



*A Look Inside
a Key Economic Debate:
How Should Monetary Policy Respond
to Price Increases Driven by
Supply Shocks?*

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*Remarks to the Massachusetts Chapter of
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I would like to thank David Begelfer and his colleagues at NAIOP Massachusetts for inviting me to join you today to discuss the economy and monetary policy.

I am happy that financial markets and the economy have made significant progress since the depths of the financial crisis, but I am far less happy that the recovery to date has been so undesirably slow and anemic. In my reading of economic history this is, unfortunately, typical of economic downturns that are accompanied by severe financial disruptions.

The debate I'd like to focus on today is the one over the likely impact of recent increases in the prices of food and energy, and how monetary policy should respond.* The Fed's policy stance, as you know, is currently very accommodative – a stance that I believe is appropriate given the tentative recovery and still-high unemployment. But with food and energy prices rising, some observers think the Fed should shift its stance to less accommodation – slowing economic growth now to ensure we don't have undesirably high inflation in the future – even though current measures of core inflation (that is, inflation omitting volatile food and energy prices) remain low by historical standards.

As the recovery continues – albeit slowly – several events have occurred that further complicate the outlook for inflation and real economic activity. Political upheaval in the Middle East has contributed to sharply higher oil prices. Severe weather has reduced harvests from Russia to Australia, causing higher prices for many agricultural products. And Japan's tragic earthquake and tsunami caused not only terrible loss of life, but also disruption to a supply chain that is increasingly global.

So today I would like to discuss how monetary policy should react when the economy is buffeted by a series of these so-called “supply shocks.” I'd like to just highlight my major points before getting into the data and analysis that underpin my perspective.

First, I want to explain that while I will be making distinctions in this talk between so-called “core” and overall or total measures of inflation, we at the Federal Reserve look at *all* prices, including food and energy prices, when developing U.S. monetary policy. While we

* *Of course, the views I express today are my own, not necessarily those of my colleagues on the Board of Governors or the Federal Open Market Committee (the FOMC).*

often use core measures as a guide to where overall inflation is most likely to go, our goal is to stabilize overall inflation.

Allow me to preview one of my conclusions. Because my analysis suggests that recent food and oil price increases have their roots in concerns about wheat harvests in Russia and oil production in Libya and the like, I do not believe that monetary policy is the appropriate tool to respond to these disruptions. While many observers see food and energy prices rising and assume the Fed should tighten policy – raise the cost of money and credit – to head off inflation, I would suggest taking a step back and recognizing that tighter U.S. monetary policy will do nothing to stabilize Libyan oil production, reduce uncertainty about political stability in the rest of the Middle East, or increase the wheat harvest in Russia.

In fact, tightening monetary policy solely in response to contractionary supply shocks would likely make the impact of the shocks *worse* for households and businesses. To see why this is so, it is important to keep in mind how supply shocks affect the economy.¹

First, supply shocks can lead to increases in food and energy prices that slow economic growth. For example, because a person's need to drive may not be very flexible, spending on gas consumes a bigger portion of their budget. So an oil shock tends to force consumers to reduce their spending on other goods and services as they absorb higher oil costs.²

Second, while the prices of goods directly affected by the supply disruption increase, other prices in the marketplace may be unaffected – at least initially. If the supply shock involves food or energy, this dynamic causes measures of *total* inflation to rise, but does not have a large impact on what economists call *core* inflation – which excludes the volatile food and energy sectors. But in the longer-run, the impact of the supply shock on the prices of *other*

goods will depend importantly on how inflation *expectations* respond to the shock. If people expect that food and energy prices will stabilize – in other words, that the price shock will be temporary – and do not believe that the central bank will allow any long-run effect on inflation, then the disruption to total inflation will likely be temporary and the total inflation rate will eventually converge with the lower core inflation rate. Since 1986, this has largely been what happened when we experienced these types of supply shocks – as I’ll illustrate in a moment with some charts.

Alternatively, if expectations of inflation do rise in response to the supply shock, then (nominal) wages and salaries across the economy will be pressured to increase over time to keep pace. If that happens, the supply shock could affect prices throughout the economy – not just those that were part of the initial supply shock. In this case, the core rate of inflation rises to converge with the higher measure of total inflation. This was the U.S. experience in the 1970s, for reasons I’ll discuss in a moment.

We at the Fed need to very closely monitor the data to make sure that inflation remains contained. And we will. But as I believe I will demonstrate this morning, the most likely result is that these supply shocks cause slower growth in the near term while having only a modest effect on longer-term inflation rates – which has been the U.S. experience since 1986.

Unemployment remains quite elevated, at 8.8 percent, and I anticipate a slower return to full employment than we would have experienced absent these supply shocks. With the core inflation rate over the prior year at a little above 1 percent, I anticipate only a gradual return of core and total inflation rates to something like our consensus “stable” rate of about 2 percent, over the medium term.

If the economic data continue to support this outlook then the current, accommodative stance of monetary policy is appropriate, and can remain in place and continue to support economic growth – so that we continue to make progress toward our goals of returning to full employment and a sustainable long-run inflation rate – the two elements of the Federal Reserve’s dual mandate from Congress.

The Impact of Recent Supply Shocks

Now that you know my basic take on this key – and current – economic debate, allow me to flesh out my perspective with the supporting data and analysis. The full impact of the recent shocks to supply that I mentioned at the outset will likely emerge over time. But clearly there have been significant increases in a variety of food and energy prices. As **Figure 1** illustrates, the recent turmoil in the Middle East has contributed to a significant increase in oil prices, which have risen to over \$100 a barrel. This is well above the average of nearly \$80 a barrel experienced over 2010, but at the same time still well below the peak of \$146 a barrel that occurred in mid July, 2008.

The recent volatility in oil prices, as the chart shows, is quite striking. Sharp increases have been followed by sharp decreases. This is one reason we may not want to overreact to price changes – they could be transitory.

Figure 2 shows the movements in oil prices – their percent change from a year earlier, in the top line – relative to the change in compensation (the lower line), since 2000. Oil prices have risen recently, but based on the history captured in this chart, one would not expect much of a response in wages and salaries. This, of course, is one reason why consumers feel worse off

after an oil supply shock. Prices at gas stations in Massachusetts are now around \$4.00 a gallon, yet most people's need to drive cars has not changed much if at all. So income available for buying other goods and services has been squeezed by the increase in oil prices.³

Some softness in measures of consumer confidence suggests that consumers tend to be less confident about the future when oil prices rise. If consumers pull back spending as a result of a supply shock, it has the potential to be a drag on the economy. The Boston Fed's statistical modeling suggests that a \$20 increase in the price of a barrel of oil will shave roughly four-tenths of a percentage point off the rate of economic growth over two years, and cause the unemployment rate to be roughly two-tenths of a percentage point higher than it would be absent the oil shock. While this is certainly not enough to completely stop the recovery, it does imply a slowing down of its pace.

Oil is not the only commodity to experience price increases of late. A variety of agricultural prices have also increased. For example, **Figure 3** shows the movement of wheat prices over the last decade. Droughts in Russia, flooding in Australia, and increased demand in emerging markets have all placed upward pressure on wheat prices.

As with oil prices, higher food prices appear to be responding to supply and demand features of this market – and these types of price changes cannot be offset by monetary policy. It goes without saying that monetary policy cannot alter the supply of oil from volatile parts of the world, nor weather conditions in countries that are major exporters of agricultural products. Monetary policy *can* have a role in insuring that relative price changes do not alter inflation expectations. Rising inflation expectations could make it difficult to achieve a moderate and acceptable inflation rate over the medium term.

Historical Experience with Supply Shocks

Supply shocks are not unique to this period. However, the evidence shows that the economic impact of supply shocks on inflation has changed over time – actually quite dramatically. **Figure 4** shows the inflation rate (total inflation and core, which again excludes food and energy) since 1970. What is striking is the way the behavior of the two series differed in the 1970 to 1985 period versus the period from 1986 to the present. The interplay of core and total inflation is very, very different in the more recent period than it was in the former.

I realize that delving into topics like total and core inflation can seem a bit abstract. So let me bring in something a bit straightforward – energy prices and inflation. **Figure 5** shows the profound effect that energy prices had in the 1970s on core inflation. In the 1970s the lines move up and down together as core inflation increased with energy prices. That is why my earlier chart shows core and total inflation moving so closely in that era. But since 1986, dramatic movements in energy prices have not affected core prices.

My next two figures look at each period separately. **Figure 6** shows that for much of that earlier period, inflation rates were much higher than they are currently. From 1970 to 1985, inflation was quite volatile – with total inflation (measured by the all-items Consumer Price Index or CPI) peaking at almost 15 percent, in 1980. The key observation is that during this period, increases in core inflation tended to follow increases in total inflation (which includes food and energy). The oil and food price increases “pulled” core inflation.

In contrast, **Figure 7** shows the total and core inflation rates since 1986. During this period, inflation has been lower and less volatile. And unlike in the earlier period, core inflation does not follow or gravitate to the level of total inflation. Total inflation jumps up and down as

food and energy prices live up to their reputation for volatility. The spikes are tough on households, to be sure. But importantly, total inflation eventually gravitates to the core measure that excludes food and energy. Core inflation stays “moored.”

Figure 8 represents another way to use the available data to explore this relationship. It too shows that the increases in total inflation in recent years have generally been temporary. For each quarter from 1998 to 2010, the figure plots the difference between total inflation and core inflation at the time, and the total inflation rate two years later. What it shows is that when there is a supply shock such that total inflation (*including* food and energy) exceeds core inflation, two years later total inflation tends to be lower – when supply shocks such as oil prices drive up total inflation relative to core, the total tends to come back down toward the core inflation rate.

Figure 9 performs similar analysis but focuses on the future *core* inflation rate, instead of the total. It shows no strong relationship. When total and core inflation diverge, core inflation tends to stay put. In other words, in recent years, when something like an oil shock causes total inflation to diverge from core, there was no consistent implication for the future core inflation rate. The shock to total inflation did not become embedded in core inflation.

Why is all this important? If supply shocks tend to have a transitory impact on headline inflation, and do not pass through to any meaningful extent into core inflation, then monetary policy need not respond to the price increases caused by the supply shock. Currently, we have experienced sharply higher food and energy prices. If the relationship we document over the last 13 years continues, we should expect the impact on inflation to be transitory – and that total inflation will converge back to core inflation, which remains well below 2 percent.

To digress, it is likely the case that supply shocks have become transitory because of the way in which monetary policy has tended to respond. So, as long as monetary policy behaves about as it has in recent years, then there is no reason to expect supply shocks to have lasting effects.

So is Fed policy behaving as it has since the mid 1980s? Interestingly, although Fed policy is perceived as exceptionally accommodative, because of hitting the zero lower bound the federal funds rate is actually higher – has come down less – than would be expected if the Fed behaved as it has over the last 25 years. The current level of the funds rate suggest that we have been *less* accommodative in recent years given that interest-rate reductions (policy easing) ran into at the zero lower bound.⁴

Why the Different Reaction to Supply Shocks Over Time?

But how confident should we be that the relationship we have experienced over the past 25 years – little response in medium term inflation rates to supply shocks – will continue? The answer is rooted in why we are seeing different reactions to supply shocks – in other words a different interplay of total and core inflation – now versus in the past.

