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Crude Awakening: Behind the Surge in Oil Prices

by Stephen P. A. Brown, Raghav Virmani and Richard Alm

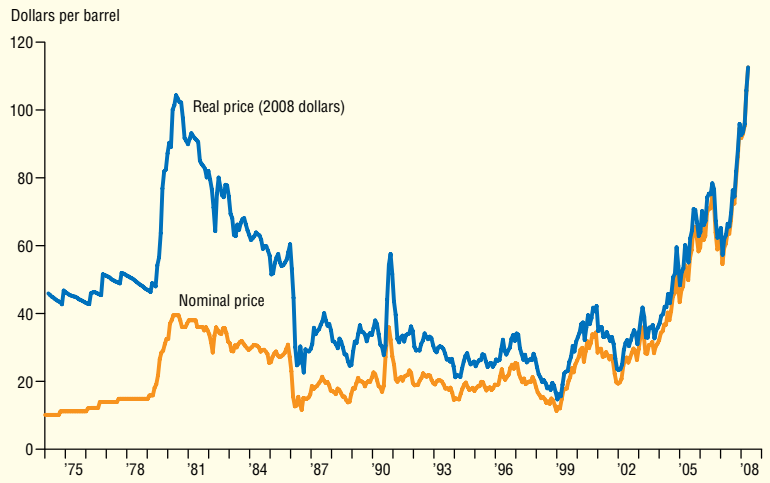
Demand, market expectations, the dollar and fear of disruptions ended two decades of relatively stable oil prices—and sent them skyward.

The first few months of 2008 saw crude oil prices breach one barrier after another. They topped $100 a barrel for the first time on Feb. 19, then rose past $103.76 about two weeks later, surpassing the previous inflation-adjusted peak, established in 1980. In April and early May, oil prices pushed past $110 and then $120 a barrel and beyond.[1]

These milestones reflect a new era in oil markets. After the tumult of the early 1980s, prices remained relatively tame for two decades—in both real and nominal terms (*Chart 1*). This long stretch of stability ended in 2004, when oil topped $40 a barrel for the first time, then embarked on a steep climb that continued into this year.

Modern economies run on oil, so it's important to understand how recent years—with their surging prices—differ from the preceding two decades.

Chart 1
Oil Prices Hit Record Highs



SOURCES: *Wall Street Journal*; Bureau of Labor Statistics.

A good starting point is strong demand, which has pushed world oil markets close to capacity. New supplies haven't kept up with this demand, fueling expectations that oil markets will remain tight for the foreseeable future. A weakening dollar has put upward pressure on the price of a commodity that trades in the U.S. currency. And because a large share of oil production takes place in politically unstable regions, fears of supply disruptions loom over markets.

These factors have fed the steady, sometimes swift rise of oil prices in recent years. Their persistence suggests the days of relatively cheap oil are over and the global economy faces a future of high energy prices. How they play out will shape oil markets—and determine prices—for years to come.

Supply and Demand

As incomes rise, economies use more energy for transport, heating and cooling and producing goods and services. A broad cross section of nearly 180 countries shows that doubling per capita income more than doubles per capita oil consumption (*Chart 2*).

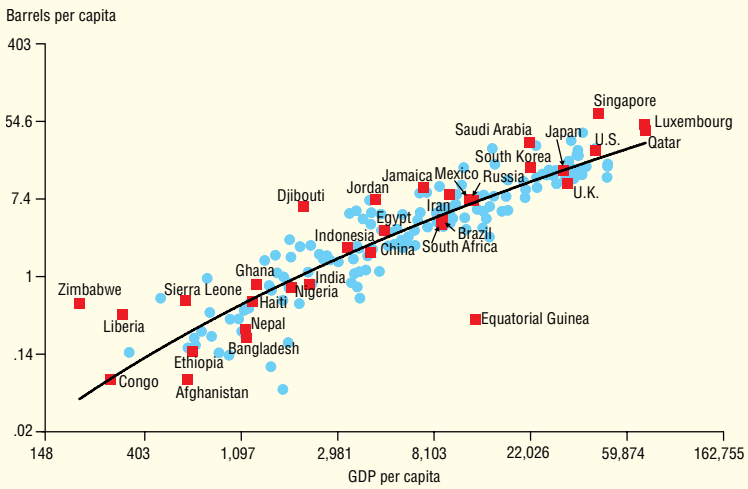
How much each country contributes to increases in global energy demand depends on its population and rate of income growth. Big nations moving quickly up the income ladder have huge implications for oil markets.

