

Energy Prices and the Economy



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Abstract

Before Katrina and Rita disrupted energy production in the Gulf, the rising cost of oil had a surprisingly modest effect on the overall health of the economy. The economy's resilience to higher energy prices is easily explained. The economy uses less energy per unit of output today than it did thirty years ago. Compared to previous energy shocks, energy expenditures represent a smaller share of the budget of the average consumer. As a result, consumer spending is less sensitive to higher oil and natural gas prices. Several trends in today's economy – the increase in labor productivity, for example – have also weakened the influence that higher energy prices might have to lower GDP growth, lower employment or stoke inflation.

The damage the hurricanes wrought in the Gulf did little to slow the economic expansion. Employment growth did sag immediately following the hurricanes, but rebounded in November. Higher home heating costs might make a dent in consumer spending and, over time, higher energy prices might shave a couple tenths of a percentage point off of economic growth. Most dismal forecasts of slow growth are based on the structure of the economy thirty years ago and overstate the effects of higher energy prices on economic growth and employment. If investment remains strong, the prospects for maintaining above-average GDP growth for 2006 are positive.

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Energy Prices and the Economy

This paper explores why the economy is much more resilient to the increases in energy prices today than in previous “oil shock” episodes. For example, during the 1970s, severe oil price shocks seriously disrupted an already fragile U.S. economy. However, despite recent high oil prices and related hurricane damage in the Gulf of Mexico, the U.S. economy displayed impressive resilience last year, with economic growth accelerating in the third quarter of 2005.

Economic growth for 2005 as a whole is expected to be about 3.5 percent. Yet past research on the economic impact of high oil prices indicates that a sharp slowdown or recession last year would have been a more likely outcome. Despite August and September’s double-digit rate of increase in the cost of gasoline (compared to the year before), rising energy prices did little to dampen economic growth. Consumer spending remained buoyant and core inflation – inflation that does not include changes in the volatile prices of energy and food – stayed low. Because the economy is much more resilient to high oil prices today than it was in the 1970s and 1980s, there are good reasons to be confident that the rising oil prices will continue to have a modest influence on economic growth, jobs or inflation.

This paper examines why the U.S. economy is less vulnerable to energy price shocks than it was twenty five years ago, including the following:

- The U.S. economy is now more energy efficient
- The U.S. economy is now less energy intensive as the service sector has grown
- The share of the household budget devoted to energy expenditures has fallen
- Oil and gas prices after adjustment for inflation remain below historical highs

The first section of this paper focuses on how higher energy prices might affect production – or the supply side of the economy. The second section looks at the expected effects of higher petroleum and natural gas prices on consumer spending. This section primarily discusses the direct consumer reactions to energy prices but also considers the indirect consumer reaction of higher gasoline prices on automobile purchases. This paper would not be complete if it did not consider the empirical research on the impact of high energy prices on the macro economy. The third section, therefore, reviews how economic models forecast the effect of high oil prices on economic growth and why those attempting to make use of the forecasts need to be wary. The fourth section discusses the effect that the recent hurricanes have had on energy prices. The fifth section analyzes the underlying causes of the high oil prices.[§]

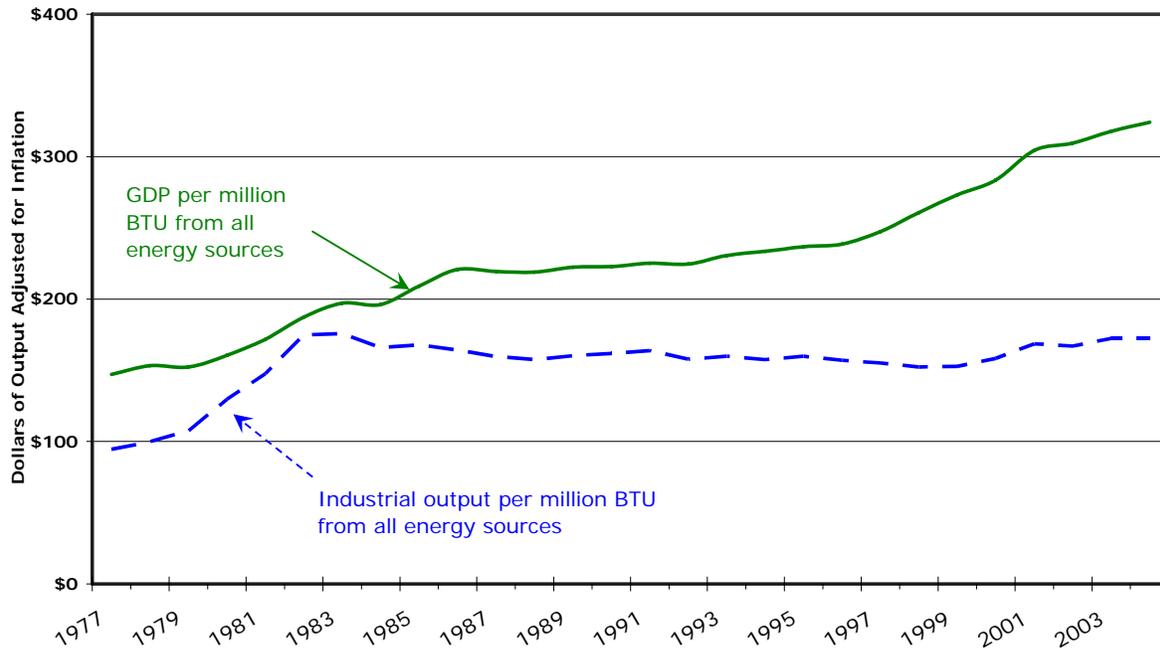
I. ENERGY PRICES AND ECONOMIC OUTPUT

Will higher energy prices have much of an impact on industry? In the 1970s and early 1980s, several sectors of the economy underwent tremendous pressure due to rising energy prices. Today, the fast rise in oil prices – the first energy shock – was one of the reasons economic growth stalled in the 1970s. The same supply side response is unlikely because the production side of the economy is less sensitive to higher oil prices than it was in the 1970s for at least three reasons.

[§] This paper focuses primarily on petroleum and petroleum-based product prices, and secondarily on natural gas prices. The term “energy” in this paper is used as short hand for both petroleum and natural gas.

One, the economy as a whole is less energy intensive. Figure 1 shows that for each unit of energy input, the economy today produces more output than it did during the oil shock of the 1970s. In other words, there is a bigger economic production bang for every energy input buck. (The energy “buck” on the graph is measured in energy units called British Thermal Units or BTUs).

Figure 1. Economic Output Per Unit of Energy



Source: Energy Information Administration and Bureau of Economic Analysis

Two, a smaller percentage of total employment is devoted to energy intensive industries than thirty years ago and, as a result, the economy is less vulnerable to high oil prices. The principle reason for this is that service industries – a less energy intensive sector – contribute to a greater proportion of economic output and employment today than thirty years ago. Another way to look at it is that energy intensive industries – manufacturing, for example – are a smaller portion of economic output. Because energy is a far smaller component in the service industry input mix, higher energy prices will have a relatively small effect on service industry prices, profitability and employment.

Three, heavy industries – construction, manufacturing, mining and utilities – have become more energy efficient. Industry output per unit of energy input has increased since the oil shocks of the 1970s. In Figure 1, the lower line shows how the ratio of industrial output per unit of energy input rose quickly in the late 1970s and early 1980s. As the price of energy quickly rose, firms were motivated to become more energy efficient. Once the price of energy stabilized, however, the trend in industrial energy efficiency leveled off.

