephone, radio and television equipment. Texas job growth in this industry has not been as strong as in other high-tech sectors, mainly because new technology has made workers more productive. Nevertheless, employment growth in this industry has been positive in Texas while declining at the national level. The Dallas/Fort Worth area is the heart of Texas' telecommunications industry, with firms such as Nortel, DSC, MCI and Nokia. Recently, Dallas/Fort Worth was chosen as the site for the headquarters of PCS PrimeCo, a joint venture of Bell Atlantic, Nynex, US West and AirTouch Communications.

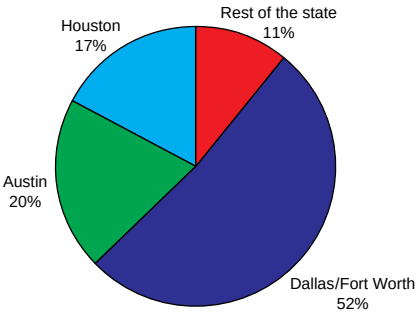
Where Are the Jobs?

Like Dallas, with its communications nexus, other Texas cities have attracted concentrations of high-tech industries. Computer-related services and the production of electronic components, computers and communications equipment—major players in the Texas high-tech sector—are located mostly in major cities, as shown in Chart 4.[7]

Austin's computer manufacturing sector provides more than half of the state's jobs in that industry. The capital city also has a large concentration of computer chip makers, such as Motorola and AMD, and their suppliers, such as Applied Materials and Tokyo Electron America. As a result, one-fifth of the state's electronic component manufacturing is in Austin.

With 52 percent of the state's total, Dallas/Fort Worth has the lion's

Chart 4
Where Texas' High-Tech Jobs Are



NOTE: Percentages are each city's share of Texas jobs in four leading high-tech industries–computer-related services, electronic components manufacturing, computer manufacturing and communications manufacturing. The share of total employment these four industries contribute to the Texas economy exceeds the national average.

SOURCES: Texas Employment Commission and Texas State Comptroller of Public Accounts.

"In Texas, employment at high-tech firms has grown twice as fast as the state's overall economy during the past 10 years."

share of high-tech jobs. Over half of the state's computer-related services providers, such as programming and software design firms, are in D/FW. The area also houses most of the state's communications equipment manufacturing firms, with almost 80 percent of Texas jobs in that sector. D/FW telecommunication firms, such as DSC, Siemens, Motorola and Ericsson, produce products ranging from switching devices used to transmit data and voices to cellular phones. Like Austin, Dallas/Fort Worth has a large concentration of computer chip manufacturers and is home to more than 50 percent of the state's electronic equipment jobs.

Houston's strongest high-tech industries are computer manufacturing and computer-related services. Home of Compaq Computer, Houston has 17 percent of the state's high-tech jobs—rivaling Austin's 20-percent share.

Why Texas?

Texas' history in the defense and oil industries helps explain why the state has become a high-tech mecca. Texas Instruments, for example, built on its success in the oil business to become a large defense contractor and later one of the largest computer chip producers in the country.[8] But other factors have contributed to the state's appeal to high-tech firms as well.

Texas' low costs, high-tech research, large labor pool and prominence as a worldwide distribution hub have drawn firms to the state. Many of Texas' high-tech exports go to Mexico. In 1994, for the first time since state export figures became available in 1987, Texas' leading export industry was electronic components manufacturing, which contributed $11.2 billion in state exports. The industrial machinery and computer manufacturing industry was a close second with $11.1 billion in exports. Of the electronic components exports, $5.8 billion went to Mexico, along with $2.4 billion of the industrial machinery and computer equipment. Several electronics firms, such as General Electric, Toshiba and Philips Consumer Electronics, are located in the El Paso/Juarez area and take advantage of the maquiladora program between the United States and Mexico.

In addition, Texas is an ideal location for firms exporting elsewhere. Several high-tech firms (such as Nokia, Zenith Electronics and GWS Perlos—a phone parts supplier) have located manufacturing plants or distribution centers at Alliance Airport in Fort Worth, partly because the airport's central location and air, rail and highway access make it ideal for global distribution.

High-tech firms tend to cluster near one another to be close to suppliers and skilled workers. More than 20 suppliers followed Applied Materials to Austin after its move in 1988, for example. Texas' labor force is younger and faster growing than the national average. And, while Texas' level of educational attainment is about even with the national average, the skill distribution is widespread.[9] Despite its large percentage of high school dropouts, Texas also has a high percentage of skilled workers who help attract high-tech firms to the state.