There are a variety of reasons why medium-term inflation has not been significantly influenced by short-run supply shocks in recent years. In my view the reasons include the increased role of services in the economy, the importance of labor costs in such an economy, the reduced share of oil consumption relative to GDP, and as I mentioned earlier the improved conduct of monetary policy versus the 1960s and 1970s.⁵

Figure 10 shows that the service sector has grown from a little over 60 percent of private sector employment in 1970 to a little over 80 percent in 2010. As the economy has come to emphasize services versus manufacturing, it may be that commodities (and thus their prices) have become somewhat less important to the production of goods and services. And goods prices are more volatile than services prices, and more likely to be priced like commodities.

Figure 11 shows the per capita consumption of oil declining in the United States. Conservation measures by consumers and businesses have made the economy less dependent on oil than in the 1970s. While oil remains a very important commodity, the trend towards reducing dependence on oil provides greater insulation from oil-induced supply shocks.

Figure 12 shows the U.S. share of world oil consumption (in blue) ticking down, but also clearly shows (in red) the steady climb in the share consumed by three of the so-called emerging-market economies – China, India, and Brazil. **Figure 13** shows the growth in oil consumption in those three countries, in the upper three lines. Both charts depict quite strikingly the heightened demand for oil emanating from emerging markets.

Returning to the U.S. and inflation concerns, **Figure 14** shows that the growth rate of employee compensation has generally been declining over the past two decades. With compensation slowing and productivity increasing, many firms have been profitable and able to withstand increases in commodity prices without passing such costs on to final prices. This fits with the observation that higher food and energy prices have not tended to have much of an impact on prices in situations where food and energy are not direct costs of doing business.

Figure 15 shows two measures of inflation expectations, plotted alongside oil price movements. The red line shows what professional forecasters expected inflation to average over

the next 10 years, at various points in time. Their expectations have declined somewhat over the past 20 years, but what is striking is the relative stability of their inflation expectations. In addition, there was no significant reaction to the oil price shock that we experienced in 2008. The chart also shows a second measure of inflation expectations – the University of Michigan Survey (the green line), which asks respondents about their expectations for inflation over the next 5 to 10 years⁶. Again these expectations are not very responsive to movements in oil prices, and have remained quite stable over the past two decades.

It is worth noting that countries can be affected quite differently by supply shocks. As **Figure 16** shows, the importance of food in the “basket” of goods purchased by consumers can vary greatly by country. In less developed countries, food is a very significant component of overall purchases by consumers. In a developed country such as the United States, food is a much smaller share of overall purchases. Thus the impact of a food-supply shock on the overall inflation rate and on other important economic variables such as wages and total imports can vary widely by country. Given the different impacts of supply shocks, it is not surprising that monetary policy is likely to react differently to a supply shock such as food, depending on the unique characteristics of the particular country.

Figure 17 shows that in the United States, the importance of food as a component of inflation measures has been declining over time. And, despite improvements in energy conservation that have lowered the per capita consumption of oil, higher energy prices have contributed to recent increases in the importance of energy in the consumer price index. The fact that food and energy prices have been quite volatile recently, but remain a relatively small part of the entire basket of goods, helps to explain why core inflation rates have not been particularly responsive to food and energy shocks.

Concluding Observations

In conclusion, I recognize that recent supply shocks have caused pressures on many household budgets, and have led some analysts and observers to become concerned about potential long-term inflationary impacts. However, I think the evidence shows that over the past 25 years most supply shocks have been transitory – and have had no long-lasting imprint on longer term inflation, or on inflation expectations.

Nonetheless, recent historical trends do not always continue, so it is important to monitor inflation dynamics very closely to make sure that this pattern is continuing in the incoming data. In particular, I will look intently at whether there is any evidence that the expectations of underlying inflation have changed. To date, expectations seem quite stable and show no evidence of diverging from the recent past. I am committed to responding decisively, and as forcefully as necessary, to ensure that long-term inflation expectations remain stable and that food and energy price increases are not passing through to other prices.⁷

Given the important role of labor costs in a developed, services-focused economy such as the United States, it is important to closely monitor trends in labor markets. Currently, wages and salaries are reflecting heightened unemployment, and show no evidence that potential inflation concerns are placing upward pressure on wages and salaries.

Core inflation rates tend to be a reasonable predictor of inflation in the intermediate term. Core inflation remains well below my long-run target for inflation. This gives us flexibility to focus on accommodative monetary policy doing what it can to promote more rapid growth in the economy. As **Figure 18** illustrates, the percent of the adult population that is employed now is

quite low in relation to recent history, and has shown only a slight improvement over the course of the recovery.

So with significant slack in labor markets, stable inflation expectations, and core inflation well below our longer run target, there is currently no reason to slow the economy down with tighter monetary policy. Until we make more progress on both elements of the Federal Reserve's mandate – employment and inflation – the current, accommodative stance of monetary policy is appropriate.

Thank you.

NOTES:

¹ My colleague Geoffrey Tootell, Director of Research at the Boston Fed, has prepared an illuminating public policy brief that investigates whether commodity price spikes cause long-term inflation. The brief, which will be available at <http://www.bostonfed.org/economic/ppb/2011/ppb111.htm>, examines the relationship between trend inflation and commodity price increases and finds that evidence from recent decades supports the notion that commodity price changes do not affect the long-run inflation rate. Evidence from earlier decades suggests that effects on inflation expectations and wages played a key role in whether commodity price movements altered trend inflation.

² Readers may be interested in “Oil and the Macroeconomy in a Changing World,” the proceedings of a 2010 symposium held at the Boston Fed to explore the interactions between energy prices, growth, and inflation – the determinants of oil prices and about the effect that oil prices have on the world economy. The proceedings are available at <http://www.bostonfed.org/economic/conf/oil2010/index.htm>

³ Even future purchases can be affected, if saving for them is squeezed.

⁴ The Fed's Large-Scale Asset Purchases have partly, but not completely, substituted for the constraint imposed by the zero lower bound on policy easing. With all the excess capacity — a reflection of our inability to be as accommodative as we might have liked, given the zero bound — it seems unlikely that supply shocks will turn into increased inflation expectations that will affect wages and non-oil, non-food prices.

⁵ Vice Chair Yellen notes that “a key lesson from the experience of the late 1960s and 1970s is that the stability of longer-run inflation expectations cannot be taken for granted. At that time, the Federal Reserve's monetary policy framework was opaque, its measures of resource utilization were flawed, and its policy actions generally followed a stop-start pattern that undermined public confidence in the Federal Reserve's commitment to keep inflation under

control. Consequently, longer-term inflation expectations became unmoored, and nominal wages and prices spiraled upward as workers sought compensation for past price increases and as firms responded to accelerating labor costs with further increases in prices. That wage-price spiral was eventually arrested by the Federal Reserve under Chairman Paul Volcker, but only at the cost of a severe recession in the early 1980s. Since then the Federal Reserve has remained determined to avoid these mistakes and to keep inflation low and stable.”

[<http://www.federalreserve.gov/newsevents/speech/yellen20110411a.htm>]

⁶ The average annual expected price change they expect over the next 5 to 10 years

⁷ See for example the comments on commodity price pressures and monetary policy by my colleague William Dudley, president of the New York Federal Reserve Bank and Vice Chair of the Federal Open Market Committee: “Inflation expectations are well-anchored today and we intend to keep it that way. A sustained rise in medium-term inflation expectations would represent a threat to our price stability mandate and would not be tolerated.”

[<http://www.newyorkfed.org/newsevents/speeches/2011/dud110228.html>]

How Should Monetary Policy Respond to Price Increases Driven by Supply Shocks?

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May 4, 2011

The Debate...

- What's the likely impact of increasing food and energy prices?
- How should monetary policy respond?
 - Accommodative monetary policy appropriate given anemic recovery, high unemployment
 - Given food and energy prices, some say policy should be less accommodative

New Supply Shocks

- Political upheaval in the Middle East:
...higher oil prices
- Severe weather affecting global harvests:
...higher prices for agricultural products
- Japan's tragedy:
...disruption in global supply chain

An Important Distinction

- The Fed looks at **all** prices, including food and energy, when developing policy
- **Core** measures of inflation take out volatile food and energy
- Often we use core as a **guide** to where overall inflation is likely to go
- But our goal is to stabilize **overall** inflation

Effects of a Supply Shock: *Near Term*

- A supply shock can slow economic growth (reduces spending on other things)
- Other prices may be initially unaffected – total inflation rises, but not core inflation

Monetary tightening would likely worsen the shock's impact for households and businesses

Effects of a Supply Shock: *Longer Term*

- Longer-run impact on other prices depends on how inflation **expectations** respond...
 - If people expect it's temporary and the central bank will act, then the rise in total inflation will be temporary:
 - **total will converge with core (...the experience since 1986)**
 - If inflation expectations do rise, then wages and salaries will be pressured to increase in time to keep pace:
 - **other prices will be affected and core will converge with total (...the experience in the 1970s and early 1980s)**

My Outlook

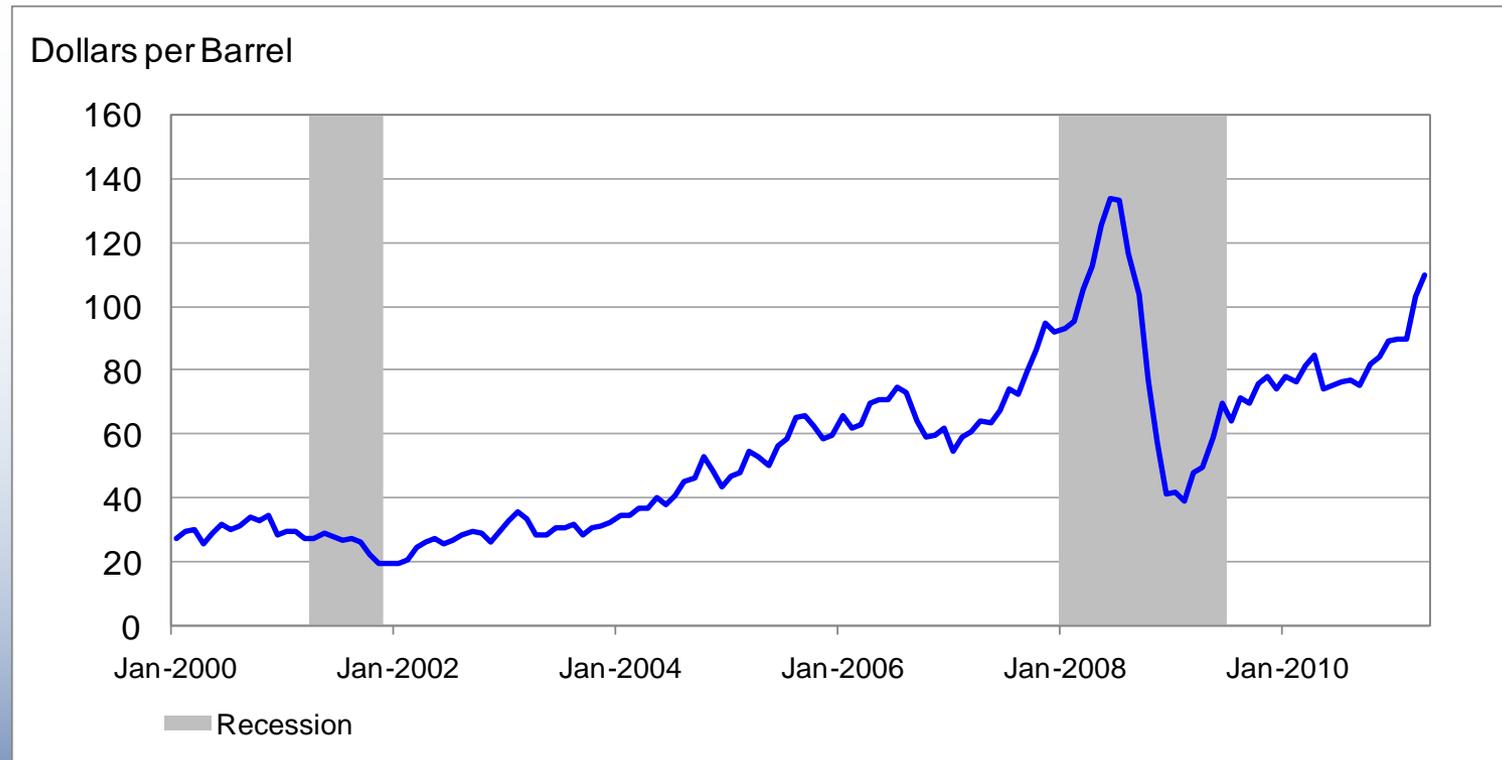
- The Fed will ensure that inflation remains contained over time
- Supply shocks will bring slower growth near term; only modest effects on longer-term inflation
- Unemployment is high (8.8%); shocks mean a somewhat slower return to full employment
- Core inflation is low (a bit above 1% in prior year)

