Recent Developments in U.S. Energy Markets: A Background Note

In its October 1999 *World Economic Outlook*, the IMF assumed that oil prices would be $18 per barrel in 2000. In reality, oil prices will probably average closer to $30 than to $20 a barrel this year. As oil prices have continued to rise above expectation, analysts have scrambled to find explanations. This note outlines some of the developments that have led to persistently high oil prices over the past two years. It compares the current situation with that prevailing at the time of previous oil shocks, and outlines some of the difficulties entailed in measuring the impact of sharp oil price increases on U.S. inflation and output.

I. The Current Situation

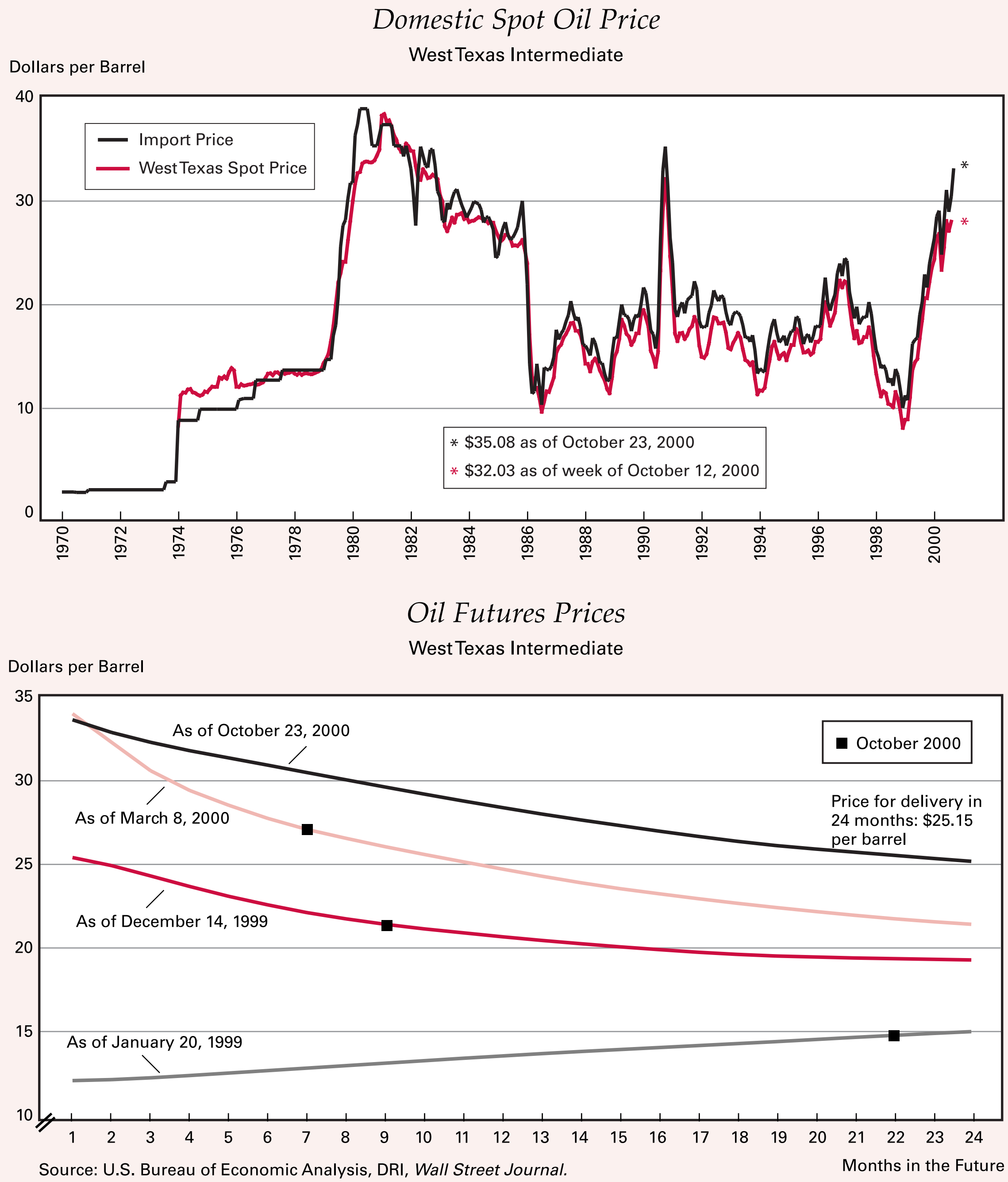
As Figure 1 shows, crude oil prices averaged close to $34 a barrel in September 2000. That was 200 percent above late 1998 prices (which, to be sure, were unusually low) and the highest nominal level since October 1990 during the Gulf War, when oil prices hit $35.90. Looking ahead, the (volatile) futures markets suggest that oil prices will remain above $30 per barrel at least through the first quarter of 2001, with prices falling to $28 per barrel by late in the year. That outcome would be a good deal higher than expected in January 1999.[1] According to Figure 2, the price of natural gas, our second most important energy source, has also increased almost 200 percent since late 1998 to reach $5 per million Btu, its highest level since 1985. Because dual capacity systems have spread and customers have an increased ability to switch between fuels, oil and gas prices may be more closely linked than in the past.

In part because oil prices have been "backwardized" for the past 18 months, with futures prices well below the contemporaneous spot, refiners and wholesalers have hesitated to buy petroleum stocks in advance.

Jane Sneddon Little

Assistant Vice President and Economist, Federal Reserve Bank of Boston.
The author is very grateful to Oksana M. Nagayets and Matthew P. LaPenta for excellent research assistance. This note is based on a talk to the New England Advisory Council on October 27, 2000.

Figure 1



Source: U.S. Bureau of Economic Analysis, DRI, *Wall Street Journal.*

Rather, anticipating lower oil prices, they have drawn down inventories instead. Accordingly, as Figure 3 indicates, U.S. crude and heating oil stocks are well below their normal range. Indeed, in August 2000 total stocks were near 24-year lows. In New England, the U.S. region most dependent on oil for heat, stocks of heating oil are about one-third of last year's level. The United States is not alone in this situation — oil stocks are low in other OECD countries as well. As for natural gas, because gas is increasingly being