High-tech companies have cited low costs as another factor drawing them to Texas. Although the real estate market has been improving in recent years, Texas apartment rents and construction costs are much lower than the national average. The average price of a Dallas home, for example, remains about 10 percent below the national average. Texas is also a low-tax state. Among the 50 states, Texas ranks 31st in per capita state and local tax revenues and 42nd in per capita expenditures.

Finally, Texas has industry consortiums and universities that provide high-tech research to benefit high-tech industries. For example, Austin is home to two of the nation's

premiere research consortiums: Microelectronics and Computer Technology Corp. (MCC) and Sematech. These consortiums enable companies with common requirements for new technology to share the costs and risks of development. Also, the Technology Licensing Office at Texas A&M University and the IC^2 Institute at the University of Texas at Austin provide university research that benefits high-tech industries.

Clouds on a Bright Future?

Although Texas' high-tech future looks bright, a few clouds on the horizon could impede employment growth. Environmental considerations, such as water purity, could deter companies from relocating to or expanding operations in Texas. Water is an important input in the computer chip manufacturing process, and companies in Austin are concerned about the water availability from the Edwards Aquifer.

A lack of office space in some prime high-tech office districts is another consideration. The office vacancy rate in Northwest Austin—the most popular area among high-tech companies—is about 3 percent. Even after completion of construction projects under way, space may not be available to meet demand. Although they are lower than the national average, Dallas' suburban office rents have risen rapidly in the past two years and are eating away at one of Texas' biggest draws.[10]

Signs also indicate that Texas' skilled labor market is tightening. Industry contacts in Austin report that they must look beyond Texas' borders to find skilled workers. In fact, the estimated unemployment rate for engineers and software developers is below 1 percent in Austin. Several high-tech companies that recently located outside of Texas cited the state's tightening labor pool as a major factor in their decision. So far, Austin appears to be the only Texas city straining at the seams, but labor market pressure could occur in other Texas cities with a high concentration of high-tech industries.

Despite these obstacles, Texas should be a major benefactor in the quest for faster, more efficient ways to work and better leisure products. High employment growth should continue in high-tech industries concentrated in Texas—namely, computer-related services, electronic components manufacturing, computer manufacturing and communications equipment manufacturing—for several reasons. Industry consortiums, such as MCC and Sematech, and ongoing research at Texas universities yield synergies for high-tech businesses. The state's already strong base of high-tech companies and suppliers can entice other companies to relocate to Texas. And Texas' growing labor force and the ease of relocating workers from other areas of the country are valuable assets that should continue to attract high-tech relocations and expansions.

—D'Ann M. Petersen
Michelle Thomas

Notes

[1] In this article, we define high-tech to include the following three-digit Standard Industrial Code (SIC) categories: pharmaceuticals and drugs, computer manufacturing, electrical transmission and distribution equipment manufacturing, electrical industrial apparatus manufacturing, household audio and video equipment manufacturing, communications equipment manufacturing, electronic components manufacturing, miscellaneous electrical machinery manufacturing, measuring and controlling instruments manufacturing, photographic equipment and supplies manufacturing, computer-related services, and research and development. Our definition of high-tech industries is taken from the Texas Comptroller of Public Accounts. The comptroller's office bases its definition of high-tech on the following characteristics: (1) employing a higher percentage of technicians, engineers and scientists than most manufacturers and (2) having an above-average research and development component. Because of recent budget cuts and military personnel cuts, ammunitions and aerospace industries are excluded from this analysis.

[2] The oil and gas extraction industry accounts for a larger share of state output than of total state employment. In 1982, oil and gas extraction accounted for roughly 18 percent of total state output, compared with about 7 percent in 1994.

[3] We use the Bureau of Labor Statistics ES202 employment data for the U.S. and Texas three- and four-digit SIC sectors. In the calculations of employment shares, we use U.S. and Texas total nonagricultural employment from the Bureau of Labor Statistics Establishment Survey. For the city employment data, we use ES202 employment data provided by the Texas Employment Commission (TEC) and the Texas Comptroller of Public Accounts.

[4] We use 1988 as our reference point because several four-digit SIC sectors in high-tech industries were not available before 1988.

[5] Computer- and telecommunications-related employment is a subset of high-tech employment and includes computer manufacturing, electrical transmissions and distribution equipment manufacturing, household audio and video equipment manufacturing, communications equipment manufacturing, electronic components manufacturing, miscellaneous electrical machinery manufacturing and computer-related services.

[6] Nationally, employment in computer manufacturing has fallen since 1988, but production has risen 136 percent. Over the past two decades, computer manufacturing has become much less labor-intensive because of new equipment technology. While output has risen sharply, new technology has enabled workers to become more productive.

