
Can U.S. Oil Production Survive the 20th Century?

By Russell L. Lamb and Chad R. Wilkerson

The oil industry has been an important component of the U.S. economy throughout the twentieth century, contributing as much as 4 percent to gross domestic product in the early 1980s. Recently though, world oil demand has slowed, while world supply has boomed, pushing oil prices to their lowest levels in decades.

The plunge in world oil prices has brought further difficulties to U.S. oil production, which has been declining in recent years. At the current low prices, most domestic oil wells are not profitable. This calls into question the long-run viability of oil production in the United States. Whether oil production is a viable part of the U.S. economy in the next century will depend on how long oil prices remain at their current low levels.

The recent low prices for oil on world markets reflect a combination of demand and supply effects, with both short-run and long-run forces at work. For example, sluggish demand growth reflects both milder weather in some parts of the world (a short-run phenomenon) and the impacts of the Asian financial crisis, which could persist for some time. Meanwhile, supply

has mushroomed, in part by the short-run effect of Iraq's return to higher levels of oil production. In the main, however, the increase in supply reflects sharp declines in the cost of discovering and extracting oil reserves. On balance, the current low prices appear to be mainly the result of longer run demand and supply forces, suggesting that prices are likely to remain low for some time to come. If world oil prices remain low, U.S. oil is unlikely to be competitive in world markets. Therefore, the domestic oil sector is likely to continue to lose market share for the foreseeable future.¹

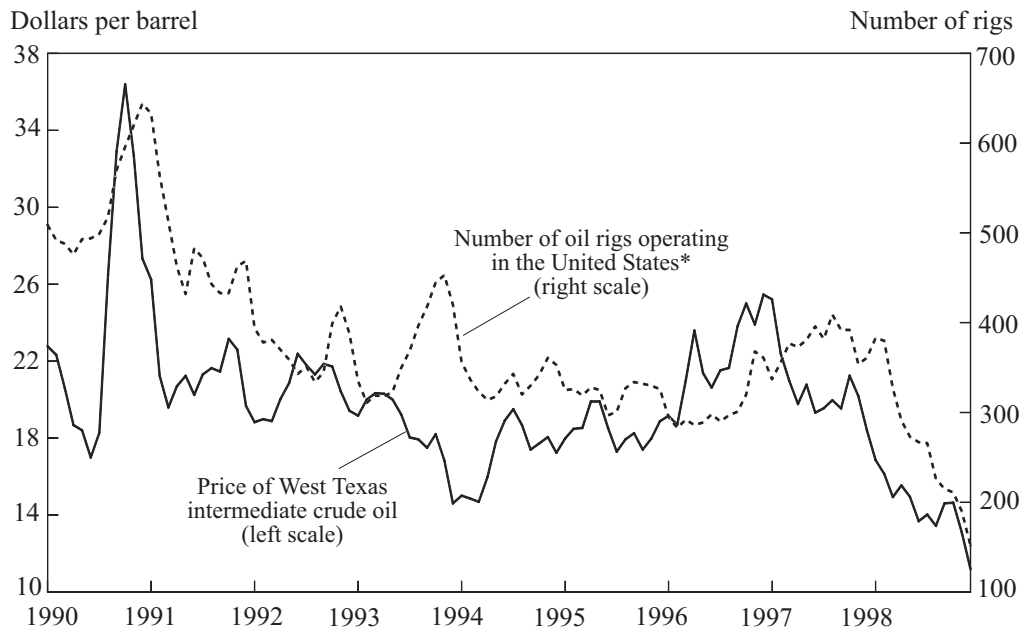
The first section of this article outlines the recent history of oil prices and world oil demand and supply. The second section shows that weak world demand growth reflects both the slowdown in Asian demand and weaker growth elsewhere in the world. The third section explains the recent strong supply growth in terms of the sharp reduction in production costs and argues that low oil prices are likely to persist.

I. WORLD OIL PRICES HAVE PLUNGED

World oil prices have undergone sizable fluctuations over the past several years. Following the Gulf War in 1991, oil prices settled into a trading range centered around \$20 per barrel, although short-term fluctuations in demand and

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Chart 1
OIL PRICE AND RIG COUNT



* The Baker Hughes oil rig count includes only “the number of drilling rigs actively drilling wellbores to find or develop oil . . . that use a significant amount of oilfield services and supplies.”

