

Houston Business

A Perspective on the Houston Economy

The Oil Industry and the Cities: Consolidation in The Oil Extraction Industry

Oil industry employment in the United States has been in decline for more than 15 years. Total jobs in the industry rose 256 percent—by 491,000 jobs—from 1973 to 1981. Many of these gains were erased, however, after the oil bubble burst in 1981. Within six years, 374,000 jobs had disappeared.

Table 1 (on page 2) depicts the boom and bust in the oil and natural gas extraction industry as reflected by changes in industry employment from 1973 to 1994. The table shows total jobs, as well as jobs in the oil and gas production, services and machinery sectors.

The reasons for the oil bust are well-known. In the 1970s, the Organization of Petroleum Exporting Countries (OPEC) cartel mistakenly assumed that its chief competition was oil production from synthetic liquid fuels that could only be produced at prices of \$60 per barrel or more, and OPEC sought to push world oil prices to that level. Worst of all, governments of consuming nations and much of the oil industry believed this story and acted accordingly. It turned out, of course, that OPEC's chief competition was consumer conservation and oil-on-oil competition from non-OPEC producers in the North Sea, Alaska and Mexico. OPEC raised oil prices to unsustainable levels by the early 1980s, lost control of price to overproduction in 1981, and the oil bust was under way.

This article focuses on employment trends in the oil and natural gas extraction industry since 1987. By 1987, the industry had completed its most compelling adjustments to lower prices in world oil markets. The worst of the decline in oil

Oil-related employment in the United States has continued to shrink in recent years. . . . Consolidation into the largest oil cities is another of the industry's responses to cost pressures.

Table 1
Employment in Oil and Gas Production,
Services and Machinery
(Thousands of jobs)

Year	Producers	Services	Machinery	Total
1973	135.6	134.6	45.4	315.6
1981	254.3	430.2	122.3	806.8
1987	199.4	197.0	36.4	432.8
1994	161.9	168.3	36.8	367.0

SOURCE: Bureau of Labor Statistics, Employment and Earnings.

and natural gas prices and employment was over, yet the industry continued to lose jobs. Table 1 shows an overall decline of 15.2 percent from 1987 to 1994.

This article reviews some of the reasons for the continued decline in American oil jobs—low and volatile prices, a shift of exploration activity overseas, new technology and rising industry productivity. Recent changes in the *level* of oil and gas jobs, as well as *geographic shifts* in employment and the relative job gains and losses among 29 U.S. oil cities are examined. Some cities have fared better than others in recent years, and consolidation has generally favored oil cities with the largest concentration of industry activity. This article explores reasons for this pattern of industry consolidation.

RECENT TRENDS IN OIL EXTRACTION JOBS

Several factors have shaped U.S. oil extraction employment since 1987. Low oil and natural gas prices still play a key role, as OPEC's cartel pricing now recognizes oil-on-oil competition from basins around the world. OPEC prices continue to contain monopoly revenues but are presumably set low enough to discourage exploration and production from non-OPEC basins, including those in the United States.

Volatile oil markets also play a role in restraining job growth. For decades before the oil bust, oil prices were stable and controlled by the Texas Railroad Commission or by OPEC. When an occasional oil price spike disrupted this stability, the aberration stood out from long-term trends and could be explained by a specific event—a refinery strike, war in the Middle East, an OPEC meeting and so forth. Since the late 1980s, volatility has increased and, despite OPEC's best efforts, prices have fluctuated widely and often.

Price volatility may restrain activity if producers are adverse to price risk, or if the cost of doing business rises as producers hedge against price risk. More importantly, however, price volatility now shapes every oil company by forcing it to reduce fixed costs. It is important to be able to quickly *expand or contract activity* in response to changing market prices. One way to achieve this flexibility is by shifting oil market risk to temporary employees, outside suppliers, contractors and consultants, and by hiring fewer workers for the permanent payroll. Outside suppliers of accounting, legal, janitorial and other services, in turn, can minimize oil-related risks by seeking clients in non-oil-related industries. The objective of industry restructuring goes beyond downsizing; it includes reorganization of suppliers, often shifting from internal to external sources.