China and India, two giants with a combined population of nearly 2.4 billion, shook themselves out of a long economic slumber and began growing rapidly in the 1990s. Adjusted for inflation and purchasing power parity, China's per capita GDP rose from $1,103 in 1990 to $4,088 in 2005; India's went from $1,202 to $2,222. In this decade, new energy demand from China, India and other emerging countries has added to continued growth from the U.S., Europe and other parts of the world.

As economic activity in the U.S., the world's largest oil consumer, began accelerating in 2003, markets began feeling the full force of the world's increased appetite for oil. Global consumption rose from 82.6 million barrels a day in 2004 to 85.6 million in 2007. Since the beginning of the oil era, prices had ebbed and flowed around the U.S. economy's ups and downs. Now, markets view demand increases as a fact of life that won't be blunted much by a slowing U.S. economy.

With consumption on the rise, oil markets grew tighter as suppliers neared productive capacity. The

Chart 2
Oil Consumption Rises with Income



NOTES: Data are for 2005. GDP is in current U.S. dollars adjusted for purchasing power parity.

SOURCES: International Monetary Fund; World Bank; Energy Information Administration.

Organization of Petroleum Exporting Countries (OPEC), a 13-member group that produces more than a third of the world's oil, has maintained excess capacity of only 1 million to 2 million barrels a day since 2004, down from 4 million in 2001 and 5.6 million in 2002 (*Chart 3*).

Although OPEC's excess capacity has rebounded from its 2005 low, the gains are largely in heavy crude oils that can only be processed in specialized refineries. Those facilities are running full bore, so the added supplies aren't relieving a tight market. The latest evidence also suggests OPEC is now restraining its output.

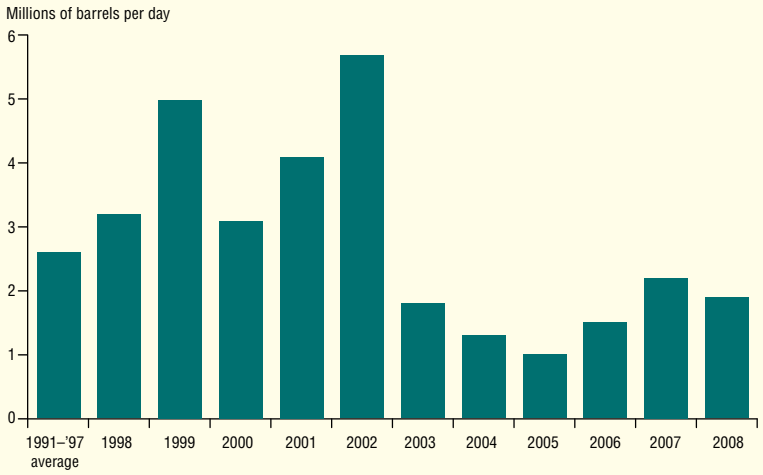
While some warn that oil production has peaked—or will soon—most industry experts contend that oil resources are plentiful; it just takes time and money to get them out of the ground and into the market.

Higher prices have done what economics would predict—stimulated efforts to increase supply. Companies have expanded their exploration budgets. Oil-producing nations have announced new projects. Drilling activity is at a high level, both offshore and on land. Wages and oilfield services costs are being bid up, while shortages persist for some key skills and equipment.