*Thus the current accommodative stance of monetary policy is **appropriate**, and can continue to support growth and both elements of the Fed mandate*

Figure 1

Spot Oil Price: West Texas Intermediate Crude Oil

January 2000 - April 2011

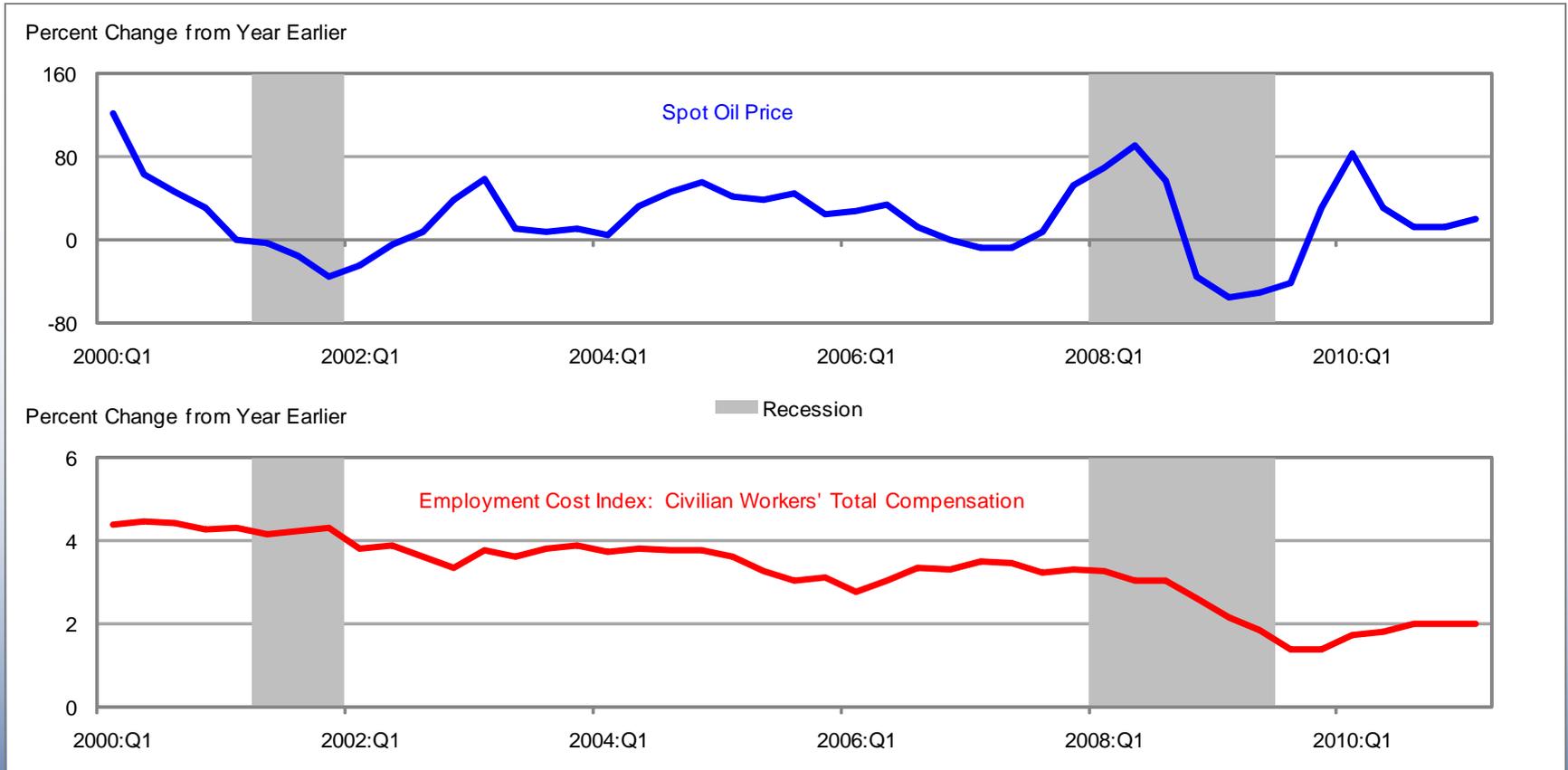


Source: WSJ, NBER / Haver Analytics

Figure 2

Oil Prices and Wages

2000:Q1 - 2011:Q1

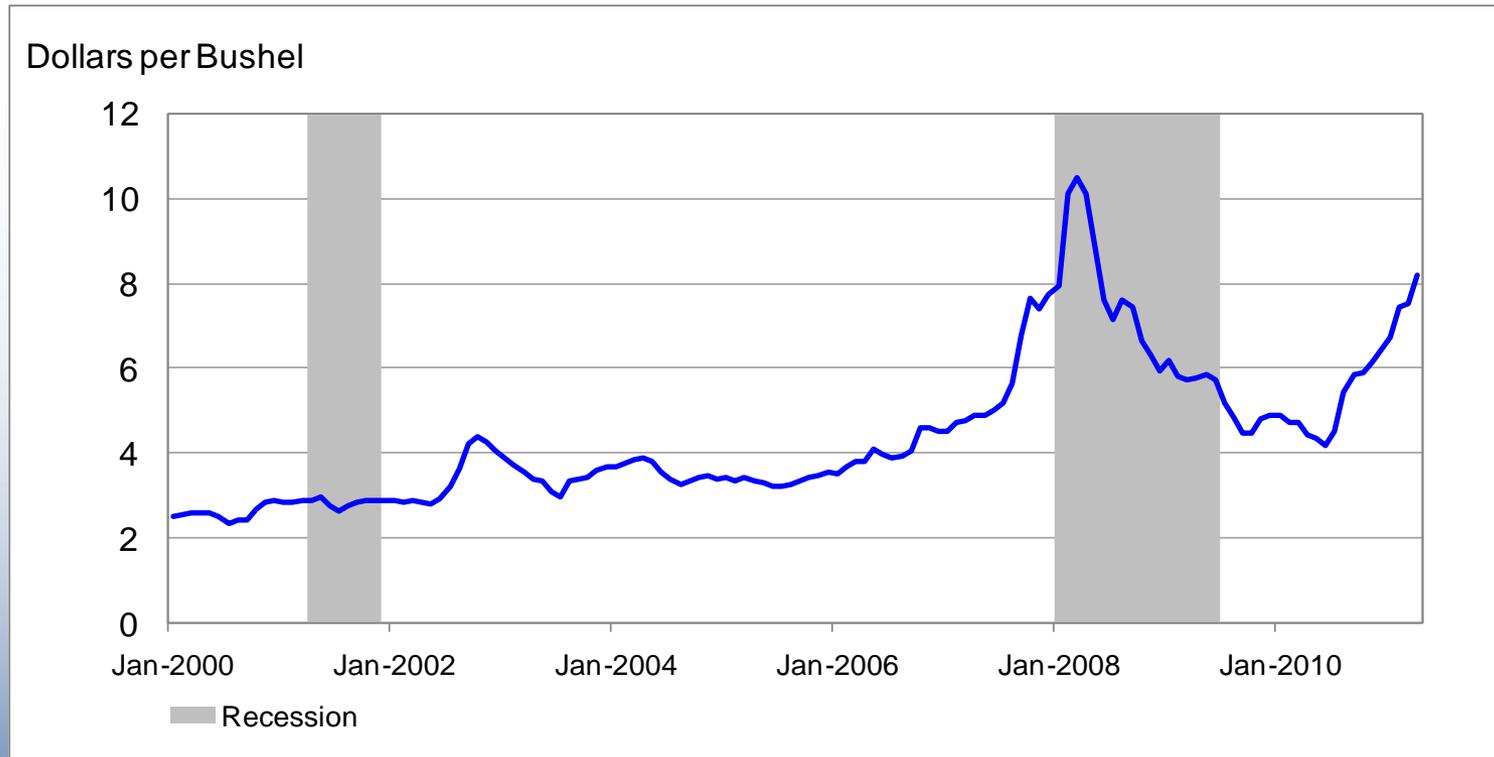


Source: WSJ, BLS, NBER / Haver Analytics

Figure 3

Wheat Prices Received by Farmers

