Effect of Falling Oil Prices on Energy Employment

Recent declines in oil prices have raised serious concerns about future employment in energy-related industries. Because lower oil prices reduce expected profits from oil and natural gas production and development, energy industries become less attractive sources of investment, causing reductions in the employment base. Estimates for Texas indicate that each 10-percent decline in real oil prices (including declining value attributed to general price inflation) yields approximately a 10-percent employment reduction in oil field machinery and oil and gas extraction sectors.

Falling Oil Prices

After adjustment for inflation, oil contract prices have now been quoted below those that prevailed before the major oil price hike in 1976-79. As demonstrated by recent volatility in spot market prices, the eventual oil price level remains uncertain, but there is little doubt that prices will be considerably lower than in 1985.

Lower oil prices directly reduce the profitability of oil and gas activity. Just as rising oil prices sparked a boom in exploration and development activity, falling oil prices force oil companies to cut back on exploration and production budgets as prospects for profitable return on investment disappear.

Estimated Effect on Employment

Reductions in exploration and production budgets also directly affect employment in oil-related industries. A model of the effect of oil prices on energy extraction and oil field machinery employment is presented in Table 1. Falling oil prices directly reduce the rig count, thus lowering consumption of oil field machinery and equipment and causing a drop in related employment. Oil and gas extraction employment also falls directly in response to the rig count because fewer drilling crews are employed. The negative effect of the rig count is augmented in the case of extraction employment by the direct impact of lower oil prices on employment away from the field, including white-collar jobs. The model, which tracks historical experience quite closely, also incorporates the observed evidence that complete adjustments in all of these variables to price shocks are not immediate.

The effects of different oil prices on employment are shown in Charts 1 and 2. In each case, it is assumed that a

(Continued on back page)

Lower Oil Prices Will Boost U.S. Refinery Production

In contrast with their negative impact on oil field exploration and development, lower world oil prices can be expected to boost U.S. refinery production. As lower crude oil prices are passed through to customers in lower prices for refined products, consumption of these products will increase. Although the near-term impact on consumption is likely to be relatively modest, if crude oil prices remain no greater than $25 per barrel, growth in U.S. refinery production through 1990 should prove greater than that of gross national product.

Consumption Boosted in Several Ways

Lower prices for refined products boost oil consumption through a number of avenues. Lower oil prices encourage consumers to substitute refined products for other fuels, as well as increasing the attractiveness of energy-intensive means for producing goods and services. In addition, final demand will shift toward those goods using greater energy-consuming means of production because lower oil prices will make such goods relatively less expensive. And because the United States is a net importer of energy, reduced oil prices stimulate its economic growth. Each of these responses increases U.S. consumption of refined products.

To estimate the impact of the oil price decline on U.S. refinery production, econometrics and simulation analysis were used. Econometrics was used to estimate the responsiveness of domestic refinery production to changes in the oil price, holding gross national product constant. From this estimate and an adjustment to account for the impact through gross national product, refinery production implied by crude oil prices of $10, $15,

(Continued on back page)
Chart 1
EFFECT OF OIL PRICES ON OIL AND GAS EXTRACTION EMPLOYMENT

325 THOUSAND EMPLOYEES

OIL PRICES

$25

$20

$15

$10


NOTE: All prices quoted in constant December 1985 dollars per barrel.

Table 1
A MODEL OF ENERGY EMPLOYMENT

ln(EXTt) = 0.035 + 1.566 • ln(EXTt - 1) - 0.582 • ln(EXTt - 2)
(0.91) (22.20) (-8.59)
+ 0.007 • ln(Pt) + 0.011 • ln(RIGt)
(1.66) (2.63)
ln(RIGt) = 0.448 + 1.491 • ln(RIGt - 1) - 0.538 • ln(RIGt - 2)
(3.42) (22.02) (-8.20)
+ 0.048 • ln(Pt) - 0.023 • D
(3.12) (-2.93)
ln(MCHt) = -0.138 + 0.958 • ln(MCHt - 1) + 0.045 • ln(RIGt)
(-2.28) (71.94) (3.15)

Where:
EXT = oil and gas extraction employment in Texas.
RIG = Texas rig count.
MCH = oil field machinery employment.
P = domestic refiner's acquisition cost deflated by the consumer price index.
D = 0 before January 1981.
D = 1 after January 1981 (modeling the effect of oil price deregulation).

NOTES: All variables are seasonally adjusted monthly data. Estimated t statistics for the coefficients from the three-state least-squares estimation are reported in parentheses.

SOURCES: Hughes Tool Co.
U.S. Department of Energy.
Federal Reserve Bank of Dallas.

Chart 2
EFFECT OF OIL PRICES ON OILFIELD MACHINERY EMPLOYMENT

100 THOUSAND EMPLOYEES

OIL PRICES

$25

$20

$15

$10


NOTE: All prices quoted in constant December 1985 dollars per barrel.

Chart 3
U.S. REFINERY PRODUCTION

140 (1977 = 100)

OIL PRICES

$10

$15

$20

$25

60 70 80 90 100 110 120 130

ACTUAL PROJECTED

1. Prices quoted in constant fourth quarter 1985 dollars.

SOURCES: Board of Governors, Federal Reserve System.
Author's estimates.

SEISMIC CREW COUNT

540 CREWS

(SEASONALLY ADJUSTED)

480

420

360

300


Federal Reserve Bank of Dallas.