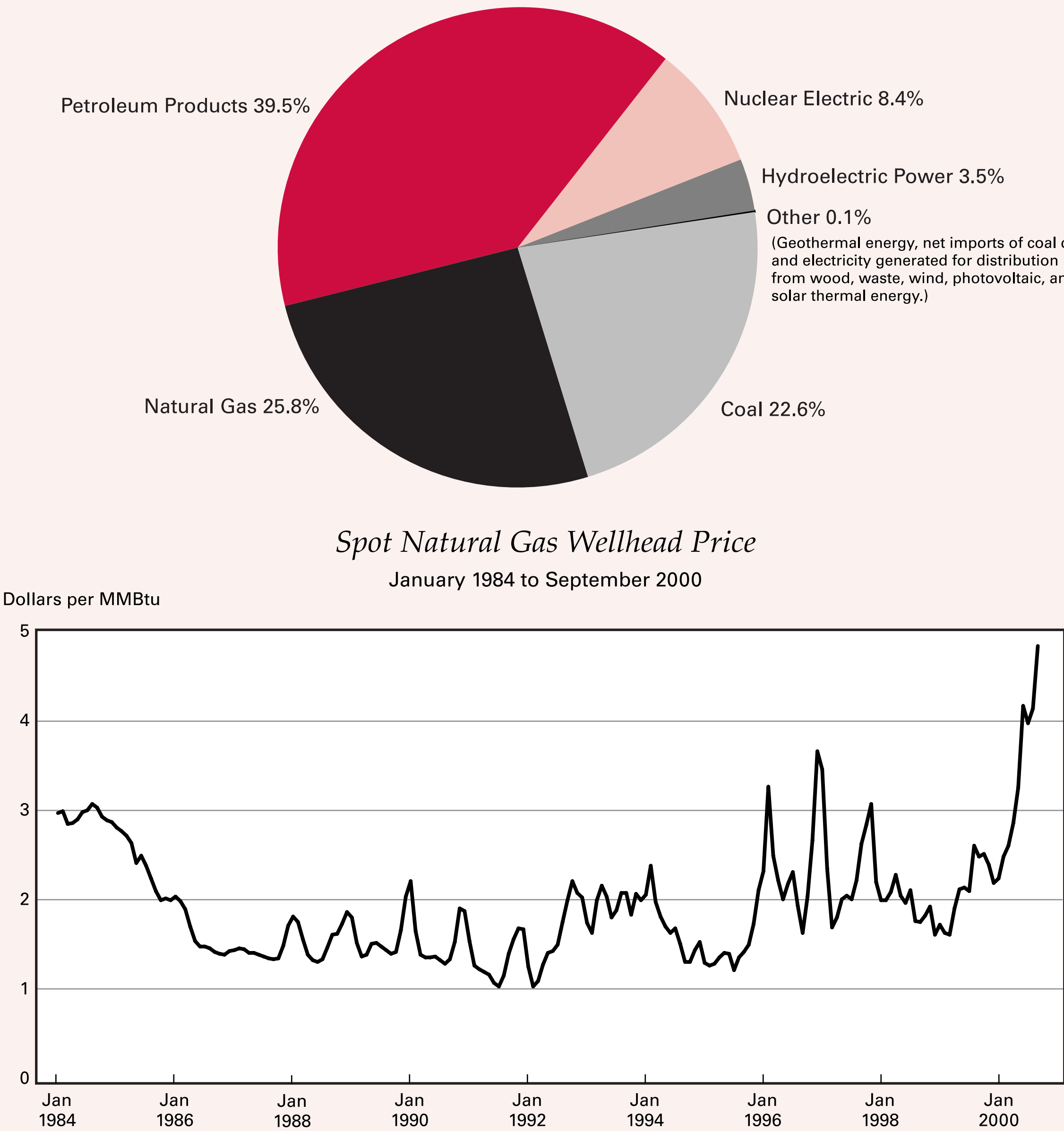
Figure 2

U.S. Energy Consumption by Source

January to June 2000

Spot Natural Gas Wellhead Price

January 1984 to September 2000



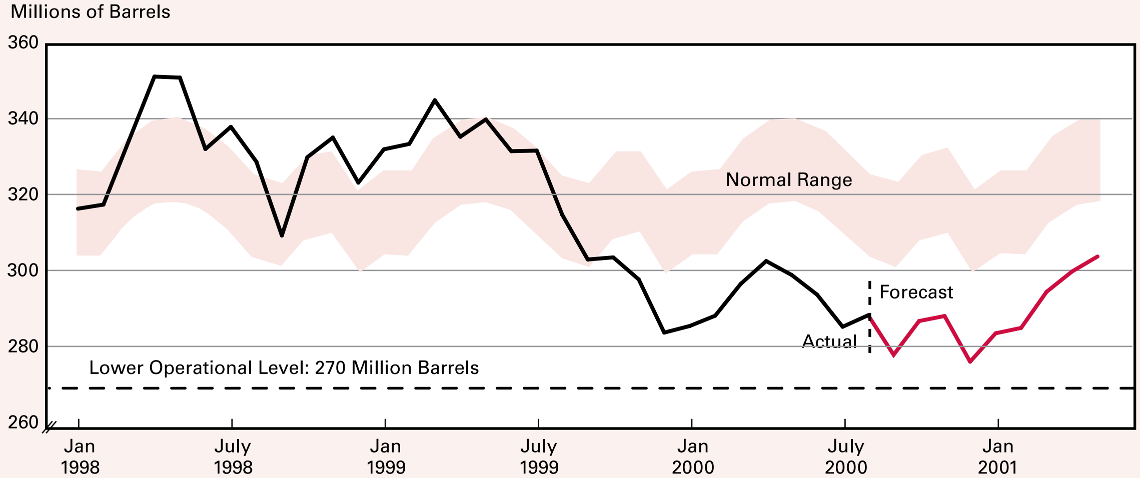
Source: U.S. Energy Information Administration.

used for U.S. electric power generation, and a hot summer led to a surge in power use in Texas and California, U.S. natural gas stocks are also below normal — by about 9 percent.

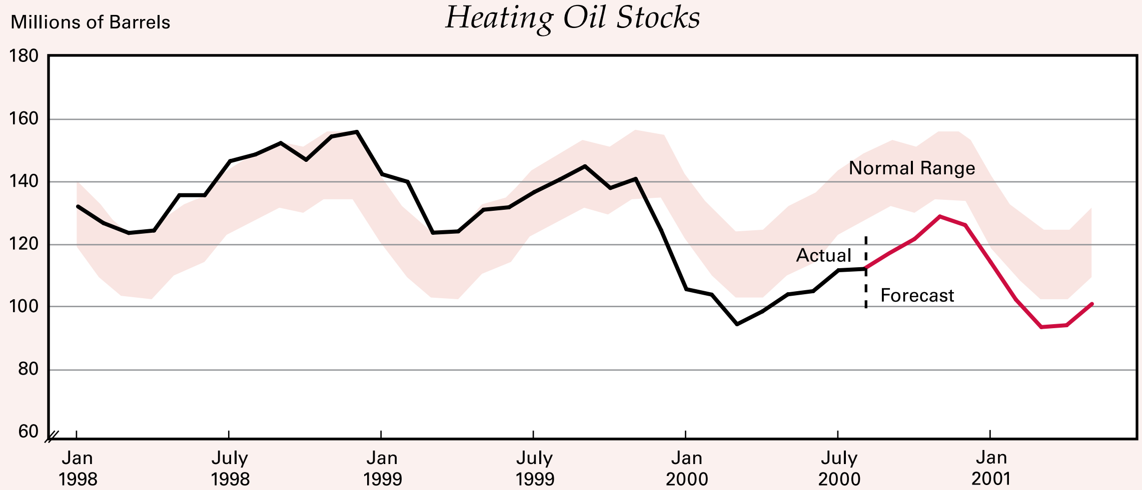
Further, both the oil and the gas industries are facing short-term capacity constraints through much of the supply chain. At the wellhead, for instance, among the major oil-producing nations, only Saudi Arabia has the ability to pump significant amounts of additional oil over the very near term, as Table 1 indicates.[2]

Figure 3

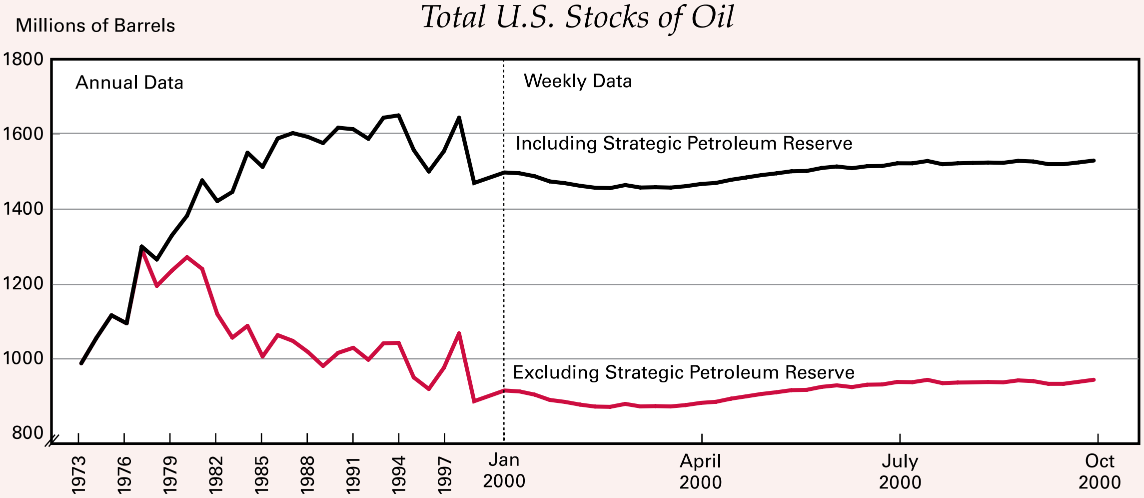
U.S. Crude Oil Stocks



Heating Oil Stocks



Total U.S. Stocks of Oil



Source: U.S. Energy Information Administration.