Sources: West Texas intermediate price - Platt’s Oilgram Price Report; oil rig count - Baker Hughes, Inc.

supply pushed the price up and down substantially at various times (Chart 1). Beginning in late 1995, however, oil prices began to rise as uncertainty about future prices led some oil producers to be reluctant to boost inventories of oil.² On a monthly average basis, oil prices peaked in December 1996 at \$25.46 per barrel.³ Prices began to trend downward after that time, and by mid-1998 prices were falling sharply. In December 1998, the monthly average price for crude oil registered \$11.20, a decline of 56 percent from the peak in 1996.

The decline in oil prices has dampened the pace of activity in the U.S. oil sector. The number

of oil rigs operating in the United States reached as high as 409 in 1997, but tumbled to 152 by the end of 1998 (Chart 1). A recovery in the U.S. oil sector depends crucially on a rise in world prices for crude oil. So understanding the sources of the decline in crude oil prices is crucial to understanding the future of oil production in the United States.

One explanation of the price decline may lie in the fundamentals of demand and supply factors in the industry. Viewed simply, a surplus of oil has built up in world oil markets, pushing down prices. Throughout much of the 1990s—since the Gulf War at any rate—growth in world oil

Chart 2
WORLD OIL SUPPLY AND DEMAND
(Quarterly, seasonally adjusted)



Source: Energy Intelligence Group, Inc.

demand has roughly kept pace with growth in world oil supply (Chart 2). More recently, though, a gap has developed between world production and consumption. For example, in 1997 total world oil production averaged about 74.6 million barrels per day, while total world consumption of oil averaged only 73.9 million barrels per day. While seemingly small, this gap is big by historical market measures. By the beginning of 1998, the surplus in production grew large enough to cause a plunge in prices.

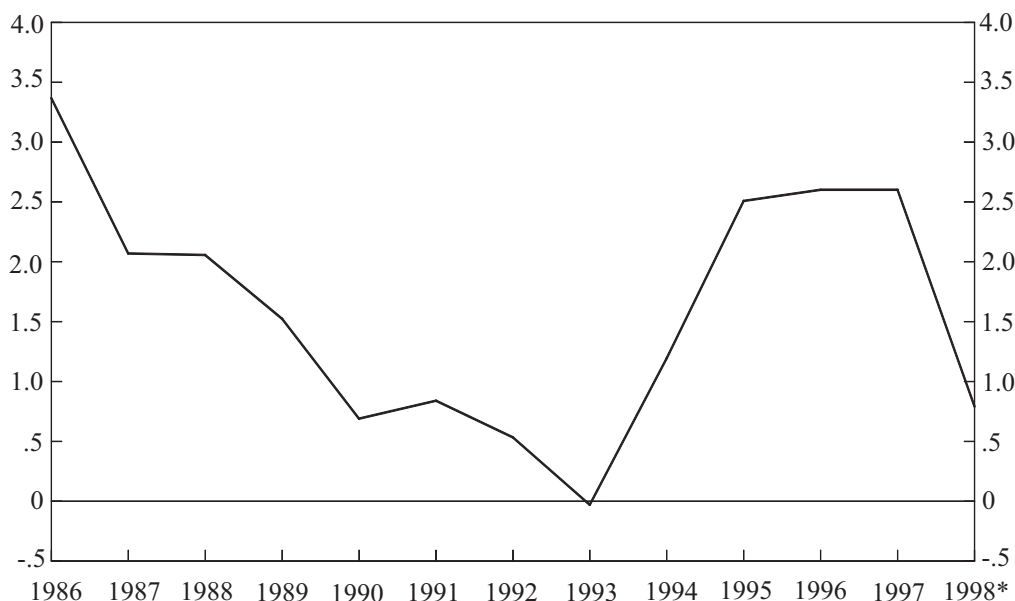
The future path of oil prices depends on whether the plunge in prices mainly reflects short-run or long-run factors. If the decline in oil prices reflects mainly short-run weakness in demand or temporary supply factors, then a

recovery in oil prices is likely at least in the intermediate term (and U.S. oil production could rebound). On the other hand, if the glut of oil reflects longer run supply or demand factors that could last for several years, a recovery in oil prices is unlikely in the near future.