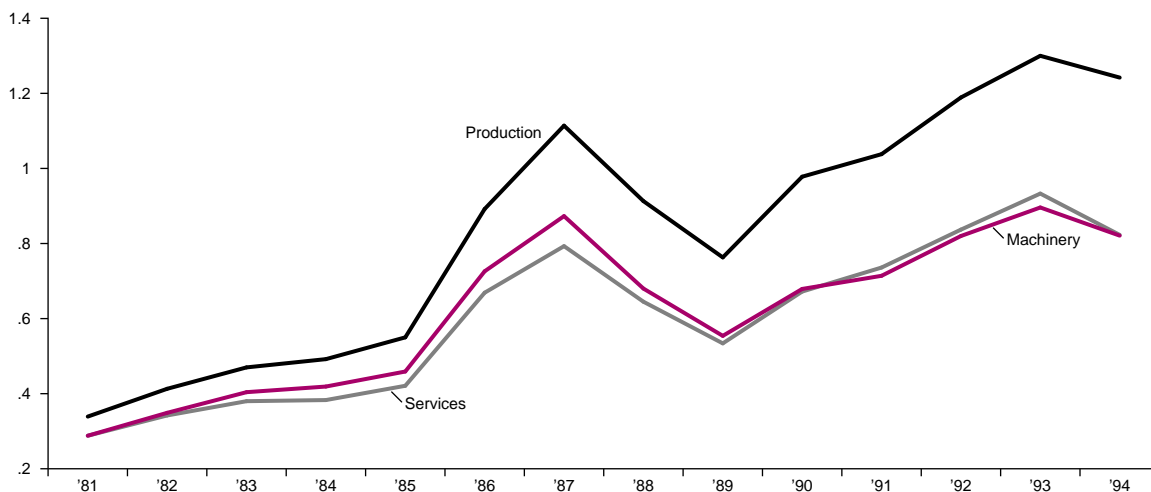
Another important trend in the 1990s has been the shift of many of America's largest oil producers from domestic to foreign exploration and production. The U.S. onshore fields are perceived as drilled out, and offshore opportunities are mostly confined to the western Gulf of Mexico. Among large, integrated producers in particular, restructuring and downsizing of their domestic operations staffs have been hallmarks of the early 1990s.

The net employment impact of increased overseas exploration is difficult to gauge. Large producers have retained the best management and technical skills and refocused them on overseas projects, often easing total reductions at corporate headquarters. And sell-offs of large domestic properties have opened opportunities for independents willing to purchase and exploit these properties for incremental reserve additions. Although many properties simply change hands, both new technology and more frugal independent management have exerted downward pressure on domestic jobs. The employment consequences often have been severe for rural areas and smaller cities, where local oil production is tied to specific domestic oil fields.

Finally, improved management and technology is reshaping the oil and gas extraction industry. Important new tools—such as three-dimensional seismic, coiled tubing and measurement while drilling—have lowered drilling cost, reduced risk and widened the range of economic prospects available to the industry. The recent strong interest in the Gulf of Mexico, both in deep water and in the subsalt regions,

Figure 1
Implied Productivity in Oil and Gas Mining

Ratio: Hourly wage to oil price



SOURCE: Bureau of Labor Statistics, Department of Energy and authors' calculations.

is largely a product of advancing technology. Figure 1 shows the ratio of industry wages relative to the price of oil, an implicit measure of industry productivity that shows strong gains since 1985.

AN URBAN OIL INDUSTRY

Industry trends are shaping both the level of U.S. oil employment and also its geographic distribution. In particular, an urban and technology-based oil industry has emerged that operates equally well at home and around the world. In 1993, 75 percent of the industry's wages, salaries and benefits were paid by oil producers and service establishments located in metropolitan areas, and in Texas, the metropolitan share of these earnings is higher at 83 percent. The shift of oil jobs and earnings into the cities has been a steady trend since the early 1980s.