So far, new supplies haven't materialized quickly enough to keep up with growth in world demand, largely because various hurdles have slowed their development. Oil resources, for example, are concentrated in countries with state-run oil companies or little economic freedom. Where market signals aren't allowed to work, incentives to boost production may be muted.[2]

Oil demand is inelastic in the short run—that is, it doesn't react quickly to changing prices. Consumers adjust their spending to maintain consumption as prices rise, even if they have to pay more for it.[3] Most likely, this reflects businesses' commitment to keep up production and individuals' need to drive to work, run errands and heat homes.

Chart 3
OPEC's Excess Capacity Dwindles



SOURCE: Energy Information Administration.

When demand is inelastic, even modest tightening in markets translates into strong price movements. In recent years, this inelasticity has magnified tight markets' impact on prices.

The Role of Expectations

The fundamentals of supply and demand not only led to higher crude oil prices but also fed expectations that world demand will continue to grow faster than supply. The result is escalated price expectations, which show up in futures markets. The anticipated price for 2011 crude oil has moved steadily upward—from around $60 in January 2007 to more than $120 in the first week of May 2008 (*Chart 4*).

Futures prices reveal oil traders' expectations, but they also feed back into current prices. As a market efficiency condition, spot prices have to increase with futures prices to keep investors equally willing to hold or sell the marginal barrel of oil. If current and futures prices get out of sync, traders taking advantage of arbitrage opportunities bring prices back in line.

Forecasters offer another window on expectations. Their outlooks

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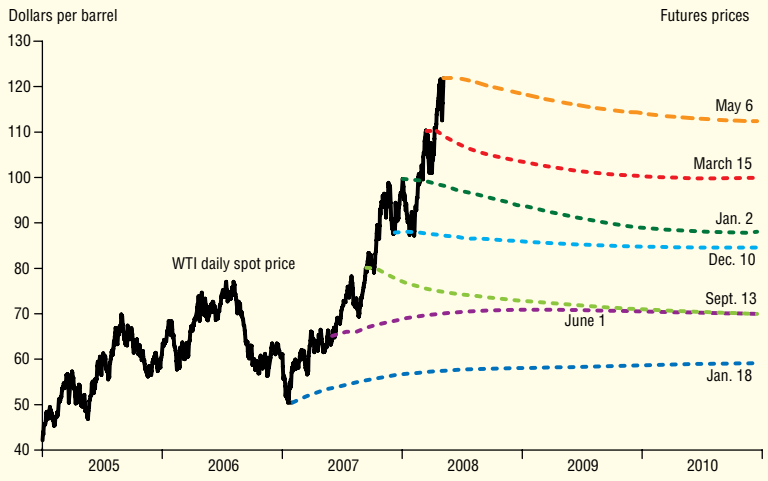
Chart 4
Markets' Rising Expectations



SOURCES: *Wall Street Journal*; Futuresource.com.

The Energy Information Administration's best guess for long-term prices doubled in just four years.

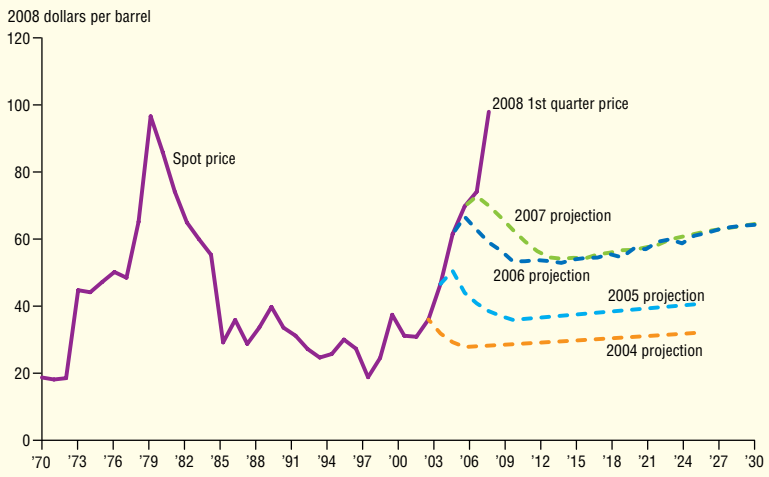
can provide additional information about possible price scenarios because they incorporate data beyond traders' sentiments. Each year, the Energy Information Administration (EIA) presents a mainstream forecast, which incorporates projections on the supply and demand forces expected to shape the marketplace.