II. THE OUTLOOK FOR WORLD OIL DEMAND

World oil consumption edged up barely 0.8 percent in 1998 (Chart 3). Both short-run factors—like a mild winter in North America—and longer run changes, such as the Asian economic crisis, contributed to the slowdown. While the effects of milder weather are likely to be transitory, the impact of the Asian meltdown could

Chart 3
GROWTH IN WORLD OIL DEMAND
(Percent change from previous year)



* First three quarters 1997 to first three quarters 1998
 Source: Energy Intelligence Group, Inc.

dampen demand growth in world oil markets for some time to come.

A temporary slowdown in North American demand

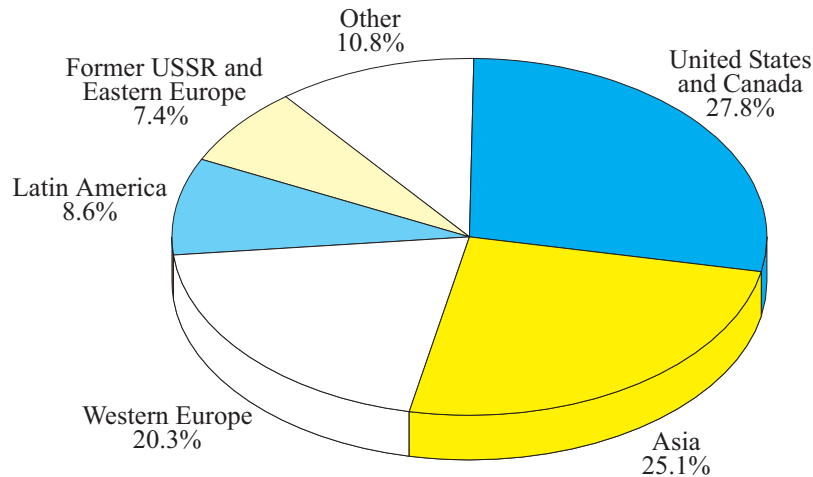
Most of North America was blessed with mild winter weather in 1998, helping hold back demand for oil in the United States and Canada. Nearly half of all the oil produced in the world is consumed in the United States, Canada, and Western Europe, making these regions highly important in determining overall world oil demand (Chart 4).⁴ In recent years, demand growth in Western countries as a whole has been relatively stable, with annual increases in oil consumption of 1.5 to 2 percent in most years since the 1990-91

recession. However, the 1.3 percent growth posted in 1998 marked the second straight year of slowdown in Western demand. A closer review of the data reveals that both the United States and Canada saw sizable drop-offs from recent growth levels in 1998, while growth in European demand was slow in both 1997 and 1998.

U.S. oil consumption grew much more slowly in 1998 than in recent years. After rising roughly 1.8 percent per year in the six years following the 1990-91 recession, oil demand grew only 1.1 percent last year. This slowdown is especially interesting given the continued strong growth of the U.S. economy. In most developed countries, growth in oil demand typically mirrors growth in gross domestic product. Throughout the 1990s,

Chart 4

MAJOR OIL-CONSUMING REGIONS OF THE WORLD

(Share of world consumption, 1997)

Source: Energy Intelligence Group, Inc.

U.S. oil consumption (which accounts for over a quarter of the world total) has moved almost in step with GDP, and oil demand has not fallen in absolute terms since the recession years of 1990 and 1991. But in 1998, while GDP continued to grow at a robust pace in the United States, oil demand growth fell considerably. The demand for gasoline, however, which accounts for nearly half of U.S. petroleum consumption, continued to increase. So a milder winter apparently did dampen oil consumption in 1998, as American households and businesses used less fuel to keep warm.

Like the United States, Canada saw a smaller rise in oil consumption in 1998 than in the past several years. But the slowdown in demand growth in Canada was much more dramatic. After growing 3 to 4 percent annually from 1995

to 1997, consumption growth dropped to just 1.1 percent last year. Again, the milder winter was likely an important factor.

Longer run weakness in Europe and Asia

Like North America, Western Europe saw weak growth in oil consumption in 1998. But such weak growth in petroleum use has been more common in Europe than in the United States in recent years, largely reflecting differences in transportation preferences. Europeans love their minicars and motorcycles, and with gasoline prices over six dollars per gallon, it is easy to understand why. In contrast, Americans have turned toward driving bigger cars (or, increasingly, trucks and sports-utility vehicles), boosting gasoline consumption in the United States. While gasoline accounts for only a quarter

of total petroleum use in Europe, in the United States it accounts for nearly half. In each of the past five years gasoline demand has actually fallen in Europe's four largest countries (France, Germany, Italy, and the United Kingdom).⁵

Weak demand for gasoline and other petroleum products is a feature of the European economic landscape that is not likely to change. In part, it reflects the strong environmental sensitivities of most Europeans. But it also reflects the historical development of Europe into tightly bound cities, in contrast with the geographical sprawl of U.S. suburbs. Either way, Europe's petroleum consumption is not likely to rise sharply in coming years, helping to dampen overall growth in world oil demand.