[7] Due to confidentiality concerns, TEC will not release computer manufacturing employment for Houston and Fort Worth. We approximate this employment by using estimates for the number of jobs at computer manufacturers Compaq (Houston), Tandy Electronics (Fort Worth) and AST (Fort Worth).

[8] See "Industry: High Tech and Defense," *Forces of Change* (Austin: Texas Comptroller of Public Accounts), 1994.

[9] See Stephen P. A. Brown and Lea Anderson, "The Future of the Southwest Economy," *Southwest Economy*, November 1988.

[10] While downtown Dallas has one of the nation's highest office vacancy rates, the suburban rate has tightened. Most high-tech companies are located in the suburbs.

The Changing Meaning Of Money

"What growth in conventionally measured money means for inflation will continue to change."

Because inflation can quickly disrupt an economy, central banks have tried to develop policies to keep inflation in check. One approach assumes that there is a stable relationship between economic activity and the measured money supply. Recently, this relationship has been changing because people have been changing how they handle their finances and how they pay for goods and services. As a result, what the measured money supply means, in terms of what it reveals about economic activity, has also changed.

Does M2 Still Measure Up?

Money and economic activity are linked by the famous equation of exchange:

$$\textit{money} \times \textit{money's velocity} = \textit{the price level} \times \textit{real GDP},$$

or

$$M \times V = P \times Y.$$

In other words, changing hands V times during a year, the money stock, M, facilitates the transaction of Y goods, which each cost P dollars. Converting this equation into growth rates yields two important relationships:

$$\textit{inflation} = \textit{money supply growth} + \textit{velocity growth} - \textit{real output growth}$$

and

$$\textit{nominal GDP growth} = \textit{money supply growth} + \textit{velocity growth},$$

where *nominal GDP growth* equals growth in the dollar volume of gross domestic production (output growth plus inflation). U.S. output typically grows at about 2.5 percent annually. Thus, the equation of exchange strongly suggests that, over the long run, inflation can be kept at zero by limiting money supply growth to equal 2.5 percent minus growth in velocity.

Money holdings typically fall and velocity rises as the spread between a riskless short-term market interest rate and the average yield on monetary assets rises. The stability of the relationship between interest rates and velocity is what makes it possible for money to be a useful indicator of not only inflation, but also of nominal GDP ($P \times Y$), since GDP data are available after a long lag, unlike data on money and interest rates. If velocity is predictable, then by controlling money supply growth, the Federal Reserve can control long-run inflation. While this sounds easy, shifts in how people conduct their finances and how they pay for goods can undermine the stability of the money–GDP relationship, thus making the Fed's inflation-fighting job more difficult in practice.

History bears this out. The M1 monetary aggregate that measures the money supply as checking deposits plus currency was once touted as the "holy grail" by monetarists. But M1 began to fall from grace in the mid-1970s when its velocity was unusually high, and M1 growth underpredicted real GDP, based on prior velocity behavior. Then in the early 1980s, the interest-rate sensitivity of M1 jumped as financial innovations and deregulation created new deposits that combined savings and transactions features and helped firms avoid holding non-interest-bearing demand deposits. As a result, attention turned to M2, a broader and less interest-rate-sensitive aggregate that was created in 1980.

M2 was redefined to include not only conventional M1, passbook savings accounts and small time deposits, but also new types of money, such as money market mutual funds, overnight instruments and, in 1982, money market deposit accounts. M2 had a stable relationship with nominal GDP during the 1980s (Small and Porter 1989). However, this relationship broke down in the 1990s as M2 became more sensitive to bond yields and as households shifted toward bond and stock mutual funds and toward Treasury securities (see Duca 1995b for references).

Such breakdowns in the link between money and nominal output have spurred efforts to either redefine money to include new types of "money" or revise money models to account for changing relationships between money and nominal output.[1] Understanding why the money–income relationship can shift is critical to finding new ways of deriving information from money.

Why the Money–Nominal GDP Relationship Can Shift

A stable link between M2 and nominal GDP will hold as long as people handle their finances in the same way.[2] However, a market economy will continuously create new financial products and markets will react to fundamental changes in the tastes of households (*Table 1*).