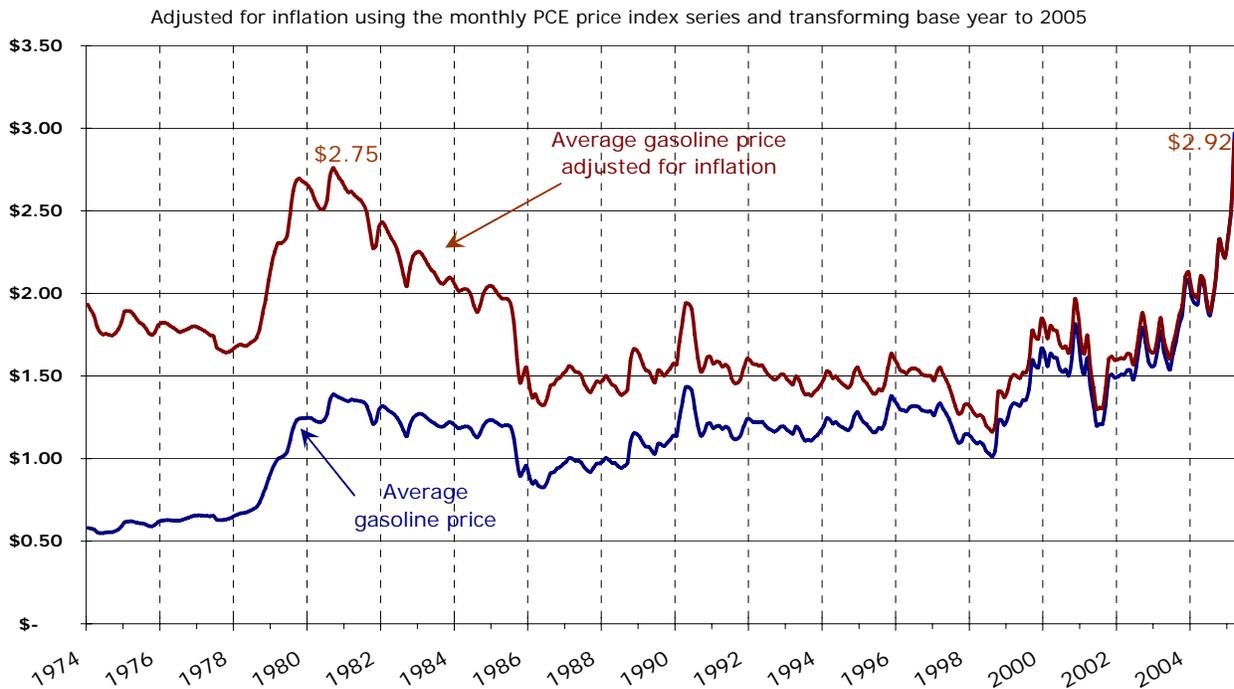
For these reasons, the production side of the economy is much less sensitive to higher energy costs.

II. THE EFFECTS OF GASOLINE PRICES ON CONSUMER SPENDING

Because of the relative speed of recent gasoline price increases, consumers soon felt significant discomfort. In September, gasoline prices, even adjusted for inflation, surpassed the previous 1981 high. (In 1981, gasoline prices were consistently high for the entire year. As a result, 1981 will probably remain the *year* of the highest inflation-adjusted gasoline prices.) The rise in gasoline prices has been cited as one of the leading causes for the decline in consumer confidence earlier this year. The question then becomes: will this translate to a slowdown in consumer spending and economic growth?

High gasoline prices do affect consumer spending, but they will not have the impact they had twenty or thirty years ago. This is because purchases of gasoline represent a much smaller share of consumer purchases than in the 1970s and early 1980s.

Figure 2. Price of Gasoline, U.S. City Retail Average Including Taxes

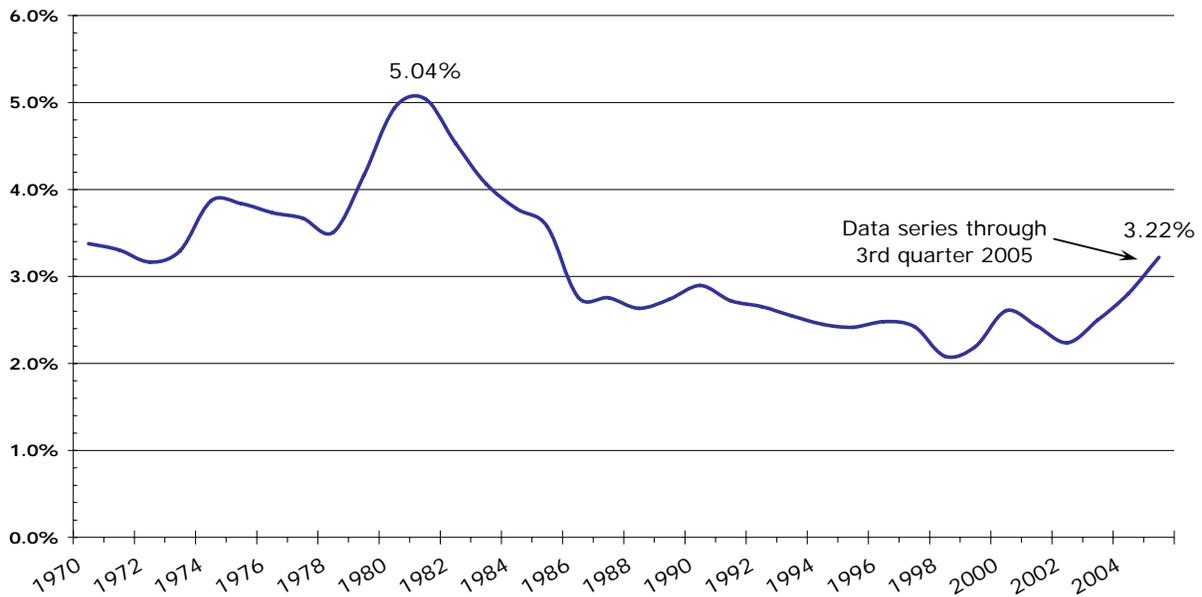


Source: Nominal monthly average gasoline prices (Energy Information Administration) and personal consumption price index (Bureau of Economic Analysis)

Figure 3 shows the percentage of personal consumption expenditures (PCE) – that is, everything that consumers purchase – attributed to gasoline. On average, gasoline purchases through September 2005 have commanded a 3.22 percent share of total consumer purchases. In 1981, over 5 percent of consumer purchases were devoted to gasoline. Since 1986, the percentage of gasoline to PCE has averaged 2.5 percent. Even after the run up of gasoline prices, consumers devote a significantly smaller share of their budgets to gasoline today than they did in 1981. Through September, gasoline purchases, as a percentage of personal consumption expenditures, are a modest eight-tenths of one-percentage point greater than the average percentage for the last twenty years. In dollar terms, eight dollars out of every thousand dollars of consumer budgets have shifted to gasoline purchases.