While demand growth in North America and Europe was certainly sluggish in 1998, the biggest drag on world oil demand last year was the Asian economic crisis. After growing at roughly 5 percent every year since 1990, oil consumption in Asia declined 1.2 percent in 1998. And some of the fast developing "tiger economies" that have been hardest hit by the crisis saw the sharpest declines last year. The problems in Asia should be of particular concern to oil producers. For one thing, the region consumes a quarter of the world's oil. But, more important, over three-fourths of the *growth* in world petroleum demand this decade has come from Asian countries, including practically all of the gains from 1990 to 1994 (Table 1).

The fast growth in Asian oil demand this decade occurred largely as a result of the rapid development of many Asian economies. As incomes have risen in these countries, so has the demand for greater conveniences of modern living, especially petroleum-based energy sources; consequently, oil consumption has soared. But income growth in Asia hit a snag in mid-1997, and petroleum consumption among the tiger economies either declined or slowed significantly in 1998. In Thailand, for example, annual oil demand

growth was greater than 10 percent throughout the early and mid-1990s. But when the financial and economic crises hit in 1997, growth in oil consumption came to a screeching halt, and in 1998 consumption dropped almost 12 percent. Hong Kong, Indonesia, Malaysia, and Singapore also suffered sharp slowdowns in oil demand in 1998. Oil consumption in the Philippines began declining in 1997 and continued last year. Demand in Taiwan also slowed, although not as sharply as elsewhere.

But the tigers were not the only Asian nations where economic difficulties caused a falloff in oil demand. Petroleum consumption in the region's two OECD countries, Japan and South Korea, has also fallen sharply over the last year and a half. Oil demand in Japan, which accounts for approximately 8 percent of the world total, has declined nearly 5 percent since 1996. Japan has seen relatively slow growth in petroleum use throughout this decade, however, reflecting the slower growth of GDP there relative to other Asian countries. In South Korea, Asia's third largest oil consumer behind Japan and China, demand plummeted 14 percent in 1998 after more than doubling over the previous seven years. Although another decline of this size is unlikely, weaker future growth could be troubling to oil producers, since South Korea has accounted for more than one-sixth of the growth in overall world oil consumption this decade.

The effects of the Asian crisis did not stop in Asia. As the crisis spilled across the Pacific, Latin America suffered its slowest growth in oil demand this decade. The slowdown more than likely reflected the economic problems that developed in Brazil, the region's largest consumer of oil. Brazilian oil consumption rose less than 3 percent in 1998, following annual growth of 7 to 8 percent in the previous three years. The economic meltdown in Russia and other former Soviet countries also led to a sharp decline in petroleum demand. In 1990, the old USSR accounted for more than one-eighth of world oil

Table 1
GROWTH IN ASIAN OIL CONSUMPTION
(Percent)

	Total growth 1989-96	Average annual growth 1990-1996	1997	1998*	Share of world consumption 1997
China	51.0	6.2	11.4	5.1	5.4
Hong Kong	57.3	6.8	5.1	-1.0	.3
India	44.1	5.4	5.5	1.8	2.4
Indonesia	44.9	5.5	2.2	-6.7	1.2
Japan	15.5	2.1	-.7	-3.8	7.7
Malaysia	88.6	9.6	3.9	-.7	.6
Philippines	68.5	7.9	-2.1	-1.9	.5
Singapore	60.2	7.0	4.0	.5	.7
South Korea	142.9	13.7	6.6	-14.0	3.1
Taiwan	40.1	5.0	4.5	1.6	1.1
Thailand	106.3	11.0	.3	-11.7	1.0
Asia**	44.2	5.4	4.5	-1.7	25.1
Non-Asia	.5	.1	2.1	1.3	74.9

* Jan-Aug 1997 to Jan-Aug 1998 for Asia, non-Asia, China, India, Japan, Philippines, South Korea, Taiwan, and Thailand (source: Energy Intelligence Group, Inc.); Jan-Dec 1997 to Jan-Jun 1998 for Hong Kong, Indonesia, Malaysia, and Singapore (source: EIA).