This shift may be surprising, but only because we think of oil extraction as a resource-based industry. Yet there is a growing urban component that is becoming footloose—perhaps working in several U.S. oil basins, perhaps operating overseas or perhaps both. Large integrated oil companies make up one footloose component, of course, operating as they always have on a global scale. But American oil services play a worldwide role as well. When the North Sea opened up to oil exploration, a key economic objective of the British

government was to develop an oil service industry for Scotland. When the North Sea wells dried up, the British wanted Aberdeen to have what the Americans already had—global exports of skilled and technology-based geophysics, drilling, construction and oil production. Aberdeen's failure to develop such an industry has been well documented, and the key reason for failure was American experience and our grip on essential patents. The French and Norwegians have developed competitive oil service industries, but only with the help of large government subsidies. The dominant exporter remains the United States.

This growing footloose contingent of the industry, operating at home and abroad, has created not just a split between metropolitan and nonmetropolitan areas, but also a division between large and small oil cities. Industry consolidation has generally favored those cities that are home to the largest clusters of oil industry activity.

IN SEARCH OF OIL CITIES

We know surprisingly little about America's system of oil cities—about where they are, what they do or how their oil-related employment has changed in recent years. The most readily available data come from the *Regional Economic Information System* from the Bureau of Economic Analysis, which provides geographic detail on wages, salaries and employer-paid

Table 2
Industry Definitions

Producers — Establishments engaged in operating oil and gas field properties. Activities may include exploration for crude petroleum and natural gas; drilling, completing and equipping wells; and all other activities up to the point of shipment from the producing property.

Drilling Oil and Gas Wells — Establishments engaged in drilling wells for oil and gas field operations for others on a contract basis.

Oil and Gas Field Exploration Services — Establishments primarily engaged in performing geophysical, geological and other exploration services for oil and gas on a contract basis.

Other Oil and Gas Field Services — Other establishments engaged in oil and gas services performed for others on a contract or fee basis. For example, excavating slush pits and cellars; grading and building foundations at the well; cutting and pulling casings; well surveying; and cleaning out, bailing and swabbing wells.

Oil and Gas Machinery — Establishments primarily engaged in manufacturing machinery and equipment for use in oil or gas fields, including portable drilling rigs.

Headquarters — Central administrative establishments and some other central auxiliary establishments that are designed to serve several other establishments, such as warehouses or research laboratories.

SOURCES: U.S. Standard Industrial Classification Manual and County Business Patterns.

benefits. The data in Figure 2 strongly suggest a dominant role for Houston in the industry, with \$5.2 billion in local wages, salaries and employer-paid benefits. Dallas is the number two oil city, with \$1.7 billion in earnings, followed by New Orleans, Midland–Odessa, Tulsa and Lafayette. Even in Figure 2, however, approximations are necessary because of undisclosed information. As we turn to other cities, the oil-specific data disappear quickly. Furthermore, no detailed information is available on industry sectors such as oil producers, services and machineries.

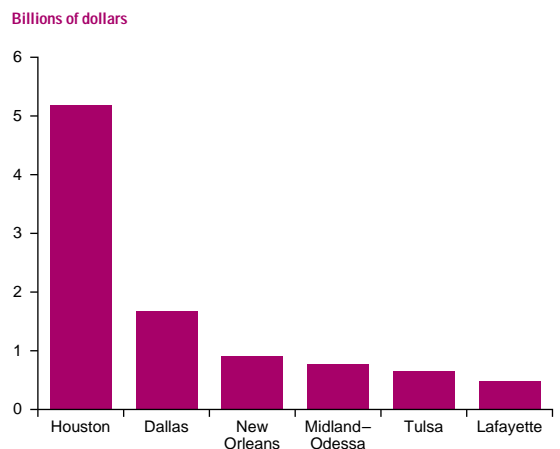
To learn more about oil cities, we referred to *County Business Patterns*, published annually by the Department of Commerce. This source provides geographic detail on employment at the county level and information on several industry categories—producers, headquarters, machinery and several categories of oil services. Industry definitions are given in Table 2. The last year of data available from *County Business Patterns* is 1993. To obtain information on metropolitan areas, we added the appro-

appropriate counties together, a tedious job that made us focus on a selected list of metropolitan areas and on the years 1987 and 1993.