As the realities of higher oil prices have sunk in, EIA forecasts have marched steadily upward (*Chart 5*). The 2004 projection, for example, saw prices relatively flat in the $30 range through 2025. The latest forecast, issued in 2007, anticipates a price decline in upcoming years, with oil settling above $60 for the long haul out to 2030.

While $60 oil looks good in today's markets, it's worth noting that the EIA's best guess for long-term prices doubled in just four years. It did so because the EIA decided its earlier demand projections were too low and supply projections were too high.

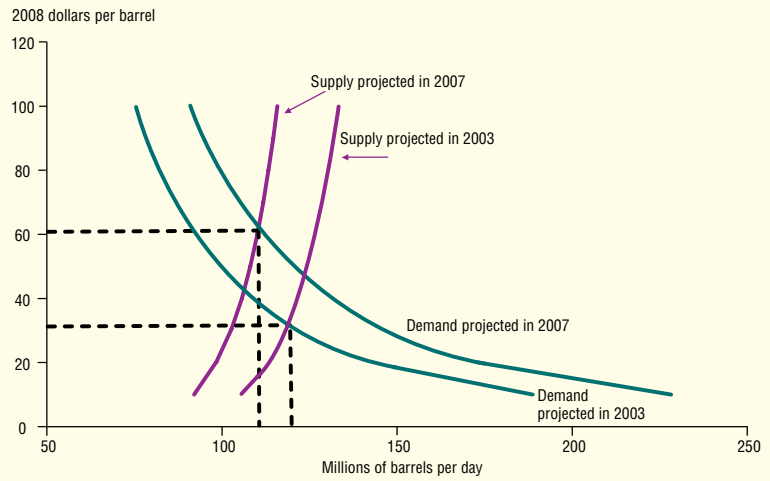
Consider the projected market for 2025 (*Chart 6*). It can be inferred that the EIA's projected demand curve moved significantly to the right between 2003 and 2007, signaling the expectation that consumers will want more oil at all prices. It can also be inferred that the projected supply curve moved significantly to the left, reflecting a more pessimistic view about future

Chart 5
Forecasters Look for Higher Prices



SOURCE: Energy Information Administration.

Chart 6
Views Change on 2025 Supply, Demand Picture



SOURCES: Energy Information Administration; authors' calculations.

If the U.S. currency had held its 2001 value against the euro, oil would have traded at about $80 a barrel in early 2008, about $21 below its actual price.

production. The market-clearing price ends up considerably higher.

Dollar's Weakening

Oil has long traded in U.S. dollars. Having a single-currency system lowers transaction costs for a commodity that trades globally. In recent years—while oil prices were rising on supply and demand fundamentals—the dollar has weakened against the currencies of the nation's trading partners, particularly the European Union's. The dollar has fallen 46 percent from its mid-2001 peak against the euro and 21 percent since 2004.

A declining dollar makes oil cheaper for Europeans and other foreign consumers, propping up their demand. A weakening U.S. currency also reduces the dollar-denominated supply from foreign producers. Together, these two factors exert additional upward pressure on prices. Daniel Yergin, chairman of Cambridge Energy Research Associates, adds a third element in arguing that some investors have used oil as a hedge against the dollar's decline.

