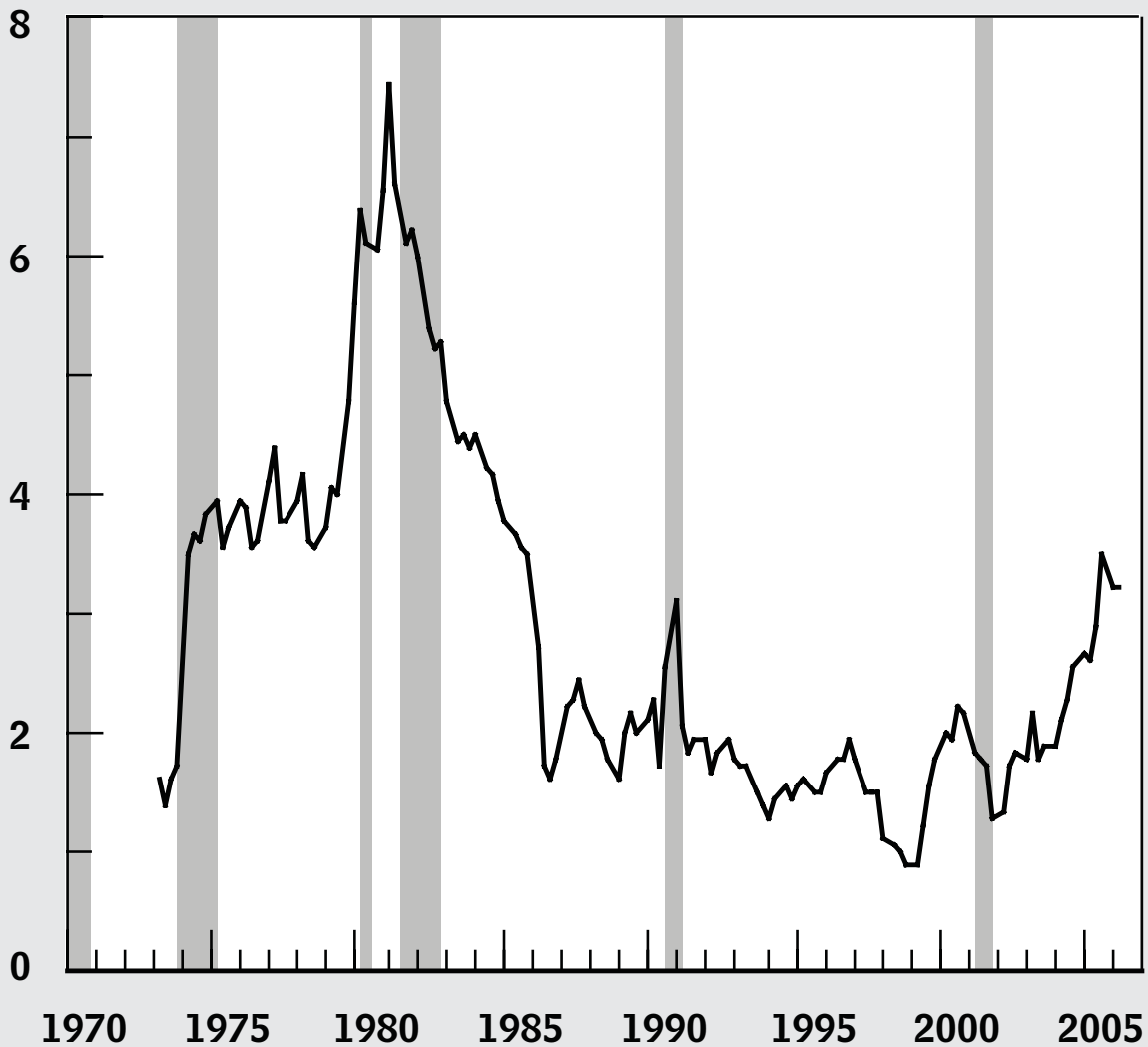


# The Economic Effects of Recent Increases in Energy Prices

U.S. Spending on Petroleum as a  
Percentage of Gross Domestic Product



JULY 2006





# **The Economic Effects of Recent Increases in Energy Prices**

July 2006

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## Notes

Unless otherwise indicated, all years referred to in this report are calendar years.

Many of the figures in the paper use shaded vertical bars to indicate periods of recession. A recession extends from the peak of a business cycle to its trough.

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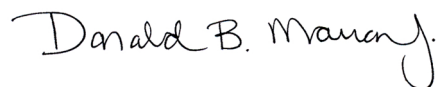


## Preface

**S**ince late 2003, the price of crude oil has doubled, and prices for gasoline and natural gas have also risen significantly. What impact have those increases had on the U.S. economy? This Congressional Budget Office (CBO) paper—prepared at the request of the Chairman of the Senate Budget Committee—analyzes the short-term macroeconomic effects of the recent rise in energy prices as well as the likely effects over the next 10 years. The paper also evaluates the reasons that those effects have been smaller than might be expected on the basis of the U.S. economy’s response to the oil price shocks of the 1970s. In keeping with CBO’s mandate to provide objective, impartial analysis, this report makes no recommendations.

John Peterson of CBO’s Macroeconomic Analysis Division wrote the paper—with assistance from Richard Farmer, Mark Lasky, Angelo Mascaro, and Adam Weber—under the supervision of Robert Dennis. Bob Arnold, Douglas Hamilton, Arlene Holen, Joseph Kile, Kim Kowalewski, David Moore, and Thomas Woodward of CBO provided helpful comments, as did James Hamilton of the University of California at San Diego and Ellen Hughes-Cromwick of the Ford Motor Company. (The assistance of external participants implies no responsibility for the final product, which rests solely with CBO.)

Christian Howlett edited the paper, and Christine Bogusz proofread it. Adam Weber produced the figures. Maureen Costantino designed the cover and prepared the paper for publication. Lenny Skutnik produced the printed copies, and Simone Thomas prepared the electronic version for CBO’s Web site ([www.cbo.gov](http://www.cbo.gov)).



Donald B. Marron  
Acting Director

July 2006





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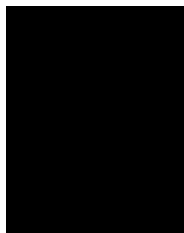
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## Summary

**C**ontrary to general expectations, the large and persistent rise in energy prices that has occurred over the past two and a half years has not caused substantial problems for the overall U.S. economy. Although many households have had trouble adjusting to the higher prices, the effects on the nation's gross domestic product (GDP), employment, and inflation have thus far been moderate. The reasons for that outcome include various interrelated factors—for example, the U.S. and many foreign economies were at robust points in the business cycle when energy prices began to rise, the Federal Reserve has built up a legacy of successful monetary policy, and the U.S. economy has changed over the past 25 years in ways that have increased its underlying flexibility and stability.

### Recent Developments in Energy Prices

Since late 2003, the price of crude oil has doubled, natural gas prices have temporarily hit new highs, and prices for coal and electricity have risen steadily. The most important of those increases, in terms of their effects, has been the rise in the price of crude oil.

The consensus view as of July 2006 is that most of the increase in the price of oil will persist. That price may fall below its recent level of more than \$70 a barrel, but because the increase stemmed largely from growth in the demand for oil rather than from a temporary reduction in the supply, market analysts do not expect the price of oil to be significantly lower, on average, over the next 10 years. (In early 2004, by comparison, analysts expected the price of oil to be on the order of \$30 a barrel for the following 10 years.)

### The Economic Impact of Higher Prices

The recent increases in energy prices have dampened economic growth in the United States. The growth of real (inflation-adjusted) GDP was probably reduced by about

a quarter of a percentage point in 2004 and by less than half a percentage point in 2005; so far this year, the reduction has been about a quarter of a percentage point. Therefore, GDP in 2006 is probably lower by about 1 percent than it would have been if energy prices had not risen.

In addition, the rise in energy prices added more than a percentage point to consumer price inflation in 2005, pushing it to 3 percent.<sup>1</sup> With energy prices excluded, however, consumer price inflation appears to have been only slightly higher than it would have been otherwise. If energy prices do not increase further and if monetary policy remains moderately restrictive, the rate of inflation is likely to fall back to about 2 percent a year by the end of 2007.

Households' income and spending were both affected by the rise in energy prices. The growth of real hourly compensation slowed (the result of a slowdown in nominal wage growth combined with the increase in inflation). At the same time, the average household's annual spending on energy goods and services rose by about \$1,700 between 2003 and mid-2006, and their saving rate dropped sharply. The fall in the saving rate helped dampen the negative effects that higher prices would ordinarily have had on the economy in the short run. If households try to rebuild their savings, however, consumer spending may be diminished slightly over the next few years.

Overall, corporations were less affected by the rise in energy prices than households were. The profits of non-energy-producing firms grew less rapidly than they would have in the absence of the energy price hike, but corporate profits overall increased. Much of that rise reflected a continuation of previous trends, as companies continued

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1. In this paper, "consumer prices" refers to the personal consumption price index unless otherwise noted.

to reduce debt-service costs and depreciation expenses grew slowly. In addition, of course, the profits of energy-producing companies increased sharply. Most energy-using industries were apparently able either to pass on the higher costs of energy to their customers or to compensate for those costs through slower growth in other production costs. Largely because the demand for goods and services remained strong, the level of businesses' investment spending on structures and equipment, which began increasing in 2003, continued to be high in recent years despite rising energy prices.

GDP is expected to largely rebound from its short-term losses, although the shift in energy prices is likely to keep the level of GDP over the next 10 years lower than it would have been otherwise. In addition, the U.S. standard of living will be depressed to a greater extent than will GDP. U.S. residents will have to exchange more of their production for a barrel of oil than would have been the case if energy prices had not risen, and that adverse

change in the "terms of trade" will affect the standard of living in the United States for many years.

### **Changes in the Economy's Response Since the 1970s**

The nation's experience with oil price increases in the 1970s led many people to believe that such increases would lead to sharp slowdowns in economic growth and persistently higher inflation. The absence of such severe effects in recent years has thus been surprising.

Many of the problems associated with the oil price shocks of the 1970s, however, were unique to that period. The U.S. economy and some foreign economies were at weak points in the business cycle before the shocks hit, monetary policymakers had been unable to control inflation in the years before energy prices rose, and many aspects of the U.S. economy's structure at that time made the economy less able to respond to price shocks than it is today.

# Developments in Oil and Natural Gas Markets Since 2003

**O**ver the past two and a half years, the price of crude oil has doubled, and retail gasoline prices have risen by 87 percent. Relative to the general price level of the economy, the price of crude oil rose to its highest level since 1980, and the wellhead price of natural gas temporarily reached a new peak (see Figure 1-1). Although natural gas prices have since declined from that peak, they remain historically high, and analysts generally expect oil and natural gas prices to remain elevated.

The underlying causes of those price increases have been strong demand combined with weak supply. A number of developments—such as the hurricanes of 2005 and reductions in output in Iraq and Nigeria—have interrupted the supply of crude oil and natural gas and the processing of energy products in recent years. But the primary force behind the steady rise in prices has been growth in the demand for energy.

## Increases in Demand

For crude oil, growth in demand around the world explains much of the price increase, whereas for natural gas, growth in demand in the United States has been the main factor. In 2004, oil consumption shot up in China and the United States and also grew in many other parts of the world (see Figure 1-2).<sup>1</sup> Members of the Organization of Petroleum Exporting Countries have apparently been limited in their ability to keep the supply of oil growing at the same pace as demand. Thus, the price rose, and a relatively large share of the growth in world oil supply had to come from other, high-cost regions. Al-

though the growth of oil consumption stagnated or declined in 2005 in the United States, Europe, and the former Soviet Union, it continued to grow in Asia, the Middle East, and Latin America.

The pressures on natural gas prices are more narrowly attributable to conditions in the United States. Although total annual consumption of natural gas has been relatively stable in recent years, new demand by electric utilities has introduced growing seasonal pressures on the supply of natural gas from U.S. production, imports, and underground inventories. Domestic production has been declining since 2003, despite record levels of exploration and development. Costly shipments from Canada and imports of liquefied natural gas have helped balance supply with demand but have put further upward pressure on prices.

## Restrictions on Supply

Growth in energy supplies has been disrupted by some specific events over the past two and a half years. Recently, production of crude oil has been hampered by civil unrest in Nigeria, foreign investors' concerns about political developments in Russia, continuing attacks on oil fields and pipelines in Iraq, and hurricanes that struck the Gulf Coast of the United States. Those disruptions to supply reinforced the effects that growing demand had on prices. In addition, worries about the potential consequences of international objections to Iran's nuclear program may have caused some oil businesses to stockpile part of their supply in recent months rather than sell it.