We derived a list of 29 oil cities from three sources. First, we examined the annual list of publicly traded oil and gas producers published in the *Oil and Gas Journal*. The industry's largest firms appear on this list, and tracking their headquarters allowed us to identify concentrations of urban oil jobs. Our 29 cities included more than 80 percent of the companies on this list in 1983 and 1993. Second, we looked at the Standard & Poor's *Register of Corporations*, a comprehensive list of incorporated companies identified by line of business. We were able to identify producers, service companies and machinery company headquarters by metropolitan area. In recent years, 70 to 75 percent of the S&P listing could be found in our 29 cities. Finally, we searched other, less comprehensive data bases looking for significant concentrations of oil earnings or employment. Cities such as Lafayette and Houma, which have few company headquarters and appear infrequently on the S&P listing, turn out to have significant concentrations of oil service employment.

The 29 oil cities and their employment are shown in Table 3, ranked in order of total oil-related employment. Houston stands at the top of the list with 33.6 percent of the jobs in the 29 cities; Dallas is number two with 10 percent; and Tulsa, Midland–Odessa, New Orleans and Lafayette follow with about 5 per-

Figure 2
Oil and Gas Extraction in Six Cities
(1993 Wages, Salaries and Benefits Paid Locally)



SOURCE: Bureau of Economic Analysis, Regional Economic Information System.

Table 3
Oil Industry Employment in 29 Metropolitan Areas, 1993

City	Producers	All services	Drilling services	Exploration services	Other services	Head-quarters	Machinery	All Oil	29-city share	Cumulative share
Houston	11,374	13,900	5,251	3,027	5,734	23,966	8,388	57,628	33.6	33.6
Dallas	4,243	3,902	2,200	1,007	460	6,291	2,735	17,171	10.0	43.7
Tulsa	2,533	1,297	441	284	612	4,421	1,205	10,289	6.0	49.7
Midland–Odessa	3,001	4,813	879	524	2,756	2,125	350	9,456	5.5	55.2
New Orleans	2,074	2,929	1,977	97	1,500	3,459	355	8,817	5.1	60.3
Lafayette	429	5,401	580	400	4,366	750	385	7,135	4.2	64.5
Oklahoma City	2,438	2,432	824	399	1,544	1,770	495	6,965	4.1	68.6
Los Angeles	2,096	1,995	126	81	1,560	1,955	323	6,369	3.7	72.3
Bakersfield	783	3,539	760	21	2,752	1,070	126	5,518	3.2	75.5
Fort Worth	1,547	348	26	66	272	2,024	1,151	5,070	3.0	78.5
Denver	2,145	765	704	124	133	1,602	10	4,704	2.7	81.2
New York	335	169	60	40	70	4,190	10	4,522	2.6	83.8
Wichita, Kansas	1,170	875	287	70	338	1,760	60	3,865	2.3	86.1
San Francisco	149	150	30	30	140	3,010	60	3,369	2.0	88.1
Houma, Louisiana	306	2,050	666	12	1,372	60	207	2,623	1.5	89.6
Longview–Marshall	486	1,342	361	88	927	0	82	1,910	1.1	90.7
Shreveport	1,117	435	127	78	268	175	60	1,787	1.0	91.7
Corpus Christi	385	1,174	340	84	740	62	60	1,681	1.0	92.7
San Antonio	766	602	143	57	441	185	60	1,613	.9	93.7
Salt Lake City	195	195	10	91	56	1,051	0	1,441	.8	94.5
Wichita Falls	808	375	171	60	249	10	175	1,411	.8	95.3
Pittsburgh	452	171	20	60	114	788	0	1,368	.8	96.1
Chicago	250	93	15	15	80	992	10	1,345	.8	96.9
Abilene, Texas	333	944	638	35	270	10	14	1,301	.8	97.7
Tyler, Texas	375	464	22	88	353	175	60	1,074	.6	98.3
Casper, Wyoming	121	618	208	48	323	175	60	974	.6	98.9
Mobile, Alabama	732	84	20	0	74	60	10	886	.5	99.4
Amarillo	305	123	60	24	20	175	0	603	.4	99.7
Laredo	165	281	281	0	0	0	0	446	.3	100.0
Total oil cities	39,415	49,896	16,636	6,750	26,754	61,726	16,321	171,341		
United States	98,138	146,300	44,463	12,334	88,482	91,192	23,616	359,246		
Oil cities as a share of the United States	40.2	34.1	37.4	54.7	30.2	67.7	69.1	47.7		