How much has the weakening dollar added to oil prices? If the U.S. currency had held its 2001 value against the euro, oil would have traded at about $80 a barrel in early 2008, about $21 below its actual price (*Chart 7*). Put another way, exchange rate

Chart 7
Weaker Dollar Drives Oil Prices Higher

SOURCES: Energy Information Administration; Federal Reserve Board; authors' calculations.

How High Are Oil Prices, Really?

As oil prices rose to $50, $70 and $90 a barrel, analysts often pointed out that these prices hadn't yet breached the all-time high in real, or inflation-adjusted, terms. That barrier finally fell in early March, when prices topped the real 1980 peak.

Looking beyond post–World War II or even 20th century oil prices presents a somewhat different picture. Real oil prices were nearly as high as they are today when North American oil production began before the Civil War in 1860.

Oil prices can also be measured relative to changes in productivity and the level of technology, factors captured by manufacturing wages.[1] In the first quarter of this year, a typical factory worker needed slightly less than four hours to "earn" one barrel of oil. In 1980, it was just above five hours. Going further back in time, the number rises—to 6.4 hours in 1920, 7.9 in 1910 and an average of 15.4 in the 1870s.

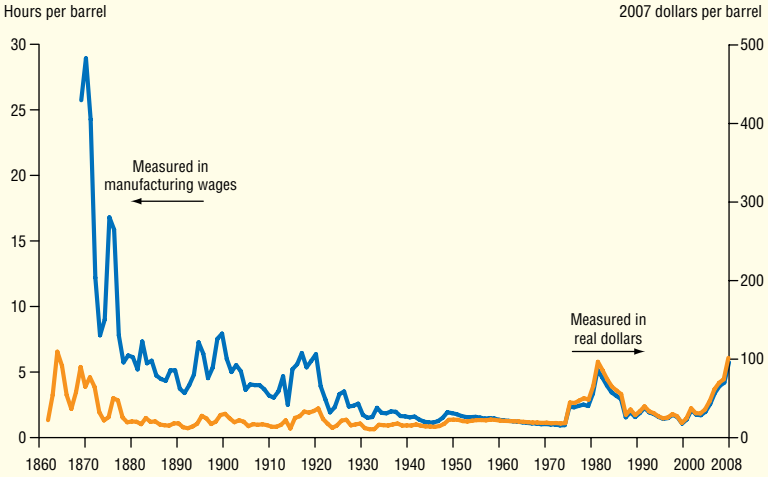
Technological advances have bolstered productivity, raised wages and made the work-time price of oil lower today than it was in the late 19th and early 20th centuries.

Finally, it is important to note that—despite rising real prices and imports—oil siphons relatively less money out of the American economy than it did in the past. Expenditures on petroleum products today account for about 5 percent of all after-tax income earned in the United States, less than half of the 11.6 percent spent in 1980.[2]

Notes

[1] "Natural Resource Scarcity and Technological Change," by Stephen P. A. Brown and Daniel Wolk, Federal Reserve Bank of Dallas *Economic and Financial Review*, First Quarter 2000.
[2] Also see "What's Driving Gasoline Prices?" by Stephen P. A. Brown and Raghav Virmani, Federal Reserve Bank of Dallas *Economic Letter*, October 2007.

Real Oil Prices: A Long View



SOURCES: *Oil and Gas Journal*; Department of Energy; Bureau of Labor Statistics; authors' calculations.

movements accounted for roughly a third of the $60 increase in oil prices from 2003 to 2007.

Most of the dollar's price impact occurred toward the end of the period. When it comes to adjustments in oil consumption and production, a declining dollar takes time to reshape crude oil prices because expectations don't shift quickly. Factors that push up expectations of future prices, however, also put upward pressure on spot prices because markets will adjust until investors are indifferent between holding and selling the marginal barrel of crude oil on the spot market.