Moreover, as of the early autumn, tankers moving oil from the Middle East to Atlantic ports or heating oil from the Gulf Coast to New England were also fully booked. Further, as Figure 4 shows, oil refineries have been operating at an unusually high level for much of the past two years — in part because U.S. refining capacity decreased markedly from the early 1980s to the mid 1990s. This summer, accordingly, when gasoline inventories were at historic lows, refiners were operating at peak capacity to meet the demand for gasoline for the summer driving season. With capacity stretched, refiners delayed the annual switchover from gasoline to distillates; as a result, stocks of heating oil were below normal at the start of the heating season. Looking ahead, over the coming winter, less than 1 percentage point of new refining capacity is expected to come on line. Gas pipelines are also expected to be operating near full capacity in the winter months. An important new conduit, the Alliance Pipeline from western Canada to the Midwest, is being developed but is unlikely to be fully operational until the close of the heating season.

Both the oil and the gas industries are facing short-term constraints through much of the supply chain.

How did we arrive at the current juncture? Because oil is stored most cheaply in the ground, and arbitrage between ground and spot oil markets is slow (it takes six to eight weeks to move oil from the Middle East to the United States), oil prices tend to be quite volatile over the near term. This volatility has been aggravated by the unusually large imbalances between supply and demand (shown in Figure 5) associated with the onset of the Asian financial crisis, and by the unexpectedly strong and rapid recovery in global growth that followed. Over the medium term, moreover, the long lag times between decisions to drill new wells or build new refineries and increased supplies of petroleum products can amplify these instabilities.

To illustrate, in 1996, after three years in which world growth exceeded 4 percent, oil prices rose, briefly touching $25 per barrel late in the year. In response, OPEC increased production in early 1997, just before world growth (and demand for oil) stagnated with the start of the Asian financial crisis in the sec-

Table 1

OPEC Crude Production Capacity

(million barrels per day)

	October 1, 2000 Targets	Sustainable Production Capacity[a]	Spare Capacity vs. October 1, 2000 Targets
Algeria	.84	.90	.06
Indonesia	1.36	1.35	.01
Iran	3.84	3.73	.12
Kuwait	2.10	2.20	.10
Libya	1.40	1.45	.05
Nigeria	2.16	2.20	.04
Qatar	.68	.75	.07
Saudi Arabia	8.51	10.50	1.99
UAE	2.29	2.40	.11
Venezuela	3.02	2.95	.07
Subtotal	**26.20**	**28.43**	**2.23**
Iraq		3.00	.13[b]
Total		**31.43**	**2.36**
Memo item:			
Mexico crude		3.40	.23[b]

Estimated Non-OPEC Oil Supply[c]

(million barrels per day)

	2000	2001	2000 vs. 2000
North America	14.38	14.70	.32
Europe	6.86	6.93	.07
Pacific	.87	.86	.01
Total OECD	**22.11**	**22.50**	**.38**
Former USSR	7.88	8.08	.20
Europe	.18	.18	.00
China	3.32	3.21	.02
Other Asia	2.20	2.21	.01
Latin America	3.72	3.81	.09
Middle East	1.88	1.86	.02
Africa	2.87	2.93	.07
Total Non-OECD	**21.97**	**22.29**	**.31**
Processing Gains	1.72	1.76	.05
Total Non-OPEC	**45.80**	**46.55**	**.75**

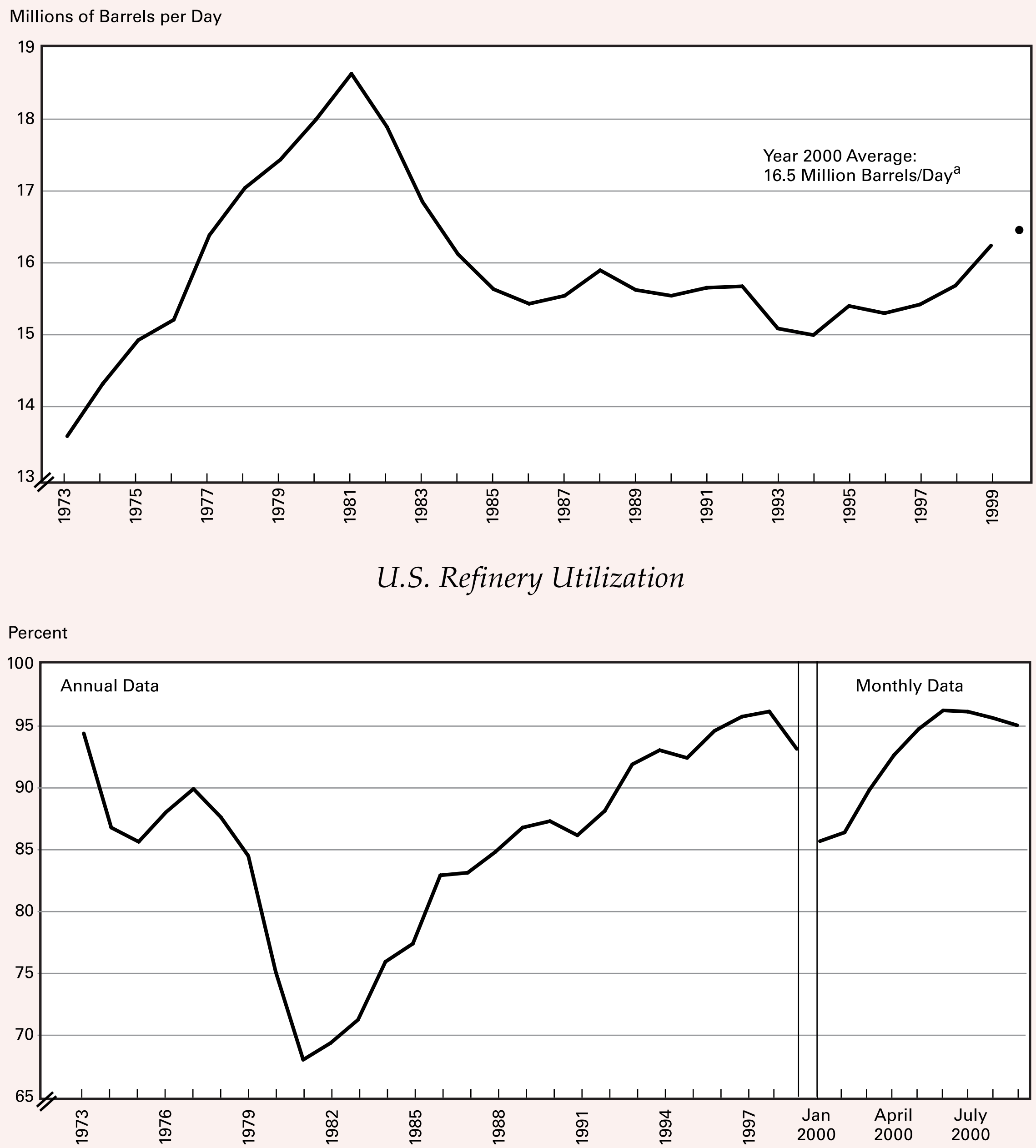
[a]Capacity levels can be reached within 3 months and maintained for 6 months.
[b]Capacity vs. September production.
[c]Non-OPEC producers, other than Mexico, generally produce at capacity except for interruptions related to maintenance, weather, and so forth.
Source: International Energy Agency, *Monthly Oil Market Report,* October 10, 2000.

[1] The lines in the lower panel of Figure 1 show expected oil prices over the 24 months ahead as of the dates indicated on the chart. The black dots mark the price of oil for delivery in October 2000 on the date noted beside each curve.