WELL PERMIT APPLICATIONS

4 THOUSAND APPLICATIONS

(SEASONALLY ADJUSTED)

TEXAS

OKLAHOMA

LOUISIANA

1. The August 1983 figure for Texas is 9,104.

Oklahoma Corporation Commission.
Texas Railroad Commission.
Federal Reserve Bank of Dallas.
ENERGY BRIEFS

• The inability of the world's major oil producers to agree on production limits will continue to depress energy prices in the near future. Although consumption will eventually rise in response to lower energy costs, it will be some time before increased demand counteracts the price weakness resulting from current high production levels. As a result, the energy sector in the Eleventh District will continue to retrench as it adjusts to weak energy market conditions.

• The rig count is likely to continue to slide until energy markets show that rising prices will make exploration and development more profitable. The number of rigs operating in Texas, at less than 410 on a seasonally adjusted basis, is approaching levels existing before the first oil price increases of the early 1970s.

• Leading indicators of drilling activity confirm that drilling will remain weak in 1986. Both the seismic crew count and number of well-permit applications fell in February. The unusually sharp drop in well-permit applications paralels the rapid oil price drop as oil company plans and budgets adapt to weak energy markets.

• Texas employment in energy-related industries is still adjusting to the latest round of oil price cuts. As drilling activity declines, oil and gas extraction and oil field machinery employment is falling at increasing rates. The decline in refining employment appears to have halted, however, both because lower oil prices have helped refiners and because earlier shakeouts have reduced excess capacity in the industry.

• Falling oil prices are beginning to affect the prices of other fuels. Petroleum products compete with coal and natural gas in electricity generation and other industrial uses. Prices of these fuels are falling in some areas as firms substitute among the least-costly fuels. Lower gas prices will reinforce the dampening effect of reduced oil prices on drilling.

CRUDE OIL PRODUCTION AND NATURAL GAS EXTRACTION
(Seasonally Adjusted)

<table>
<thead>
<tr>
<th></th>
<th>Percent change from previous quarter</th>
<th>Daily average 1985:Q4</th>
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<tr>
<td></td>
<td>1985 Q1 Q2 Q3 Q4 Thousand barrels</td>
<td></td>
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<tr>
<td>Oil</td>
<td>Texas -2.5 1.0 0.1 0.4</td>
<td>2,436</td>
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<td>Regional states 1 -1.9 0.7 -1.4 -0.8</td>
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<tr>
<td></td>
<td>United States 1.0 0.4 -0.5 0.3</td>
<td>8,628</td>
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<tr>
<td>Gas</td>
<td>Texas 4.1 -4.2 0.5 2.4</td>
<td>16,438</td>
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<tr>
<td></td>
<td>Regional states 1 -1.3 -3.4 -4.1 -1.5</td>
<td>36,171</td>
</tr>
<tr>
<td></td>
<td>United States -0.8 -1.6 -2.0 1.8</td>
<td>47,348</td>
</tr>
</tbody>
</table>

1. Louisiana, New Mexico, Oklahoma, and Texas.
2. Preliminary figures.


TEXAS ENERGY EMPLOYMENT
(Seasonally Adjusted)

<table>
<thead>
<tr>
<th></th>
<th>1983 1984 1985 1'86</th>
</tr>
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<tr>
<td>Oil field machinery</td>
<td>Texas 84 108 96 72</td>
</tr>
<tr>
<td>Oil and gas extraction</td>
<td>United States 84</td>
</tr>
<tr>
<td>Petroleum refining</td>
<td>United States 72</td>
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</tbody>
</table>

Effects (cont.)

particular price when reached then rises at the rate of overall inflation. As indicated in the charts, a decline in oil prices to $15 per barrel would eventually cost over 130,000 jobs in extraction and over 14,000 jobs in oil field machinery from December 1985 levels. Of these reductions, 43,900 jobs in extraction and 3,200 jobs in oil field machinery would be lost in 1986 alone.

Timing of Cuts

As a forecasting device, the model tends to be fairly accurate over long periods of time, but it often understates the speed with which the variables adjust. Consequently, the scenarios presented in the charts may underestimate how rapidly employment approaches final levels, suggesting that cuts in oil-related employment may be even greater this year than the model would forecast.

—Ronald H. Schmidt

Lower Oil Prices (cont.)

$20, and $25 per barrel (in fourth quarter 1985 dollars) was projected through 1990.

Long-Term Impact Could Be Dramatic

As shown in Chart 3, oil prices sustained at levels below $25 per barrel could have a dramatic impact on U.S. refinery production by 1990. At a sustained crude oil price of $25 per barrel (in fourth quarter 1985 dollars), U.S. refinery production can be expected to grow only slightly more than gross national product. If beginning in second quarter 1986, however, crude oil prices were maintained at $20, $15, or $10 per barrel, they would yield, respectively, 7.4, 17.6, or 33.8 percent more refinery production in the final quarter of 1990 than would crude oil prices maintained at $25.

Near-Term Impact Will Be Modest

In contrast, the near-term impact of an oil price decline is likely to be relatively modest. For second quarter 1986, oil prices of $20, $15, or $10 per barrel imply refinery production that is only 0.5, 1.2, or 2.1 percent greater than that implied by $25 oil. Because a complete response to lower oil prices requires a shift of the capital stock toward different final goods and toward more energy-intensive production, the response to the oil price drop is likely to be gradual.

Nevertheleas, lower oil prices improve the outlook for the U.S. refining industry. In contrast with the stagnation the industry experienced in the first half of the eighties, the industry is likely to experience growth above that of the nation as a whole for the remainder of the decade—assuming that crude oil prices remain at or below $25 per barrel.

—Stephen P. A. Brown

The views expressed are those of the authors and do not necessarily reflect the positions of the Federal Reserve Bank of Dallas or the Federal Reserve System.