Would it matter if oil were priced in euros or a basket of consuming countries' currencies? The headlines might be somewhat less alarming, but little would change in real terms. As the dollar's value declined, U.S. consumers would still be paying more for oil. It would take more dollars to acquire the euros needed to buy oil. In a world where the dollar is weakening, the burden of higher oil prices would still fall more heavily on the U.S. than Europe.

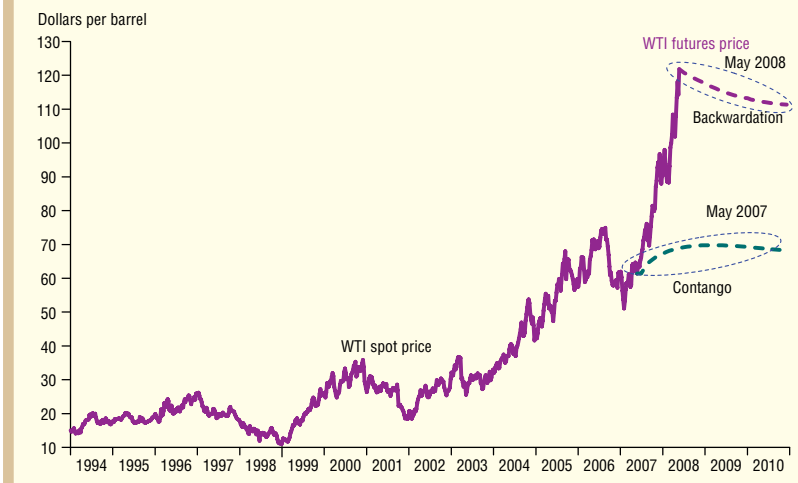
Geopolitical Risks

The geopolitics of oil is a brew for sleepless nights. The Middle East sits atop two-thirds of the world's reserves. The region pumps oil amid a war in Iraq, potential conflicts elsewhere and terrorists prowling for targets. Russia, a major non-OPEC producer, has expanded state control over the oil sector, pulling more of it into the realm of dicey internal politics tinged with nationalism. In recent years, violence has cut production by a quarter in Nigeria, Africa's top oil producer. Venezuela, South America's largest producer, is under the sway of the quixotic Hugo Chavez, who has threatened to cut off sales to the U.S.

Tight oil markets don't have the luxury of spare capacity to offset supply interruptions resulting from trouble in important oil-producing countries or regions. Because oil demand is inelastic, even the temporary or

Chart 8

Backwardation Suggests Fear of Supply Disruptions



SOURCES: *Wall Street Journal*; Futuresource.com.

Forecasting exchange rate movements is fraught with difficulty, but the currency is likely to strengthen with the U.S. economy. A stronger dollar would lower oil prices. Further dollar weakening, however, would lead to higher prices.

partial loss of significant production capacity can strongly impact prices. Wars, political intervention or unexpected breakdowns send shock waves through oil markets. Just the fear of a supply disruption is itself enough to prompt price spikes.

Fears of disruptions are reflected more in short-term price movements than in longer-term ones. The increases can prove temporary, particularly when rumored troubles fail to materialize. However, the persistent threat from some disputes—for example, Iran's long-simmering conflict with the U.S.—are likely to keep upward pressure on oil prices for longer periods.

Fear is hard to measure, but the futures market offers some help. We usually expect futures prices to slope upward from the spot price, a pattern the financial markets call "contango." However, prices for future delivery sometimes dip below the spot prices, creating a phenomenon called "backwardation." This can occur because of sudden shortages or a jolt of uncertainty.

It's in this phenomenon that we find indirect evidence of fears of oil supply disruptions. When fear spreads, refiners bid aggressively for short-term oil supplies because they face extremely high costs for shutting down operations. Not enough oil can be brought to market quickly, and spot prices rise above futures prices, putting the market into backwardation.

Oil markets have been in the grip of backwardation lately, with futures prices declining. As spot prices climbed toward $120 a barrel in early 2008, for example, futures prices stood at $102 a year out and $100 two years out—a clear backwardation (*Chart 8*).