[2] According to the International Energy Agency, in 2001 OPEC crude capacity will increase by 0.6 to 0.9 mb/d while non-OPEC supply is expected to grow by 0.7 to 0.8 mb/d — enough to meet the expected growth in world demand. Indeed, even now, total crude supply is outpacing demand, allowing some growth in stocks. However, the marginal supplies are not the most needed types and grades. And looking ahead, the IEA warns that maintaining current capital spending programs will be important to restoring oil price stability. (IEA, *Monthly Oil Market Report*, September 2000, p. 18.)

Figure 4

U.S. Refinery Capacity



[a] Based on the average of the first seven months.
Source: U.S. Energy Information Administration.

ond half of that year.[3] As a result, nominal prices fell to $11 per barrel by late 1998; real prices fell to their lowest level since the early 1970s. In early 1999, thus, non-OPEC producers Mexico, Norway, Oman, and Russia joined OPEC in implementing a series of production cuts, culminating with a cut of over 4 million barrels a day — about 6 percent of world output.

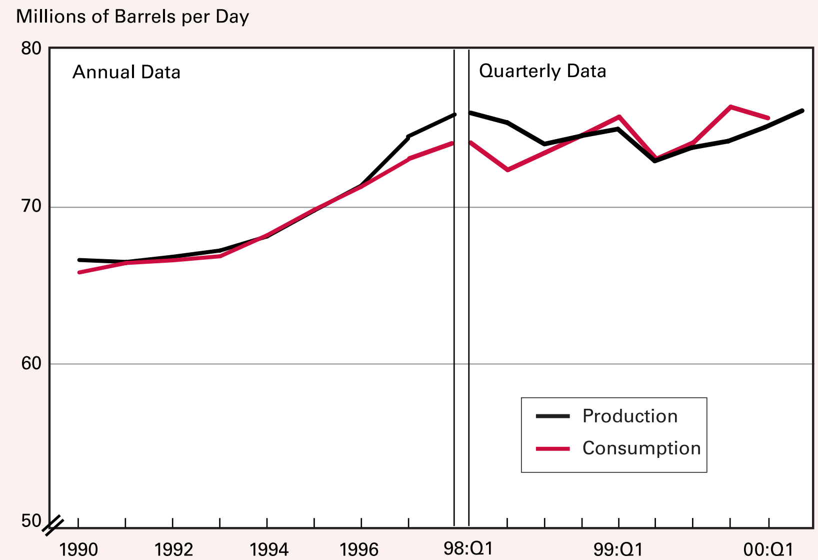
However, the global recovery turned out to be faster and stronger than expected. Thus, excess demand for oil reemerged, driving up prices. By March

2000, Mexico, Venezuela, and Saudi Arabia had grown concerned that high oil prices might slow world growth or provide incentives for increased production by non-OPEC countries. Thus, they persuaded the OPEC-plus group to raise output by 1.7 million barrels a day in the (vain) hope of keeping oil prices within a newly established target range of $22 to $28 per barrel (OPEC mix).[4] With oil prices returning to levels well above $30 per barrel this fall, however, OPEC has again raised production targets — by 800,000 barrels a day in September and, reportedly, by another 500,000 starting in November. Given the capacity constraints mentioned above, these increased targets are expected to reduce crude and product prices just modestly over the short run.[5]

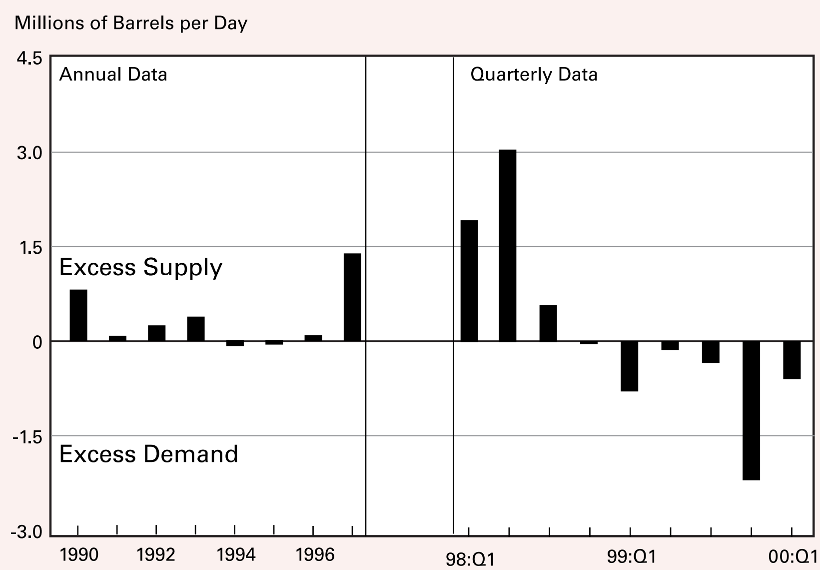
More fundamentally, moreover, as Figure 6 shows, the depressed oil and gas prices of 1997–98 discouraged drilling activity here in the United States, as well as globally. In 1998 and 1999 U.S. and world rig counts fell to their lowest levels in the data series. With the recent surge in oil prices, the U.S. rig count resumed rising this year. But, again, this new activity will not affect supplies until mid to late 2001. Basically, thus, over the next few months the weather, hoarding activity, and supply disruptions caused by technical or political problems will largely determine oil and gas prices. In the case of normal winter weather,[6] the Energy Information Agency (EIA) has estimated that the cost of heating an average house with oil in the Northeast will

Figure 5

World Oil Production and Consumption



Difference Between World Oil Production and Consumption



Source: U.S. Energy Information Administration.

[3] In 1998, world growth slowed to 2.3 percent, the slowest pace since the early 1980s.

[4] In terms of WTI crude, the U.S. reference price, the OPEC target ranges from $24 to $30 per barrel.

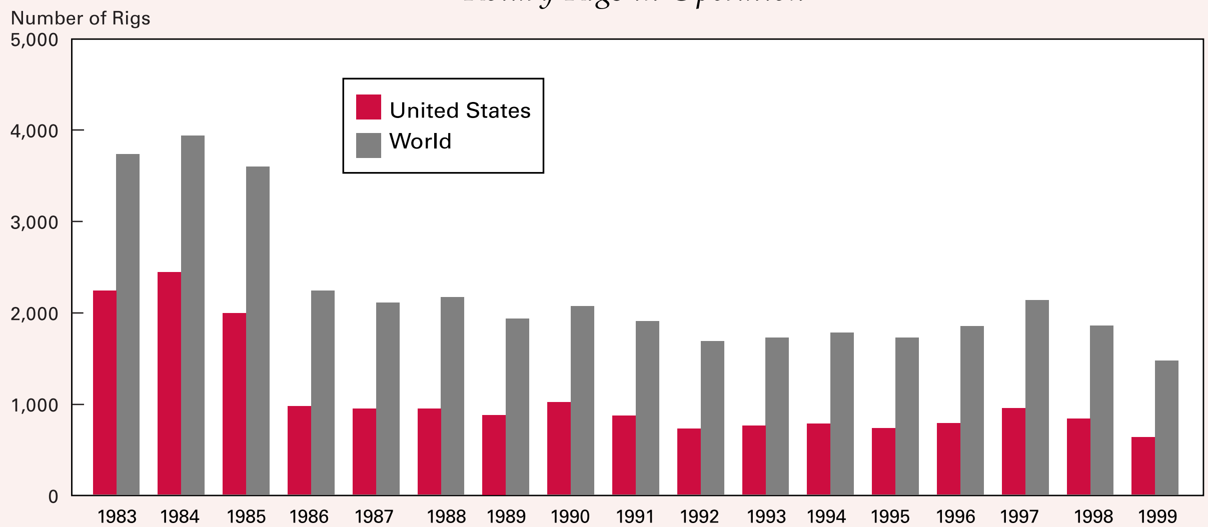
[5] In the same vein, the U.S. government's release of 30 million barrels on loan from its Strategic Petroleum Reserve (of which about half had reached the market by mid November) is likely to have had a limited impact on oil prices, although it may have helped to curb speculative activity.