Figure 3. Gasoline Spending as a Percentage of Personal Consumption

Nominal Dollar Consumer Expenditures on Gasoline* to Total Nominal Dollar Personal Consumption Expenditures

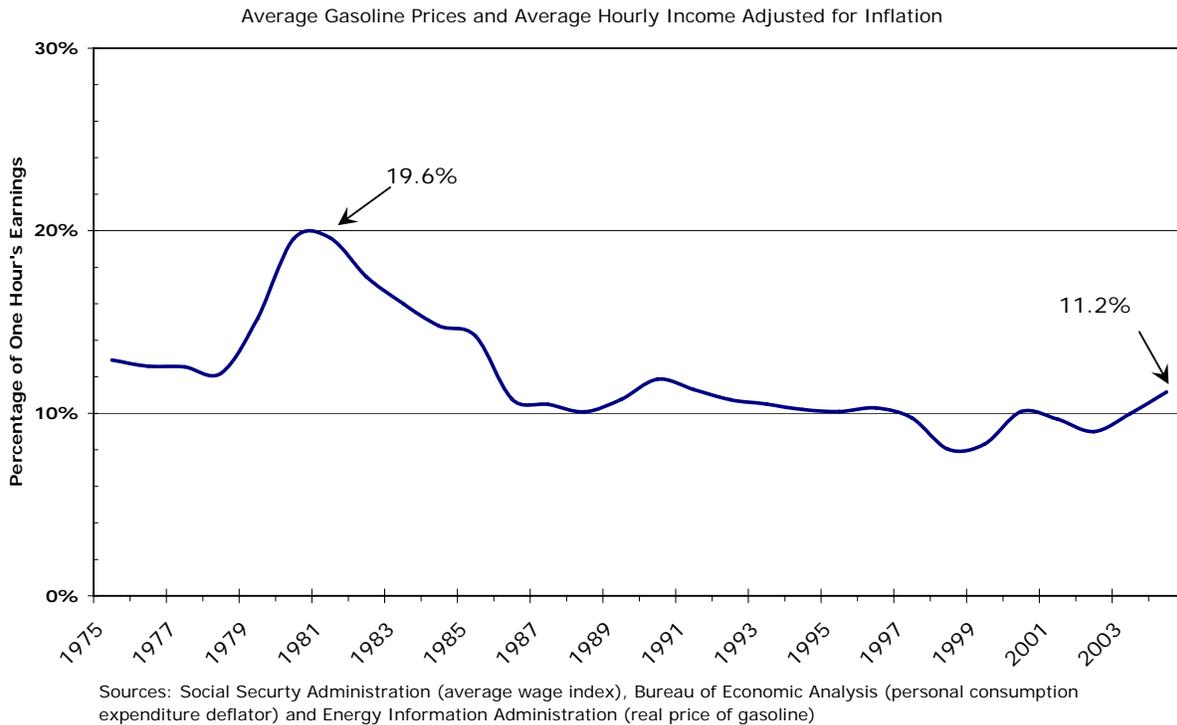


Source: Bureau of Economic Analysis

*This does not include purchases of gasoline as an intermediate input, i.e., purchases by businesses. Consumer purchases of gasoline are final goods and do not represent all gasoline purchased.

Figure 4 presents a similar story. The graph compares the average price of a gallon of gasoline with the average hourly income of wage and salary earners as reported by the Social Security Administration. It shows the percentage of an hour that the average person must work to buy a gallon of gasoline. In 1981, it took about 12 minutes of work (19.6 percent of an hour assuming a 40 hour workweek) to buy a gallon of gas. It takes significantly less time today. The average for 2004, the last year for which SSA income data are available, was less than 7 minutes (or 11.2 percent of an hour) of work to buy a gallon of gasoline.

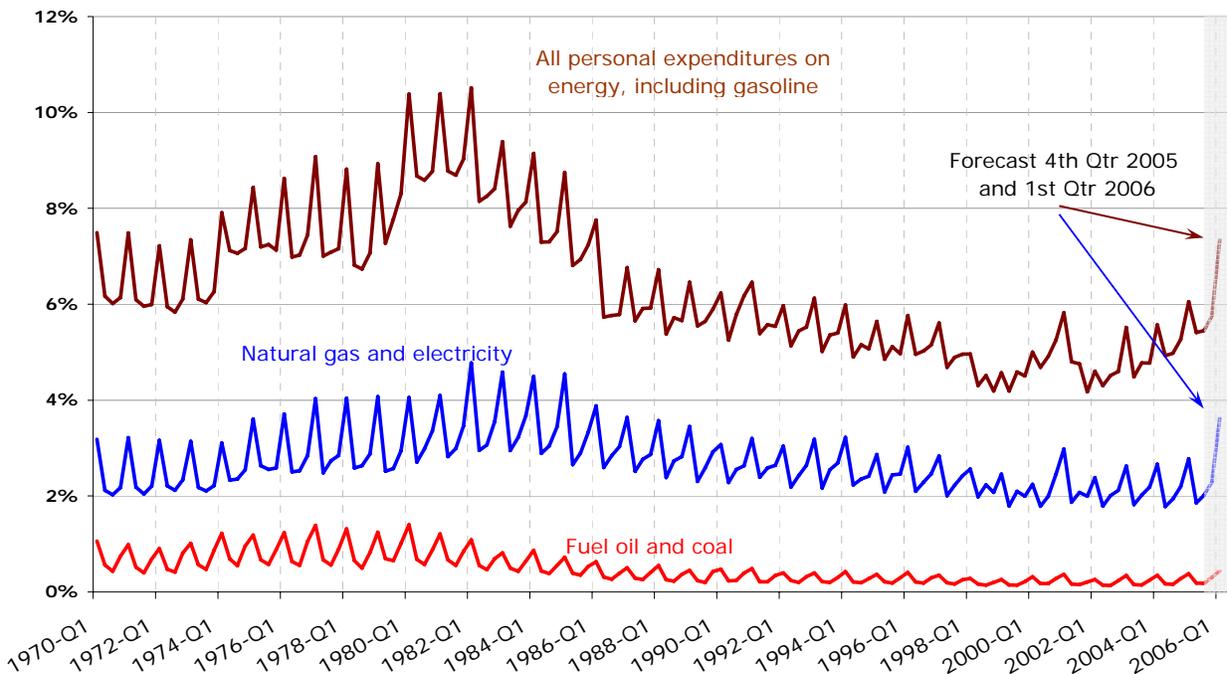
Figure 4. Gasoline Prices as a Percentage of Average Hourly Income, SSA Average Wage Index



While the expected consumer response to gasoline prices would justify a sanguine outlook about the resilience of consumer spending and the economy to higher energy prices, home heating is one potential source of immediate concern. Consumers will be spending significantly more to heat their homes this winter. According to the most recent Energy Information Administration report (January 11, 2006), households that primarily use natural gas for home heating can expect to spend, on average, 35 percent more on home heating compared to last winter. Those households using heating oil as their primary source of heat can expect to pay, on average, 23 percent more this winter than last.

The magnitude of this increase in home heating bills could take a significant toll on household budgets. If consumers experience heating bill “sticker shock,” they may restrain expenditures on other types of purchases. Figure 5 shows the winter peaks and the warmer weather valleys associated with consumer spending on energy. Winter home heating bills dramatically increase the percentage of consumer budgets devoted to energy purchases. The graph also plots EIA’s forecast of the winter energy bill spike.[§]

Figure 5. Personal Energy Purchases as a Percentage of Total Personal Consumption Expenditures



Source Data: Bureau of Economic Analysis (PCE in nominal dollars, not seasonally adjusted) and Energy Information Administration (forecasted increase in home heating costs relative to last winter)[§]

Figure 5 suggests that the considerable increase in home heating expenses may put significant pressure on household budgets, especially those budgets of lower income earners. How households actually respond to the higher cost of home heating fuel prices is, however, still an open question. Many households participate in “budget billing,” a billing feature that many utilities offer that allows consumers to evenly spread their utility bills over the course of the year. Whether a household participates in a budget billing plan or not, the overall annual spending on energy is the same. Nevertheless, the budget billing feature may, on average, dampen any dramatic consumer response to higher home heating bills. Participation in budget billing varies widely across the country, according to an informal survey conducted by the National Regulatory Research Institute. In the Midwest, for example, budget billing participation ranges from 11 percent of customers for a utility in Wisconsin to

[§] The data series used in Figure 5 are not seasonally adjusted and, as a result, show the seasonal nature of energy consumption. The PCE series used in Figure 3 is seasonally adjusted. The forecasted energy expenditures were calculated using last winter’s PCE and increasing the particular PCE series detail by the percentage forecasted by EIA. Non-seasonally adjusted detailed PCE series for 2005 (that will be reported later in the year) were estimated using the quarterly percentage change in the available seasonally adjusted data for 2005.

just over 30 percent for a utility in Iowa. In the Southwest, budget billing participation is 7 percent or less. In the Northeast, reports ranged from 3 percent for a utility serving a locale in Massachusetts to 42 percent for a utility in Pennsylvania. To reiterate, the degree to which budget billing would temper sudden constrictions in consumer spending in the aggregate is an open question, but for those participating, it seems reasonable to conclude that budget billing would reduce the sticker shock associated with the higher home heating costs that the Energy Information Administration is predicting.