** Includes other Asian countries not listed.

Sources: Energy Intelligence Group, Inc., U.S. Energy Information Administration.

consumption. Following the Soviet collapse in 1991, however, oil demand dropped almost in half before stabilizing somewhat three years ago. It seems likely that oil use in this part of the world will remain depressed in the near future, or at least until Russia and several other newly formed nations can pull out of recession.

Slower growth is likely to continue

World oil consumption is likely to remain moderate, as longer run factors appear to be more important in the recent slowdown than short-run factors. While stronger growth in oil demand should return to the United States and Canada in the near future, the weak demand environment in Asia and Latin America could continue for

several years. While these two troubled regions account for just a third of world petroleum use, they have been responsible for nearly all of the *growth* in world oil demand since 1990.

A look at recent history may provide some clues to how long weak oil demand growth could persist. In particular, it is useful to remember the slower economic times of the early 1990s, when annual growth in world oil demand averaged 0.6 percent (Chart 3). The strong demand growth posted from 1995 through mid-1997 was probably boosted by a happy coincidence of strong economic performance in Asia, Latin America, and the United States. Growth in world oil demand in the near future will depend largely on how fast Asia, and to a lesser degree Latin

America and Russia, can recover from their current economic difficulties.

If the economies of Western countries remain strong, and colder winters return, demand for petroleum in the West is likely to grow at a healthy pace. But even assuming annual growth in oil consumption of around 1.7 percent in the United States, Canada, and Europe, world demand will remain quite sluggish if Asian and Latin American economies remain weak. If the decline in economic activity seen in Asia last year and marginal economic growth elsewhere in the world continue, world oil demand would continue to grow somewhere near 1 percent per year. Even with demand growth of 1.7 percent in Western countries, oil demand in the rest of the world would have to average 3.5 percent in order to reach the world growth rate of 2.6 percent seen in recent years. Such growth seems unlikely in the near future.

III. THE OUTLOOK FOR WORLD OIL SUPPLIES

To the surprise of nearly all market observers, oil supplies in the past year have not fallen in response to falling prices. Special factors, such as Iraq's return as a major supplier, explain some of the increase in world production. But understanding why other major oil-producing countries have boosted oil production in the face of a sharp slowdown in demand is more crucial to assessing the outlook for U.S. oil production. One explanation for the behavior of oil producers lies in the drop in costs of finding and extracting proven reserves of oil.

Unfortunately for the United States, the declines in oil production costs apply more to oil lying outside the United States than to domestic reserves. This change in the relative cost of producing oil in the United States signals a sharp loss in competitiveness and market share for domestic oil production, since the United States will become one of the most expensive production environments.

The United States is losing market share

To be sure, short-run factors have played a role in boosting world supply in the past year or two. World oil production grew 1.1 percent in the first three quarters of 1998 when compared with a year earlier, with much of the rise reflecting Iraq's reemergence as a major oil producer. In the first three quarters of 1998, OPEC produced about 2 percent more oil than during the same period in 1997, a much sharper increase than the rest of the world's producers (Table 2). Iraqi output rose over two-thirds in 1998, and Iraq is now pumping more than three times as much oil as in 1996.

While Iraq accounts for much of the boost in production in 1998, other countries have also raised output. And in many of these countries, the recent increases are part of a longer run trend toward rising output. Most countries in the Americas, except for the United States, have ratcheted up output substantially. Production in the "other Americas" (which includes Venezuela and Mexico, both substantial producers) rose by 1.2 percent in 1998. More interesting, though, is the sharp increase in production in these countries over the past several years. Growth in the Americas (excluding the United States) has been greater than 4 percent every year since 1994, and total production in these countries was almost 45 percent higher in 1997 than at the beginning of the decade. Likewise, North Sea oil production has risen sharply throughout much of the 1990s. North Sea production was 70 percent higher in 1997 than at the beginning of the decade.

In contrast with strong growth in production by OPEC producers and in most of the western hemisphere, total U.S. production has generally drifted downward in recent years. During the first three quarters of 1998, domestic oil output rose a scant 0.2 percentage point. But throughout most of the 1990s, U.S. production has fallen. Since 1989, domestic output has dropped almost 7 percent.