[6] The past three winters have been abnormally warm in much of the country.

[7] The Midwest is the region most dependent on natural gas for heating purposes.

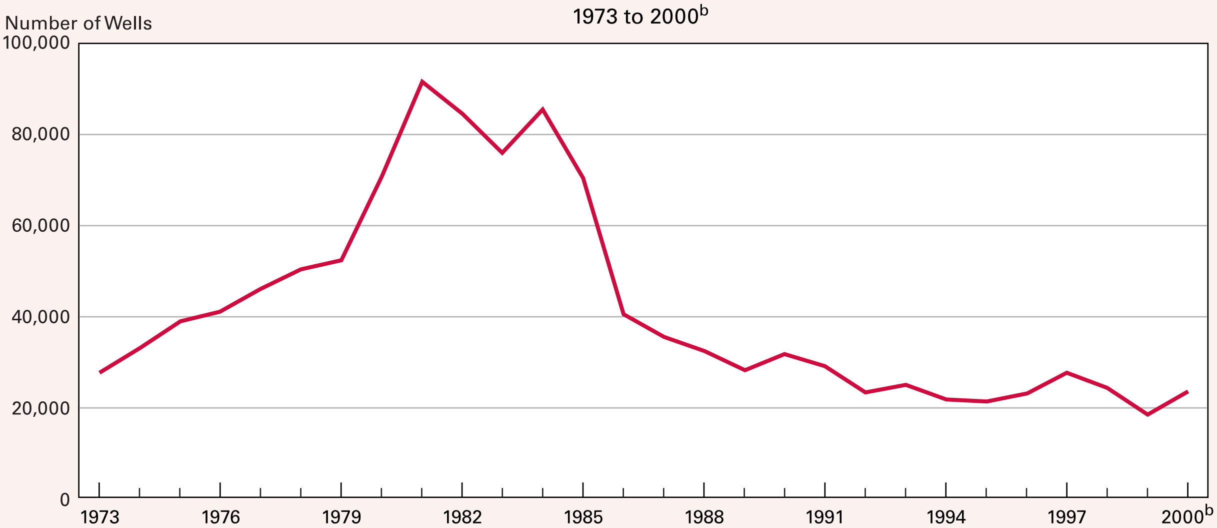
Figure 6

Rotary Rigs in Operation



Oil and Gas Wells Drilled in the United States[a]

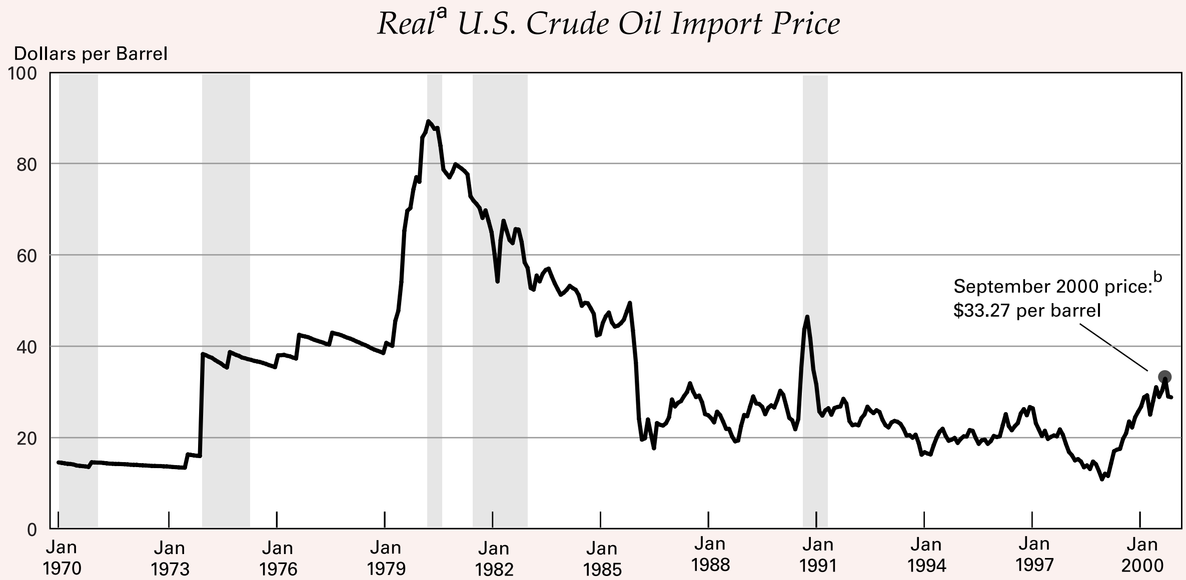
1973 to 2000[b]

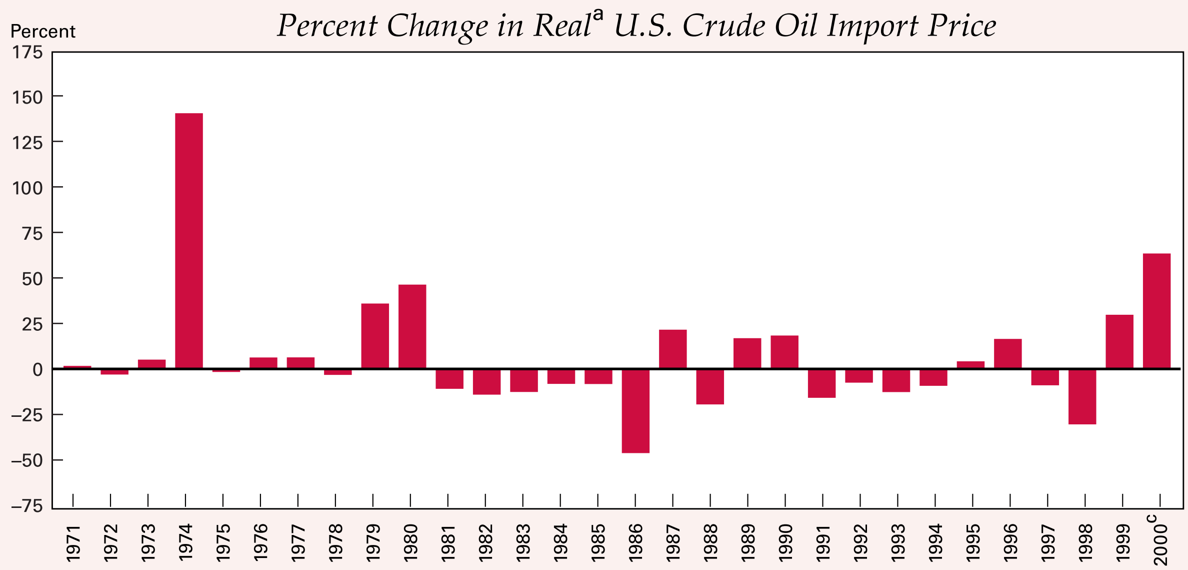


[a]Exploratory and developmental wells.
[b]The year 2000 is plotted as eight months of data at an annual rate.
Source: U.S. Energy Information Administration.

rise by 25 percent from last year, while the cost of heating an average house in the Midwest with natural gas is likely to increase by 40 percent.[7] In the event of a very cold winter, the EIA has indicated that "fuel market supplies cannot be described as adequate to ensure a high probability of supplies meeting demand . . . without difficulty." Once winter is past, with world growth forecast to slow modestly in 2001 and new pumping and refining capacity coming on line over the next 12 to 18 months, oil prices are expected to fall to $28 by late next year and to about $25 by the fourth quarter of 2002. Over the very long term, the EIA's baseline scenario results in oil prices at $22 per barrel in 2020 (in 1999 dollars). Other EIA scenarios produce

Figure 7





[a] Prices deflated using core CPI (January 2000 = 100).
[b] Average for first nine months of 2000 was $29.46 per barrel. Average for the same period in 1990 was $29.28 per barrel.
[c] Percent change for year 2000 was calculated using average for the first nine months of the year over average for the same period in 1999.
Source: U.S. Energy Information Administration, U. S. Department of Energy.

prices ranging from $15 per barrel to $28 per barrel at the 2020 endpoint.