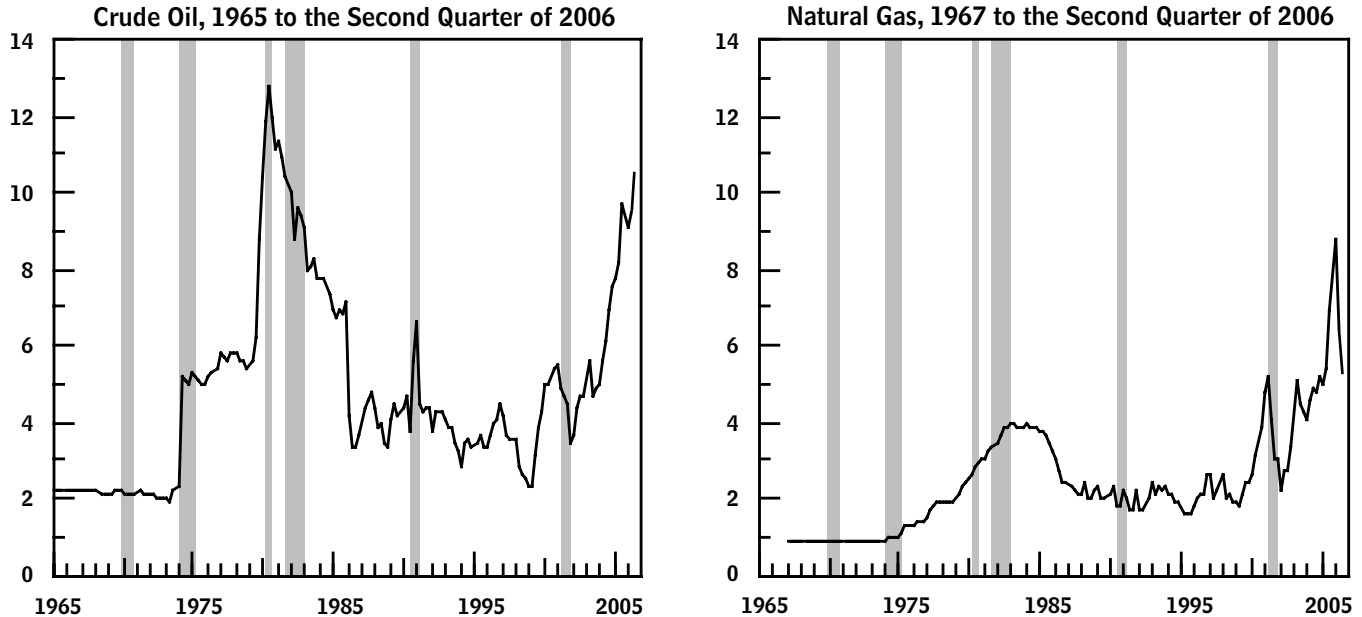
In the next few years, new oil production is expected from the Caspian Sea region, West Africa, and perhaps Russia and the Middle East. But until those lower-cost supplies arrive, prices are likely to remain high, and a rel-

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1. For an analysis of China's role in the worldwide increase in demand for oil, see Congressional Budget Office, *China's Growing Demand for Oil and Its Impact on U.S. Petroleum Markets* (April 2006).

**Figure 1-1.****Prices for Crude Oil and Natural Gas**

(2000 dollars per million British thermal units)



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis; Department of Energy, Energy Information Administration; Department of Labor, Bureau of Labor Statistics; *Wall Street Journal*.

Notes: The price of crude oil is for West Texas intermediate. Before 1982, it refers to the posted price; after 1982, it refers to the spot price. The price of natural gas is the wellhead price, extended back to 1967 using the producer price index for natural gas. The series are converted to 2000 dollars using the gross domestic product chained price index.

The final values, for the second quarter of 2006, are estimated.

atively large amount of new demand will have to be met by higher-cost producers.

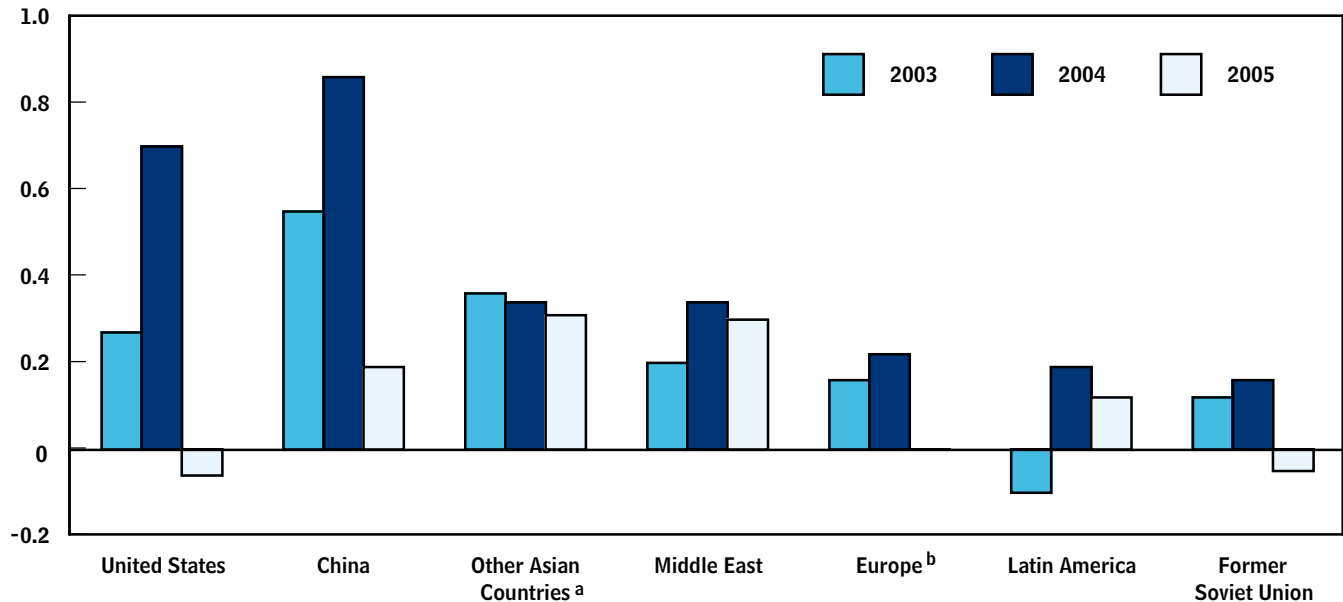
Refining of gasoline in the United States has been diminished by the 2005 hurricanes and by regulatory requirements for reformulated gasoline. Refineries that had accounted for 40 percent of the production of refined products in the United States were damaged or temporarily closed by the storms. Through the spring of 2006, three refineries—which together had accounted for 5 percent of the nation's gasoline production capacity—were not yet fully operational. This year, further problems with gasoline production resulted from efforts to replace the MTBE in reformulated gasoline with ethanol. (MTBE is an additive that helps reduce some pollutants by increasing the oxygen content of fuels.) Refiners face claims in lawsuits that maintain that MTBE has contaminated groundwater. They have accelerated the replacement of

MTBE with ethanol, but supplies have proved insufficient. The wholesale price of ethanol increased from \$2.10 per gallon in January 2006 to about \$3.60 per gallon in June, which has placed additional pressure on gasoline prices. New restrictions on the sulfur content of motor fuels have also added to refining costs.

For supplies of natural gas, the United States relies on domestic production to a greater extent than it does in the case of oil. Consequently, the large decline in natural gas production in the Gulf region as a result of the 2005 hurricanes had a significant effect on prices. Natural gas prices rose sharply—from \$5.52 per 1,000 cubic feet (mcf) in early 2005 to a peak of \$10.97 mcf in October 2005—before falling back recently to \$6.59 mcf. In June 2006, natural gas production in the Gulf region was about 90 percent of the prehurricane level.

**Figure 1-2.****Annual Change in Petroleum Consumption in Selected Regions, 2003 to 2005**

(Millions of barrels per day)



Source: Congressional Budget Office based on data from the Department of Energy, Energy Information Administration, *Monthly Energy Review* (January 2006), Table 3.1b (for U.S. petroleum consumption), and International Energy Agency, *Oil Market Report* (January 17, 2006), p. 4 (for other countries' petroleum consumption).

a. Japan, Australia, and Asian countries other than China that are not members of the Organisation for Economic Co-operation and Development.

b. In 2005, Europe's change in consumption was near zero.

Unusually mild weather early in 2006 probably played a role in the recent easing of natural gas prices. Measured by heating degree-days (the temperature variation from 65 degrees weighted by the population), the need for heating between January and March was 10 percent lower nationwide this year than it was in 2005 and 16 percent lower in the mid-Atlantic region, where gas is the dominant heating fuel.

### Price Expectations for Oil

In part because the price increases for crude oil have been largely driven by demand, most oil market analysts believe prices will remain high for many years. In the past, when the price of oil rose because of an interruption in supply that was thought to be temporary, analysts expected the price to fall once supply bounced back. This time, however, the increase in demand appears to be long

lasting, and many analysts believe that growing worldwide demand will continue to put upward pressure on oil prices for some time. Even among people who expect the price to decline from its recent level of more than \$70 a barrel, few forecast that it will fall below \$40 a barrel—whereas \$30 a barrel was considered the likely future price just two and a half years ago.

Before 2003, some major oil-rich nations (particularly Saudi Arabia) were producing significantly less than their capacity, and that spare capacity helped keep oil markets relatively calm. Today, however, worldwide production is close to its short-term limits. As a result, oil markets appear much more vulnerable than before to an interruption in supply or a rapid increase in demand. Even the threat of a reduction in supply of a few hundred thousand barrels per day causes sharp fluctuations in prices.



## The Economic Effects of Higher Oil and Natural Gas Prices

**S**o far, the U.S. economy has adjusted relatively easily to the recent increases in energy prices. Those increases appear to have reduced the growth of real (inflation-adjusted) gross domestic product (GDP) by less than half a percentage point per year between 2004 and 2006 and to have boosted inflation only temporarily. If energy prices remain near their current levels or rise further, GDP is likely to remain for an extended time below the level it would have attained if energy prices had not risen. Also, the standard of living of U.S. residents will be reduced to an even greater degree than will GDP.

### The Short-Term Impact of Price Rises During the 2004–2006 Period

Paying high prices for energy and using less of it affect both the production of and the demand for goods and services. The effects on demand, however, have by far the greater potential impact on GDP in the short run. Using less energy has only a small direct effect on production because, out of all the inputs to production (labor, structures and equipment, energy, and other raw materials), energy costs account for a relatively small share of output. The effects on demand—and the consequent indirect effects on production—could be much bigger because spending more on petroleum imports generally reduces spending on domestically produced goods and services.<sup>1</sup>

Despite those potentially large effects, demand for U.S.-produced goods and services has held up well in recent years. The rise in energy prices slowed the growth of real household income significantly, and spending on petroleum imports and energy rose sharply. But the growth of consumer spending on nonenergy goods and services remained relatively high, largely because households' saving

rate declined. Overall corporate profits and businesses' spending on investment also remained strong in spite of higher energy prices, while the profits of energy companies jumped significantly.

Such short-term effects on supply or demand can be exacerbated or muted by government policies. Both microeconomic policies (primarily regulations, such as controls on energy prices) and macroeconomic policies (the conduct of monetary and fiscal policy) affect the way in which the economy responds to an increase in energy prices. As discussed in Chapter 3, differences in government policies are one reason that the energy price shocks of the 1970s took a much greater toll on the U.S. economy than the recent price rises have.

### How Increases in Energy Prices Can Affect Production and Demand

As noted in Chapter 1, the price of crude oil has doubled since the end of 2003. In that year, the total cost of oil was equal to about 2 percent of output (or GDP). Thus, the direct effect of a 10 percent loss in the supply of oil—roughly associated with a 100 percent increase in price in the short run—would be a reduction in GDP of approximately 0.2 percent.<sup>2</sup> (With the recent price rise, the total cost of oil now accounts for about 3½ percent of output, so a similar percentage increase in the price of oil today would have a larger direct effect.)

The loss in output would be less if firms could use other sources of energy or otherwise find relatively low-cost ways to modify their production practices to conserve oil. However, some structures and equipment may be cost-effective only in an environment of low energy prices and

1. As used in this paper, “petroleum” refers to crude oil, natural gas liquids, and refined products such as gasoline and fuel oil.