SOURCE: *County Business Patterns*.

cent each. The remaining 23 cities are left to divide up the remaining one-third of the jobs.

Table 4 shows the 29-city employment as a share of the oil extraction industry. In 1993, these 29 cities made up 47.7 percent of all U.S. oil extraction jobs but had 67.7 percent of headquarter/central facility jobs, 69.1 percent of machinery jobs and 54.7 percent of exploration services. The share of producer, drilling and other service jobs shifts sharply in favor of other metropolitan or rural areas.

Table 5 shows the change in oil industry employment from 1987 to 1993 using the *County Business Patterns* concepts and definitions. These cities held on to oil-related employment better than the rest of the nation. Total

oil employment among the 29 cities declined by 12.7 percent, while the rest of the United States lost 23.9 percent of these jobs. The most striking change among the individual industries is a 26-percent increase in producer employment in the 29 cities, while producer jobs fell by 31 percent elsewhere. The increase in 29-city producer employment is almost completely accounted for by 4,840 new jobs in Houston, 1,412 in Midland–Odessa, and 1,099 in New Orleans. The industry's turn away from domestic production hurt both small metropolitan and non-metropolitan producer employment, and forced producers into the largest oil centers to seek domestic alternatives or international work.

Any division between haves and have-nots,

Table 4

Twenty-Nine Oil Cities as a Share of the U.S. Oil Industry
(Percent of Employment in Oil Extraction, 1987 and 1993)

	1987	1993
All oil extraction	44.4	47.7
Producers	28.5	40.2
Headquarters	67.6	67.7
Services	36.1	34.1
Drilling	37.1	37.4
Exploration	49.2	54.7
N.E.C.	33.9	30.2
Machinery	73.2	69.1

SOURCE: County Business Patterns.

however, extends to the cities on the top and bottom of this list. Table 6 shows the list of 29 cities, their employment and ranking among the oil cities in 1987 and 1993, and the change in employment from 1987 to 1993. The top five cities on the list in 1987 together accounted for over 60 percent of the total oil employment, and together they lost 5,174 jobs from 1987 to 1993 or 4.8 percent. The remaining 24 cities lost a combined 10,154 jobs or 22.6 percent. As the industry shrank, it consolidated into cities at the top of the list—into cities with the largest clusters of industry activity.

WHY CONSOLIDATION?

Throughout the U.S. economy there are many clusters of specific industry activity such as entertainment in Hollywood, autos in Detroit or financial services in New York. This need for establishments in the same line of business to be close to each other is also important to understanding consolidation in the oil extraction business.

Table 5

Percent Change in Oil Extraction Jobs Since 1987
(Twenty-Nine Cities Compared with the United States)

	29 cities	Other	U.S.
Producers	26.0	-31.0	-15.0
Headquarters	-18.5	-23.1	-19.4
Services	-22.5	-19.2	-20.4
Drilling	-15.2	-20.8	-18.7
Exploration	-23.1	-41.6	-32.5
N.E.C.	-26.4	-16.6	-19.9
Machinery	-23.8	-9.5	-20.0
Total jobs	-12.7	-23.9	-18.6

SOURCE: County Business Patterns.