So far, this note has generally quoted energy prices in nominal terms. But, as Figure 7 illustrates, in real terms oil prices are just nearing levels experienced at the time of the Gulf War. They remain well below their levels during the oil shock of the late 1970s to early 1980s. Moreover, as Figure 8 shows, the G-7 countries have generally cut their dependence on petroleum by 40 to 50 percent since that time, through

The Idiosyncratic Aspects of Previous Oil Shocks

Previous oil shocks have all followed periods of strong economic demand, accelerating inflation (from higher levels than prevail currently), a weak dollar (at least in terms of the major foreign currencies), actual or threatened cuts or disruptions in oil production, and hostilities in the Middle East. Yet each episode also exhibited some unique features that aggravated the oil price increases.

In the years leading to the first oil shock (1973–74), the U.S. economy was characterized by oil import quotas and widespread price controls, while U.S. monetary policy targeted a variety of goals in addition to price stability. From today's perspective, the overall policy approach was strongly interventionist. Moreover, in the early 1970s, the collapse of the Bretton Woods system of fixed but adjustable exchange rates had exacerbated U.S. inflation and prompted OPEC to demand oil price increases to offset the impact of dollar depreciation on their dollar-denominated oil revenues. In addition, globally bad harvests in 1972 produced sizable gains in food and feed prices. Indeed, Bernanke, Gertler, and Watson (1997) find that rising non-oil commodity prices were as influential as rising oil prices in spurring the Fed to tighten monetary policy.

Against this background, at the start of the Arab–Israeli War in October 1973, six Gulf states decided to use oil as an economic weapon; they announced cutbacks in oil production and an embargo on petroleum exports to unfriendly states, including the United States. (In the United States the embargo lasted until June 1974.) U.S. consumers and policymakers reacted strongly, as the following headlines suggest: "Curfews Hinted in Oil Shortage: . . . Possibility of School Closings and Heatless Subways" (Clines 1973) and "Airlines Slash Domestic Flights Because of U.S. Fuel Allocations" (Lindsey 1973). A November 1 *New York Times* article reported that federal officials believed that the cuts in Arab oil production and the embargo against the United States "may be portents of oil shortages for years to come" (Cowan 1973a). In late November, the Nixon Administration announced a package of measures to reduce energy consumption; these measures included a 15 percent cut in deliveries of home heating oil, a 15 percent cut in gasoline production (to increase the supplies of heating oil, which were less profitable than gasoline), a ban on gasoline sales on Sunday, a reduction in the speed limit to 50 miles per hour, and a ban on outdoor Christmas lights (Cowan 1973b). The cuts in the production of gasoline led to legendary gas lines, informal rationing, and angry protests by truck drivers. Indicators of consumer and business confidence and productivity fell.

In the months leading up to the second oil crisis, the oil price controls from the early 1970s remained largely in place. A 28-month phase-out began in June 1979 and lasted until President Reagan ended the controls several months early in January 1981. The crisis itself was triggered by the turmoil surrounding the fall of the Shah of Iran in

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both increased energy efficiency and a shift to other sources of power. Progress in this regard slowed after oil prices declined sharply in the mid 1980s, however. And developing Asia has made few significant gains in reducing its energy dependence since 1985. Moreover, while real oil prices have clearly been unusually low in recent years, the average real oil price for 2000 to date has been almost double the average for 1998 — a far greater (and more persistent) percentage gain than that experienced in 1990.[8]

[8] While this comparison may seem a bit misleading given the unusually low level of real oil prices in 1997 and 1998, some economists argue that an oil shock should be measured by a sharp change in oil prices, and not by their level, as will be discussed further below.

II. Measuring the Impact of Oil Price Shocks

In the past, of course, sharp increases in real oil prices have been associated with both higher inflation and recession — possibly because an oil price increase acts something like an excise tax, with the bulk of the proceeds accruing to the oil producers. (See the box for a description of the idiosyncratic events surrounding previous oil shocks.) Recent estimates by the Organisation for Economic Cooperation and Development (OECD) suggest that a $10 increase in the price of oil maintained for a year (roughly the current situation) is likely to add 0.5 to 1 percentage point to overall consumer price inflation (less to core) and to cut 0.2 to 0.5 percentage point from output growth in early 1979 and the Iranian revolution that followed. By late 1979, the Bakhtiar government installed by the departing Shah had fallen, the Ayatollah Khomeini had returned from exile, and the Iranian revolutionaries had seized Western hostages. In return, President Carter ordered an end to U.S. imports from Iran, and Iran canceled all contracts with U.S. companies. The turbulent conditions in Iran, aggravated by a serious pipeline fire in Iraq in late 1978, led to sharply rising world oil prices. As in the first oil shock, shortages of heating oil and gasoline reappeared in the United States. The gas lines reformed, odd–even rationing and minimum purchase requirements were installed, and the sniper fire and vandalism that accompanied an independent truckers' protest aggravated this country's reputation for violence. However, unlike the oil shock of the early 1970s, this crisis did not produce shortages of crude oil in the United States. Indeed, U.S. crude stocks rose 8 percent in 1978, 14 percent in 1979, and 8 percent in 1980, while gasoline stocks fell 8 percent in 1978 and edged down further in 1979. In this case, seemingly, the refiners were being squeezed between rising oil prices and remaining price controls on refined products. Thus, they chose to draw down inventory and, eventually, to curtail production of refined products.

The third oil shock resulted from Iraq's invasion of Kuwait on August 2, 1990. President Bush responded by dispatching troops to Saudi Arabia, and consumer confidence plunged. As the confrontation escalated, refinery problems hit the United States, and a severe earthquake struck Iran's oil-producing region. Oil prices spiked. However, reports of increased Saudi oil production and decreased world demand soon led to lower prices. In late November, the U.N. Security Council approved a resolution authorizing the use of force in the Persian Gulf if Iraq did not withdraw from Kuwait by January 15, 1991. On January 16, with Iran still in Kuwait, the U.S. air attack began. Simultaneously, the President also ordered the sale of 33.75 million barrels of oil from the Strategic Petroleum Reserve. Crude oil prices, which had risen $3 to $5 per barrel in the first half of January, dropped $9 to $10 in one day. The Gulf War was over by the end of February. Perhaps reflecting the brevity and timing of the oil price spike, which actually coincided with a slowdown in economic growth, Bernanke, Gertler, and Watson (1997) find little evidence that the behavior of oil prices led to the recession of 1990–91. Rather, they point to the financial fragility that developed in the late 1980s and to the blow to consumer confidence dealt by the Gulf War.

In sum, each of the previous oil shocks reflected market distortions and expectations regarding inflation and monetary policy that differed considerably from today's. By contrast, the unique feature of recent oil market developments may be the near-term capacity constraints found in many parts of the petroleum industry.

the major industrial countries within two years after the shock. The OECD exercise assumes that policymakers offset the impact of a temporary rise in oil prices on core inflation (excluding food and energy) and that inflation expectations do not rise. In effect, thus, the exercise abstracts from the crux of the problem because, without a change in expectations, a temporary jump in oil prices will likely cause just a one-time blip in inflation.

Of course, with recent growth unusually strong, and inflation unusually well behaved, the world is in a relatively good position to absorb such a shock. As Figure 9 shows, inflation and capacity utilization are both lower than they were in previous episodes of rapidly rising oil prices.[9] Moreover, long-term interest rates have been fairly stable, suggesting that inflation expectations are little changed.[10] On the demand side, in most of the G-7 countries other than the United States, fiscal policy is turning stimulative and will thus help to cushion the dampening effects of higher oil prices.[11] Less fortuitously, rising oil prices could hurt

[9] Non-oil commodity prices have actually been very soft relative to oil. On the other hand, labor markets have been extremely tight in the United States and several European countries, including the Netherlands and the United Kingdom.