2. See James D. Hamilton, “Oil and the Macroeconomy” (draft, Department of Economics, University of California, San Diego, August 24, 2005), available at [http://dss.ucsd.edu/~jhamilton/JDH\\_palgrave\\_oil.pdf](http://dss.ucsd.edu/~jhamilton/JDH_palgrave_oil.pdf).

become obsolete when energy prices rise. Retiring such equipment might result in a larger loss in output. Studies of that effect during the 1970s indicate that it was small, but a much greater reduction in energy availability could cause the effect of retiring obsolete equipment to be disproportionately larger.<sup>3</sup>

Compared with the direct effect on production, a doubling of crude oil prices would be likely to have a bigger impact on the demand for goods and services. That impact, in turn, would cause production to weaken. Both declines in demand and changes in the composition of demand would reduce production, which could slow the growth of GDP significantly. The impact on overall demand operates through three major channels:

- Higher prices for crude oil (and to a lesser extent for natural gas, of which the United States imports a smaller share) siphon off buying power from the United States as U.S. residents pay more for energy imports. The additional buying power overseas may not immediately translate into increased demand for U.S. exports, so one short-term effect of higher energy prices is a decline in demand for goods and services produced in the United States. That reduction in consumer demand tends to temporarily dampen investment and other spending as well, magnifying the negative effect on GDP growth. (Other spending falls because businesses that lose sales tend to slow their investment and employment, reducing household income and further lowering consumer spending.)
- A similar but smaller effect is the shift of income and wealth within the United States to energy producers and owners of energy assets. That shift can also temporarily reduce demand but to a smaller extent than does the channeling of spending overseas.
- A large and sudden change in the price—or disruption in the supply—of an important consumer good can have a short-term impact on consumer spending by affecting consumer confidence. People may postpone some purchases that they can currently afford out of concern about how the disruption to the economy may affect their jobs or income in the future.

In addition, increases in energy prices would induce changes in the composition of demand. Businesses and households would tend to purchase more items that helped them conserve energy (for example, demand for fuel-efficient vehicles would increase relative to demand for sport utility vehicles), and consumers would generally change the composition of their spending to increase the share of goods and services that were less energy intensive. Those shifts would cause some productive capacity to be idled even if the total amount of spending did not decline.

Such effects reduce demand at the same time that the costs of production increase. In those circumstances, monetary policymakers potentially face a difficult decision. If they tighten policy by raising short-term interest rates to avoid an increase in inflation, they will exacerbate the drop in output and the rise in unemployment. If they accommodate the temporarily higher inflation with easier monetary policy, output will not fall as much. But they risk inadvertently fostering a climate of inflationary expectations—that is, they risk creating the impression that inflation will remain high. Fortunately, the reaction of the core rate of inflation (which excludes prices for energy and food) to the recent increases in energy prices was not large enough to lead to the adoption of monetary policies that would have had major negative effects on the economy.

In addition to their impact on the overall economy, higher energy prices are likely to affect different households and firms differently. People with relatively high income and the few households that own significant amounts of stock in energy companies would probably maintain their spending more than other households would. Similarly, firms that produced energy or that were not energy intensive would be better able to maintain their employment and investment growth than would companies that were heavy users of energy.

### **Estimated Effects on GDP and Inflation Since 2003**

Although it is difficult to determine exactly how the economy would have fared if energy prices had not risen as much as they did, those price increases appear to have dampened the growth of GDP by roughly a quarter of a percentage point in 2004, less than half of a percentage point in 2005, and about a quarter of a percentage point so far this year. Thus, the level of GDP in 2006 is about 1 percent lower than it would have been otherwise.

3. Charles R. Hulten, James Robertson, and Frank Wykoff, "Energy Obsolescence and the Productivity Slowdown," in Dale W. Jorgenson and Ralph Landau, eds., *Technology and Capital Formation* (Cambridge, Mass.: MIT Press, 1989).



So far, the recent increases in energy prices had their peak effect on consumer price inflation in 2005. The higher prices that consumers faced for energy not only added about a percentage point to the inflation rate that year but also affected nonenergy consumer prices. The extent of that effect is uncertain, but nonenergy prices appear to have grown by about half a percentage point more than they would have if energy prices had not risen.

The small change in core inflation thus far implies that if energy prices remained fairly steady from now through the end of 2007, overall inflation would fall back from its current rate of about 3½ percent to about 2 percent next year. That is, the increase in energy prices would not cause inflation to be persistently higher.

Those estimates are based on a macroeconomic model by Global Insight, an economic analysis and forecasting firm. The Congressional Budget Office (CBO) used the model to simulate what would have happened to the economy if energy prices during the 2004–2006 period had grown by about 2 percent per year (the average growth of the GDP price index in the years before the energy price increase) and then compared that simulation with actual outcomes. The simulation assumed that monetary policy would react to changes in inflation and employment.<sup>4</sup>

The structure of the Global Insight model partially captures the major short-term effects of higher energy prices: the reduction in nonenergy consumption and investment, the impact of that reduction on employment and personal income, and the likely consequences for financial markets. Thus, the model provides estimates of what would have happened if energy prices had not risen. The model may not reflect all of the effects adequately, however. It is not designed specifically to simulate the response to changes in energy prices; rather, it embodies households' and firms' average responses to a variety of economic shocks that have occurred in the past. Also, the U.S. economy has changed in many structural ways over the years, and the model's equations may not capture the effects of those changes adequately. In spite of those

shortcomings, the Global Insight model probably yields reasonable rough estimates of how the economy would have performed in the absence of the price increases. Econometric modeling work at the Federal Reserve using a variety of models has yielded some similar estimates of the effect of the energy price increases on GDP growth.<sup>5</sup>

### Effects on Households

The rise in energy prices has affected households' income, spending, and saving rates. Real household income has grown less rapidly in the past few years than it would have if energy prices had not risen substantially. That slower growth reflects the direct effect of higher energy prices on consumer price inflation as well as a slowdown in the growth of the economy overall. Consumer price inflation increased as the growth of hourly compensation (wages and employer-provided benefits, such as health insurance) slowed. Consequently, the real growth of compensation fell as energy prices rose.

Households are spending much more on energy goods and services today than they were in 2003. Such spending totaled about \$580 billion per year in the second quarter of 2006, up from about \$380 billion per year at the end of 2003. That \$200 billion difference implies that annual energy spending per household rose by an average of about \$1,700 over that period. The increase in the price of energy relative to the prices of other goods and services also caused a rapid rise in the ratio of energy spending to disposable income (see Figure 2-1), even though nominal disposable income per household was about \$9,000 greater in mid-2006 than it was in 2003.

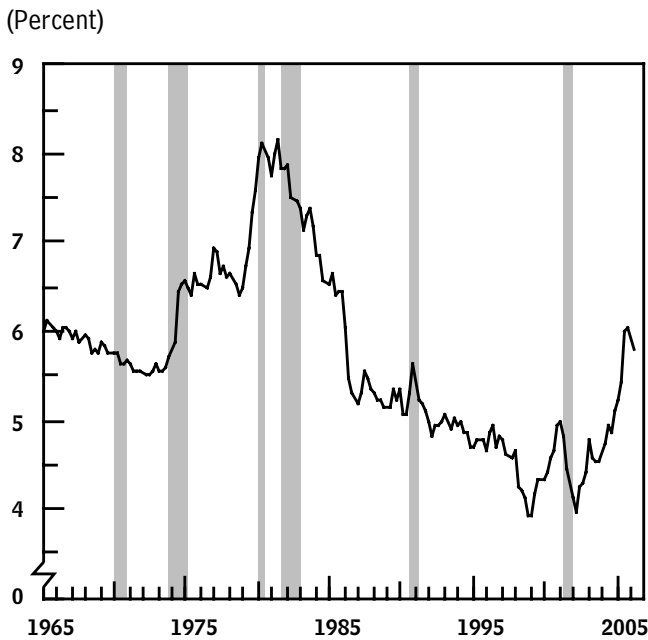
So far, higher prices have had little effect on the amount of motor fuel and fuel oil used per household (see Figure 2-2). If prices remain elevated, however, households are likely to try to reduce their energy consumption in the future.

Increases in energy prices can have offsetting effects on the amount of money that households save. On the one hand, the overall personal saving rate tends to decline when the price of energy rises rapidly (although the response differs among individual households). On the

4. The simulation used a version of the Taylor rule, described in John B. Taylor, "Discretion Versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, vol. 39 (December 1993), pp. 195–214, available at [www.sciencedirect.com](http://www.sciencedirect.com).

5. See Donald L. Kohn, "Economic Outlook" (remarks at the Bankers and Business Leaders Luncheon, Federal Reserve Bank of Kansas City, April 13, 2006).

**Figure 2-1.**  
**Households' Spending on Energy as a Percentage of Disposable Personal Income, 1965 to the First Quarter of 2006**



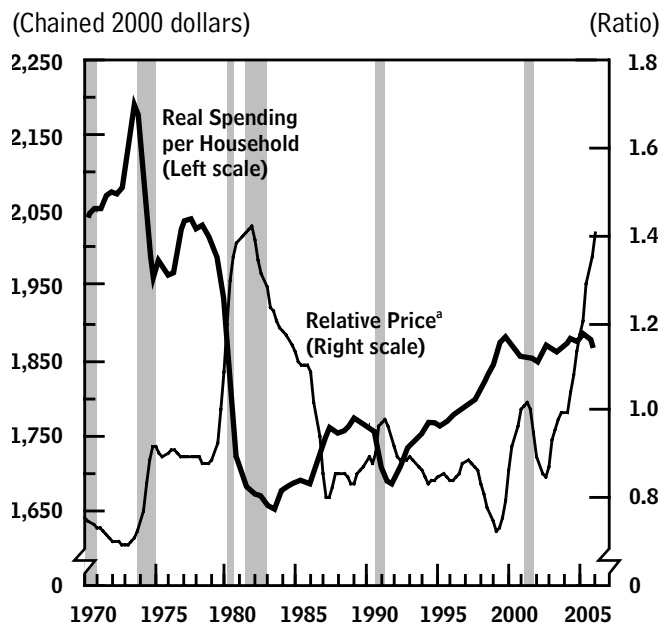
Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

other hand, the effect of the price increases on people's expectations about the future may initially encourage households to try to save more. Relatively wealthy or high-income households can maintain their spending on nonenergy goods and services while also spending more on energy, thus lowering their saving rate. Lower-income households, by contrast, generally have to curtail other spending to maintain their energy consumption. Some lower-income households may also be able to reduce their saving or increase their debt to pay for some of the increase in their energy costs, but others have limited access to credit and have to cut nonenergy spending. Changes in consumer confidence can also affect decisions about spending as people postpone large purchases—of vehicles or appliances, for example—until they are more sure about how higher energy prices will affect their jobs and income in the future. Deferring such purchases tends to increase the saving rate in the short run.

The extent to which individuals have drawn down their savings or increased their debt to finance greater energy spending is difficult to estimate accurately. But preliminary data show that the personal saving rate fell unusually quickly between late 2003 and mid-2006—by about 3 percentage points (see Figure 2-3). Much of that drop probably stems from the rapid increase in housing-related wealth during the period. If households spent some of that increase in wealth—perhaps after refinancing their mortgages—they could consume more relative to their income, lowering their saving rate. The rising cost of energy appears to have encouraged households to lower their saving rate in order to maintain their spending.

Households' ability and willingness to reduce their saving blunted the adverse impact that higher energy prices

**Figure 2-2.**  
**Households' Real Spending on and the Relative Price of Motor Fuel and Fuel Oil, 1970 to the First Quarter of 2006**

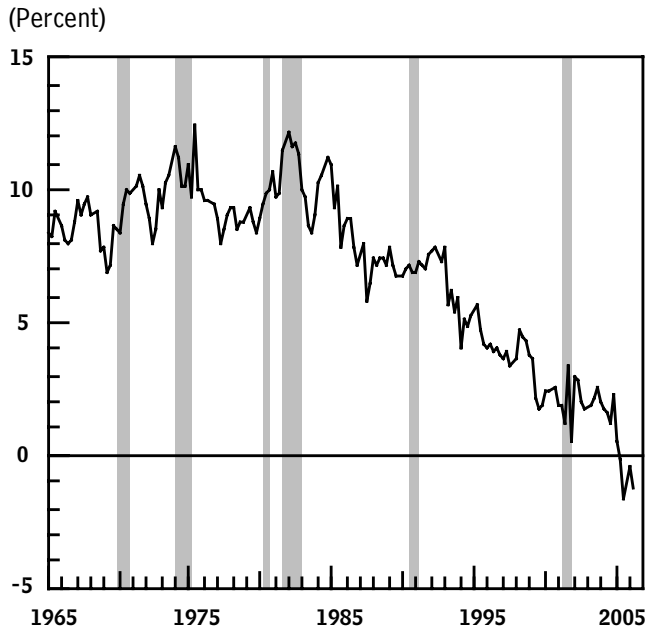


Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis and Bureau of the Census.

Note: Data were smoothed using a four-quarter moving average. The number of households was adjusted to remove discontinuities in the data series in January 1982 and January 2002.

a. The relative price is the ratio of the chained price index for consumer nondurable energy goods to the gross domestic product chained price index.