Since the early 1980s, the attractiveness to households of owning non-M2 assets has increased because of two types of technological change: lower costs of transferring funds from nonmonetary assets to transactions deposits (from bond mutual funds to money market funds, for instance) and greater use

Table 1
How Market Forces Can Cause Unusual Weakness in Money

Fundamental type of factor	Examples
Technological innovations	
Lower transfer costs	Lower mutual fund commission (load) fees Easier purchase of Treasury securities Electronic banking Easier banking and investing by phone
Financial services from nonassets	More widespread credit cards and lines Automatic teller machines Electronic wires and transfers
Demographics, preferences and learning	
Demographic shifts	Rising population share of middle-aged people preparing for retirement
Preferences and financial sophistication	Rising share of households with portable pensions due to IRA/Keogh laws and increased job uncertainty Greater tolerance of investment risk

of financial services from nonasset products (such as credit cards). Nonmonetary assets are any assets not included in the definition of the monetary aggregates, while nonasset products are instruments or ways of conducting transactions that do not directly and immediately involve holding an asset (for example, using a credit card to pay for something) until final settlement is made. As the cost of shifting between non-M2 assets and checkable deposits falls, the incentive to hold checking deposits to avoid transfer costs declines. Since households balance the transfer cost savings from holding money against the higher yields on alternative assets, lower transfer costs have induced lower money holdings. For example, over the past 10 years, the costs of shifting from a bond mutual fund to a checkable money market fund have fallen as transfer fees have fallen and as transfers have become easier. As a result, when longer term interest rates (on bond funds) are high relative to short-term rates (on money market funds), people are more likely to hold bond funds today than 10 years ago when transfers involved higher fees and greater headaches.

Thanks to improvements in financial products, households and firms can now better coordinate cash inflow with cash outflow. As a result, they can reduce check usage by consolidating many purchases into fewer check payments. They also have less need to hold checking balances for unexpected expenses.

Aside from technological changes, a rise in households' awareness of assets outside of M2 and their tolerance for risk can lead to unusual weakness in M2. For example, if households needed less extra return on stocks to compensate them for the extra investment risk, then at a given gap between the yields on M2 and stocks, they will hold less M2 and more stocks.

Technology and New Products

Lower asset transfer costs. The costs of shifting between non-M2 and checkable M2 assets have fallen in several ways. First, load (commission) fees on mutual funds have fallen sharply over the past two decades.[3] Furthermore, many mutual funds now also allow a greater number of free transfers among funds in asset management accounts. These accounts offer a host of investments, including bonds and equities, and allow no-cost shifts among investments within mutual fund families that typically include a checkable money market fund. So, a person who unexpectedly gets hit with a big car repair bill can use the phone to shift funds from an equity fund to a money market fund (without incurring a fee) and then write a money market fund check. Furthermore, many banks now offer mutual funds and allow customers to jointly manage their mutual fund and deposit balances. Additionally, the Federal Reserve has made it easier for people to buy Treasury securities, a change that, coupled with interest rates, encouraged people to take money out of M2 deposits and buy Treasury securities.[4]

More generally, the spread of better information technology is lowering transfer costs. In particular, the rise of electronic banking (especially via personal computer) poses potentially large reductions in the pecuniary and convenience costs of making such transfers.[5] Unfortunately, continuous data on asset transfer costs over long periods are lacking. Nevertheless, the limited evidence implies that lower transfer costs have led people to reduce M2 balances. In particular, lower transfer costs of using bond and equity funds likely explains why most of the unusual weakness in M2 during the 1990s has been in small time deposits (which compete with stocks and bonds) and money market mutual funds (which were unusually weak when relative yields on stocks and bonds yields were high).

Financial services from nonassets. In the 1970s and 1980s, technological advances and high interest rates induced firms to avoid using non-interest-bearing demand deposits to conduct transactions. Cash management techniques, coupled with the increased use of electronic transfers, allowed firms to more easily and cheaply tap nonmonetary assets to meet cash shortfalls. Breaking with the tradition of holding a lot of non-interest-bearing demand deposits, firms adopted cash management techniques that enabled them to better predict their cash

needs. Also, firms increasingly used wire transfers when they needed to shift funds. The result was a decline in demand deposits held by firms.

Financial innovations later spread to households after improvements in computer software made such innovations cost-effective for people. By providing liquidity and by enabling households to weather temporary changes in asset prices (such as stock prices), credit cards and credit lines likely induced many households to hold less money and more nonmoney assets.