January 2000 - April 2011



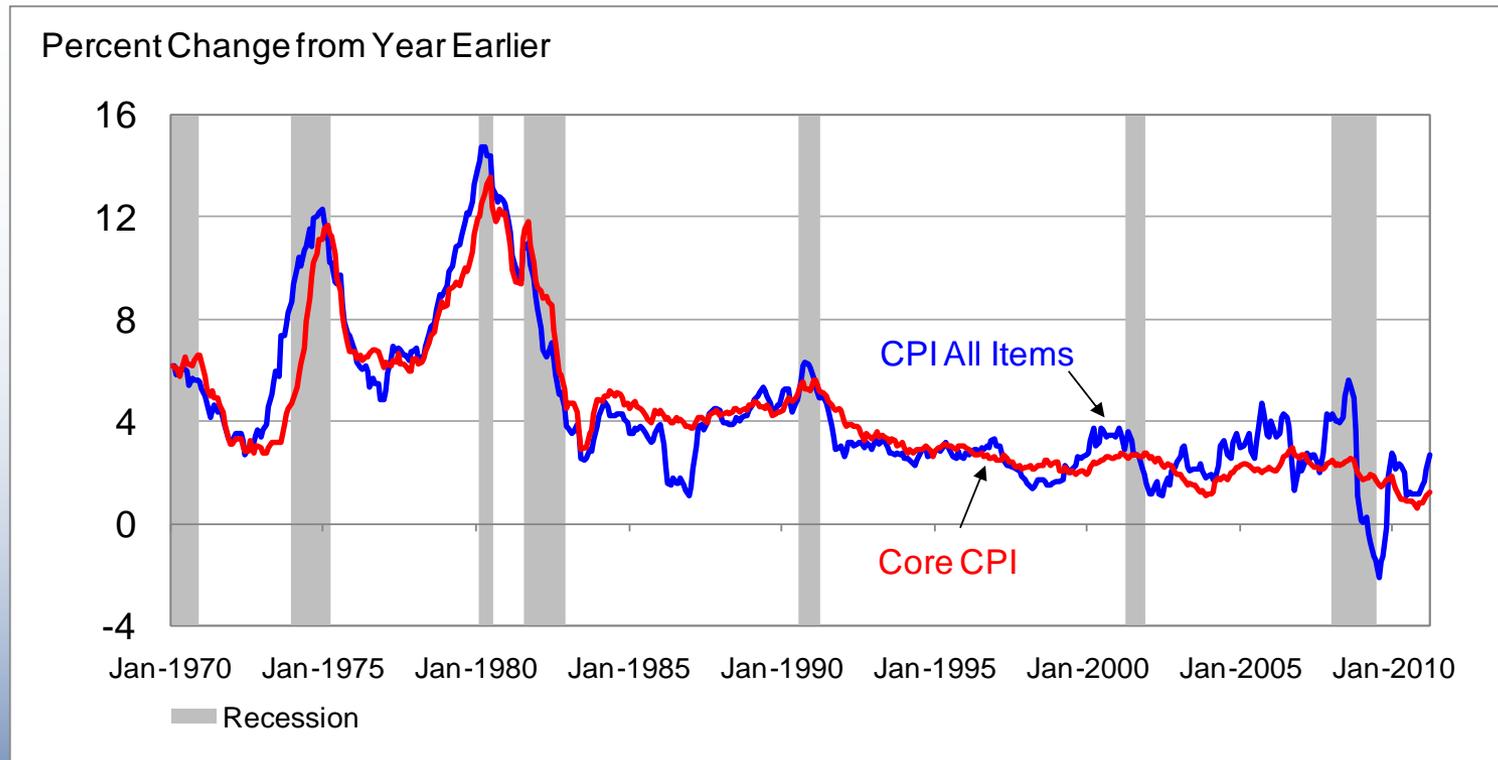
Source: USDA, NBER / Haver Analytics

Figure 4

Inflation Rate:

Core and All-Items Consumer Price Indexes

January 1970 - March 2011



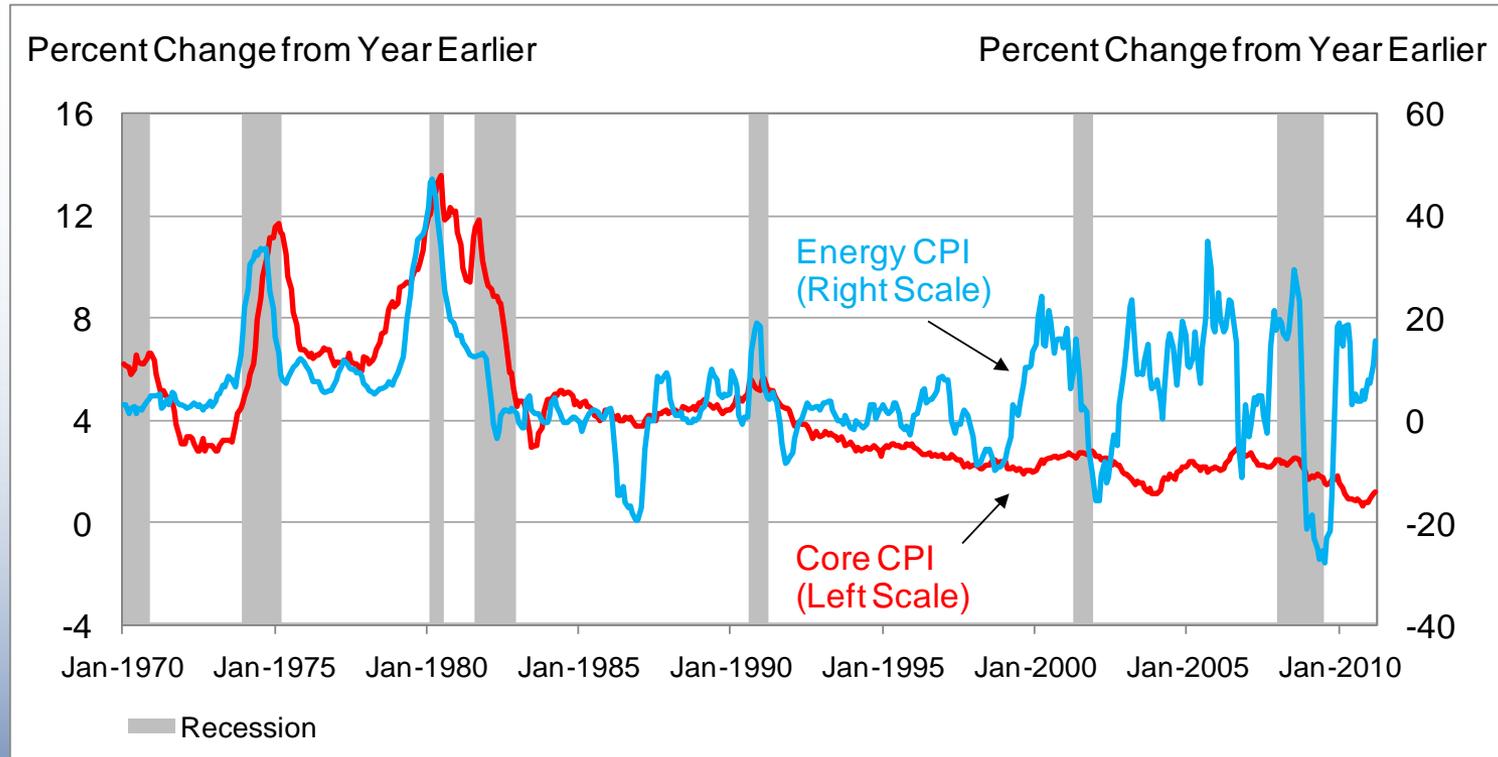
Source: BLS, NBER / Haver Analytics

Figure 5

Inflation Rate:

Core and Energy Consumer Price Indexes

January 1970 - March 2011



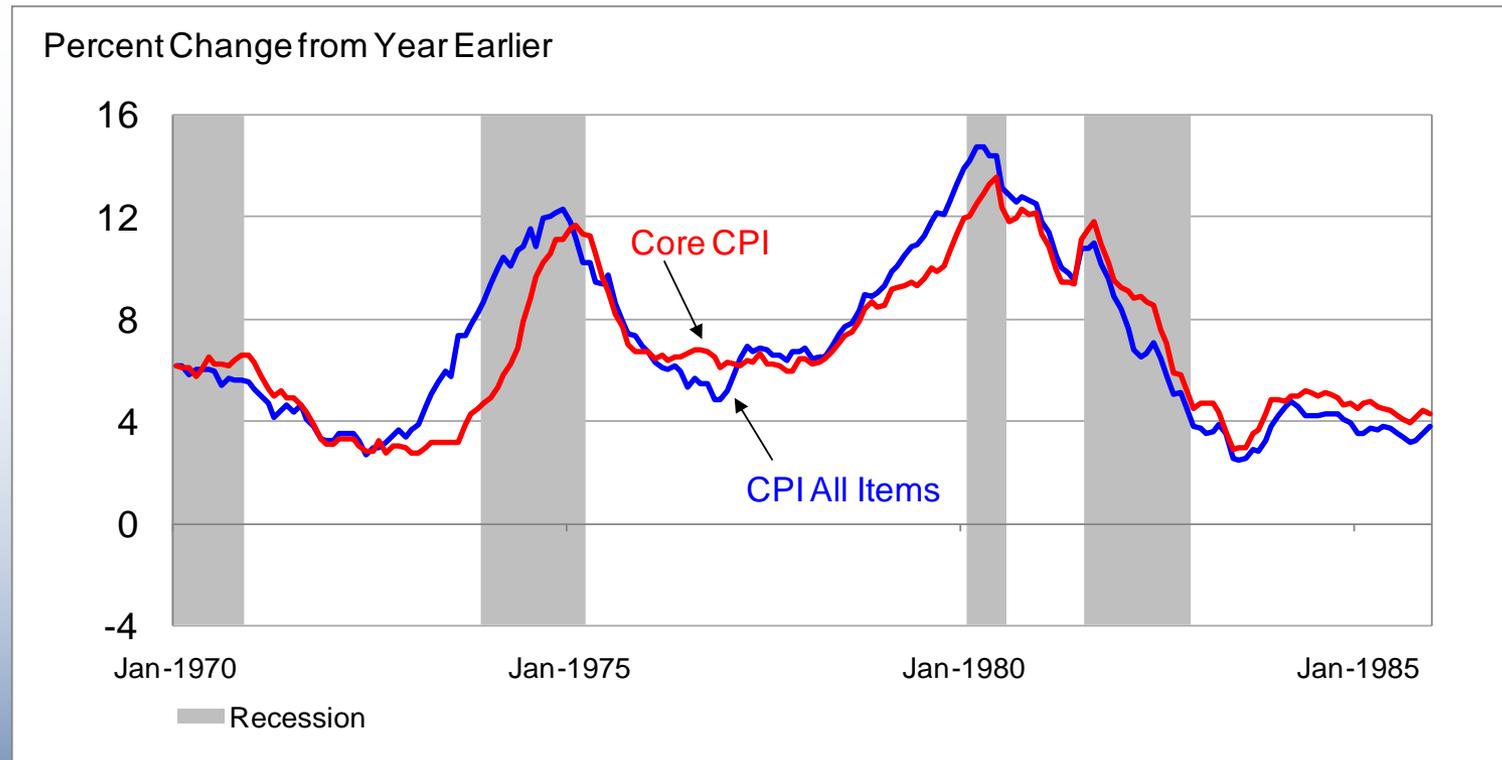
Source: BLS, NBER / Haver Analytics

Figure 6

Inflation Rate, 1970 - 1985:

Core and All-Items Consumer Price Indexes

January 1970 - December 1985



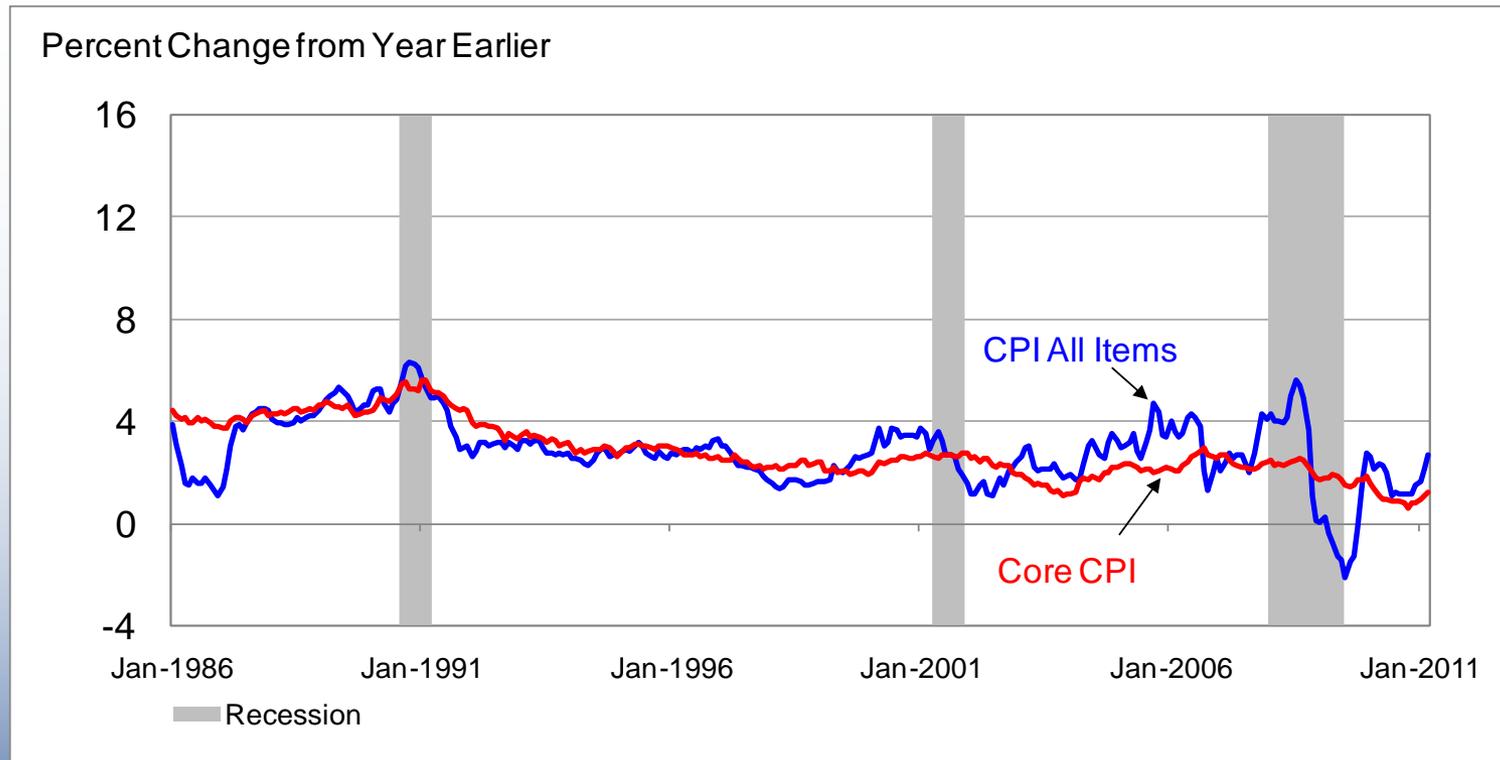
Source: BLS, NBER / Haver Analytics

Figure 7

Inflation Rate, 1986 - 2011:

Core and All-Items Consumer Price Indexes

January 1986 - March 2011

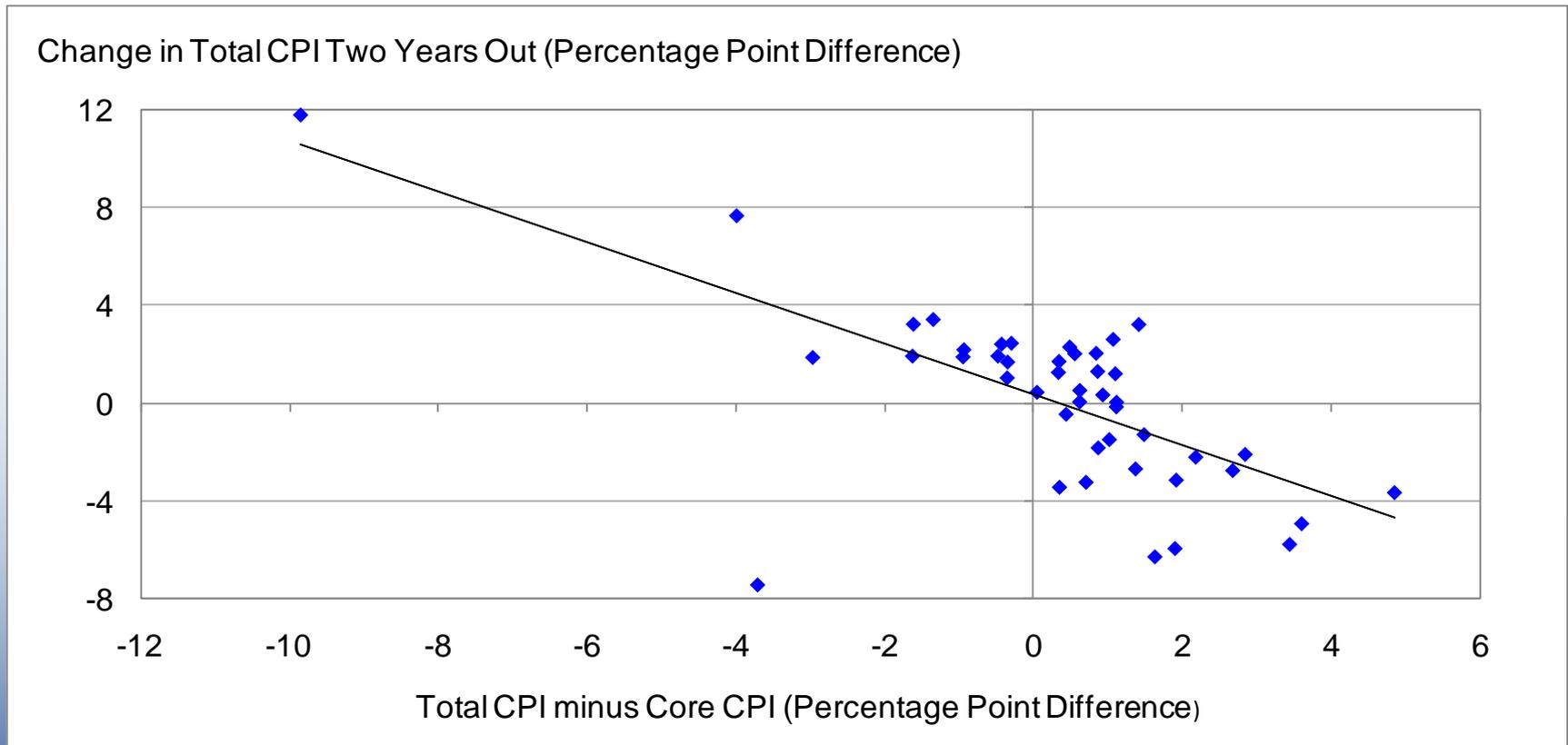


Source: BLS, NBER / Haver Analytics

Figure 8

Gap Between Total and Core Inflation vs Change in Total Inflation

1998:Q1 - 2011:Q1

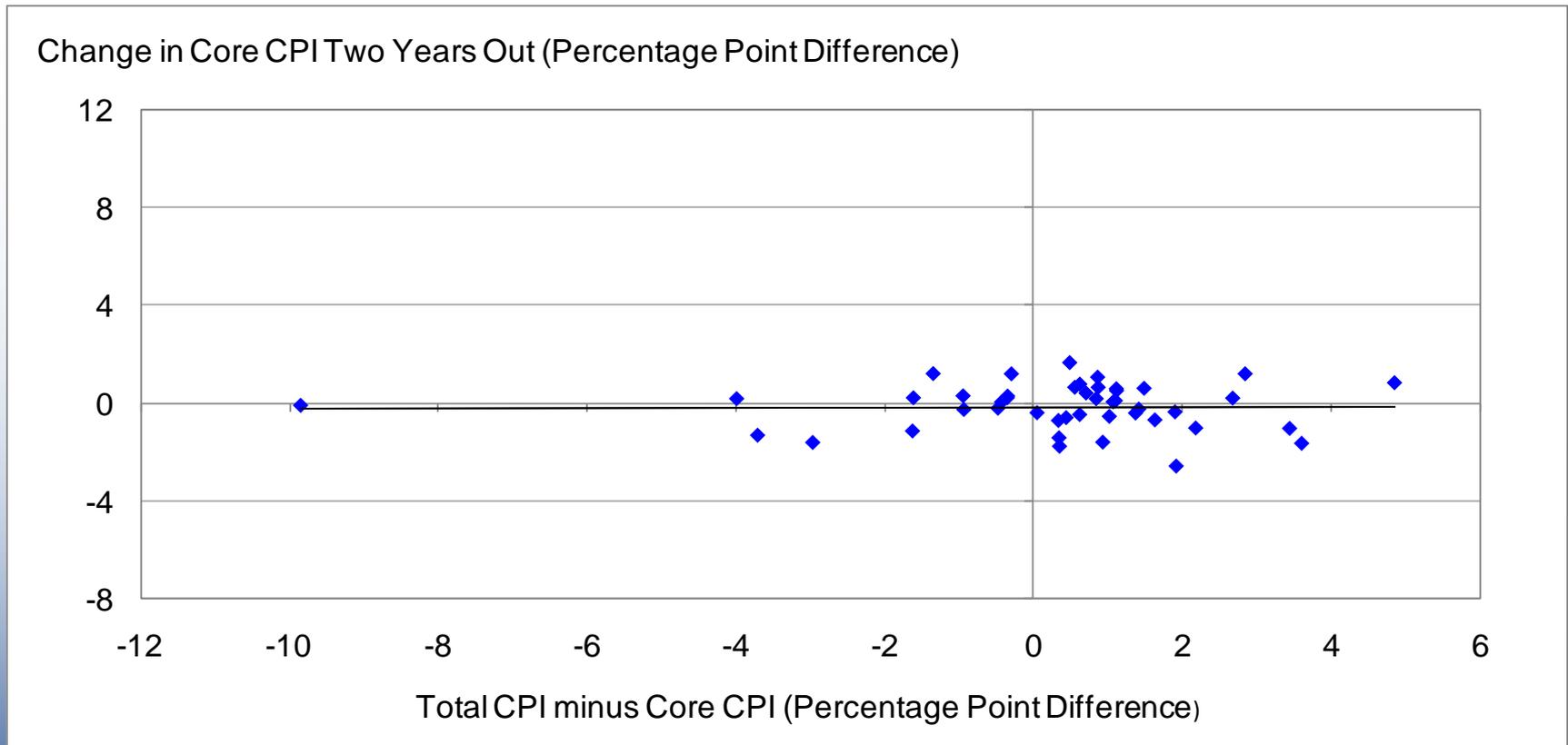


Source: BLS / Haver Analytics

Figure 9

Gap Between Total and Core Inflation vs Change in Core Inflation

1998:Q1 - 2011:Q1

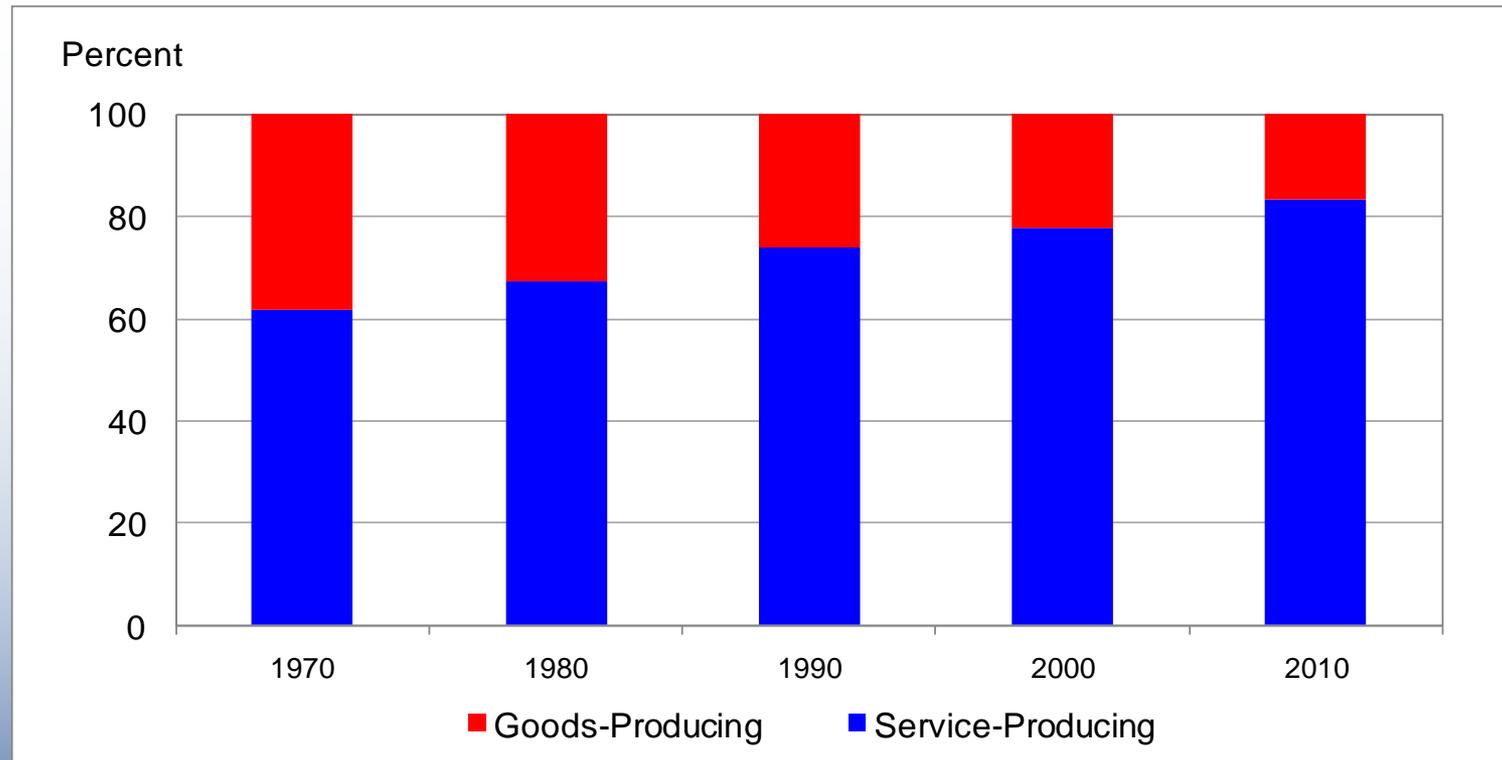


Source: BLS / Haver Analytics

Figure 10

Distribution of Private-Sector Employment between Goods-Producing and Service-Producing Industries