Three reasons are often given for the formation of large industrial clusters. First, there is the need to be plugged into cutting-edge activity, to be part of the industry's knowledge loop. Economists call this *informational spillovers*—insights gleaned from professional groups and meetings, from technical smalltalk and gossip or by keeping an eye on your competitor. Second, large clusters allow a specialized labor force to form. A wide choice of employees with industry-specific skills and experience is attractive to employers; the cluster is similarly attractive to employees because of the range of job alternatives offered them. Finally, just as labor specializes, so do suppliers and financial providers. The opportunity to be close to a large number of potential clients is an irresistible attraction for suppliers.

Note the strong cumulative effects of success. The bigger the city the more attractive it is; the more attractive it is, the bigger it gets. Also, as the oil industry has come under severe cost pressure in recent years, the cost savings

Table 6

A Comparison of Total Oil Employment in 29 Cities, 1987 and 1993

City	1987 29-city rank	1987 total oil jobs	1987 percent total oil	1993 29-city rank	1993 total oil jobs	1993 percent total oil	Change total oil jobs	1987-93 percent change
Houston	1	55,160	28.09	1	5,7628	33.6	2,468	4.5
Dallas	2	18,626	9.49	2	1,7171	10.0	-1,455	-7.8
Midland-Odessa	3	12,876	6.56	4	9,456	6.0	-3,420	-26.6
New Orleans	4	12,103	6.16	5	8,817	5.1	-3,286	-27.2
Tulsa	5	9,770	4.98	3	10,289	5.5	519	5.3
Top 5 cities		108,535	55		103,361	60	-5,174	-4.8
Remaining 24 cities		87,820	45		67,980	40	-19,840	-22.6
All 29 cities		196,355	100		171,341	100	-25,014	-12.7

SOURCE: County Business Patterns.

associated with the right location has become a matter of survival. And the process works in reverse as well, as a cluster unravels, its past success can quickly spiral into failure.

All of these forces work for oil extraction clusters just as they do for other industries. To see how strongly these factors worked for oil, we turned to our 29 cities and asked what explained success as measured by the number of jobs in the local industry. We assumed a number of factors might contribute to local employment: access to nearby oil fields, access to financial markets, urban cultural or infrastructure advantages associated with being in a big city, wage differentials or the size of the local oil cluster measured by the number of oil establishments. We tried to include for oil services and machinery the value of being close to customers, measured by the number of local headquarter establishments in each city, but headquarters proved too closely correlated with the overall size of the cluster to find an independent effect.

Our statistical results showed no consistent value in being close to the oil fields or in a big city. Wage effects, if anything, indicate a large and successful cluster is associated with higher wages, results that make sense only if the cost savings from being in a large oil cluster are high enough to pass some of the savings to employees in the form of higher wages. But the dominant factor in every case—for producers, services and machinery—was the size of the oil cluster. Table 7 shows the percentage increase we might expect in local oil employment if the size of the oil cluster, or the total number of oil establishments in the city, was increased by 1 percent. By the same token, and applicable to many of the smaller oil clusters in Table 5, these would be employment declines expected if the oil cluster shrank by 1 percent.

CONCLUSION

Oil-related employment in the United States has continued to shrink in recent years. As exploration activity has shifted overseas, it has reduced the level of activity in specific U.S. basins. Further, strong productivity trends have reduced the level of drilling activity needed to replace reserves, lowered cost, and generally reduced employment. In contrast with the oil bust, this decline in jobs in recent years represents cost-conscious decisions made by a healthy and highly profitable oil industry.

Table 7

**Employment Elasticities by Industry
(Percent Increase in Employment for 1-Percent
Increase in All Oil Establishments)**

	1987	1993
Producers	1.28	1.35
Headquarters	1.54	1.62
Services	1.04	1.18
Drilling	.93	1.37
Exploration	1.85	2.12
Other services	1.03	.81
Machinery	2.53	2.40

SOURCE: Authors' calculations.