For example, using 1983 data, Duca and Whitesell (1995) find that each 10-percentage-point rise in the probability of owning a credit card lowers checking accounts by 9 percent and checkable money market mutual funds and money market deposit accounts by 11 percent. The impact of credit cards on checkable balances is likely larger today because credit card ownership has spread, credit cards are more widely accepted, credit card purchases are more quickly processed, and consumers are now offered greater incentives to use credit cards. Another important innovation is the spread of automatic teller machines (ATMs). ATMs have reduced the need for people to carry extra cash by allowing them to easily withdraw cash from their checking or savings accounts.[6]

Evidence shows that because people gained a greater choice in how to pay for goods, the composition of M2 had shifted away from transactions and toward nontransactions accounts. Coupled with lower transfer costs, greater use of nonmoney ways of making payments could now be lowering M2, in addition to altering its composition.

Are Demographics, Preferences And Learning Playing a Role?

Greater tolerance of investment risk can stem from changes in employment patterns, demographics and in other factors that boost financial awareness.

Demographics. According to the life-cycle theory of consumption, people borrow when they are young because their income is below that of later years, save in middle age when their income is highest and then draw down their savings in retirement. An implication of this theory is that savings rates and the share of wealth invested in higher earning non-M2 assets should rise in the peak earning years before retirement. By increasing the average need to fund retirement, demographic trends may be inducing an overall shift toward risky assets with higher expected long-term yields and away from lower earning M2 deposits. Alternatively, as people reach their peak earning years, their ratio of income to spending falls. As this ratio falls, so too will the public's demand for low-transactions cost M2 deposits.

Consistent with these implications, Duca and Whitesell (1995) find that small time and savings deposits are higher for older age groups, after controlling for income and wealth. Furthermore, Morgan (1994) finds that the average share of household assets held in stocks and bonds rises with the population share of 35- to 54-year-old people.

Changing preferences and learning. Two factors that could be depressing M2 holdings are households' increased awareness of investments outside of M2 and an associated rise in households' willingness to tolerate risk in the assets they control. Aside from new technology and financial products, increased job uncertainty and the liberalization of IRA/401K accounts have induced a shift toward portable (defined contribution) retirement plans that have given households a greater role in managing their retirement assets. This shift, in turn, has induced households to incur large, one-time costs to learn more about bond and equity investments for retirement. In addition, with many mutual funds, people can count their IRA/Keogh mutual fund balances along with other mutual fund holdings toward meeting the minimum balance requirements for opening asset management accounts. As a result, IRA and Keogh assets effectively reduce the minimum balance requirement on non-IRA/Keogh mutual fund assets. Consistent with this, both IRA/Keogh and non-IRA/Keogh bond and equity fund assets rose in the mid-1980s after tax laws were eased and in the early 1990s.[7] Cross-section data confirm a big shift in household portfolios toward bond and equity funds and away from bank CDs since the late 1980s.[8]

Conclusion

The recent breakdown in the link between nominal GDP and conventionally defined M2 reflects how technological changes have enabled households to hold less money and more nonmonetary assets. Such innovations have reduced the costs of transferring funds from other assets to checking accounts, or, as in the case of credit cards and lines, have reduced the need to hold money that arises from mismatches of cash inflow and outflow. Changes in tastes and the age composition of the U.S. population may also be heightening the extent to which people can substitute other financial assets for money.

The information revolution will likely further reduce the benefits from holding traditional forms of money by fostering the spread of new electronic types of money, banking through personal computer, credit lines and financial management software. Together with these advances, a likely continuing shift toward portable (defined contribution) retirement plans and tax incentives will likely increase peoples' role in managing their retirement assets. These factors will likely lead people to further reduce their holdings of conventionally defined "money" and increase their investments in higher earning alternative assets. As a result, what growth in conventionally measured money

means for inflation will continue to change.

—John V. Duca

Notes

I thank the late Stephen Goldfeld and my many colleagues throughout the Federal Reserve System for sharing their insights on money with me over the years.

1 For examples, see Collins and Edwards (1994), Duca (1995a and 1994) and Koenig (1995).

2 For a more technical discussion, see Duca's (1995b) modified version of Milbourne's (1986) model of money.

3 For evidence, see Orphanides, Reid and Small (1994).

4 See Feinman and Porter (1992).

5 For more details, see Holland and Cortese (1995) and Lewis (1995).

6 Daniels and Murphy (1994a) find that a 100-percentage-point rise in the probability of ATM use increased the velocity of currency (transactions/currency) by 40 to 45 percent for transactions account holders, while Daniels and Murphy (1994b) estimate that a 5-percent rise in the proportion of ATM users would boost average transactions account balances by 4.5 percent. Together, these studies imply that ATMs induced households to shift from holding cash to holding transactions balances in the mid-1980s.