In summary, consumer spending will be less sensitive to high gasoline prices than it has been in the past, but consumer response to higher home heating bills this winter is still an open question. Higher energy prices do affect the budgets of lower income earners disproportionately, but the average consumer will, most likely, continue to accommodate higher energy prices much more easily than in the early 1980s.

INDIRECT EFFECTS OF GASOLINE PRICES ON CONSUMER SPENDING

The economic outlook across industries is uneven. While the higher gasoline prices might not have a dramatic effect on overall consumer spending, high gasoline prices have had a noteworthy effect on the profitability of the automotive industry. Of late, U.S. automobile manufacturers have watched their profits shrivel or have reported large losses.

Rising gasoline prices have led to consumer unease about purchasing new automobiles. The demand for SUVs and other low mileage vehicles has dropped, leading car manufacturers to offer cash incentives for the slow selling models in order to maintain unit sales. A study by the Transportation Research Institute at the University of Michigan shows a direct relationship between the increase in the cost of fuel from 2001 to 2004 and the manufacturer incentives offered to offset the increased operating costs associated with the increase in gasoline prices. For example, the average additional fuel cost increase for an average SUV from 2001 to 2004 was estimated to be about \$1200 and the average incentive in 2004 for SUVs was about \$1900. The incentives have cut profits on the most profitable models U.S. car companies offer resulting in significant losses for the companies as a whole. GM, for example, admitted that gas prices are contributing to soft demand for SUVs, products that have been the company's most profitable models. Ford has announced that it is changing its product mix to de-emphasize the SUV and ramp up the profitability of other models.

III. IS THIS AN OIL SHOCK? THE EMPIRICAL EVIDENCE

Much of the empirical and econometric research on the effects that energy prices have on the economy would point to high energy prices as having a significantly negative impact on growth and inflation. Some of the empirical research shows that economic growth would be reduced by as much as 1.4 percentage points the year following a 10 percent increase in the price of oil. The economic forecasting models based on this research are circumspect. According to these models, the rise in oil prices over the course of the last couple years should have pushed the economy into a recession. In 2002, the spot price of a barrel of West Texas Intermediate (WTI) crude, a benchmark price for oil, averaged just over \$26. A 10 percent price increase would not have hit \$30 a barrel, but the spot price of WTI in 2005 averaged over \$41. Last summer crude spot prices topped \$70 a barrel, but the economy continued to grow at a healthy rate.

In order for forecasting models to produce accurate predictions of future economic performance, relationships between economic variables incorporated in the models cannot change dramatically. But the economy has undergone significant transformations over the course of the last thirty years. In the same way that higher gasoline prices have had a diminished effect on consumer spending today relative to the 1970s – as discussed in Section II – oil price increases will not have the negative effect on the economy predicted by many economic models. The more credible research studies are those that suggest that the effects of high oil prices on economic activity are less important than in the past. As a result, one should be wary of forecasts that predict that high oil prices will have a substantial impact on economic growth and inflation.

It may be helpful to briefly discuss how the economic models represent the transmission mechanisms by which an increase in the price of oil affects the rest of the economy. In this way, one can see that the mechanisms for transmitting high oil prices into slower economic growth and lower employment have largely atrophied.

The first mechanism is that an oil price increase will reduce the purchasing power of oil importing countries relative to oil exporting countries (also called the terms of trade). The degree to which an oil-importing country undergoes a reduction in purchasing power partially depends on the oil-intensity of production. As discussed in Section I, production is considerably less energy intensive today than it was in the 1970s. The loss in U.S. purchasing power for imported goods during the oil shock of 1979-80 was four times that of the 2003-4 timeframe.

Second, higher oil prices can translate into higher domestic prices through the mechanism of the wage/price cycle. Higher prices for gasoline and home heating fuels will tend to increase one headline inflation measure – the consumer price index. While discomfiting to the consumer, the affect of the initial round of this price change is relatively minor; the consumer adjusts spending according to a new set of relative prices. Higher energy prices can have a knock-on effect. If, as energy prices rise, workers or businesses are able to compensate for the loss in real income or profits through higher wages or prices, the effects of higher energy prices can translate to core inflation measures.

In the recent past, workers typically recovered a decline in real wages by means of cost of living adjustments, or COLAs. These COLAs would have the effect of cycling higher oil prices through the economy. But COLAs are not as prevalent as they once were. As the economy moved from union represented labor and manufacturing to an economy dominated by services, COLAs have fallen out of fashion. Of the labor contracts subject to renegotiation in 2005, a mere 15 percent had COLA provisions, down from 48 percent in 1983, according to an employer survey done by the Bureau of National Affairs (BNA). Moreover, the BNA has noted that the trend is away from COLAs even in union contracts currently under renegotiation. In short, the wage/price mechanism that spreads energy price increases throughout the economy has atrophied. As a result, the economy's sensitivity to a run up in oil prices is substantially reduced.*

The third mechanism is labor and capital responding in a way that reduces output. Higher input prices reduce profitability. Profitability will also be reduced if labor market dynamics maintain real wages in

* Monetary policy is the most important determinant to overall changes in the price level. Monetary policy also has an effect on how changes in the energy prices translate into changes in economic performance. The economic models also have the ability to represent different monetary regimes.

light of higher energy prices. On the other hand, if wages, relative to other input prices, decline, or if labor productivity increases, profitability would be maintained. As a result, firms would not be under pressure to reduce output or reduce employment. Since 2000, productivity has increased at rates that are twice that of the average productivity growth from 1973 to 1995. This robust productivity growth helps to offset higher input costs. This may mean that firms will not react to higher input prices by reducing output, employment and real wages.

The mathematical models economists use to predict the effect of an increase in oil prices represent these mechanisms and incorporate other important economic aspects, for example, whether monetary policy is tight or easy. Based on the historical relationships between economic variables – for example, the degree to which the quantity demanded of gasoline declines with an increase in price – these models predict the economic outcome of increases in the price of oil.[§] These models are empirically based, that is, data on the behavior of economic variables from the past are used to determine what the behavior of those economic variables will be in the future, given a change in the price of energy. The assumption at issue is whether the economy today and tomorrow will perform the same as it did yesterday.

As the foregoing discussion suggests, there are good reasons to believe that the effects of high oil prices on economic activity are fading and the dismal predictions of the negative impact of high oil prices are overstated. Key economic variables used to build the models do not behave in the same way today as they did in the 1970s or 1980s. One need simply observe how U.S. economic growth and oil prices have behaved in recent years to conclude that higher oil prices will continue to have a surprisingly modest effect on the economy. Indeed, the (inverse) relationship between real GDP growth in the U.S. and oil prices has, at the very least, weakened, as has the relationship between personal consumption expenditures and oil prices. The relationships observed in the 1970s do not hold in recent years and, therefore, the models that were based on historical relationships of economic variables would tend to produce erroneous results.

[§] Most of the effects that these models predict occur with a lag of a year or more. That is, most of the dampening effect on growth and most of the changes in relative prices become evident a year after the rise in oil prices.

Figure 6A. The Strong Inverse Relationship Between Oil Price Changes and U.S. Personal Consumption Expenditures in the 1970s...