Table 2
GROWTH IN WORLD OIL PRODUCTION
(Percent)

	Total growth 1989-96	Average annual growth 1990-96	1997	1998*	Share of world production 1997	Share of world production 1989
Saudi Arabia	61.5	7.8	4.8	-2.1	11.1	7.7
Iraq	-77.8	**	95.1	68.6	2.8	4.4
Kuwait	13.6	**	.2	1.5	2.5	2.5
Other OPEC	25.3	3.4	4.4	-1.1	25.2	22.3
Total OPEC	19.8	2.6	6.2	1.9	41.7	36.9
United States	-6.6	-.9	-.4	.2	9.6	11.8
Americas (excl. U.S.)	35.1	4.4	6.5	1.2	16.1	12.7
North Sea	70.1	8.0	.4	.0	7.8	5.3
Former USSR	-43.3	-7.6	3.4	-2.3	9.5	18.9
China	15.4	2.1	2.8	-1.3	4.4	4.3
Other non-OPEC	33.2	4.2	1.6	.3	15.2	12.8
Total non-OPEC	3.3	.5	2.2	.5	58.3	63.1
Total world	9.4	1.3	3.8	1.1	100.0	100.0

* First three quarters 1997 to first three quarters 1998.

** Extremely wide swings.

Source: Energy Intelligence Group, Inc.

The decline in U.S. production, in the face of rising production in the rest of the world, represents a sharp loss in market share for the United States. The U.S. share of all the oil produced in the world has dropped from almost 12 percent in 1989 to only 9.6 percent in 1997 (Table 2). Explaining this loss in market share is key to understanding the future of domestic oil production.

What explains the changes in the domestic oil industry?

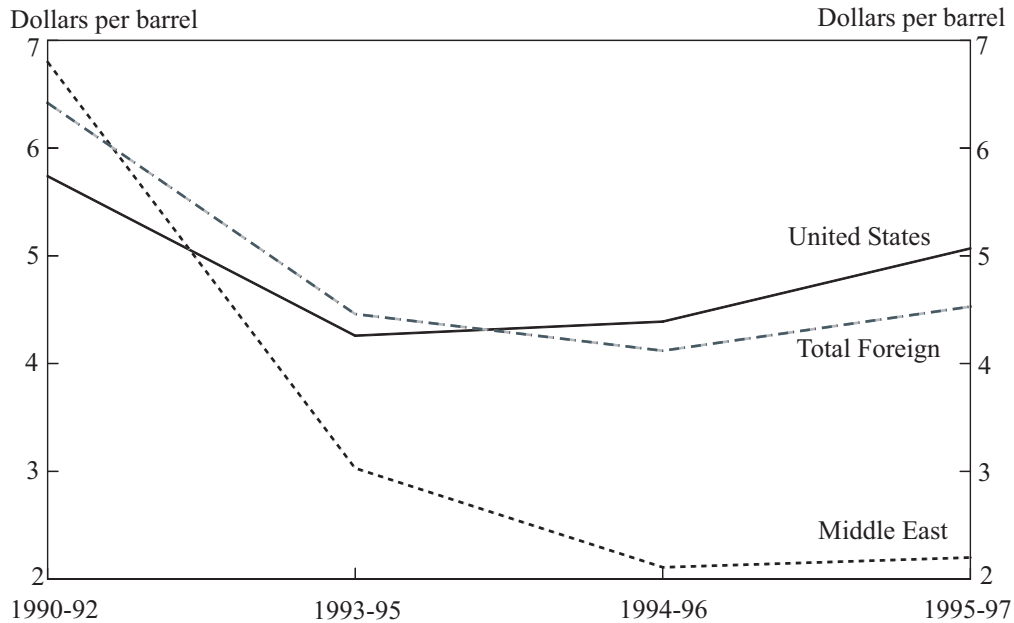
A number of analysts predicted that Asian oil demand would weaken in 1998. In view of this, it is surprising that producers continued to ratchet up production. One explanation is that world producers became willing to accept lower prices for their oil. In the language of economics, such a change represents an outward shift in the supply

curve. A closer look at world oil developments suggests that such a shift occurred in petroleum markets in the 1990s.