7 See Duca (1995a) for evidence.

8 See Kennickell and Starr-McCluer (1994) for cross-section evidence. These factors are consistent with a study by Blanchard (1993), who found that the extra return that investors demand from equities over bonds has trended downward since the 1940s and abruptly fell in the early 1980s.

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Beyond the Border

A Look at the Top U.S. Trading Partners

The U.S. economy grew 1.1 percent in the second quarter of this year, down from 2.7 percent in the first quarter. How much of a role has international trade played in determining that growth, and what is it likely to contribute in the future? Over the past 14 years, U.S. trade (exports plus imports) as a share of gross domestic product (GDP) increased from 8.8 percent to 17.8 percent. As the role of trade becomes more significant in the U.S. economy, our trading partners' economies have a greater effect on the U.S. economy. This column examines what is happening now in the economies of the largest U.S. trading partners and what 1996 may hold.

Canada represents nearly 22 percent of U.S. trade and is the top U.S. trading partner. Because the United States accounts for more than 80 percent of Canadian merchandise exports, Canada's economic fortunes are closely tied to those of the United States. In second-quarter 1995, Canada's real GDP fell 1 percent after a large drop in exports to the United States. Capacity utilization declined in the second quarter as business inventories rose from already-high levels. Consumers also spent less on big-ticket items. Probably the biggest source of uncertainty has been Quebec's quest for secession. Before the vote, the secession referendum caused some uneasiness in financial markets, as everyone tried to anticipate the outcome. Despite current weak economic conditions, forecasters expect real GDP to grow 3.1 percent in 1995 and 2.5 percent in 1996.

Japan's economy appears to be in a state of uncertainty. Although real GDP grew 3.1 percent in the second quarter after declining 0.1 percent in the first quarter, other economic signals paint a different picture. Industrial production and capacity utilization have been falling and unemployment rising. Difficulties in the Japanese banking industry are adding to the economy's woes, and the government recently introduced its sixth stimulus package since 1992 in hopes of jump-starting the economy. Blue Chip forecasters predict growth of 1 percent for 1995 and 2.3 percent for 1996.

Mexico, the United States' third largest trading partner, is still recovering from the December 1994 peso devaluation. The country's real GDP fell 7.8 percent in the first quarter of 1995, but only 3.1 percent in the second quarter, on a seasonally adjusted, quarterly change basis. A bright spot is the drop in interest rates on *cetes*, peso-denominated debt issued by the Mexican government. The interest rate on 28-day *cetes* was 40.6 percent on October 19, down dramatically from the 80-percent high in April.

Mexico's economic indicators show some negatives, however. Industrial production continues to fall and is nearing the lowest rate of the 1990s, while unemployment is rising to the highest rate of the decade. Although Mexico recently repaid $700 million of its debt to the United States, financial markets continue to rain on Mexico's parade. From September 4 to October 18, Mexico's Bolsa stock exchange deteriorated 10 percent and the peso fell 7 percent. For the year, the Organization for Economic Cooperation and Development (OECD) expects Mexican real GDP to decline by 3 to 4 percent. Growth should resume in 1996, however, at a rate of 2.5 percent.

Germany experienced 2.2-percent growth in the second quarter, down from 2.9-percent growth in the first quarter and 3-percent growth for 1994. The unemployment rate remains high, while industrial production dropped significantly in August after steadily increasing in the past four months. Competitive pressures, however, are helping liberalize some parts of the economy. For example, laws preventing retail stores from selling past 6 p.m. are being challenged, and there is a movement to ease the tax burden on businesses. The OECD expects real GDP to grow by 2.9 percent in 1995 and 2.7 percent in 1996.

The *United Kingdom* experienced real GDP growth of 1.8 percent in the second quarter, down from 2.6 percent in the first quarter. Analysts attribute the slowdown to a sharp drop in exports. On a more positive note, the unemployment rate has been steadily decreasing over the past two years. Capacity utilization remains far above average, and industry surveys have reported more than half of all firms are working at full capacity. Real GDP is expected to grow 3 percent in 1995 and 2.6 percent in 1996.

So, what does this all mean for U.S. exports and growth? This year, U.S. exports to Japan, Germany and Canada have surpassed 1994 levels, while exports to Mexico and the United Kingdom have lost ground. The outlook for next year is somewhat mixed as well. Mexico is expected to start its recovery next year, although uncertainty is still undermining the economy.

Canada, Germany and the United Kingdom should grow at a healthy rate in 1996. Forecasters expect Japan's global trade surplus to continue to decline throughout 1995 and 1996. Given Japan's weakness, however, its imports from the U.S. may be weak.