Oil Price Prospects

What happens with oil prices will be determined by the same four factors that have shaped the market in recent years—global demand, expectations about future market tightness, the value of the dollar and fear of supply interruptions. If these factors stay on their present course, prices are likely to be pushed higher. If one or more factors change, markets could see some easing of price pressures.

At first blush, crude oil demand doesn't offer much hope for lower prices. It is likely to grow with an expanding world economy. Higher oil prices will prompt some conservation and take some of the edge off prices—but not much.

The past response of U.S. oil consumption to rising prices suggests the quadrupling of oil prices since 2003 might reduce U.S. consumption by 10 to 20 percent over the next decade. Europe might see similar declines. However, these reductions won't be sufficient to relieve pressures on prices, given the projected demand growth from China, the Middle East, India and other rapidly expanding economies. Only a dramatic, worldwide move toward energy conservation or a much stronger U.S. and European response to higher oil prices could substantially alter the outlook.

Geopolitical factors affecting supply disruptions aren't likely to change much, either. The Middle East's heavy concentration of conventional oil resources suggests the region will become an even more important source of world oil production. Given the region's historical instability, episodic fears of supply disruptions could

remain part of oil pricing well into the future.

The dollar might offer some relief. Forecasting exchange rate movements is fraught with difficulty, but the currency is likely to strengthen with the U.S. economy. An appreciating dollar would lower oil prices for U.S. consumers. Further dollar weakening, however, would lead to higher prices.

Geopolitics and exchange rates aside, long-term oil prices will largely be set by supply and demand, which will affect prices directly and influence the expectations that shape futures markets. The key lies in how much new oil reaches markets. Four scenarios for conventional oil resources show a range of outcomes and impacts for the trajectory of prices:

- Oil production reaches a plateau or peak—prices likely to rise further.
- Oil nationalism continues to slow the development of new resources—prices likely to remain relatively high.
- In a shift of strategy, OPEC increases its output sharply—prices likely to fall.
- Aggressive exploration activities pay off with the quick development of significant new resources—prices likely to fall.

Both the futures markets and EIA forecasts currently anticipate some softening of oil prices over the next few years, suggesting markets expect supplies to gain ground on demand. International Strategy and Investment, an energy consulting business, has documented a substantial number of projects under way that would boost world oil supplies. The development of these resources could undermine the expectations underlying the higher oil price scenarios—even those of oil nationalism.

Supplies could be bolstered by nonconventional oil sources—tar sands, oil shale, coal-to-liquids. Industry experts regard these resources as plentiful, with development and production costs well below current oil prices. Tar sands and oil shale are already in production. Biofuels are too limited in scale and currently too costly to make much difference to crude oil pricing.

The substantial development of these nonconventional oil resources could mean downward pressure on crude oil prices in future years. Actual and expected costs of nonconventional resources suggest it might be difficult to sustain oil prices above $70 a barrel. However, the relatively high costs of these nonconventional oil sources could inhibit development because producers fear losses during a price collapse. The production and use of nonconventional resources would also generate more pollution, which could mean conventional oil could command a premium.

What's the bottom line? Absent supply disruptions, it will be difficult to sustain oil prices above $100 (in 2008 dollars) over the next 10 years.

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Notes

[1] This article looks at oil prices through the first week of May and uses West Texas Intermediate as the reference price. Throughout the article, we've used a combination of daily, weekly, monthly, quarterly and annual data, which may alter the apparent timing of peaks and troughs in prices.

[2] "Running on Empty? How Economic Freedom Affects Oil Supplies," by Stephen P. A. Brown and Richard Alm, Federal Reserve Bank of Dallas *Economic Letter*, April 2006.

[3] In some countries, government policies that maintain low prices interfere with the link between world oil prices and energy consumption. China, for example, hasn't fully passed price increases on to its consumers.

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