Consolidation into the largest oil cities is another of the industry's responses to cost pressures. Houston and Tulsa were the only major oil cities with net job gains from 1987 to 1993, although Dallas gained market share. Houston, Dallas and New Orleans perhaps have a distinct role in the oil industry, emerging with large numbers of urban producers, headquarters and technical jobs in oil services. Although qualified by the location of a few major producers and integrated companies in these cities, Midland–Odessa, Lafayette, Tulsa and Denver have important regional roles. Their recent performance has been tied more closely to the experience of their respective basins. Large cities that the oil industry might have sought out in the past for financial reasons, such as New York, Chicago or Los Angeles, play a diminished role today.

Finally, this exercise of counting up oil jobs is becoming a less meaningful exercise. Outsourcing and restructuring are driven by low and volatile energy prices, and they allow the industry to respond to market conditions by increasing or decreasing operations at lower cost. As the oil industry operates from larger and more industrially diverse cities, as labor supplies and suppliers become more sophisticated, it becomes more difficult to know who does and does not work for the oil industry. Janitorial, accounting, personnel and other companies perform oil industry jobs—but get counted as financial or business services. Direct employment becomes a less meaningful guide to industry health and activity.

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Weather remained a significant factor in Houston in February and March—either too hot or too cold to sell autos and clothing. And successive cold waves on the East Coast and in the Midwest drove up energy prices.

RETAILING AND AUTOS

Houston retailers continue to report a difficult retail environment. Untimely hot weather sandwiched between cold spells hindered efforts to clear winter inventories, and the resulting markdowns hurt profit margins. Some upscale stores with established clientele report good results.

Cold January weather hurt auto sales, but the market rebounded nicely in February. February sales were 13 percent above the same month last year. Even so, the poor January record leaves Houston 6 percent behind the first two months of 1995.

CRUDE OIL AND ENERGY PRODUCTS

Crude oil prices have risen sharply in recent weeks, despite concerns that Iraqi oil might re-enter world oil markets. No one has been willing to build crude inventories because of uncertainty over Iraq, fearing potential write-downs if the price plunges. As a result, crude oil inventories have been pulled to the lowest levels in 19 years, leaving many refiners living hand to mouth. This low inventory and strong product demand have pulled crude prices up steadily.

Heating oil and natural gas have been on a weather-driven roller-coaster for several months, with spot natural gas in early February briefly setting dramatic highs in New York and Chicago equivalent to \$300 per barrel. Natural gas storage was pulled below one-third of capacity by March, and it will take an increase of 6 percent of U.S. production over 200 days or more to refill capacity. This should keep gas prices strong through much of this year.

Wholesale gasoline markets recently jumped sharply as the summer driving season approaches, because of low inventories of gasoline and crude oil. Refiners margins have

improved with gasoline prices in recent weeks, but low crude inventories often hurt margins this winter as refiners were forced into rising spot markets for scarce crude oil.

OIL SERVICES AND MACHINERY

Profits for oil services came in much stronger than expected in the fourth quarter, based largely on a surge in demand from offshore activity. In early 1996, local companies report continued strong orders and growing backlogs for oil services and machinery. The number of rigs working in the United States and Texas remains higher than last year, and the Gulf remains the most active U.S. basin.

PETROCHEMICALS

Orders remain slow and spot markets continue to weaken, but the petrochemical industry seems to have engineered its own soft landing in 1996. In an industry highly prone to crashes, the industry collectively reported respectable profits in the fourth quarter, reports no major inventory build-up and should return to strong profitability with any meaningful pickup in the U.S. economy. Higher energy prices mean higher feedstock prices, and margins have been hurt recently by rising costs.

REAL ESTATE

Recent sales of new homes in Houston have inspired comparisons with the early 1980s, as sales for the three-month period from December to February have been 38 percent above 1995 levels. Existing homes sales were up 20 percent over February 1995, marking the highest level of sales for any February in Houston history. Home starts are up 44 percent compared with last year, and builders are hoping to raise prices by as much as 6 percent in 1996. Low interest rates and strong job growth have converged to produce a surprisingly strong market. The hottest segment of the market is the \$100,000–\$200,000 range, not the starter-home market that has dominated local sales figures for the past couple of years.

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