— David Gould
Michelle Thomas

Regional Update

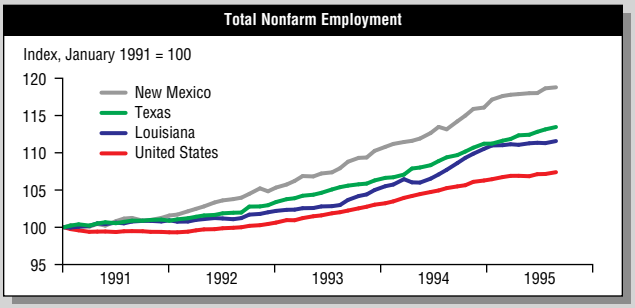
The Eleventh District economy is growing at a moderate pace. Employment in Louisiana accelerated slightly from July to September, following weak growth since January. New Mexico employment growth picked up in the third quarter, after weakness in the second quarter. Texas nonfarm employment growth slowed in September, following strong growth in the prior three months. The most recent Beige Book survey of District business conditions also suggests slightly weaker growth in Texas.

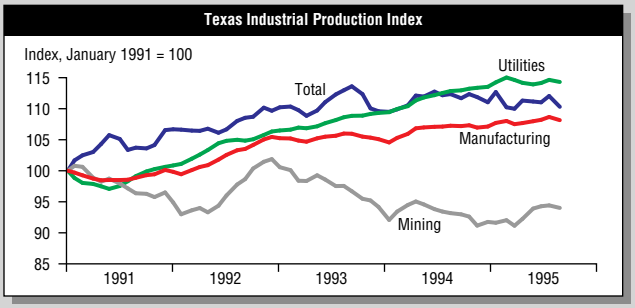
Manufacturing remains one of the weakest sectors of the District economy. Texas manufacturing production declined in August after a mild pickup in June and July. Manufacturing employment in the District states increased only slightly in the third quarter. Weakness in the national economy this year and a decline in exports, particularly to Mexico, have led to weakness in the manufacturing sector. In the second quarter, a 10-percent decline in exports to Mexico caused total Texas exports to decline 2.2 percent. Construction-related manufacturing industries have also been weak, although a recent pickup in residential building should result in increased orders for these industries over the next six months.

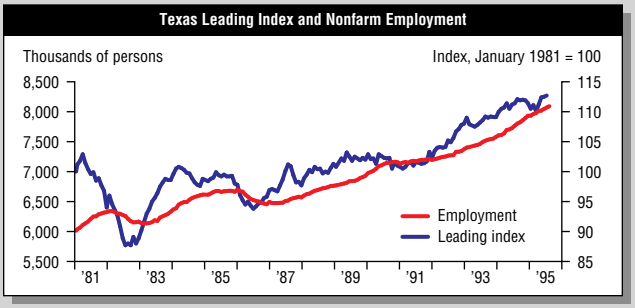
A recent pickup in new home building has boosted District construction employment, which surged in August and September. Despite declines in the first quarter, construction employment levels remain higher than the strong levels posted a year ago. District business contacts report that lower mortgage rates and declines in home prices in many markets have spurred the turnaround.

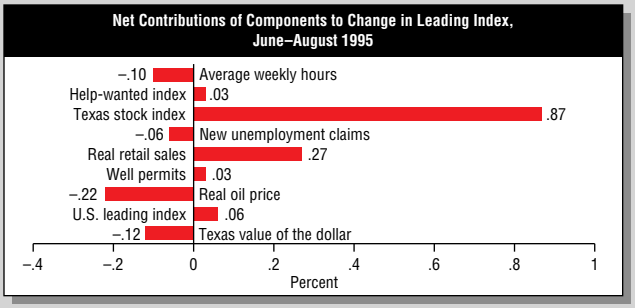
The Texas leading index increased in August for the fifth straight month. The index has recovered from sharp declines in the first quarter that were mainly due to the peso devaluation. In May, the index surpassed its previous peak and has since experienced steady growth. Five of the nine indicators increased in the three months ending in August, led by solid gains in stock prices and retail sales. Recent movements in the index suggest that moderate expansion will continue over the next six months.