1970 - 2010

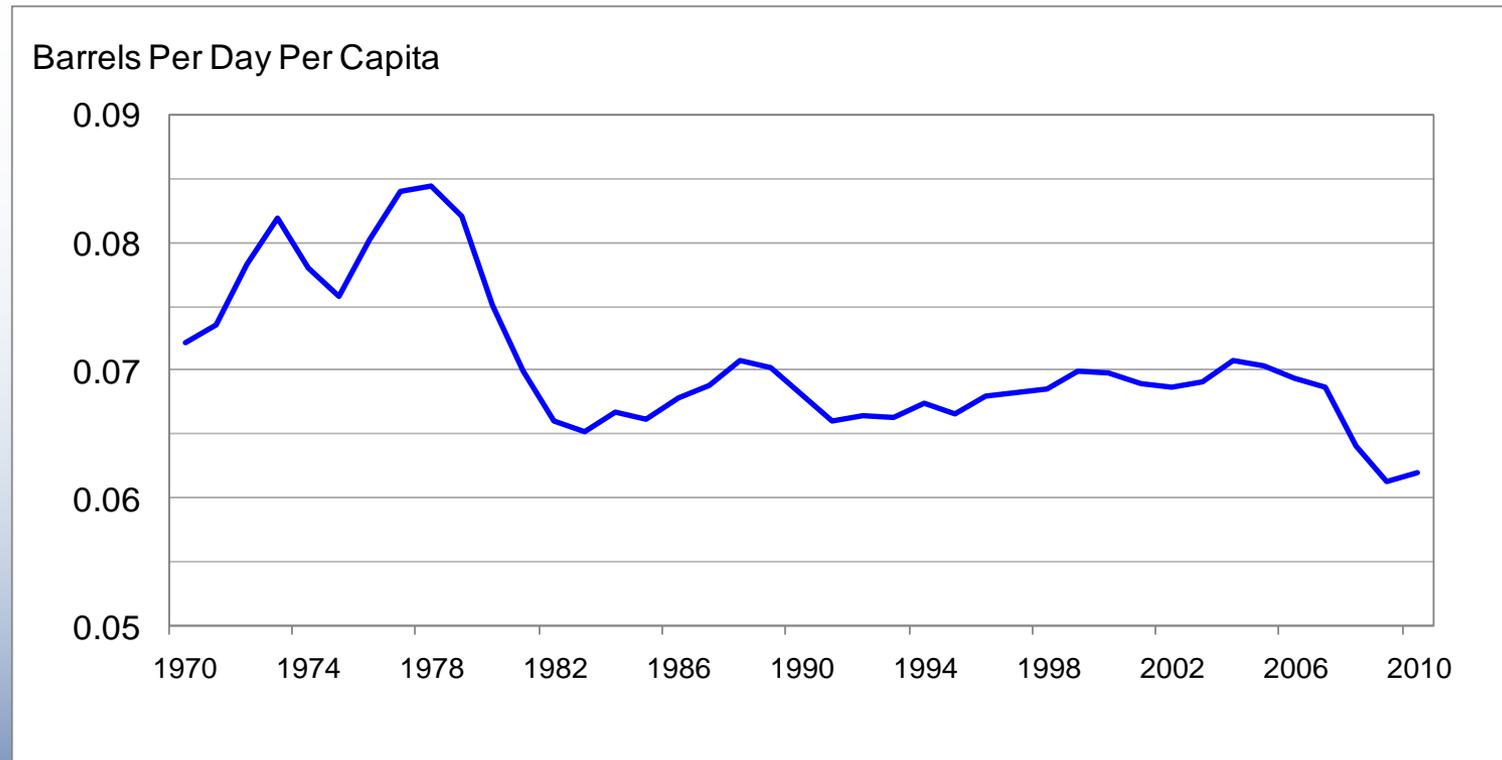


Source: BLS / Haver Analytics

Figure 11

US Per Capita Oil Consumption

1970 - 2010

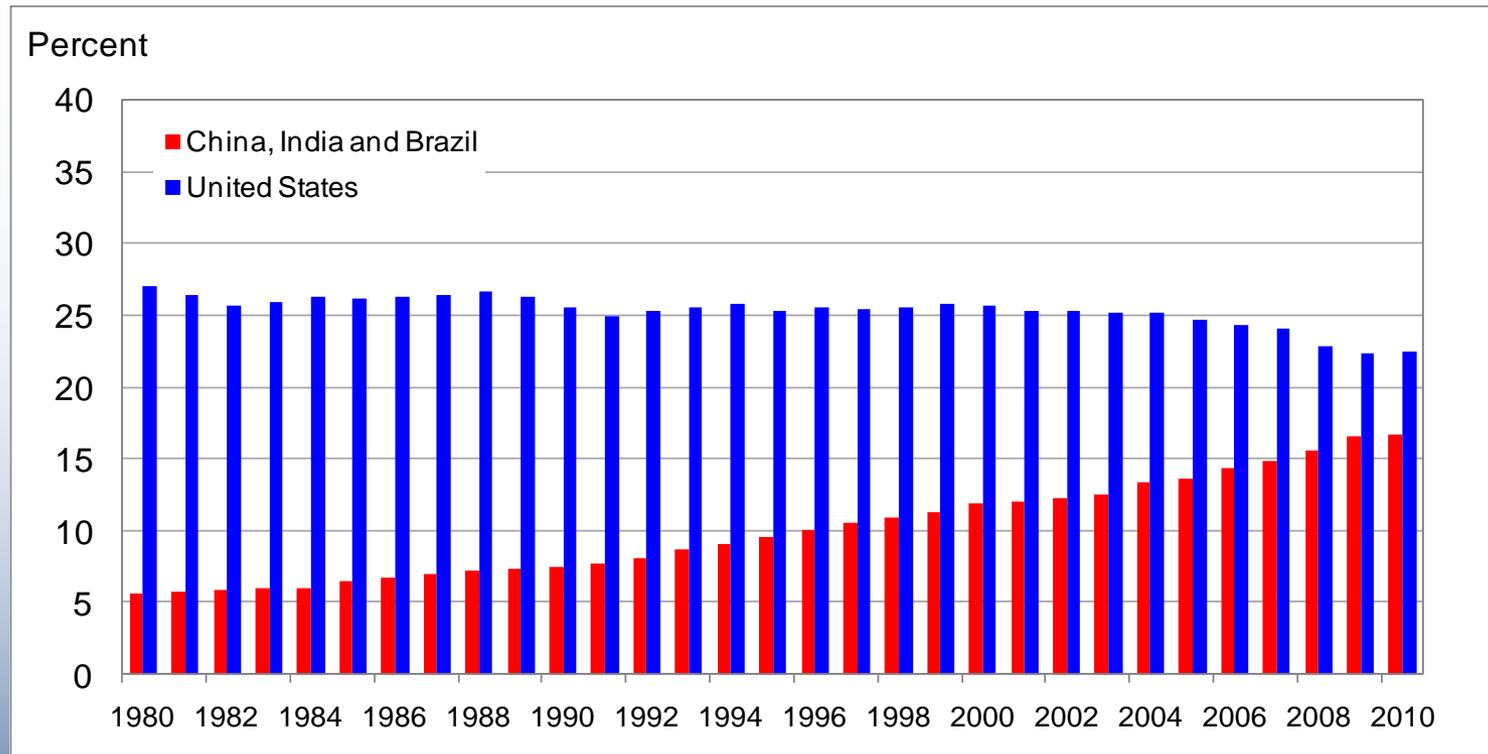


Source: Energy Information Administration, Census Bureau / Haver Analytics

Figure 12

Share of World Oil Consumption

1980 - 2010



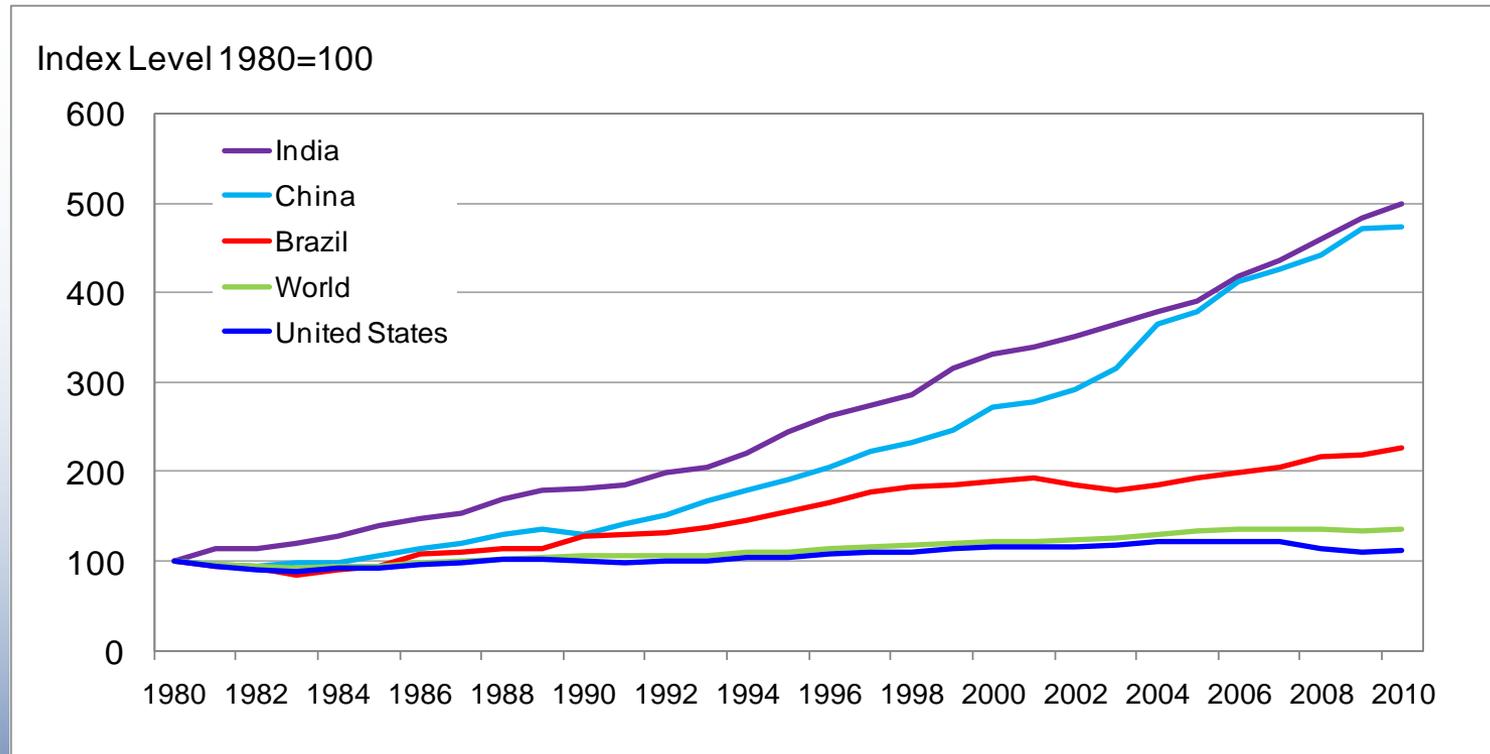
Note: Figures for 2010 are based on Energy Information Administration forecasts

Source: Energy Information Administration

Figure 13

Growth in World Oil Consumption

1980 - 2010



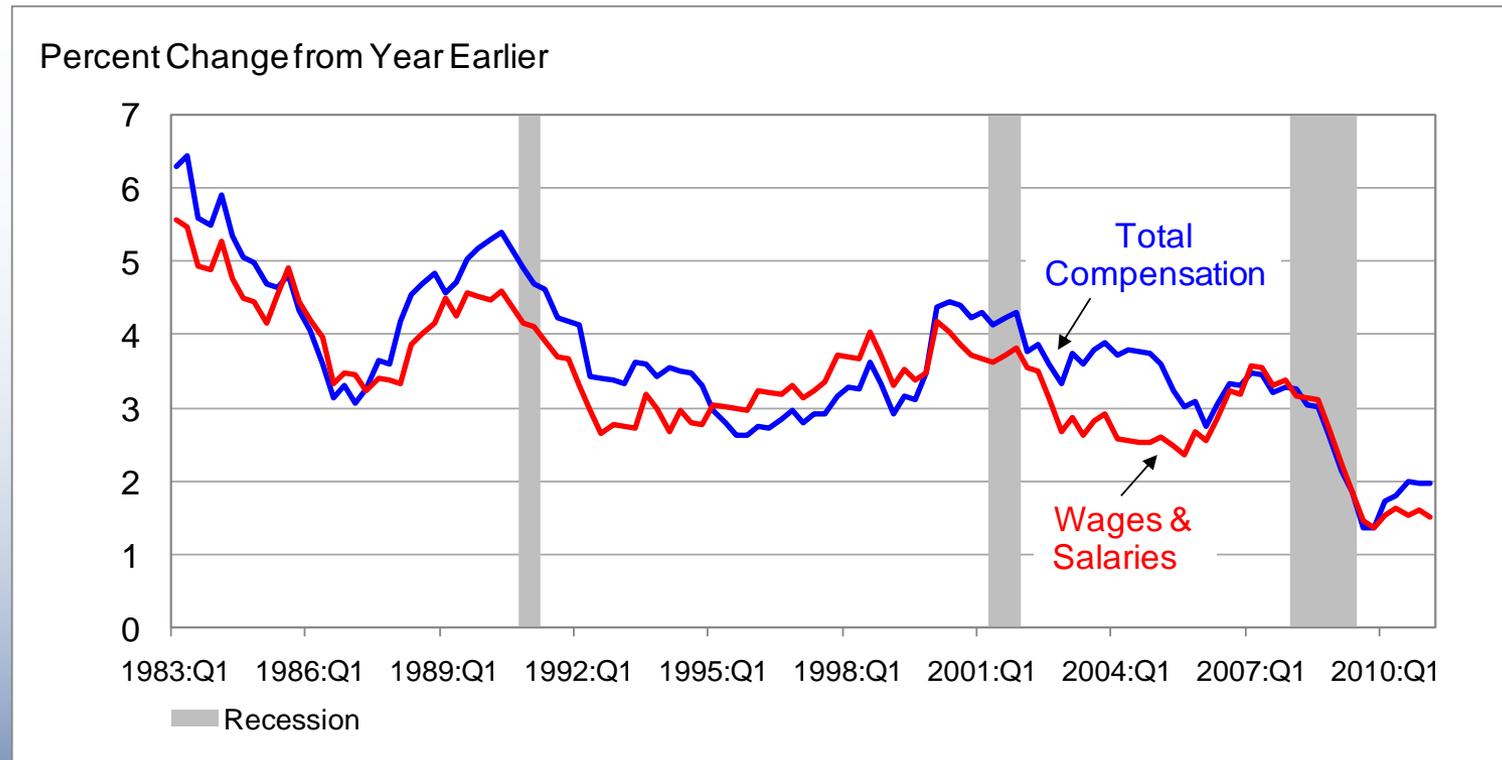
Note: Figures for 2010 are based on Energy Information Administration forecasts