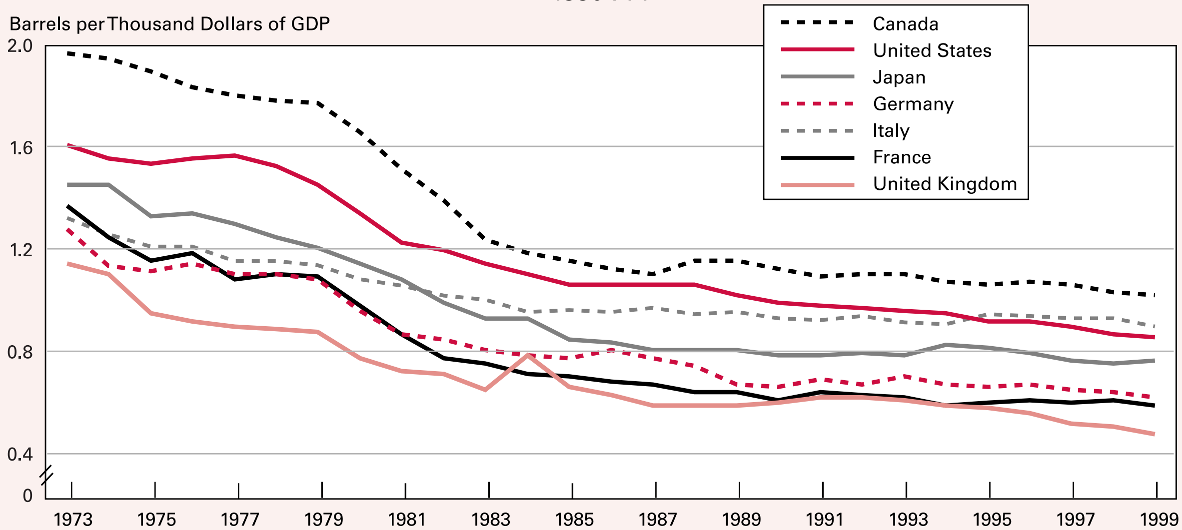
[10] An alternative interpretation of recent interest rate behavior would point to the reduced supplies of U.S. government securities.

[11] The shift to fiscal stimulus was under way even before fuel tax protests led to actual and possible future fuel tax cuts.

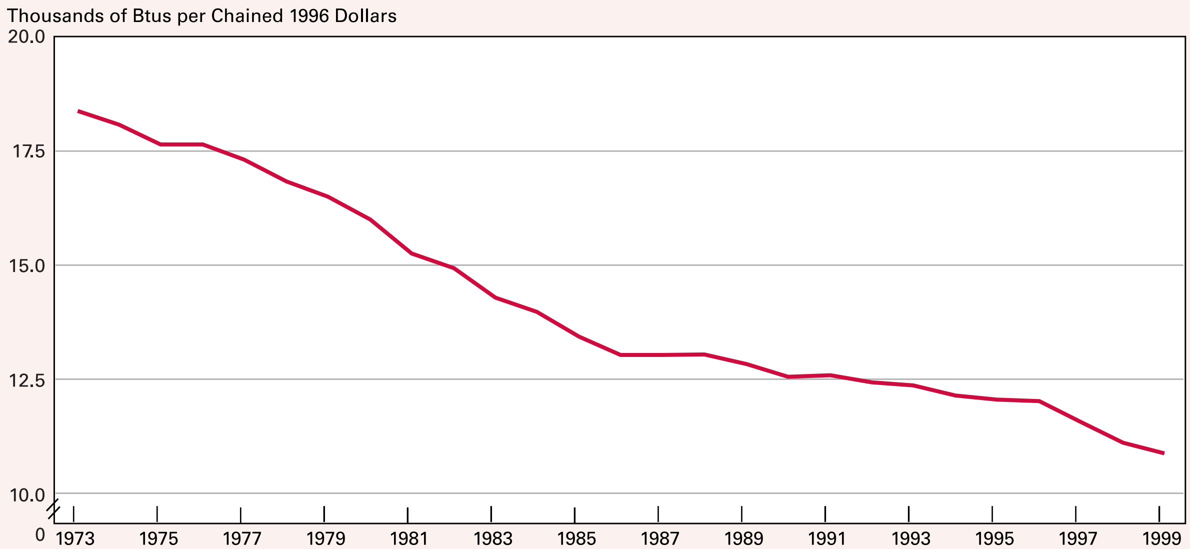
Figure 8

Petroleum Consumption per Thousand of Dollars of GDP

1990 PPP



U.S. Total Energy Consumption per Dollar of GDP



Source: U.S. Energy Information Administration.

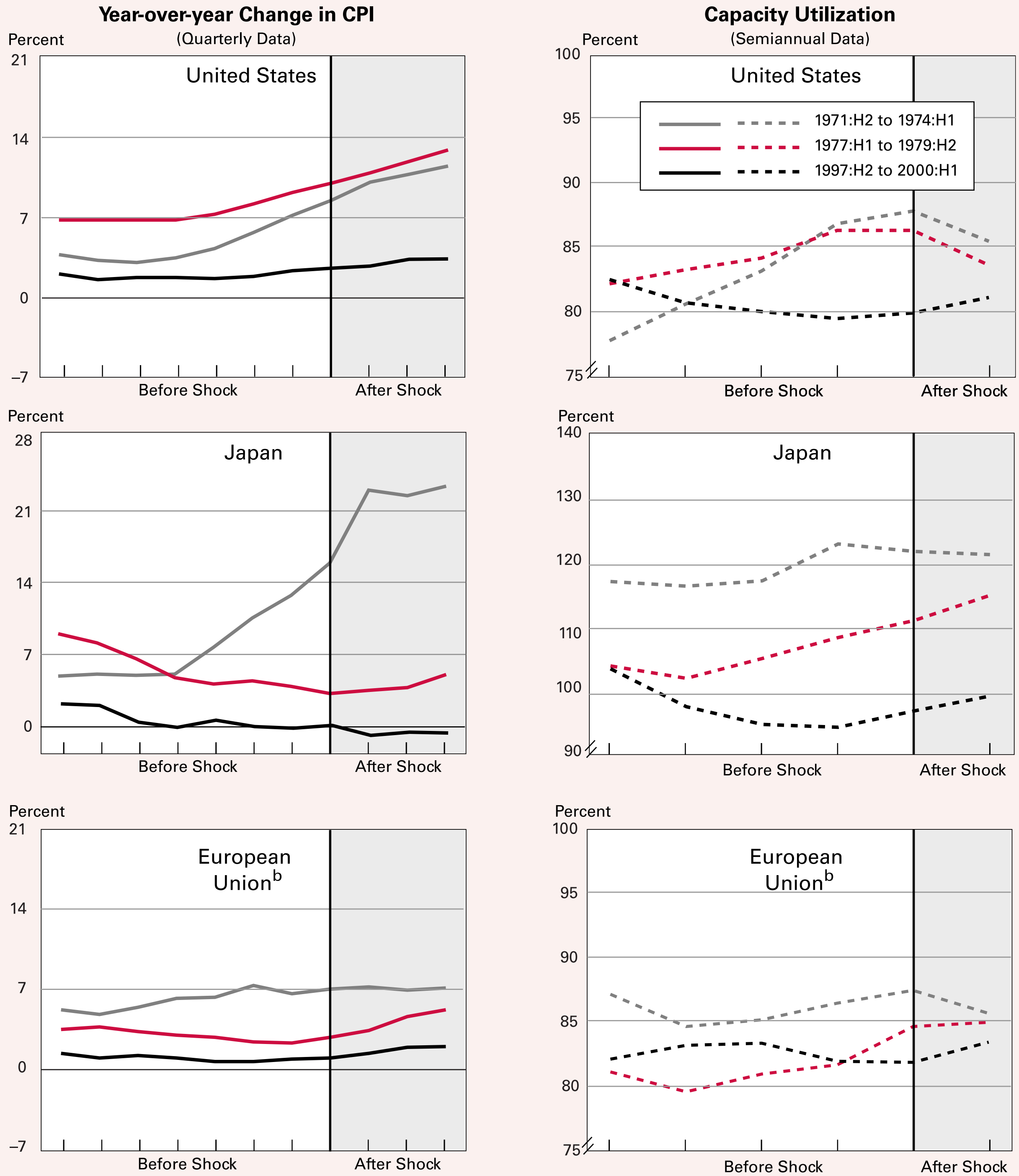
corporate profits and spook stock markets, aggravating oil's dampening effect on demand. And, given currently tight labor markets, persistently high oil prices might start to affect wage demands and core inflation. The European Central Bank is particularly concerned about such an outcome because the impact of rising oil prices, which are quoted in dollars, has been compounded by the euro's 25-percent depreciation against the U.S. dollar since its launch in January 1999.[12]

As the above list of complicating circumstances suggests, measuring the impact of oil price changes is not easy. Indeed, just defining an oil price shock turns out to be harder than one might expect. For example, do oil price increases and declines have symmetric

[12] The currencies of some oil-importing developing countries, like the Philippines and Thailand, have also experienced substantial depreciation against the dollar this year.