**Figure 2-3.**  
**Personal Saving Rate, 1965 to the First Quarter of 2006**



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

would ordinarily have had on demand, because otherwise consumers would have had to cut back on nonenergy spending. The growth of nonenergy consumption does not appear to have been significantly depressed so far, although the effect of higher energy prices may slow the growth of such spending in the future if households try to rebuild their savings.

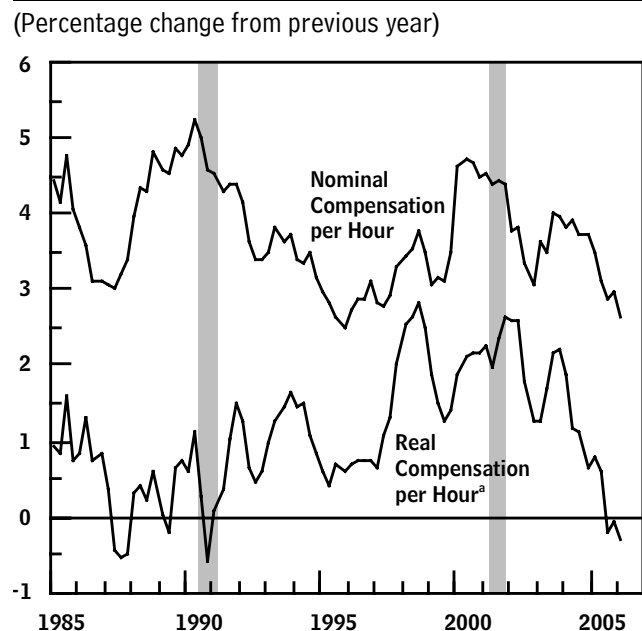
The rise in energy prices also dampened increases in households' inflation-adjusted income. The growth of one measure of real compensation per hour—the employment cost index divided by the personal consumption price index—slowed from 2 percent at the end of 2003 to about zero by early 2006 (see Figure 2-4). CBO's model simulation indicates that real wages would have grown about half a percentage point faster in 2004 and about three-quarters of a percentage point faster in 2005 if energy prices had not risen. The growth of employment would also have been slightly faster.

### Effects on Firms

Overall, the income and spending of the corporate sector appear to have been little affected by the rise in energy

prices. Corporate profits fared better than household income over the past two and a half years, but much of the increase in profits was unrelated to the change in energy prices. Corporate profitability in general grew rapidly, and energy producers in particular recorded large gains in profits. Preliminary data indicate that corporations' total economic profits rose to a 40-year high in early 2006 relative to GDP (see Figure 2-5). That increase partly reflected a continuation of trends that predated the rise in energy prices. Firms continued to restructure debt to take advantage of low long-term interest rates, and depreciation charges against profits grew slowly in response to low investment rates from mid-2000 to early 2003. Adding those costs to profits provides a rough measure of the gross income that companies earned as a return on capital. That measure shows much less increase over the past few years than do profits alone. CBO's model simulation suggests that corporate profits would have been slightly higher if energy prices had not risen.

**Figure 2-4.**  
**Hourly Compensation, 1985 to the First Quarter of 2006**



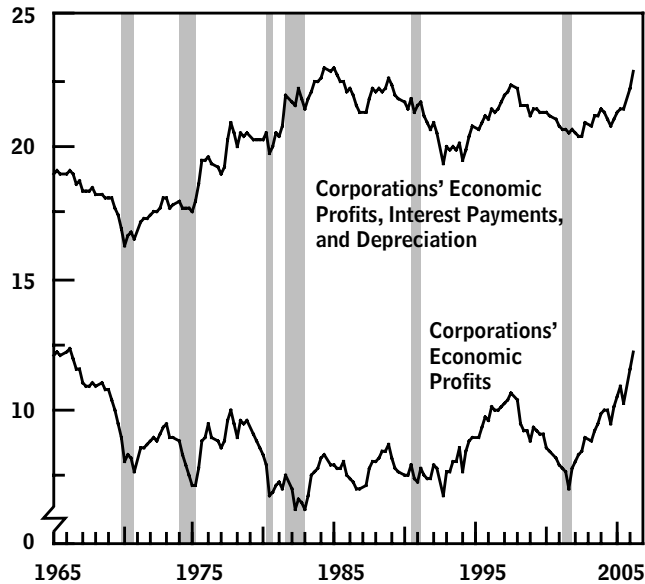
Sources: Congressional Budget Office; Department of Labor, Bureau of Labor Statistics; Department of Commerce, Bureau of Economic Analysis.

- a. The employment cost index for private-sector employees divided by the chained price index for personal consumption expenditures.

**Figure 2-5.**

## Measures of Capital Income, 1965 to the First Quarter of 2006

(Percentage of gross domestic product)



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

Note: Economic profits are corporate profits adjusted to remove distortions in depreciation allowances caused by tax rules and to exclude the effects of inflation on the value of inventories.

Nevertheless, energy-producing firms account for a significant part of the recent growth in profits. According to Standard & Poor's data for publicly traded firms, the profits of oil and natural gas companies rose from \$97 billion in 2003 to \$219 billion in 2005.

It appears that energy-using firms have generally been able to maintain profit growth by passing a large share of the higher energy costs on to their customers and by keeping labor costs from rising with inflation. (As noted above, the growth of real labor compensation per hour has fallen during the past two and a half years.)

Because higher energy prices slowed the growth of demand only slightly and did not have a large negative effect on profits, corporations maintained the pace of their investment spending. The growth of firms' spending on structures and equipment, which had started a strong recovery in 2003, was not adversely affected. In fact, higher energy prices stimulated investment in energy exploration

and in oil and gas wells. Overall, real business fixed investment grew by about 9 percent in both 2004 and 2005 and appears likely to rise even faster this year.

### Effects on the Trade Deficit and Interest Rates

The jump in the price of petroleum imports has caused the U.S. trade deficit to widen. But the additional savings accumulated by petroleum-exporting countries may have kept long-term interest rates in the United States somewhat lower than they would have been otherwise.

Higher energy prices have had a number of effects on the trade deficit. In nominal terms, U.S. spending on imported petroleum rose from \$133 billion at the end of 2003 to more than \$300 billion by the middle of 2006—or from 1.2 percent of GDP to 2.3 percent (see Figure 2-6). That rise has contributed to the growth of the U.S. trade deficit over the past two and a half years. Other changes, however—such as an increase in the growth of U.S. exports to oil-exporting countries and a slight reduction in U.S. residents' ability to purchase nonoil imports—have partly offset the effect of petroleum imports on the trade deficit. Recently, the growth in the amount of petroleum imported relative to the size of the economy (real GDP) has slowed.

Because of an increase in total saving worldwide, the rise in energy prices may have slightly reduced long-term interest rates in the United States relative to what they would have been. Saving in petroleum-producing countries went up more than saving in petroleum-importing countries fell, so additional worldwide saving was available for investment. Even if those additional funds were not directly invested in dollar-denominated assets, they would keep U.S. interest rates lower than would otherwise be the case, because a decline in interest rates for other currencies would tend to encourage third parties to invest in dollar-denominated assets in the United States.

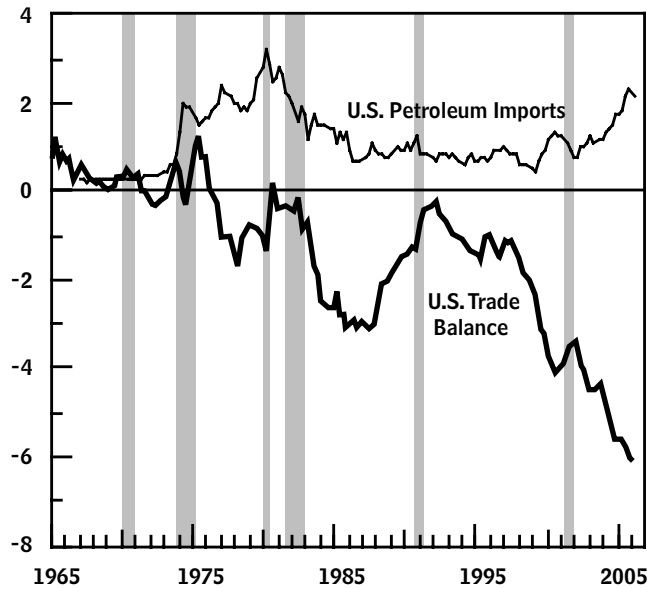
### The Impact of the Recent Energy Price Increases over the Next Ten Years

The recent shift to higher energy prices is likely to reduce the level of real GDP over the next decade but is unlikely to have a persistent effect on inflation. In addition, if the price rises prove permanent, the level of the standard of living in the United States will be reduced by more than the level of GDP.

**Figure 2-6.**

## The U.S. Trade Balance and Petroleum Imports, 1965 to the First Quarter of 2006

(Percentage of gross domestic product)



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

As noted earlier, an increase in energy prices in the short run has much greater potential to alter GDP through its effects on demand than through its direct effects on production. Over the longer term, however, the effects on production may be more important. After a few years, households and firms will adjust to the change in relative prices, and total demand for goods and services will tend to return to a level that will keep resources in the economy fully employed. Therefore, any longer-term effects on GDP will stem from the impact on productive capacity—that is, the levels of productivity, the capital stock, and the labor force.

### Past Evidence of Effects on Productivity

The level of productivity of capital and labor is likely to be lower over the next 10 years because of the recent rise in energy prices, even though the evidence indicates that higher energy prices do not permanently reduce the growth of productivity. The lower level stems from a temporary slowing in the growth of productivity that will not

be made up in subsequent years if energy prices remain high.

To estimate the effects of higher energy prices on the long-term growth of the productivity of capital and labor, economists have analyzed the impact of the energy price increases of the 1970s. Some analysts have blamed a rise in oil prices for a slowdown in productivity that began in the early 1970s, largely because that price rise roughly coincided with the beginning of a period of subpar growth in total factor productivity.<sup>6</sup> After growing at an average annual rate of 2.1 percent from 1950 to 1973, total factor productivity increased by just 0.8 percent a year, on average, between 1973 and 1994.

In principle, higher prices for imported oil will reduce the growth of productivity for some time. Businesses will reallocate resources in response to the higher prices, diverting some resources from their best possible use under the old set of prices and redirecting them to their best possible use under the new set of prices. Essentially, firms will substitute away from oil; they will also divert resources away from other uses in order to pay for the more-expensive oil that they do use. Some output will inevitably be lost as resources are diverted from other uses. That process will harm productivity growth while the adjustment is going on, but the growth of productivity should not be affected once all of the adjustments are complete.

In practice, however, higher energy costs do not appear to explain any permanent reduction in the growth of productivity. Energy was too small a share of the economy in the early 1970s to account for more than a small part of the productivity slowdown that began in 1973. As noted earlier, the direct impact on production in the short run of a decline in the use of oil is measured by oil's share of total GDP. Given that oil costs accounted for roughly 2 percent of total output in 1973, a 10 percent reduction in the use of oil would produce a one-time reduction in output of no more than 0.2 percent.<sup>7</sup>

Some analysts have reasoned that the energy cost increases of the 1970s had a disproportionate impact on the

6. Total factor productivity is average real GDP per unit of combined labor and capital services. The growth of total factor productivity is defined as the growth of real GDP that is not explained by the growth of labor and capital.

7. See Hamilton, "Oil and the Macroeconomy."

economy because they affected investment or innovation by enough to permanently reduce the growth of productivity. One prominent explanation is centered on the idea that the increase in energy costs rendered part of the capital stock obsolete.<sup>8</sup> In that view, productivity growth slowed because some energy-intensive capital was taken out of service, thus reducing output, but the decline in capital services went unmeasured in economic statistics. That capital-obsolescence view was partly undermined by a more recent study, which concluded that the relative price of used equipment on the secondary market was largely unaffected by the increase in oil prices.<sup>9</sup> If that increase had caused some capital goods to become obsolete, the price of used energy-intensive equipment would most likely have fallen. However, it is possible that the study did not capture some of the short-term effects or the effects on some types of structures and equipment, since there is no secondary market for major parts of the capital stock, such as furnaces for steel plants, chemical factories, and the like.

Evidence about the role of energy costs in the productivity slowdown that began in the mid-1970s is still inconclusive. Some empirical studies that analyze productivity growth using industry data indicate that the slowdown from 1973 to 1994 was concentrated in energy-intensive sectors of the economy;<sup>10</sup> other studies find no such effect.<sup>11</sup>

Researchers have proposed several other explanations for the slowdown in productivity. Those explanations include a decline in spending for research and development, an increase in environmental or worker-safety regulations, a misallocation of resources arising from high tax rates or high inflation, a general lessening of competitive pressure on businesses, or a shift in the structure of

the economy away from manufacturing and toward service industries. However, those explanations still cannot account for the sharp drop in productivity growth that began in the mid-1970s.