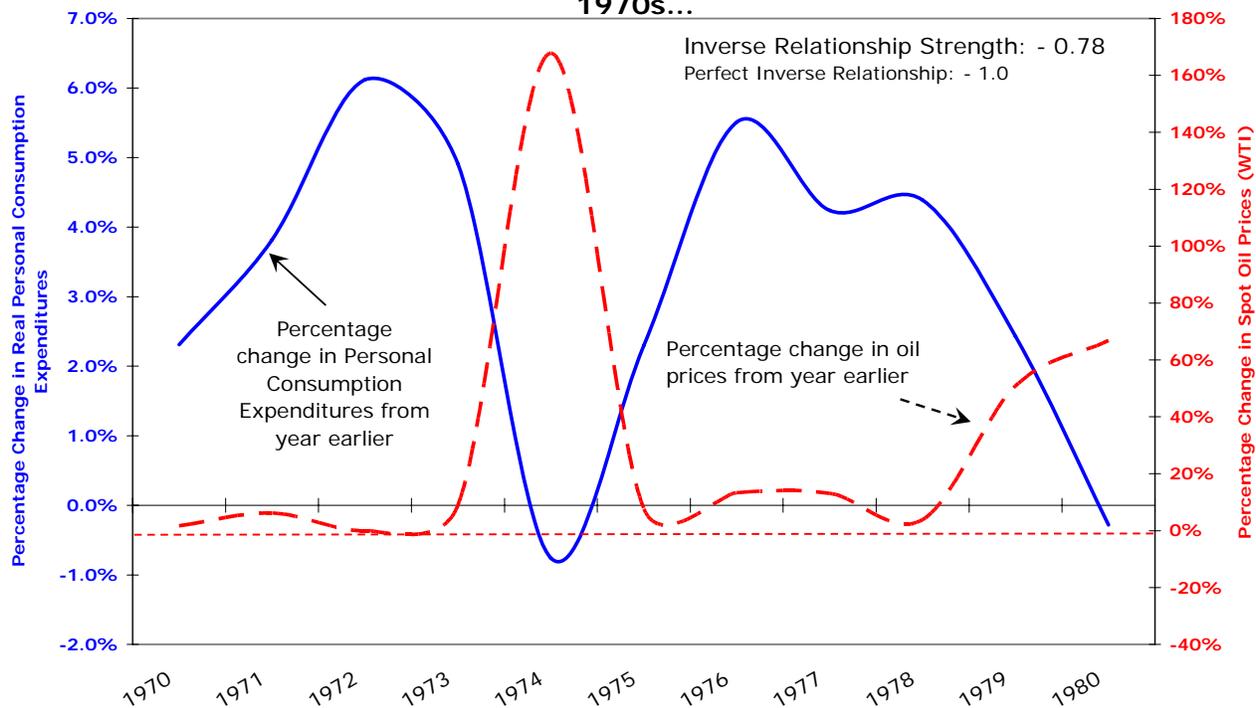


Figure 6 (A, B and C) is a series of graphs showing that the strong inverse relationship* between changes in personal consumption expenditures and changes in the price of oil during the 1970s no longer holds. As one would have expected, the price of oil increased over 160 percent in 1973 and, because consumer budgets were squeezed with the rise in the price of gasoline and other fuels, consumer spending plummeted. Consumer spending rebounded, but, starting in 1979 with the second oil shock, consumer spending again hit the skids. The inverse relationship between oil prices and personal consumption expenditures was, statistically speaking, strong.

The early 1980s brought several economic changes, but oil prices stayed relatively high, easing only slightly until 1986 when, as a result of OPEC losing much of its group cohesion, oil prices almost halved. Over the course of the 1980s, the inverse link between oil prices and consumer weakened. One would have expected that the drop in gasoline (and other energy prices) around 1986 to have precipitated a jump in consumer spending. Yet, the rate of consumer spending growth moderated. Later, with the first Iraq war, consumer spending did drop in response to another oil price spike, as one would have expected, and as the economy headed into a recession, consumer spending continued to fall.

* An inverse relationship means that the increase in one variable, say the price of champagne, results in the decrease in the other variable, say the amount of champagne purchased. An inverse statistical relationship can get no stronger than -1.0 (negative one).

Figure 6B. ...Weakens in the 1980s...

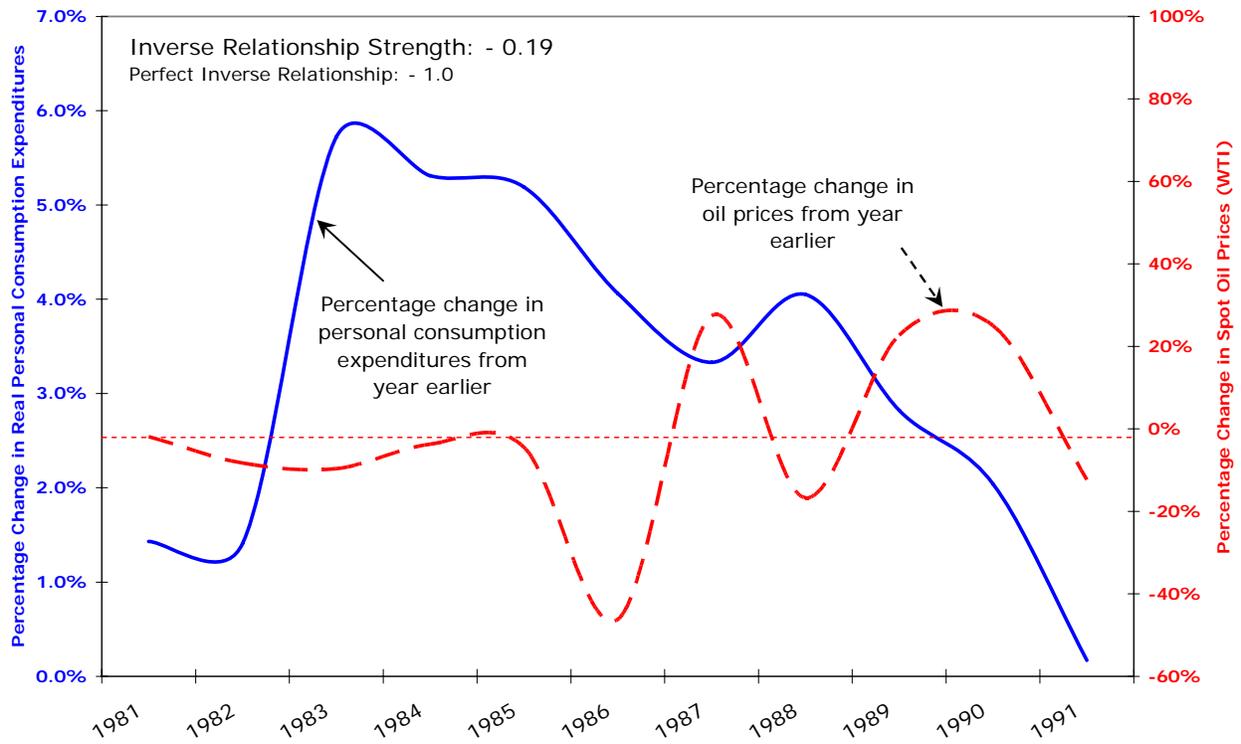
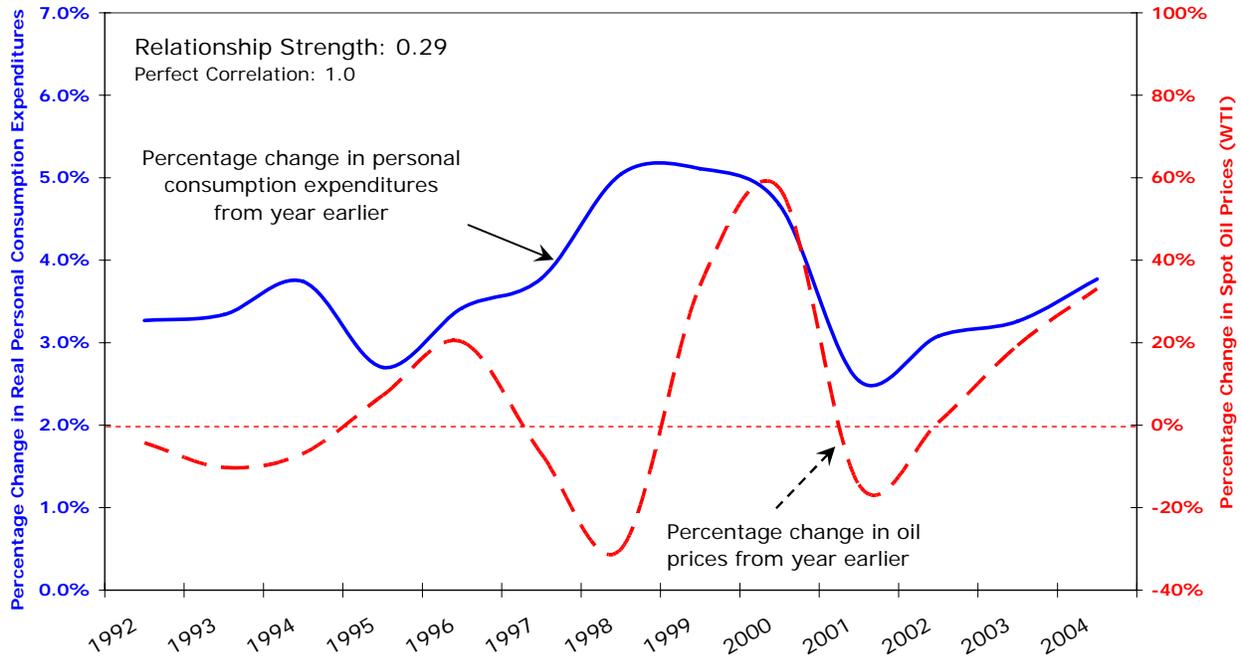