—Keith R. Phillips









REGIONAL ECONOMIC INDICATORS

	Texas Leading Index	TIPI total	Texas Employment					Total Nonfarm Employment		
			Mining	Construction	Manufacturing	Government	Private service-producing	Texas	Louisiana	New Mexico
9/95	—	—	154.4	412.3	1,035.0	1,463.1	5,042.9	8,107.7	1,796.0	694.6
8/95	113.2	119.2	153.8	407.6	1,034.4	1,466.4	5,037.7	8,099.9	1,791.2	691.1
7/95	112.9	119.6	154.1	405.2	1,031.9	1,458.5	5,020.0	8,069.7	1,786.8	690.3
6/95	112.6	119.2	155.3	404.2	1,032.3	1,451.9	5,002.9	8,046.6	1,787.6	686.6
5/95	112.4	119.1	155.7	402.7	1,031.3	1,448.1	4,980.7	8,018.5	1,786.5	686.5
4/95	111.2	118.8	156.1	403.7	1,033.4	1,444.6	4,975.2	8,013.0	1,783.2	685.8
3/95	110.1	118.7	156.7	406.3	1,032.2	1,441.0	4,941.8	7,978.0	1,784.4	685.3
2/95	111.1	119.1	157.3	405.7	1,029.7	1,438.3	4,930.7	7,961.7	1,782.4	684.3
1/95	110.4	118.9	157.6	402.0	1,026.5	1,433.3	4,914.0	7,933.4	1,781.8	681.5
12/94	111.4	118.3	158.9	398.8	1,025.0	1,433.2	4,916.9	7,932.8	1,774.5	675.3
11/94	111.9	118.2	160.1	393.0	1,021.7	1,426.8	4,893.0	7,894.6	1,764.0	674.2
10/94	112.0	118.5	160.6	388.2	1,018.8	1,424.5	4,865.5	7,857.6	1,755.1	669.0

FURTHER INFORMATION ON THE DATA

For more information on employment data, see "Reassessing Texas Employment Growth" (*Southwest Economy*, July/August 1993). For more information on TIPI, see "The Texas Industrial Production Index" (Dallas Fed *Economic Review*, November 1989). For more information on the Texas Leading Index and its components, see "The Texas Index of Leading Indicators: A Revision and Further Evaluation" (Dallas Fed *Economic Review*, July 1990).

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THE CHALLENGE OF NAFTA

An international economic forum evaluating NAFTA's impact almost two years after the treaty's passage. Panelists will examine international trade and investment in the NAFTA countries, financial interdependencies, macro-industrial and micro-industrial development, and retail trade.

WHEN: December 3, 6:30 p.m.–8:30 p.m. (reception) and December 4, 9:00 a.m.–6:30 p.m. (program)
PLACE: Camino Real Paso del Norte Hotel, 101 S. El Paso St., El Paso, Texas 79901
REGISTRATION DEADLINE AND FEE: November 24, 1995; $90 per person
FOR MORE INFORMATION: Leigh Bloss, El Paso Branch–Federal Reserve Bank of Dallas, (915) 521-8235, Fax (915) 521-8284

PROGRAM HIGHLIGHTS

- Addresses by Raul Hinojosa-Ojeda, UCLA; Dallas Fed President Robert D. McTeer, Jr.; and Ariel Buira, subgovernor, Banco de México.
- *NAFTA and International Trade and Investment* with Oscar Vera Ferrer, Centro de Estudios Económicos del Sector Privado; Alan Rugman, University of Toronto; and Dallas Fed economists Harvey Rosenblum, Lucinda Vargas and William C. Gruben.
- *NAFTA and Financial Interdependence* with William C. Gruben, Alfredo Phillips Olmedo, North American Development Bank; Sylvia Maxfield, Yale University; Catherine Mansell Carstens, Instituto Tecnológico Autónomo de México.
- *NAFTA and Macro-Industrial Development* with Timothy P. Roth, UT El Paso; Chuck Cunningham, Delphi Packard Electric Systems — General Motors; Alberto Sandoval, Internacional de Cerámica; Carlos de Orduña, Sanyo North America Corp.; José Reyes Ferriz, Reyes, Estrada y Fernández
- *NAFTA and Micro-Industrial Development* with Lucinda Vargas; Hector Moreira, Instituto Tecnológico y de Estudios Superiores de Monterrey; Luis Ortega, Kokopeli; Gabriela Quirarte, D.M. Distillery; Ed L. Romero, Advanced Sciences.
- *NAFTA and Retail Trade* with Frank Hoy, UT El Paso; Nora Yu, Cámara Nacional de Comercio de Cd. Juárez; and Michael Patrick, Texas A&M International University.

Sponsored by the El Paso Branch of the Federal Reserve Bank of Dallas, in conjunction with the University of Texas at El Paso, College of Business; New Mexico State University, Border Research Institute; Universidad Autónoma de Cd. Juárez, Instituto de Ciencias Sociales y Administración; and Universidad Autónoma de Chihuahua, Departamento de Vinculación y Transferencia de Tecnología.

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