Although the recent increase in energy prices is unlikely to reduce the growth of productivity permanently, that growth will probably be lower for a few years because of the need to reallocate resources. The temporary losses in productivity will not be made up in subsequent years, so the level of productivity in the long run is likely to be lower than it would have been without the energy price increase.

### Effects on the Capital Stock and the Labor Force

The levels of both the labor force and the capital stock (structures and equipment) 10 years from now will probably also be slightly lower than they would have been if energy prices had not risen. Individuals' decisions to work (particularly in the case of second wage earners in households and people on the verge of retirement) are affected by the level of real compensation. If energy costs remain high, the prices of consumer goods and services, which include imports, will be higher relative to the prices of the goods and services that U.S. workers produce. Since employees' compensation tends to grow in line with their contribution to the value of the goods they are producing, a relative increase in consumer prices will tend to reduce the level of real compensation. Such a reduction will most likely dissuade some people from working, and the overall labor force in the United States will be slightly smaller.

The capital stock will tend to be smaller as well, although the extent of the reduction is difficult to estimate. As mentioned above, some equipment will be retired early because of obsolescence, temporarily reducing the size of the capital stock. Once firms adjust to the new level of energy prices, however, the growth rate of the capital stock will probably return to its previous trend. The reduction in productive capacity during the transition period will not necessarily be made up, so the level of the capital stock may be permanently lower than it would have been if energy prices had not increased.

### Effects on Inflation

A higher price for oil will raise the level of prices and temporarily speed up the growth of price inflation, but it is unlikely to permanently increase that rate of growth. Ultimately, the inflation rate depends on the Federal Re-

8. Martin Baily, "Productivity and the Services of Labor and Capital," *Brookings Papers on Economic Activity*, no. 1 (1981), pp. 1–50.

9. Hulten, Robertson, and Wykoff, "Energy Obsolescence and the Productivity Slowdown."

10. Dale W. Jorgenson, "Productivity and Postwar U.S. Economic Growth," *Journal of Economic Perspectives*, vol. 2, no. 4 (Fall 1988), pp. 23–41; and William Nordhaus, *Retrospective on the 1970s Productivity Slowdown*, Working Paper No. 10950 (Cambridge, Mass.: National Bureau of Economic Research, December 2004), available at [www.nber.org/papers/W10950](http://www.nber.org/papers/W10950).

11. Douglas R. Bohi, "On the Macroeconomic Effects of Energy Price Shocks," *Resources and Energy*, vol. 13, no. 2 (1991), pp. 145–162, available at <http://econpapers.repec.org/article/eeereseng/>.

serve, whose policies could neutralize the effects of higher energy prices on the overall price level, could accommodate their effects, or could exacerbate them, leading to persistent inflation.

### **Effects on the Standard of Living**

Because the United States imports a substantial part of the energy it needs, energy price increases have a larger negative effect on the standard of living of U.S. residents than on the level of real GDP per capita. If all of the petroleum used in the United States were produced domestically, higher oil prices would not lower the overall U.S. standard of living in the long run by any more than they would lower GDP. But since the United States imports petroleum and since U.S. residents have to trade more of

their production for a barrel of oil than they did before the price increased, the standard of living is lower. (The effect on living standards is greater than the effect on GDP because the way GDP is measured does not take into account how much more of their production U.S. residents have to trade for imports.)

Estimating the magnitude of the reduction in living standards is problematic because it depends on how easily households and businesses can decrease their use of oil products—that is, on the extent to which efforts to conserve energy reduce consumers' standard of living and increase companies' costs of production. New technologies or methods of energy use may make those adjustments less costly in the future than they appear to be today.





# Why Have the Negative Effects of Recent Energy Price Increases Been Smaller Than Those in the 1970s?

In the past, large increases in oil prices coincided with major macroeconomic problems: recessions and higher inflation. For example, the jump in oil prices that began in late 1973 occurred at the same time as an increase in core consumer price inflation and just before the 1973–1975 recession (see Figure 3-1). Likewise, the oil price increases of the 1979–1980 period coincided with higher inflation and the 1980 recession. The price hikes of 1990 and 1999 also appear to have been related to recessions and increases (albeit short-lived) in inflation. Given that record, why has the economic impact this time, as described in Chapter 2, been relatively mild?

Accounting for differences between the effects of energy price increases in the 1970s and over the past few years is complicated by the variety of possible explanations, many of which are interrelated. Separating the explanations into three levels helps clarify the differences between the time periods. The first level focuses primarily on the immediate cyclical effects of higher energy prices on the demand for U.S.-produced goods and services, as evidenced by consumers' spending and businesses' investment. That level of explanation highlights the reasons that households were able and willing to draw down their savings during the recent oil price hike, why firms continued to invest, and why U.S. exports remained strong.

The second level of explanation focuses on the role of monetary policy and inflation before and during the increases in energy prices. In the years prior to both of the oil price shocks of the 1970s, monetary policy had not been able to keep inflation under control, and firms and households had come to expect persistently high inflation. When the shocks occurred, that environment of high inflationary expectations caused monetary policymakers to tighten policy much more than has been needed during the past few years. That level of explanation rests on the effects of monetary policy on spending

by households and firms and on companies' pricing behavior. In so doing, it provides a complementary view of how increases in energy prices affected demand.

The third level examines underlying, or structural, differences between the economy in the 1970s and today, which appear to have made oil price hikes generally less pernicious and the task of monetary policymakers less onerous. Some aspects of that level of explanation are more speculative than the first two levels because they rely on indirect evidence of the economy's "flexibility," or ability to adjust quickly to changes in the relative availability and prices of goods and services. If prices can adjust rapidly to reflect relative scarcities, then, in principle, scarce items will be put to their most valued uses, and the negative effect on output will be limited. In that case, a price shock does not pose as difficult a policy decision for the Federal Reserve as it would if price setting were more rigid and output losses were greater.

## Immediate Effects on Demand and on Production Costs

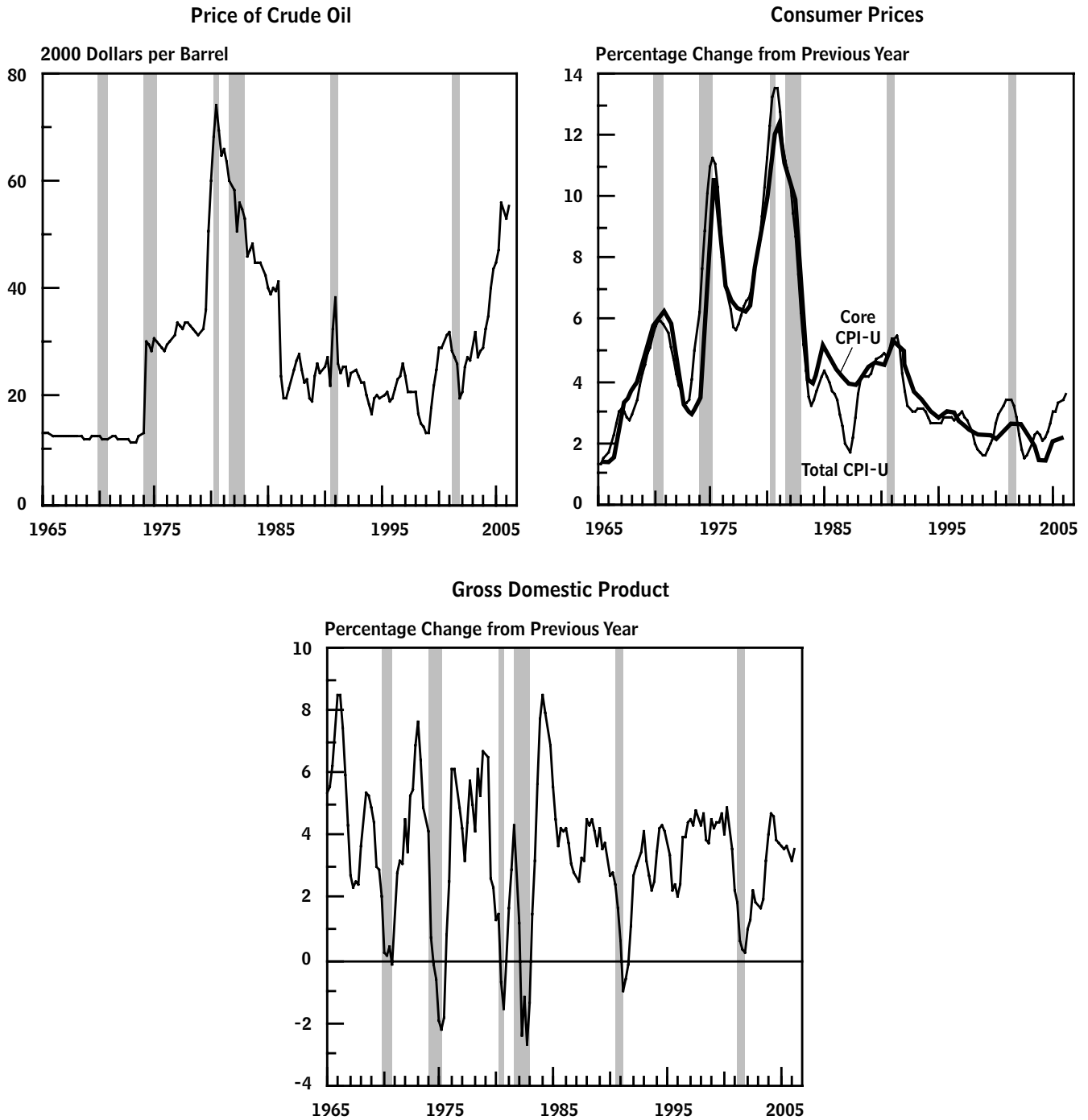
Three major categories of overall demand—consumer spending, business investment, and exports—remained strong during the recent rise in energy prices, whereas they faltered in the early phases of the 1970s shocks. However, the direct effect of higher energy prices on production did not have a large impact in either period.

### Consumer Spending

The persistence of strong consumer spending on nonenergy goods and services in the face of higher energy costs since 2004 is a dramatic departure from the situation three decades ago. A measure of consumer confidence, which can be used as an indicator of both current income and households' expectations for the near future, has been

**Figure 3-1.**

**Comparison of the Price of Crude Oil, Consumer Price Inflation, and GDP Growth, 1965 to the First Quarter of 2006**



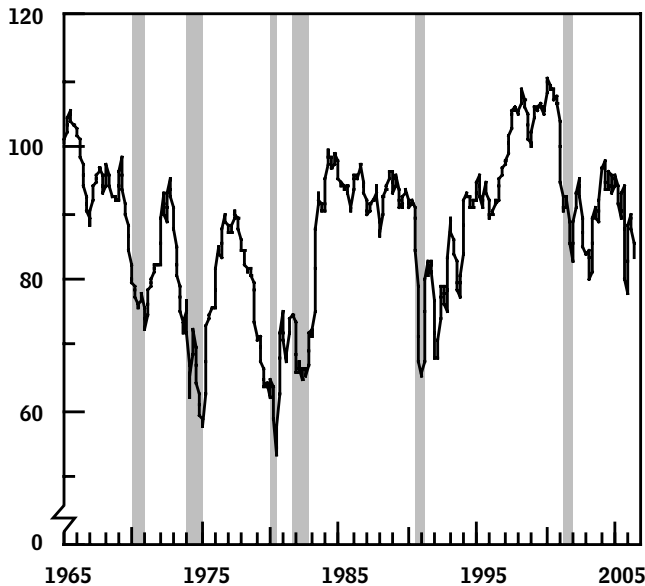
Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis; Department of Labor, Bureau of Labor Statistics; *Wall Street Journal*.

Notes: The price of crude oil is for West Texas intermediate. Before 1982, it refers to the posted price; after 1982, it refers to the spot price. The series is converted to 2000 dollars using the GDP chained price index.

The CPI-U is the consumer price index for all urban consumers; the core CPI-U excludes food and energy prices. Data for the CPI-U were smoothed using a four-quarter moving average.

### Figure 3-2. Consumer Confidence, 1965 to June 2006

(Index, first quarter of 1966 = 100)



Sources: Congressional Budget Office; University of Michigan.

Notes: The measure of consumer confidence shown here is the University of Michigan's Index of Consumer Sentiment.

Data were smoothed using a three-month moving average.

much stronger recently than it was during the oil price increases of the 1970s (see Figure 3-2). That attitude has apparently encouraged people to continue to spend even as the growth of income has slowed. Differences between consumers' recent behavior and their behavior in the 1970s can also be seen in the personal saving rate (shown in Figure 2-3 on page 9).