Figure 6C. ...And Became Weakly Positive in the 1990s

Conclusion: personal consumption expenditures are much less sensitive to changes in energy prices than during the Oil Shocks of the 1970s and 1980s



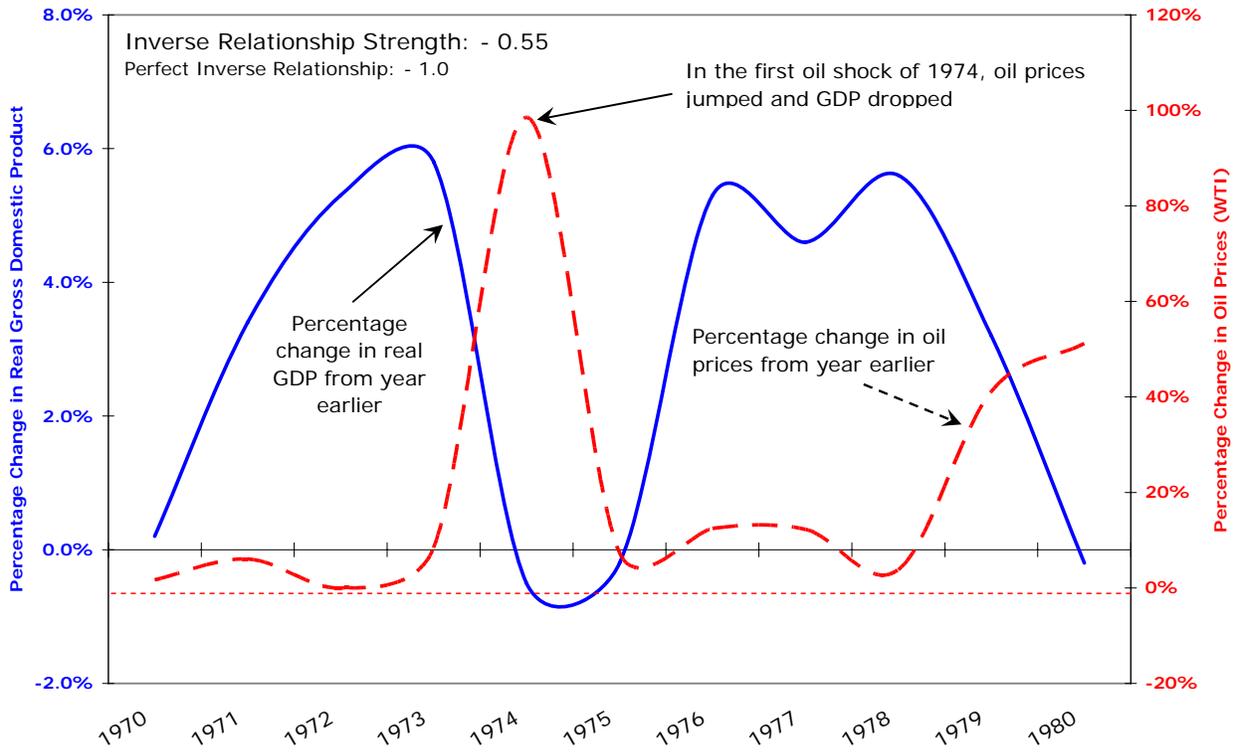
Source: Bureau of Economic Analysis (real personal consumption expenditures) and Haver Analytics (West Texas Intermediate crude)

In the 1990s, the inverse relationship completely vanished. Adjusted for inflation, oil prices stayed low. The U.S. economy enjoyed healthy, consistent growth, as did much of the rest of the world. The Asian economies grew at a hectic clip and with that growth, so did their demand for energy. One can see how the Asian economic crisis in 1998 and the slowdown of the U.S. economy in 2001 are reflected in the drop in oil prices that were caused, in turn, by a drop in oil demand. As the graph shows, for the last five years or so, changes in oil prices and consumer spending have moved together in a positive relationship.*

* A positive relationship – shown by a positive correlation statistic – is one for which there is a simultaneous change (in the same direction) in two variables. For example, as income increases so does the amount of champagne purchased.

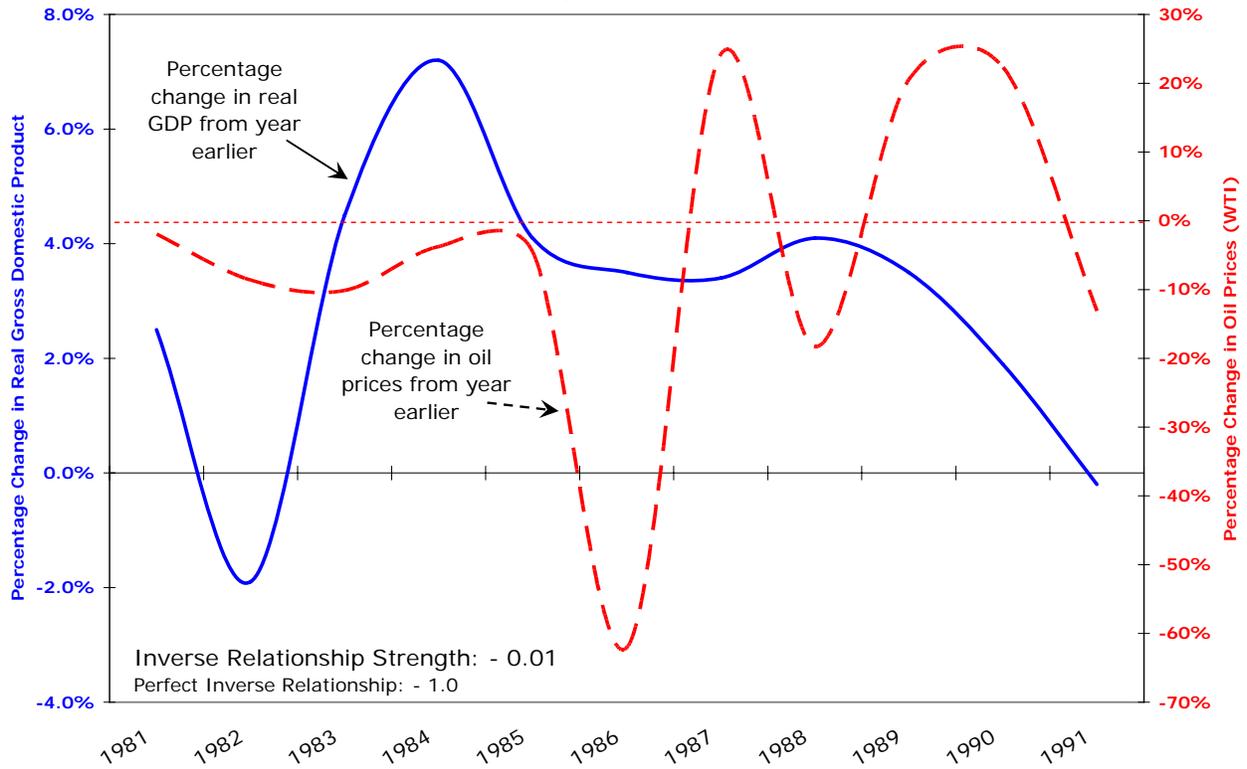
Just as the change in the relationship between gasoline prices and personal consumption expenditures has changed over the last thirty years, the linkage of the 1970s between change in the price of oil and the changes in growth of GDP does not appear to hold for the economy today. (See Figure 7A, B and C.) In 1973, the increase in the price of oil was dramatic – a “shock” – and the rate of GDP growth fell, thus showing a classic inverse relationship.