The supply curve for a product reflects production costs. For evidence of an outward shift in the curve, where lower prices can be taken at any level of production, economists look for a decline in production costs. One important component in the cost of producing oil is the *finding cost*, or the cost of tapping previously unknown reserves of oil. Finding costs reflect both the cost of exploring for oil to discover potential underground pools and the cost of tapping those pools by drilling. Historically, finding costs have represented more than a third of the cost of producing a barrel of oil.⁶

The cost of finding and extracting new oil reserves has fallen sharply in recent years. The

Chart 5
FINDING COSTS OF PETROLEUM*



* Finding costs for U.S.-based energy companies that are subject to the Financial Reporting System (FRS) maintained by the U.S. Energy Information Administration. The data focuses on three-year averages in finding costs to account for the lag between the time when costs are incurred, oil is discovered, and oil is extracted.

Source: U.S. Energy Information Administration.

sharp declines reflect the major technological advances achieved in both exploring for new reserves and drilling wells to tap those reserves once they have been pinpointed. For example, three-dimensional imaging has allowed geologists to pinpoint oil reserves far more quickly and efficiently than in the past. And directional drilling has made it easier to extract oil, even from wells previously thought to be exhausted (Cunningham and Mancuso).

In every part of the world, finding costs have declined significantly since the beginning of the

decade (Chart 5). But even more revealing for the future of U.S. oil production than the worldwide decline in finding costs is the huge cost decline for oil produced in the Middle East. In the Middle East, the cost of discovering new reserves has dropped from about \$7 per barrel at the beginning of the 1990s to just above \$2 per barrel in the most recent period (1995-97). In contrast, finding costs in the United States have dropped from just under \$6 at the beginning of the 1990s to around \$5 in the 1995-97 period. While the United States could produce oil more cheaply than the Middle East at the beginning of

the decade (perhaps because of rich Gulf of Mexico fields), U.S. costs are now more than twice as high as those for the Middle East. This represents a sharp deterioration in the competitiveness of U.S. oil, especially over the longer run as old reserves are depleted.

A number of factors explain the Middle East's larger drop in finding costs. The Middle East has experienced a sharp rise in the finding rate, the amount of oil discovered for every dollar of expenditure on oil exploration. A rise in the finding rate directly lowers finding costs. While the finding rate has risen for the United States, the rise is nowhere near as large as in the Middle East. In part, this simply reflects the fact that the United States has been tapping its oil reserves longer. More U.S. reserves have been exhausted, and it may be difficult in the future for U.S. fields to achieve similar oil output as fields in other parts of the world. Substantial reductions in drilling costs have also helped lower finding costs across the world. In fact, reductions in the cost of drilling account for most of the decline seen in U.S. finding costs.

The United States has clearly suffered a sharp deterioration in its competitiveness against other oil-producing countries. While the return of Iraq to world markets probably explains most of the dramatic plunge in world oil prices in 1998,

longer run forces are likely to push world supply higher in the years to come. Much of this increase will likely originate outside the United States, where oil can be produced far more cheaply.

IV. CONCLUSIONS

The recent plunge in world oil prices has led some analysts to question the longer run viability of U.S. oil production. Unless prices regain some lost ground, much of the domestic oil sector cannot compete effectively in international markets. The analysis in this article suggests that prices may be slow to return to the levels posted in 1995 and 1996, and U.S. oil production may in fact have a difficult time competing.

Both demand and supply factors are keeping world oil prices low. World oil demand will likely not grow at the rapid pace seen in 1995-97 in the foreseeable future because of weak economic conditions in Asia, Latin America, and Russia. Likewise, the economics of supply are working to boost world oil production substantially, leading producers in some parts of the world to accept dramatically lower prices. With relatively higher costs of extraction, wells in the United States may not be able to operate profitably at these new, lower levels. All these factors suggest a dim future for U.S. oil production as the 20th century comes to a close.

ENDNOTES

¹ In this article, U.S. market share refers to oil produced within the United States (both onshore and offshore), not oil produced by U.S.-based companies.

² The economics of oil prices in this period are particularly interesting. For oil producers who take delivery of oil at the time it leaves the ground, movements in the price of crude oil represent a substantial source of risk, since declines in the price of crude oil represent a drop in the value of their inventories. Thus, the risk of a large future drop in crude prices could lead to a temporary decline in the supply of oil on the market.

³ All prices given are for West Texas Intermediate crude oil.

Focusing on monthly average price smoothes away extreme short-term fluctuations in price and gives a clearer picture of longer run trends.

⁴ In this article, Western Europe is defined as the European members of the Organization for Economic Cooperation and Development (OECD) minus the Czech Republic, Hungary, and Poland.

⁵ European oil demand data at the product level was only available for these four countries.

⁶ The cost of pumping itself and transportation costs are the two other large components of oil production costs.

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