Figure 9

Inflation and Capacity Utilization During Three Oil Shocks[a]



a The vertical lines indicate the timing of oil shocks. For inflation, dates of shocks are 1973:Q3, 1979:Q1, and 1999:Q3. For capacity utilization, dates of shocks are 1973:H2, 1979:H1, and 1999:H2.

b German data used prior to 1997.

Sources: Organisation for Economic Cooperation and Development, International Monetary Fund.

effects on macroeconomic developments? Or, as some have argued, does an oil price increase have a bigger impact than a decline? Moreover, does a sharp recovery from unusually low price levels qualify as a shock? Although analysts have drawn somewhat different conclusions about these issues, the evidence suggests that the impact of oil price movements on inflation changed significantly after 1980. For example, using a Phillips-curve framework, Hooker (1999a) finds that oil price increases substantially affected both core and total inflation before 1980, but that since then, oil prices have affected the total CPI just modestly with no significant impact on the core measure.

Possible explanations for this structural break include the Volcker Fed's obvious determination to quell inflation and the resulting increased credibility of U.S. monetary policy. Further, the post-1980 experience has shown that oil prices can fall as well as rise. Until 1980, oil prices had tended to move primarily one way, but declines in demand associated with recession and conservation, the decline in OPEC cohesion, and the growth of non-OPEC production[13] led to sharp oil price declines that started in late 1981 but became pronounced in 1986. Thus, market participants may have come to expect oil prices to revert to their long-term mean rather than to ratchet consistently upward. The futures market provides a fragment of evidence suggesting such a change in expectations. During the oil shock of 1990–91, futures prices became backwardized, as they are currently. By contrast, in 1980 and early 1981, the earliest period for which oil futures prices were listed in *The Wall Street Journal,* the futures curves for heating oil were upward-sloping. The data for March 31, 1981 suggest that market participants expected that heating oil prices would be 18 percent higher a year in the future.

Turning to the impact of oil prices on output, Hamilton (1983) and other analysts have pointed out that every recession since the early 1970s has been preceded by an oil price shock. Hamilton even finds evidence that this correlation began in the 1950s. This association is somewhat puzzling given oil's limited, and shrinking, role in the U.S. economy. Today, energy has a weight of just 7 percent in the total consumer price index, and, by definition, a zero weight in the core CPI. Still, economists have proposed a variety of mechanisms linking oil price increases with economic downturns. These include terms-of-trade shocks, negative productivity shocks, shifts in relative prices that may induce a costly reallocation of resources across sectors, and the monetary policy response to the increased price pressures. In the case of a terms-of-trade shock, an oil price increase acts like an excise tax, as mentioned above — with a major part of the income gains going to foreign oil producers. Alternatively, the proceeds may go to domestic oil companies that have increasingly been channeling their investments into offshore facilities.

As for the relative price channel, Carruth, Hooker, and Oswald (1998) have proposed an efficiency-wage model in which an increase in the real price of oil, an important input price, leads to a decline in real wages as firms seek to avoid losses. This required decline in real wages is enforced by an increase in equilibrium unemployment. They find that real oil prices and real interest rates "explain" the overall path of U.S. unemployment from 1979 to 1995 reasonably well. Their model also outperforms two professional forecasters (the Blue Chip consensus and DRI) in predicting the recession of 1990–91 that followed the Gulf War. Rotemberg and Woodford (1996) present related evidence that introducing a modest degree of imperfect competition in product markets considerably magnifies the impact of oil price changes on real wages and output beyond what might have been expected given oil's relatively small role in the economy.

Since oil prices tend to rise when global demand is strong, it is difficult to separate monetary policy reactions to oil price increases from reactions to generalized price pressures.

Finally, analysts have found it particularly hard to disentangle the effect of the oil price changes from the effect of the policy reactions they engender. In addition, since oil prices tend to rise when global demand is strong, it is also difficult to separate policy reactions to oil price increases from reactions to generalized price pressures. Because "oil price shocks are perhaps the leading alternative to monetary policy as the key factor in postwar U.S. recessions,"[14] Bernanke, Gertler, and Watson (1997) try to separate the impact

[13] Over this period, Mexico, the United Kingdom, and Norway emerged as major oil producers.

of oil price increases from that of tightening monetary policy. After devising a way to hold monetary policy constant in a series of structured vector autoregressions, they find that most of the impact of oil price shocks on the economy stems not from the changes in oil prices themselves but from the resulting policy response. They suggest that this finding helps to explain why oil price increases appear to have had surprisingly large effects on output. They also find that the most aggressive rise in the fed funds rate was associated with the steepest decline in output (1980–82), whereas the most modest rise in the fed funds rate corresponded with the mildest recession (1990–91).[15] The authors note, however, that their simulations do not necessarily suggest that the policy response was suboptimal; turning off the policy response leads to higher inflation as well as to higher output.

In commenting on Bernanke, Gertler, and Watson's paper, Sims concurs that their simulations do not mean that the Fed could have avoided the output effects of oil price shocks, but only that the Fed could have traded output effects for increased inflationary pressures — a trade-off that he views as unsustainable (Sims 1997).[16] Hamilton and Herrera (2000) also question the feasibility of offsetting the policy dilemma posed by oil price shocks through looser monetary policy — in part because using the longer lags on oil prices that they recommend results in larger declines in output and aggravates the policy dilemma. As they note, many observers find that oil price changes have their greatest impact in 12 to 18 months, that is, beyond the seven-month lag that Bernanke, Gertler, and Watson use in their model.

[14] Bernanke, Gertler, and Watson (1997), p. 93.

[15] The fed funds rate rose in 1987 through mid 1989 but declined from mid 1989 through 1993.

[16] Sims also expresses doubts about Bernanke, Gertler, and Watson's measure(s) of oil price shocks.

Altogether, theoretical and empirical work on the impact of oil price shocks on the U.S. economy provides some reasons for optimism concerning the outcome of the current episode. In particular, as Gramlich (1979) observed more than two decades ago, as long as policy has been close to optimal in the period preceding the oil shock, a policy that minimizes the impact of higher oil prices on employment may represent the least costly response. However, as Gramlich also noted, supply-side price shocks tend to be rather costly.

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In sum, then, strong world growth and unusual capacity constraints throughout the energy supply chain may mean an expensive winter in the Northern Hemisphere. Thereafter, seasonal factors, additional capacity, and the modest slowdown in global growth widely forecast should allow oil prices to moderate. Moreover, increased energy efficiency, robust economic conditions, enhanced central bank credibility, and stable inflation expectations both here and abroad suggest that the impact of recent energy price increases on the U.S. economy will be more muted and manageable than in previous oil shocks. Indeed, the current episode suggests that one of the rewards for establishing a low-inflation environment may be an improved ability to weather moderate supply shocks. Still, it's not too soon to hope for an early spring.

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