Figure 7A. Oil Prices and Real Gross Domestic Product Are Inversely Related in the 1970s...



In the 1980s, however, that inverse relationship is no longer evident. One might have expected that the large drop in oil prices in 1985 would have a stimulative effect on GDP growth, but, as Figure 7B shows, this was not the case.

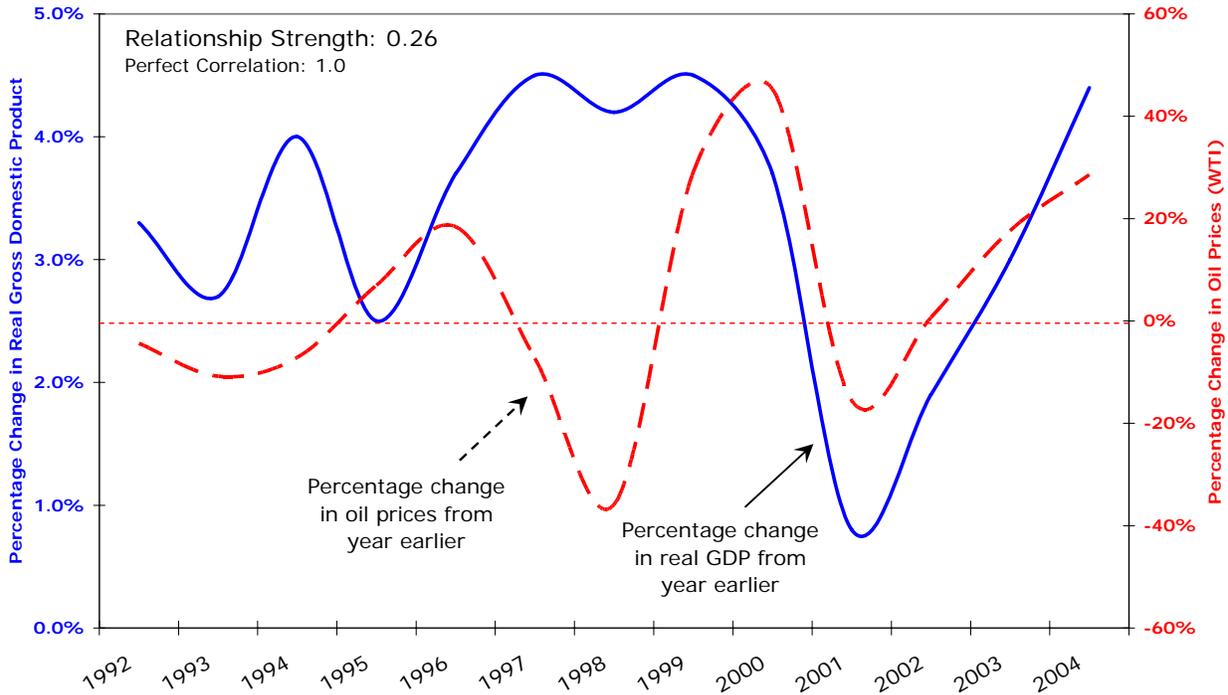
Figure 7B. ...But the Inverse Relationship Disappears in the 1980s...



The run up in oil prices resulting from the first Iraq war, did negatively affect GDP growth, but, as Figure 7C shows, since that time, GDP growth and oil price increases have followed each other in a (weak) positive relationship.

Figure 7C. ...And the Relationship Becomes Positive in the 1990s

Conclusion: the economy is considerably less sensitive to oil price spikes than in the past



Source: Bureau of Economic Analysis (real gross domestic product) and Haver Analytics (West Texas Intermediate crude)

The foregoing discussion is not to say that increases in the price of oil now cause increases in the consumer spending or encourages economic growth. The purpose of these graphical series is to show that the behavior of key variables – behavior built into many economic forecasting models – is sufficiently different in today’s economy that one needs to be wary of the dire forecasts these models generate. One can derive from these series of graphs, and by noting the change in correlation statistics, that the behavior of GDP growth and personal consumption with respect to oil price changes has undergone a significant transformation.

In summary, the magnitude of the GDP slowdown forecasted by many economic models is suspect because oil’s impact will be moderated by the structural change that the U.S. economy has undergone in the last thirty years.

IV. STORM SURGE

The human misery caused by hurricane Katrina gripped the nation. Hundreds of thousands of people from the region lost their homes, possessions, pets and, in some cases, friends and family members. Without thinking twice about it, Americans sprang into action. Some people volunteered their time or opened up their homes to the evacuees. Others donated money for relief.

What did make the average American think twice was why, if they lived thousands of miles away from Katrina's path, did their gasoline prices surge? Gasoline prices had already risen steeply over the course of the summer – average gasoline prices increased twenty cents between July and August – but a 46 cent price increase from one week to the next precipitated public outrage.

The Gulf of Mexico and the Gulf States play a critical role in domestic energy production. More than 28 percent of domestic oil and 19 percent of natural gas production is attributed to the Gulf. Gulf State refineries contribute to the supply of gasoline, home heating oil, jet fuel and other distillates for most of the nation (excluding the West Coast markets). Shortly after the hurricanes, *The Economist* reported that some energy experts feared that the destruction of energy assets due to the hurricanes could lead to the biggest energy shock since the 1970s.

Unaware of the exact level of destruction to oil and natural gas platforms in the Gulf immediately after Katrina, and fearing the worst, energy traders drove the spot price of oil over \$70 a barrel. Anticipating continued crude supply shortages, future contracts for oil delivery in late 2005 and early 2006 also increased. In November and December, the market for oil eased and stabilized to the price range seen before Katrina.[§] Gasoline prices gradually fell as well.

The price of gasoline in the wake of Hurricanes Katrina and Rita followed a path similar to other supply interruptions. In August of 2003, there was a break in the gasoline pipeline between Tucson and Phoenix, a pipeline that supplied these cities with products from refineries in the Gulf States. Several lessons can be drawn from these two supply disruptions. The first lesson is that prices increased more quickly after the supply disruption than they decreased after supply was restored. The second lesson is that the gasoline market is much more integrated than one might expect. Even though the Arizona pipeline supplied Phoenix, gasoline prices in Tucson and Los Angeles rose. The market impact was felt as far north as Oregon and Washington. The refineries in the Gulf States contribute to the fuel supplies most of the U.S. and, as a result, Katrina's damage affected gasoline prices across the nation.