Consumer confidence and spending in recent years were probably supported by increases in housing wealth as well as by various economic developments over the past quarter century—such as the record of successful inflation management by the Federal Reserve and changes in the economy that may have reduced the adverse impacts of price shocks. (Those developments are discussed in more detail later in this chapter.) In the 1970s, households lacked confidence in the stability of the economy or the ability of monetary authorities to control inflation. In recent years, households have been less concerned about their jobs and future income and more willing and able—

helped in part by increases in housing wealth—to borrow to maintain their spending.

Some analysts have argued that consumers cut back more sharply in the 1970s because energy prices rose more rapidly then. However, it is difficult to attribute the variation in consumers' response to that difference. Gasoline prices rose less sharply this time in the first year of the price increases, but they grew at about the same or a greater rate over two and a half years than they did in the 1970s. Moreover, the speed with which gasoline prices rose during the second year of the recent increases was as high as in any previous episode. In addition, natural gas prices for consumers grew more during the recent episode than they did earlier (see Figure 3-3). Differences in the speed of various energy price increases do not appear to be large enough to explain the differences in the response of consumers.

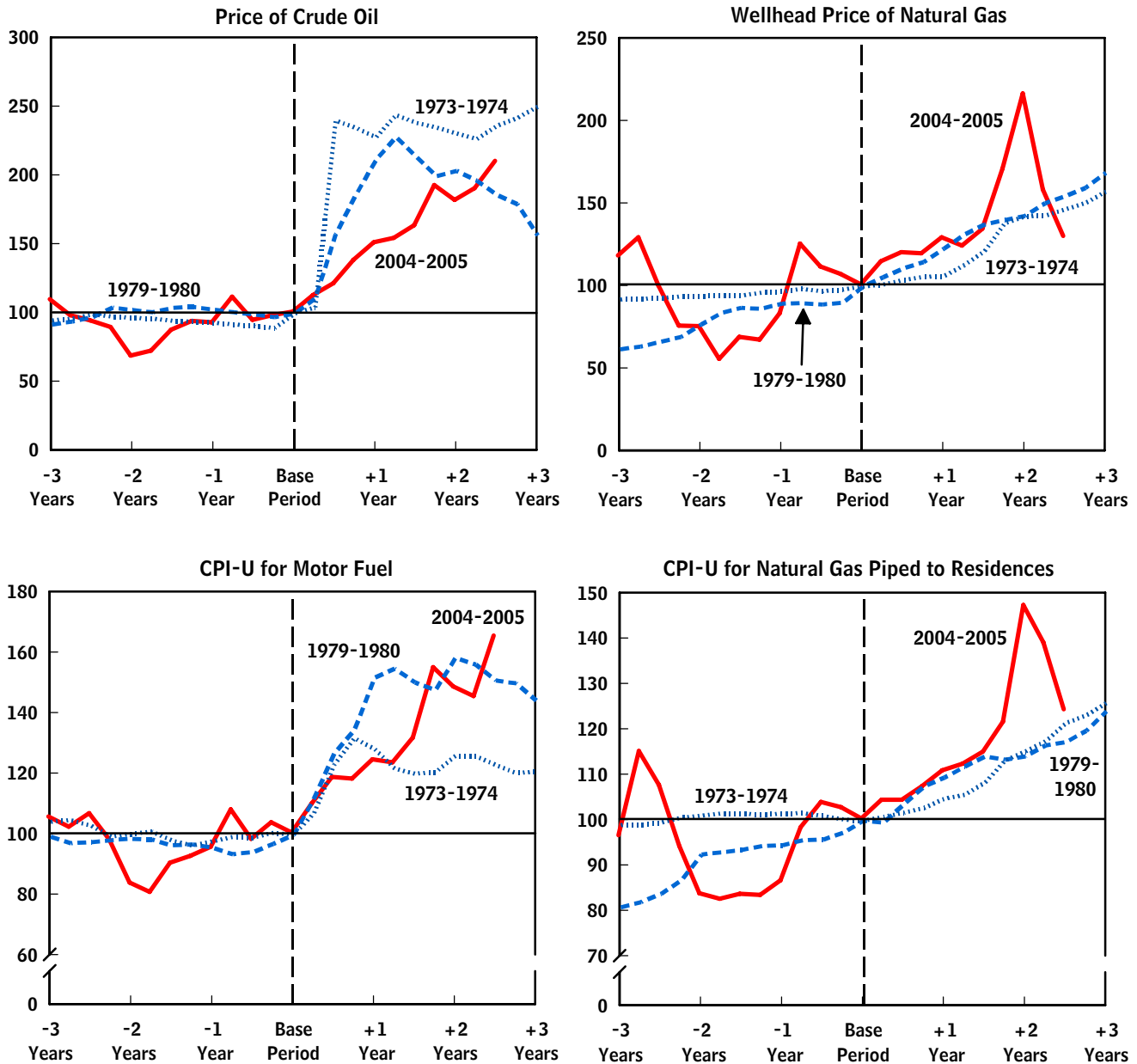
#### Business Investment

Companies' level of investment in structures, equipment, and software varies widely over the business cycle—to a much greater degree than consumer or government spending does. In addition, business fixed investment tends to create its own cycle through the interaction of short-term effects. An increase in demand for goods and services creates a need for businesses to build up their capital stocks, which in turn produces more employment and more demand for goods and services, and thus a demand for even more capital stocks. That view of investment behavior does not explain all of the variations in investment over history (a number of other factors can affect investment spending). But elements of that pattern are present in the business cycles of the post-World War II era.

The energy price shocks of the 1970s occurred when business investment was already weakening. In 2003, by contrast, business investment was just beginning an upturn. Business fixed investment had been hitting new highs as a share of potential gross domestic product in the years before the earlier energy price shocks, but it was extraordinarily low before the most recent increase (see Figure 3-4). Models of investment behavior indicate that in the late 1970s, the capital stock was large relative to firms' desired levels of capital (that is, the levels they felt would be appropriate given demand and employment growth). In 2003, however, the capital stock was below the levels that firms considered optimal to meet the

**Figure 3-3.**  
**Comparison of Energy Price Shocks**

(Index, base period = 100)



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis; Department of Energy, Energy Information Administration; Department of Labor, Bureau of Labor Statistics; *Wall Street Journal*.

Notes: The base periods are the third quarter of 1973 for the 1973-1974 price shock, the first quarter of 1979 for the 1979-1980 price shock, and the fourth quarter of 2003 for the 2004-2005 price shock.

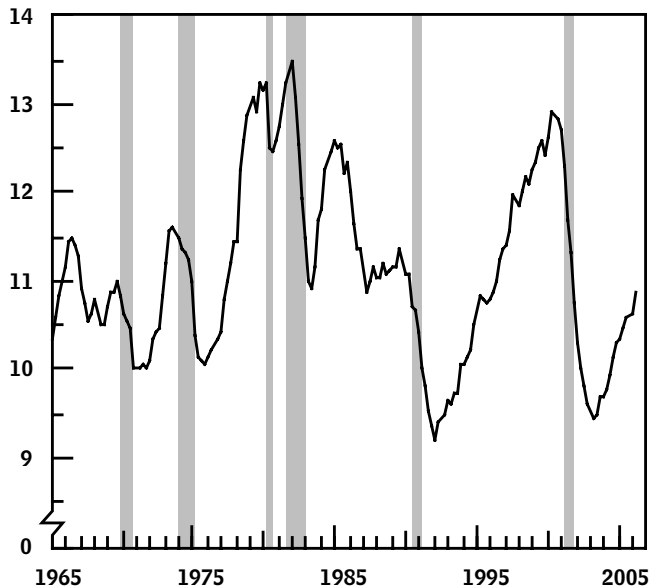
The price of crude oil is for West Texas intermediate. Before 1982, it refers to the posted price; after 1982, it refers to the spot price. The wellhead price of natural gas was extended back to 1970 using the producer price index for natural gas.

CPI-U = consumer price index for all urban consumers.

Values for the second quarter of 2006 were estimated.

**Figure 3-4.**  
**Business Fixed Investment, 1965 to the First Quarter of 2006**

(Percentage of potential gross domestic product)



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

Note: Potential GDP is the level of gross domestic product that corresponds to a high level of resource (labor and capital) use.

demand for goods and services at that time.<sup>1</sup> Thus, the demand for capital was able to partially offset the negative impact of higher energy prices in recent years, whereas it tended to worsen the response to the 1979–1980 price hike and had a mildly negative effect during the 1973–1974 price increase.

### Exports

In recent years, higher energy prices have also had less impact than they did earlier on other countries' economic growth, the amount of U.S. exports, and the prices of U.S. imports. As a result, demand from abroad has provided more support lately for U.S. growth with low inflation.

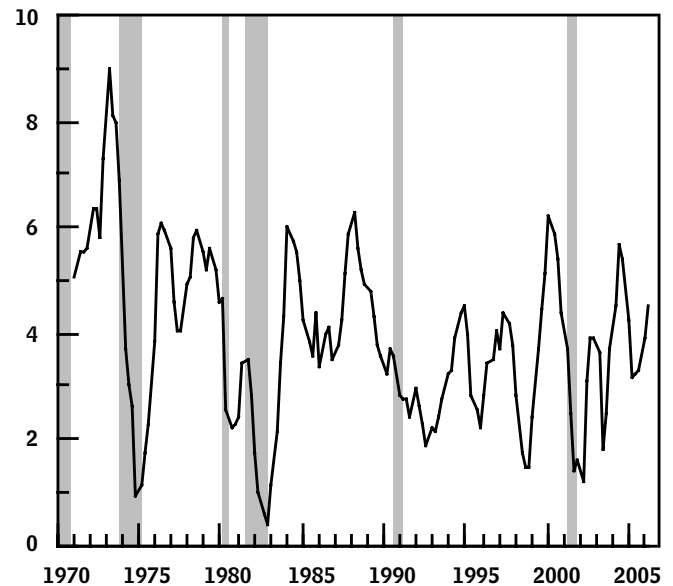
1. For a discussion of an investment model, see Mark Lasky, *A Putty-Clay Model of Business Fixed Investment*, CBO Technical Paper 2003-09 (September 2003), available at [www.cbo.gov/ftpdocs/45xx/doc4573/2003-9.pdf](http://www.cbo.gov/ftpdocs/45xx/doc4573/2003-9.pdf).

The growth of both foreign GDP and U.S. exports has been much stronger in the past two years than it was during the 1970s energy price shocks. Economic growth in the rest of the world slowed markedly in 1974 and 1980 after oil prices rose (see Figure 3-5). As a result, real U.S. exports of goods weakened—particularly in the 1973–1974 price shock—dampening economic growth in the United States (see Figure 3-6). Foreign GDP growth slowed in 2005 as well, but the effect was much smaller than that of 1974 and somewhat smaller than that of 1980.

The prices of goods imported into the United States (excluding petroleum and computers) also behaved very differently in recent years than during the 1970s. Import prices rose by 22 percent in 1973 and 13 percent in 1979 but by an average of just 3 percent in 2004 and 2005. Whereas in the 1970s the U.S. economy was operating in an environment of high worldwide inflation, in recent years the international environment has been one of near-zero average inflation for tradable goods other than oil.

**Figure 3-5.**  
**Real GDP of Foreign Economies, 1971 to the First Quarter of 2006**

(Percentage change from previous year)

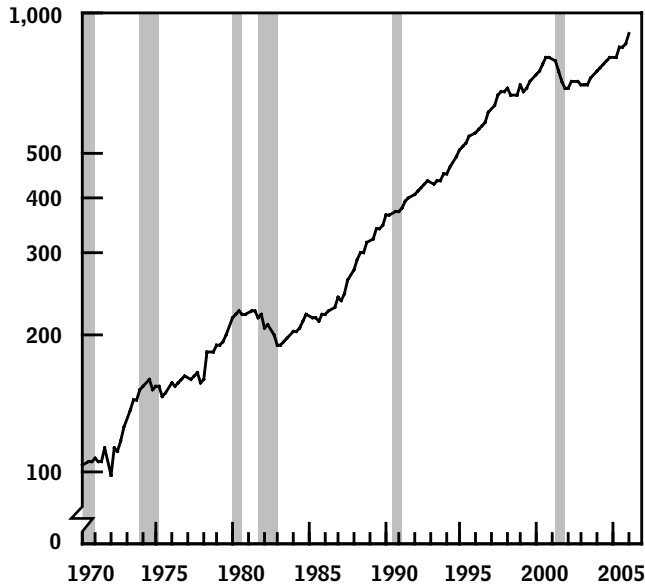


Source: Congressional Budget Office.

Note: This figure shows the growth of real gross domestic product for 16 major U.S. trading partners, weighted by those countries' shares of total exports from the United States.

**Figure 3-6.****Real U.S. Exports, 1970 to the First Quarter of 2006**

(Billions of chained 2000 dollars, log scale)



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis.