Source: Energy Information Administration

Figure 14

Employment Cost Indexes for Civilian Workers

1983:Q1 - 2011:Q1

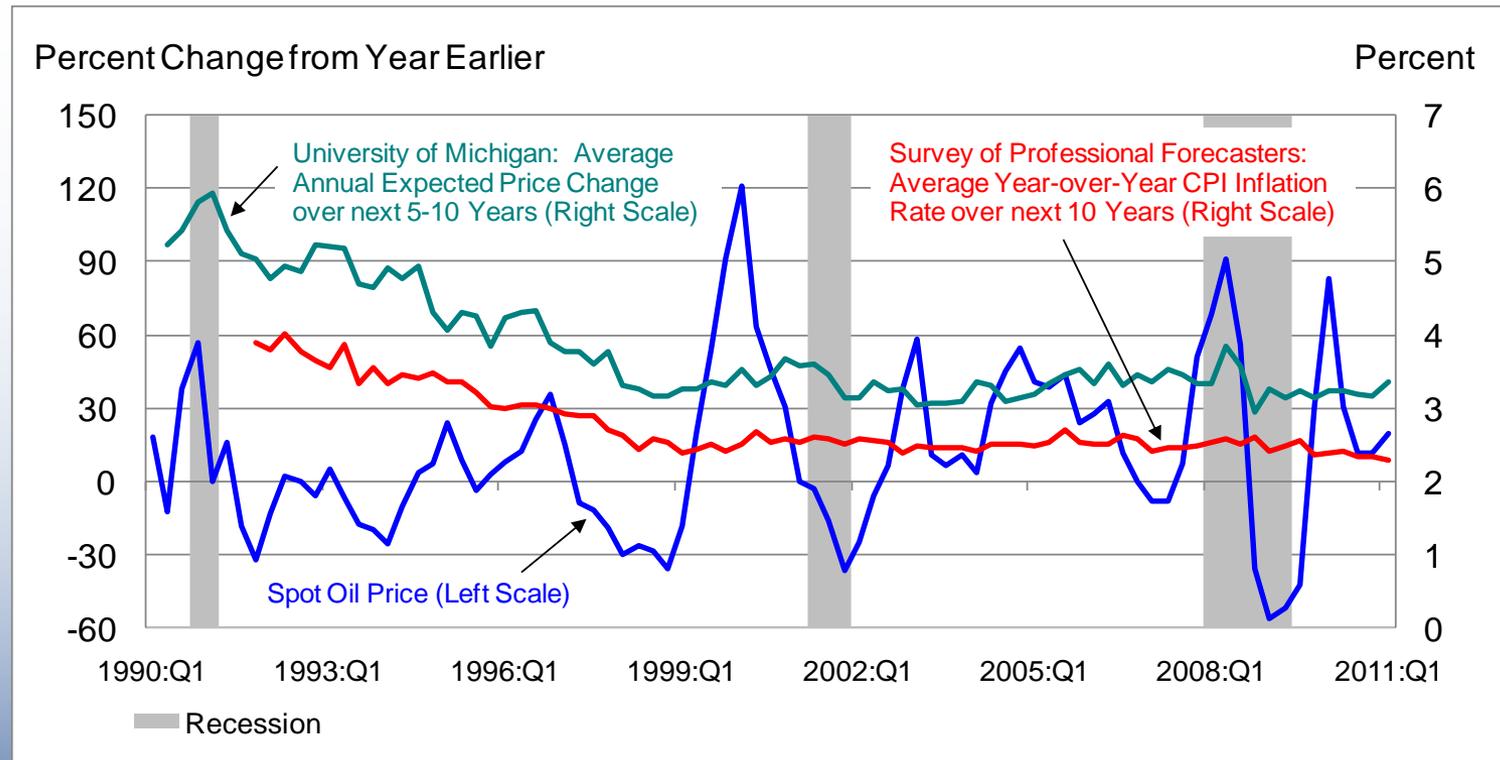


Source: BLS, NBER / Haver Analytics

Figure 15

Long-Term Expected Inflation and Oil Prices

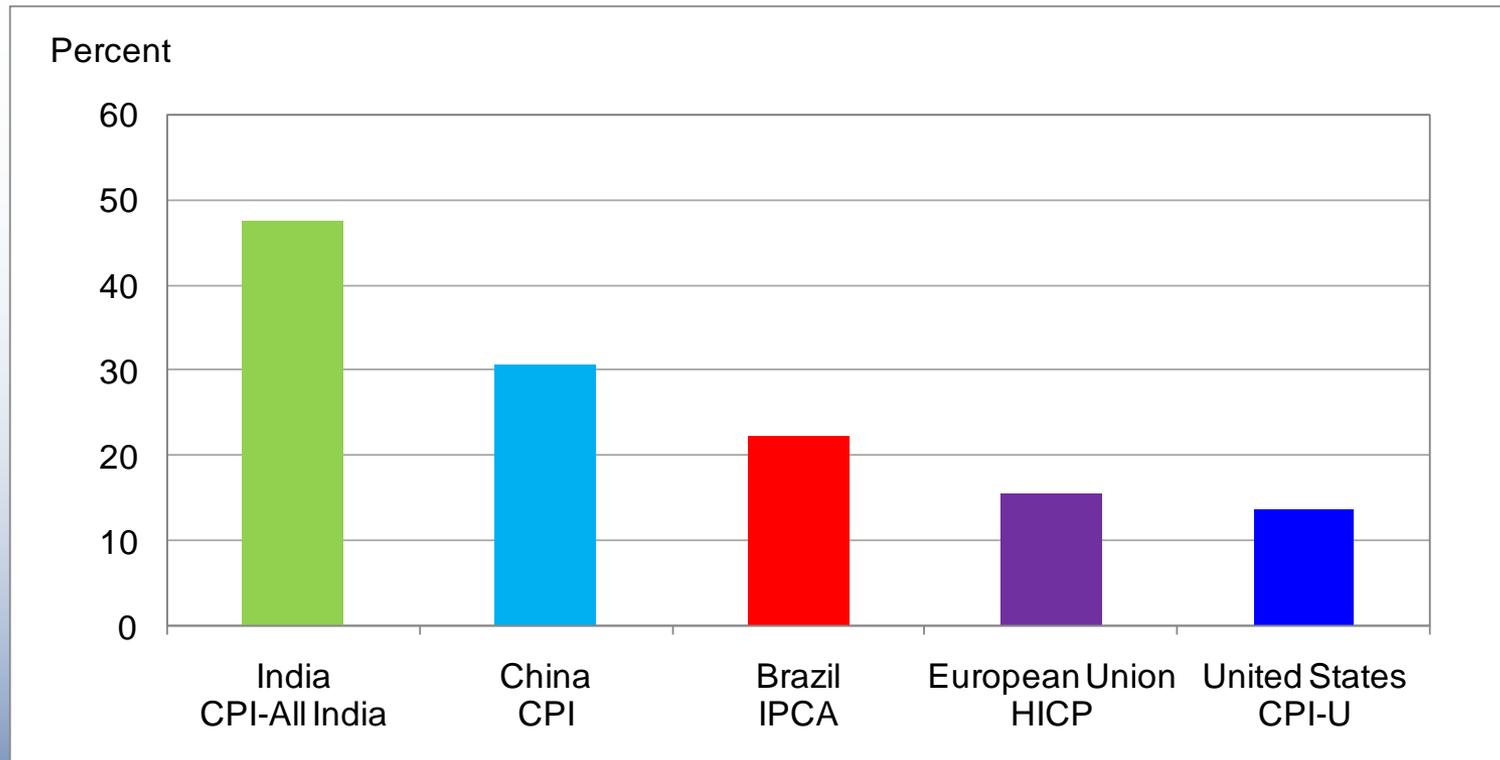
1990:Q1 - 2011:Q1



Source: Thomson Reuters / University of Michigan, Federal Reserve Bank of Philadelphia, WSJ, NBER / Haver Analytics

Figure 16

Inflation Components: Relative Importance of Food Component of CPI by Country



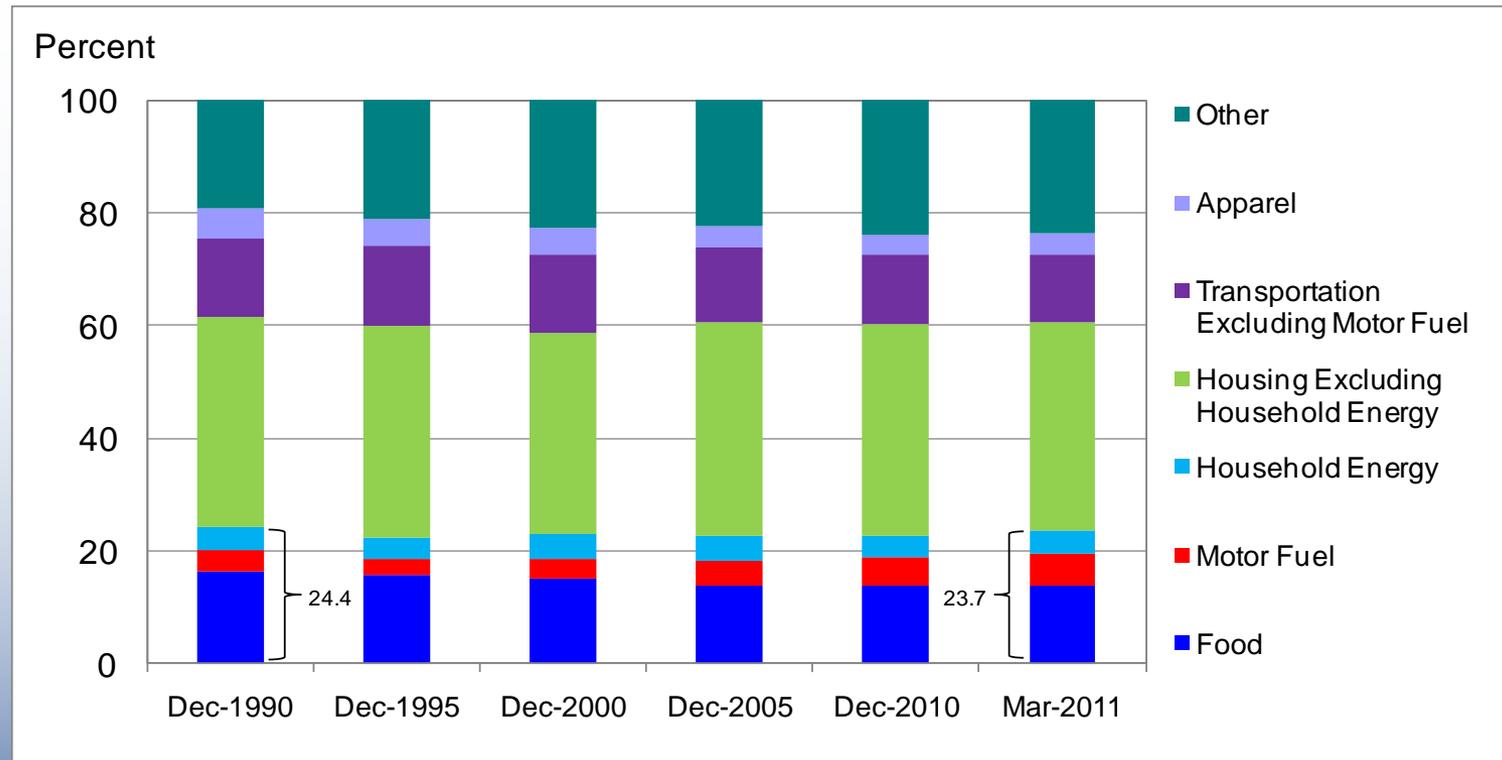
Source: India - CSO, China - The Economist, Brazil - IBGE, EU - Eurostat, US - BLS

Figure 17

Inflation Components:

Relative Importance of US CPI Components

December 1990 - March 2011



Source: BLS / Haver Analytics

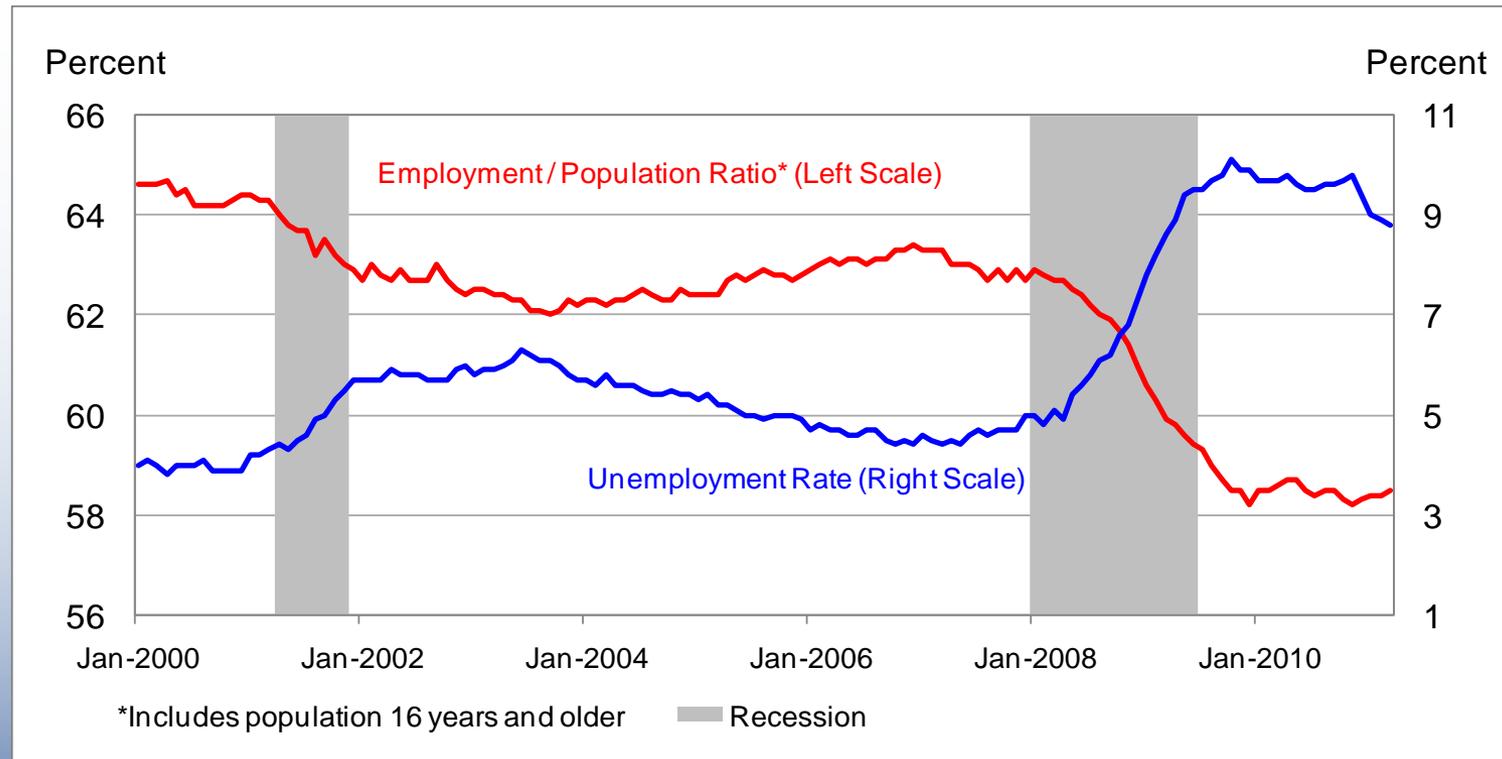
Concluding Observations

- Recent supply shocks have pressured households; raised concern about long-term inflationary impacts
- But evidence shows that over the last 25 years most supply shocks have been transitory, for inflation and expectations
- Still, recent trends don't always continue, so we must monitor inflation dynamics closely
- To date, inflation expectations seem stable
- Must respond as forcefully as necessary should that change
- Currently, wages and salaries reflect the slack in labor markets...

Figure 18

Civilian Unemployment Rate and Employment / Population Ratio

January 2000 - March 2011



Source: BLS, NBER / Haver Analytics

Concluding Observations Continued...

- Central tendency of FOMC participants expects core inflation to remain low
- Currently no reason to slow the economy down with tighter monetary policy
- Until there is progress on both elements of the Fed's mandate (stable prices and employment) the accommodative stance of policy is appropriate