The third lesson is that gasoline demand is relatively insensitive to price in the short run. Phoenix consumers did not significantly reduce the amount of gasoline they purchased, despite a 39 percent price increase.[§] According to one study, a 10 percent increase in the price of gasoline results in a 2.3 percent decrease in demand. It appears that gasoline demand continues to be relatively insensitive to price. Comparing 2004 with 2005 for the six weeks ending October 7, the weekly gasoline demand measure published by the Energy Information Administration (EIA) fell 2.8 percent, whereas the average weekly price increased 41.6 percent.

Absent the environmental regulations that went into effect in January and the increase in spot crude oil prices resulting from new political uncertainties in some key oil producing countries, gasoline prices would have continued the downward drift early in 2006. Relative to gasoline prices immediately

[§] More recently, crude spot and futures prices have risen again due to crude supply concerns unrelated to the hurricanes. In January, gasoline prices edged up due to the higher crude prices, strong demand and the consequences of environmental regulations that took effect in the beginning of 2006.

[§] The Federal Trade Commission cites a 2000 study that estimates the short-run price elasticity for gasoline is -0.23. This means that a 10 percent price increase will result in a 2.3 percent decrease in the quantity demanded. This estimate for price sensitivity, however, is based on historical data for small price changes. Price elasticity is not constant over a range of prices. The large price changes experienced more recently may have made consumers more sensitive to price changes.

following the hurricanes, consumers have had some relief at the gasoline pump. Unfortunately, the average consumer will be confronting significantly higher home heating expenses. Consumers of both home heating oil and natural gas can expect elevated home heating costs.

How consumers respond to elevated fuel prices in the coming months will determine the extent to which the hurricanes will affect economic growth. High energy prices have the potential to drain the buying power of consumers to purchase other goods and services. If consumers adjust their budgets in such a way that significantly reduces demand for clothing, entertainment, home furnishings, haircuts and the like, economic growth will slow. The average August price of gasoline was 27.5 percent higher than August of 2004, but through the middle of last summer, the rise in gasoline prices was not significantly affecting average consumer spending patterns.

Katrina and Rita have put the fragility of global petroleum and natural gas production into sharp focus. In the early 1980s, there was considerable surplus refining capacity and gasoline prices increases were due solely to the increase in crude oil prices (due to supply reductions imposed by OPEC). Today, there is no slack in global crude oil production capacity or in domestic refining capacity. As a result, Katrina and Rita placed tremendous supply pressure on the price of petroleum and natural gas products, and the prices quickly rose. While energy markets did stabilize after the hurricanes, the energy outlook for the next couple years remains mixed.

V. GASOLINE PRICES: HOW HIGH FOR HOW LONG?

Except for the short-term price spike due to the supply disruption caused by the hurricanes or the fear of potential supply disruptions in politically sensitive regions, today's high price of oil has resulted from the growth of global demand for oil outstripping the short-run production capacity of oil producing countries.

Globally, there is plenty of economically recoverable oil in the ground, but there has been underinvestment in production capacity. Absent any country's resolve to withhold its petroleum infrastructure from operation to advance a political agenda, global capacity to produce and ship oil is based on the level of oil field development – how many wells there are for any given oil field – and the capacity of the transportation network – including pipelines – to move the commodity. The infrastructure investment required to expand capacity is expensive. The goal, from a producer's perspective, is to match capacity with expected demand and minimize any unused investment.

The key element from a producer's point of view is expected demand. Current production capacity, relative to demand, is insufficient to moderate crude prices. Today's actual global demand for oil exceeds the demand projections that were made several years ago. This has resulted in a gap between planned and needed investment in production which, in turn, has caused a rapid and persistent increase in the price of oil.

As economies grow, oil demand grows to power industry, to move goods and people, and as a raw material for petrochemicals. As economies modernize and move from predominately agriculture to manufacturing, they also require more energy. As citizens become more affluent, they travel more and, as a result, consume more oil. In the last decade, China has grown economically, modernized and become more affluent at a frenetic rate. As a result, China's need for oil has ballooned.

As late as 1993, China was a net oil exporter. From 1998 to 2004, China's oil imports increased by a factor of 5, from approximately 0.5 million barrels a day to 2.5 million barrels a day in 2004. As India's economy grows, it too will demand more energy. Asia's growth in demand for oil, combined with a lack of investment in production capacity in the oil producing countries, has resulted in global oil consumers competing with each other over a level of oil production that is inelastic in the short run. In the global marketplace, consumers will compete with each other, and bid up the price of a barrel of oil, until the quantity demanded matches the (short-run fixed) quantity supplied.

In contrast to the supply shocks of yesteryear, the persistent trend of high oil prices experienced through most of 2005 was caused by robust global demand for oil. The hurricanes have highlighted the national vulnerability to the lack of spare capacity in petroleum production and refining. Because of this lack of spare capacity, small changes in productive capacity, be they the result of hurricane damage to oil rigs in the Gulf of Mexico or the political proclivities of oil producing countries, can produce pronounced price spikes.

To reiterate, the trend of increasing oil prices in the last two years is not the result of someone shutting off the oil spigot. It is because there are more consumers competing for the (short-term) fixed output capacity of the spigot. The price will rise until all purchasers are satisfied. Until investment in oil field development yields an increase in productive capacity to match the increase in global oil demand, it is unlikely that there will be a significant decline in the price of crude.

CONCLUSION

Relative to the oil shocks of the 1970s and 1980s, the pre-Katrina high energy prices would have had a modest effect on the economy in 2005 and 2006. The effect of high energy prices, however, will continue to be uneven. The automobile industry, for example, has been hurt by consumers shifting their purchases away from the highly profitable SUVs toward more fuel efficient, but less profitable, models.

Several of the mechanisms that convey high oil prices to lower GDP growth, lower employment and higher inflation have atrophied. As a result, one should be circumspect about the predictions that higher oil prices will cause a dramatic economic slowdown. Many economic forecasters are still basing their predictions of economic performance on the structure of the economy thirty years ago. Many of last year's economic forecasts overstated the effects that high oil prices would have on the economy. Instead of a sharp recession, the economy has shown its resilience to high energy prices and continues to register healthy growth. However, there are risks that there will be an economic cooling. For example, if business leaders prune investment spending, the rate of economic growth would diminish, but it would diminish because of the vital role investment spending has on economic growth and employment. While the recession of 2001 coincided with a jump in energy prices, it was the investment collapse in 2000 that propelled the economy into a recession.

In the first three quarters of 2005, the economy grew at the rate of about 3.8 percent. Over time, higher oil prices might shave a couple tenths of a percentage point off of economic growth, but the dismal forecasts of a sharp downturn due to high oil prices lack credibility. Indeed, in the December press release of the Federal Open Market Committee, the Federal Reserve stated that economic expansion appears to be solid despite higher energy prices and the economic disruptions due to the

hurricanes. The December issue of the Blue Chip Consensus reports the 2006 economic growth prediction to be 3.4 percent, a respectable margin above the 30-year average of 3.1 percent.

The prospects for healthy economic growth continue due, largely, to the economy's resilience to higher energy prices or other economic shocks. Economic output is less energy intensive than it was during the first series of oil shocks. Consumer budgets and spending are less sensitive to higher oil and natural gas prices. Several trends in today's economy – the increase in labor productivity, for example – have weakened the influence that higher energy prices might have to lower GDP growth, lower employment or stoke inflation. Before Katrina, the high cost of oil had a surprisingly modest effect on the overall health of the economy. The hurricanes caused a brief dip in the rate of employment growth, but, if investment remains buoyant, most indicators still point to solid economic performance in the near future.

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