Assessing the reasons for those differences in the economic performance of the United States' trading partners is beyond the scope of this analysis, but some of the reasons may be similar to those for the United States. First, at the outset of the most recent energy price increase, the economies that purchase U.S. goods were in a cyclical upswing (reflected by the fact that the price increase was driven more by the growth of demand than by restrictions on supply). Second, monetary policy has generally been managed better in developed countries worldwide. And third, there appears to have been a general evolution toward more market-oriented economies.<sup>2</sup>

**Costs of Production**

One commonly cited explanation for the smaller economic effects this time is that production is less dependent on energy now than it was in the 1970s. Proponents of that view argue that producers can adapt to higher en-

2. Since the late 1980s, the economies of Eastern Europe, Russia, and China have become much more market oriented, and many previously state-owned industries in Europe have been denationalized. See Alan S. Blinder, "How the Economy Came to Resemble the Model," *Business Economics* (January 2000).

ergy prices more easily today since the economy is less energy intensive, both because the share of GDP accounted for by services (such as medical care) has increased and because the economy uses energy more efficiently.

That factor does not appear to be particularly important, however. The energy intensity of the U.S. economy—measured as British thermal units (Btus) of energy used per unit of constant-dollar GDP—has indeed declined (see Figure 3-7). But in nominal terms, the share of petroleum use in the economy was not significantly different in 2003 than it was in 1973, and it is the nominal share of energy use that determines the direct effect on production of having to use less energy, not the ratio of Btus to real GDP. The latter measure does not capture the higher cost of having to make do with fewer units of energy. Therefore, the different response of the economy to the recent energy price increases does not appear to be related to the difference in the economy's energy intensity.

**Monetary Policy**

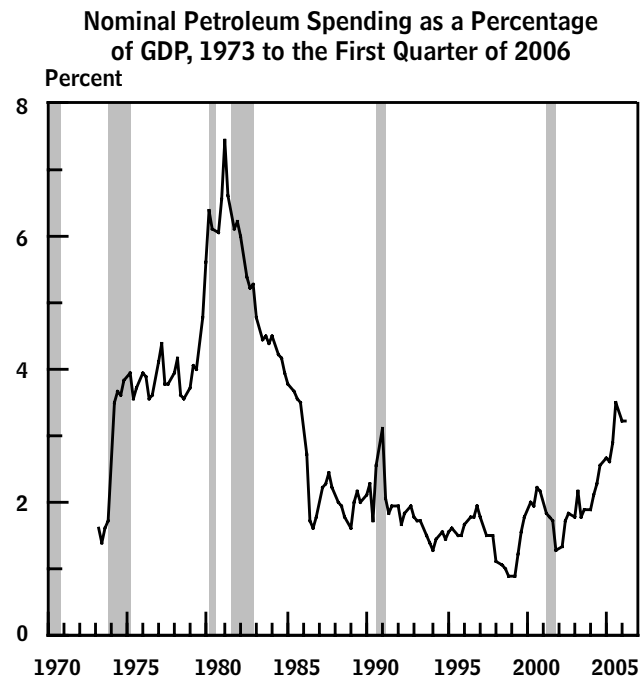
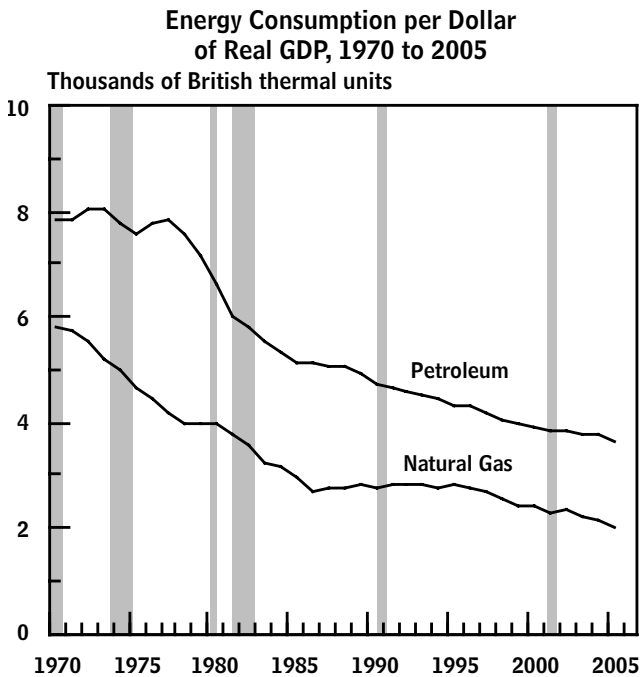
Improvements in monetary policy over the years are a major reason that the economy is weathering the recent rise in energy prices relatively well. In essence, policymakers have learned how to better manage monetary policy over the past two decades.

With the earlier increases in energy prices, monetary policy strongly affected the immediate response of consumer and investment spending. Indeed, it is widely believed that the deep recession of 1973 to 1975 and the back-to-back recessions of 1980 and 1981 to 1982 were caused not by the energy price shocks as such but by monetary policy.<sup>3</sup> During the 1973–1974 period and again from 1979 to 1981, the Federal Reserve tightened policy sharply to curtail inflation, which had been festering for years before oil prices increased. The rise in short-term interest rates caused the economy to contract and unem-

3. See J. Bradford De Long, "America's Peacetime Inflation: The 1970s," in Christina D. Romer and David H. Romer, eds., *Reducing Inflation: Motivation and Strategy* (Chicago: University of Chicago Press, 1997), pp. 247–276; Robert B. Barsky and Lutz Kilian, *Do We Really Know That Oil Caused the Great Stagflation? A Monetary Alternative*, Working Paper No. 8389 (Cambridge, Mass.: National Bureau of Economic Research, July 2001), available at <http://papers.nber.org/papers/w8389>; and Ben Bernanke, Mark Gertler, and Mark Watson, "Systematic Monetary Policy and the Effects of Oil Price Shocks," *Brookings Papers on Economic Activity*, no. 1 (1997) pp. 91–142.

**Figure 3-7.**

## Energy Consumption and Gross Domestic Product



Sources: Congressional Budget Office; Department of Commerce, Bureau of Economic Analysis; Department of Energy, Energy Information Administration.

Note: Real gross domestic product is in billions of chained 2000 dollars.

ployment to increase. The tightening of monetary policy in those years was partly spurred by the oil price shocks, but the inability of monetary policy to control inflation in the years leading up to those shocks and the need to tighten policy thereafter were the underlying cause of the recessions of 1973 to 1975 and the early 1980s.<sup>4</sup>

By the end of the 1990s, however, the Federal Reserve had earned credibility in fighting inflation, especially with three episodes of tight monetary policy:

- From 1980 to 1982, when it tightened policy (in order to quash inflation) to such a degree that a deep recession resulted, driving the unemployment rate to almost 11 percent;
- From 1988 to 1989, when the central bank raised the federal funds rate by about 3 percentage points in anticipation of inflation, even though core inflation had been relatively steady; and
- In 1994, when the Federal Reserve raised the federal funds rate even before inflation started to increase, out of concern that its monetary policy had been too stimulative in previous years.

The Federal Reserve's apparent willingness to risk recessions to forestall inflation—combined with success in reducing inflation and keeping it low—means that households, businesses, and investors are less likely to anticipate an increase in inflation than they would have been if the Federal Reserve had not established that track record.

The credibility of the Federal Reserve affects how households and firms respond to an increase in energy prices. Lack of credibility can cause higher and more-persistent inflation as well as a larger negative impact on GDP. If workers anticipate higher inflation, they will try to incorporate those expectations into wage agreements, and businesses will set prices on the basis of higher anticipated costs in the future. That behavior can lead to a “wage-price spiral,” in which the initial increase in the level of prices (which, by itself, is only a one-time rise in inflation) is perpetuated as a higher growth rate of prices for some time. The Chairman of the Federal Reserve Board recently stated that one reason that energy price increases

4. See Richard Clarida, Jordi Gali, and Mark Gertler, “Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory,” *Quarterly Journal of Economics*, vol. 115, no. 1 (February 2000).

did more damage to the economy in the past than they have recently is that wage–price spirals made it more difficult for the Federal Reserve to manage inflation in the 1970s.<sup>5</sup>

Uncertainty about inflation has an additional negative effect: consumers and businesses are less confident about the ability of the economy to avoid a recession. Concern about a future recession encourages households and firms to postpone some spending, thus weakening the economy. Therefore, by itself, the establishment of credibility by the Federal Reserve can mitigate the adverse impact of an energy price increase.

### The Flexibility of the Economy

The flexibility of today's economy is also often cited as a reason that the recent oil price increases did not have large negative effects.<sup>6</sup> Four major aspects of the U.S. economy—government regulatory policy, industrial behavior, changes in energy markets, and developments in financial markets—have evolved to produce an economy that appears to be much more resilient to price shocks now than it was before the 1980s.

Flexibility refers to an economy's ability to adjust to changes—particularly sharp ones—in the relative availability of goods and services. In a market economy, flexibility stems from the speed with which prices can shift to reflect new relationships of relative scarcity. When prices for a given commodity rise, households and businesses will make adjustments to conserve on the use of that commodity (and any goods or services produced with it), focusing their use on areas with the most value to them. In addition, firms will try to increase production of the commodity. If prices do not reflect relative scarcities, however, producers and consumers will not receive accurate signals. There will be little effort to produce more of the commodity, and reductions in its use will be less likely to be concentrated in areas that are the least valued.

5. Ben Bernanke, "The Benefits of Price Stability" (remarks at the Center for Economic Policy Studies, Princeton, N.J., February 24, 2006), available at [www.federalreserve.gov/boarddocs/speeches/2006/20060224/default.htm](http://www.federalreserve.gov/boarddocs/speeches/2006/20060224/default.htm).

6. See Alan Greenspan, "Energy" (remarks to the Japan Business Federation, Japan Chamber of Commerce and Industry, and Japan Association of Corporate Executives, Tokyo, October 17, 2005), available at [www.federalreserve.gov/boarddocs/speeches/2005/20051017/default.htm](http://www.federalreserve.gov/boarddocs/speeches/2005/20051017/default.htm).

Consequently, the need to consume less of the commodity will be more disruptive to the economy.

The increased flexibility of the U.S. economy has probably played a significant role in the aforementioned development of the Federal Reserve's credibility. In fact, the effects of that credibility are difficult to separate from the possible effects of greater economic flexibility. The short-run trade-off between inflation and unemployment depends in large part on the underlying structure of the economy, and the recent success of the Federal Reserve's policies is probably closely related to structural changes in the economy that have moderated that trade-off. The structural changes in the economy may have made it much easier to maintain low inflation in the face of a supply shock. Monetary policy appears to have fared better in part because it was applied to an economy that was intrinsically easier to manage.

### Less Economic Regulation

Some government regulations introduce rigidities that make the macroeconomy less able to respond to sharp changes in relative prices. In so doing, they make it harder for monetary policy to control inflation and lead to greater losses in output than if those regulations were not in effect.

Regulation of the economy was generally more pervasive in the past than it is now. In particular, two areas of economic regulation in the 1970s—petroleum markets and housing finance—increased the damage to the economy when energy prices rose. Restrictions in those areas have since been altered; in addition, many other economic regulations have been modified or eliminated since the late 1970s, and those changes may have helped to partially insulate today's economy from energy price shocks. Examples of such alterations are the deregulation of the transportation sector in the 1970s and 1980s and changes in financial regulations over the past 25 years.

**Petroleum Regulations.** Problems in energy market regulation in the 1970s began when the government instituted wage and price controls. Those problems were greatly exacerbated by the 1973 enactment of the Emergency Petroleum Allocation Act (EPAA).

To help independent refiners—who had been hurt by the wage and price controls—the EPAA provided for mandatory allocation of petroleum. It required large oil companies to give independent refiners shares of oil proportion-



ate to those they had received in 1972. In addition, the law created a two-tier system of price controls on U.S. crude oil. “Old” oil was tightly controlled at low prices, whereas “newly discovered” oil was uncontrolled. That system was intended to encourage new production while keeping established sources of oil from reaping windfall profits that were thought to be undeserved. Refineries that had access to old oil had a financial advantage, and a system of “entitlements” was put in place to try to force all refiners to have the same feedstock costs. In sum, the EPAA overrode market mechanisms in an effort to distribute scarce supplies to independent refiners and to insulate energy users from price increases that were not related to higher production costs—and that therefore were considered unjustified at best and “price gouging” at worst.<sup>7</sup>

The regulations on the energy sector depressed economic growth and ultimately exacerbated the rise in energy prices (and inflation overall). A major unintended effect of the two-tier system was to encourage owners of “old” oil to withhold some of their oil from the market in the expectation that they would be able to sell it later at higher prices once the controls had expired. Data on domestic production, consumption, and imports for the period show that U.S. oil production fell in 1974, even though market prices for petroleum were much higher. If energy markets had not been regulated, more oil would have been made available, dampening the increase in the international price of oil.

The domestic price of gasoline was also artificially depressed relative to the world price of petroleum. If gasoline prices had been allowed to rise to balance supply and demand, consumers would have devoted gasoline to its most highly valued uses, and more gasoline would have been supplied.

Many efforts were made between 1973 and 1978 to alter the EPAA, and legislation was put in place to gradually deregulate much of the energy sector. Nevertheless, the bulk of the controls were still in effect in 1979, when a second oil price shock occurred. As before, the distorting effects of the oil regulations created problems in 1979

and 1980. Not until 1981 were the controls on oil markets essentially eliminated.

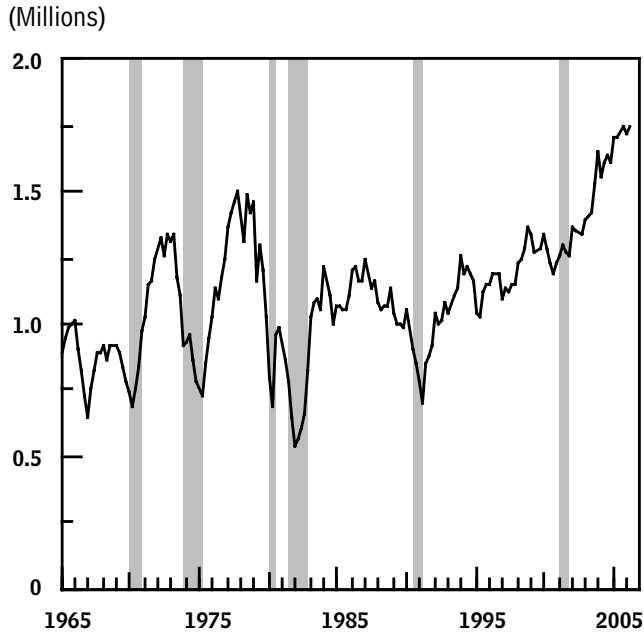
**Regulations That Affected Housing.** Changes in regulations on housing finance since the 1970s have helped insulate today’s economy from energy price increases. In the 1970s’ environment of rising inflation and interest rates, regulations on the mortgage market that had been in effect for many years—Regulation Q and usury laws for residential mortgages—turned out to be damaging to the economy.<sup>8</sup> Regulation Q set ceilings on the interest rates that most financial institutions could pay on various types of deposits. When market rates exceeded those ceilings, the growth of deposits at commercial banks and savings and loan institutions slowed (a process known as disintermediation). The result was a shortage of mortgage financing in the housing market. Other lenders were dissuaded from entering that market because state usury laws and federal regulations restricted mortgage pricing and limited the returns on mortgages.

Because of those regulations, the effort to fight inflation by raising interest rates caused a shift in funds from depository institutions to money market instruments and put binding constraints on mortgage rates. Mortgage financing dried up, and home sales and home building collapsed. Such effects exacerbated the 1973–1975, 1980, and 1981–1982 recessions and contributed to the overall volatility of GDP throughout the 1970s and early 1980s.

The large drop in housing activity during the 1973–1975 recession was not attributable entirely to the effects of Regulation Q. The rise in interest rates would probably have slowed housing activity in any event, and as recessions deepen, housing declines for reasons other than financing problems. However, by inhibiting housing activity even before the onset of the recession—single-family housing starts were already 6 percent lower than in the previous year by the second quarter of 1973—

7. Franklin Tugwell, *The Energy Crisis and the American Political Economy: Politics and Markets in the Management of Natural Resources* (Stanford, Calif.: Stanford University Press, 1988).

8. See Philip K. Robins, “The Effects of State Usury Ceilings on Single Family Homebuilding,” *Journal of Finance*, vol. 29, no. 1 (March 1974), pp. 227–235; and R. Alton Gilbert, “Requiem for Regulation Q: What It Did and Why It Passed Away,” *Review*, Federal Reserve Bank of St. Louis (February 1986), pp. 22–37, available at <http://research.stlouisfed.org/publications/review/past/1986/>.

**Figure 3-8.****Single-Family Housing Starts, 1965 to the First Quarter of 2006**

Sources: Congressional Budget Office; Department of Commerce, Bureau of the Census.

Regulation Q weakened the economy in the months before the oil price shock. It also made home building extremely sensitive to interest rates. Single-family housing starts dropped by over 20 percent in 1974 and continued to decline well into 1975 (see Figure 3-8).

Recognizing the harmful effects of Regulation Q, policymakers modified it in the late 1970s. But when high inflation and tight monetary policy pushed interest rates into double digits in 1979 and 1980, the growth of deposits again slowed, and residential investment again collapsed. As in 1973 and 1974, surging interest rates pushed housing investment down faster than they would have in the absence of regulations, and thus the regulations exacerbated the macroeconomic response to the oil shock.

In 1980, lawmakers enacted the Depository Institutions Deregulation and Monetary Control Act, which initiated a general phaseout of Regulation Q. Interest ceilings on time and savings deposits were eliminated by 1986. That change helped make residential investment less sensitive

to movements in interest rates and thereby reduced volatility in the housing market.

**Other Regulations.** The deregulation of the transportation sector and changes in financial regulations may also have improved the flexibility of the economy over the past 25 years.

Before the late 1970s, the Civil Aeronautics Board regulated the pricing and route structure of the airline industry. Carriers initially favored those controls because they discouraged competition, but the regulations inhibited airlines' ability to allocate resources properly. Federal control over airfares and routes was greatly reduced by the early 1980s, and airlines were able to operate more efficiently by adjusting their fares according to market forces.<sup>9</sup>

The trucking industry experienced a similar improvement in efficiency when it was deregulated in the 1980s. Before deregulation, the Interstate Commerce Commission controlled shipping rates and restricted firms from entering markets. With the enactment of the Motor Carrier Act in 1980, the industry became more competitive. As in the airline industry, prices began to reflect actual market conditions. As restrictions on market entry and route structure eased, the number of licensed trucking firms increased, delivery times improved, and inventory costs fell.

Changes in financial regulations may also have improved the resilience of the economy. Since the 1970s, restrictions on banks establishing branches out of state have been eliminated, risk-based capital requirements have been implemented, and the supervision of banks has been enhanced. Financial deregulation made it possible for banks to consolidate and to become larger, more diverse, and stronger financially. Capital ratios and earnings in the banking industry were high before the recent increase in energy prices, and that strength resulted in a banking industry that could "cushion" the adverse effects of the energy price shock.<sup>10</sup>

9. See Steven Morrison and Clifford Winston, *The Economic Effects of Airline Deregulation* (Washington, D.C.: Brookings Institution, 1986), pp. 11–15.

10. See Timothy F. Geithner, "Perspectives on the U.S. Financial System" (remarks to the Economic Club of New York, May 27, 2004), available at [www.ny.frb.org/newsevents/speeches/2004/gei040527.html](http://www.ny.frb.org/newsevents/speeches/2004/gei040527.html).

### Changes in Competition and Industrial Behavior

Various developments appear to have increased the competitive pressure on companies and encouraged them to be more responsive to changes in relative prices than they were in the 1970s. Those developments include the expansion of international trade, the growth of information technology and the creation of the Internet, and changes in management behavior. Now, when energy prices rise, firms may be quicker both to try to conserve energy and to pass along the higher costs to their customers. As a result, prices more quickly and accurately reflect the relative scarcity and relative value of goods and services.

Competition from abroad has probably had a much bigger impact on the behavior of goods prices in the United States in the past 15 or 20 years than it did earlier. Decreases in international communication and shipping costs, reductions in tariffs, and the expansion of market-oriented economies around the world have increased international competition and caused the prices of goods to be more responsive to changes in relative prices and other market conditions.<sup>11</sup>

Advances in information technology have also contributed to the flexibility of the U.S. economy. Computers and communications equipment have become cheaper and more powerful through developments in semiconductor technology. Those developments have allowed memory chips and microprocessors in computers, satellites, and other products to manipulate data more efficiently, thereby reducing transaction costs and facilitating coordination among firms.<sup>12</sup>

A prime example is the Internet. In addition to improving communication and generally decreasing the cost of business, it has enhanced the responsiveness of prices to changes in costs and demand by giving buyers and sellers more information relatively inexpensively. As lower search costs and more effective targeting strengthen com-

petition, price “stickiness” (resistance to change) is probably reduced.<sup>13</sup>

Other changes that may have made the economy more flexible over the past 25 years are shifts in the attitudes and goals of corporate managers and greater reliance on capital markets instead of managers to allocate investment funds. Those explanations are speculative, but various developments that affected corporate governance—including the wave of takeovers during the 1980s—may have forced managers to focus more on maximizing profits than on maximizing revenues (or other such performance measures). That change has probably encouraged managers to respond more rapidly to developments in their market. In addition, the increasing and unremitting pressure to keep a firm profitable in the face of deregulation, rapid shifts in technology, globalization, and the heightened pace of innovation and competition from start-up companies may have driven managers to be less complacent, more attuned to markets, and more concerned about enhancing productivity and managing costs than they were before.

Structural changes in industrial and labor markets may have contributed to the reduction of wage–price spirals. As mentioned above, the increasing credibility of monetary policy probably reduced workers’ and managers’ expectations that a price shock would be perpetuated as higher inflation. But structural changes, such as the increase in competition and shifts in industrial behavior, also helped keep wage–price spirals from developing by reducing the bargaining power of unions and the market power of firms.

### Developments in Energy Markets

Since the 1970s, new energy markets and institutions have arisen that help large sellers and buyers of petroleum manage uncertainty. Futures markets and other pricing institutions reduce the need for major buyers of petroleum or petroleum products to stockpile physical supplies to ensure against shortages. The resulting decrease in changes in inventory dampens the effect of a sharp price increase on the economy.

The futures market for petroleum matches people who will need petroleum in the future with people who will

11. See Donald L. Kohn, “The Effects of Globalization on Inflation and Their Implications for Monetary Policy” (remarks at the Federal Reserve Bank of Boston’s 51st Economic Conference, “Global Imbalances: As Giants Evolve,” Chatham, Mass., June 16, 2006), available at [www.bos.frb.org/economic/conf/conf51/papers/kohn.pdf](http://www.bos.frb.org/economic/conf/conf51/papers/kohn.pdf).

12. See Dale W. Jorgenson, “Information Technology and the U.S. Economy,” *American Economic Review*, vol. 91, no. 1 (March 2001).

13. Erik Brynjolfsson and Michael D. Smith, “Frictionless Commerce? A Comparison of Internet and Conventional Retailers,” *Management Science*, vol. 46, no. 4 (April 2000).

have petroleum to sell in the future. The buyer and seller enter into a contract that requires the seller to deliver the petroleum, and the buyer to accept it, at a specified price a few months, a year, or longer in the future. Because oil producers and customers who use futures markets face less uncertainty about the price and quantity of oil they will be able to sell or buy in the future, they are more willing to reduce their stock of inventory (or at least feel less need to add to that stock) during a shortage.<sup>14</sup>

The effects of futures markets can be seen in the differing behavior of inventory stocks during the various oil price shocks of the past 30 years. During the 1970s, inventories grew when markets were disrupted. During the 1990–1991 Persian Gulf War and the recent increase in energy prices, by contrast, inventories remained relatively stable.

### **Developments in Financial Markets and Institutions**

Financial innovations since the 1970s have also had a role in making the economy more flexible. Securitization (the conversion of a cash flow into securities), credit derivatives (financial instruments designed to transfer credit risk from one party to another), and interest-rate swaps (in which two entities exchange a series of payments calculated using different interest rates) have provided an alternative to bank lending, broadened the financial-

intermediation mechanism between borrowers and lenders, and enhanced risk management.

Financial innovations have also improved households' access to credit and lowered the cost of credit since the 1970s, and they probably played a role in the way households responded to the most recent energy price rise. Numerous improvements in mortgage finance, including home-equity lines of credit and easier refinancing, encouraged households to use the equity in their homes to maintain their spending when the growth of household real income slowed.

Those innovations, together with changes in financial regulation, appear to have improved the resiliency of the financial system by spreading the risk of default more widely and efficiently. As the former Chairman of the Federal Reserve Board noted, "Deregulation and the newer information technologies have joined, in the United States and elsewhere, to advance flexibility in the financial sector. Financial stability may turn out to have been the most important contributor to the evident significant gains in economic stability over the past two decades."<sup>15</sup>

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14. See Congressional Budget Office, *Rethinking Emergency Energy Policy* (December 1994).

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15. Alan Greenspan, "Economic Flexibility" (remarks to the annual meeting of the National Association for Business Economics, Chicago, September 27, 2005), available at [www.federalreserve.gov/boarddocs/speeches/2005/20050927/default.htm](http://www.federalreserve.gov/boarddocs/speeches/2005/20050927/default.htm).