Economic Trends

In This Issue:

FEDERAL RESERVE BANK
of CLEVELAND

Yield Curve and Predicted GDP Growth, March 2011

Covering February 25, 2011–March 25, 2011
by Joseph G. Haubrich and Timothy Bianco

Highlights

	March	February	January
3-month Treasury bill rate (percent)	0.09	0.11	0.15
10-year Treasury bond rate (percent)	3.29	3.60	3.36
Yield curve slope (basis points)	320	349	321
Prediction for GDP growth (percent)	1.0	1.0	1.0
Probabilty of recession in 1 year (percent)	0.9	0.7	1.2

Overview of the Latest Yield Curve Figures

Over the past month, the yield curve flattened, as long rates dropped sharply, reversing their pattern of the past several months. Short rates edged down yet again. The three-month Treasury bill rate moved down into the single-digit range, at 0.09 percent, down from February's 0.11 percent, and January's 0.15 percent. The ten-year rate dropped to 3.29 percent, down from February's 3.60 percent, and even below January's 3.36 percent. The slope dropped by a full 29 basis points, and is now just above January's level of 321 basis points.

Projecting forward using past values of the spread and GDP growth suggests that real GDP will grow at about a 1.0 percent rate over the next year, the same numbers as January and February. The strong influence of the recent recession is leading toward relatively low growth rates, with a steady beat of 1 percent predictions. Although the time horizons do not match exactly, the forecast comes in on the more pessimistic side of other forecasts, although, like them, it does show moderate growth for the year.

Using the yield curve to predict whether or not the economy will be in recession in the future, we estimate that the expected chance of the economy being in a recession next March is 0.9 percent, up slightly from February's 0.7 percent and slightly down from January's 1.2 percent.

## The Yield Curve as a Predictor of Economic Growth

The slope of the yield curve—the difference between the yields on short- and long-term maturity bonds—has achieved some notoriety as a simple forecaster of economic growth. The rule of thumb is that an inverted yield curve (short rates above long rates) indicates a recession in about a year, and yield curve inversions have preceded each of the last seven recessions (as defined by the NBER). One of

Yield Curve Spread and Real GDP Growth

Percent
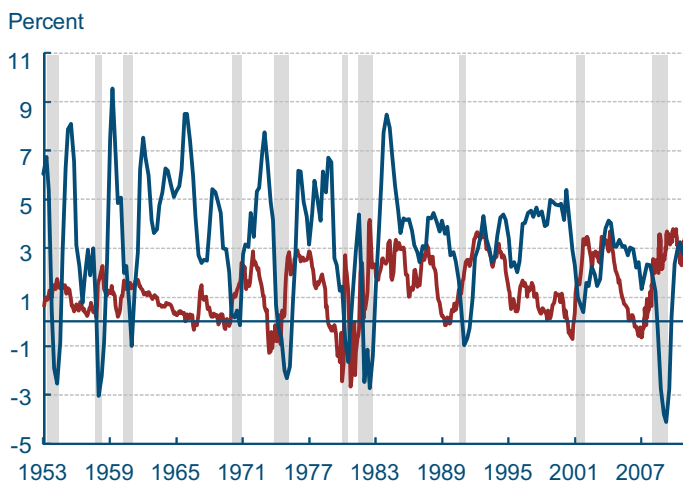
Note: Shaded bars indicate recessions.
Source: Bureau of Economic Analysis, Federal Reserve Board.

Yield Spread and Lagged Real GDP Growth

Percent

One-year lag of GDP growth (year-over-year change)

Ten-year minus three-month yield spread
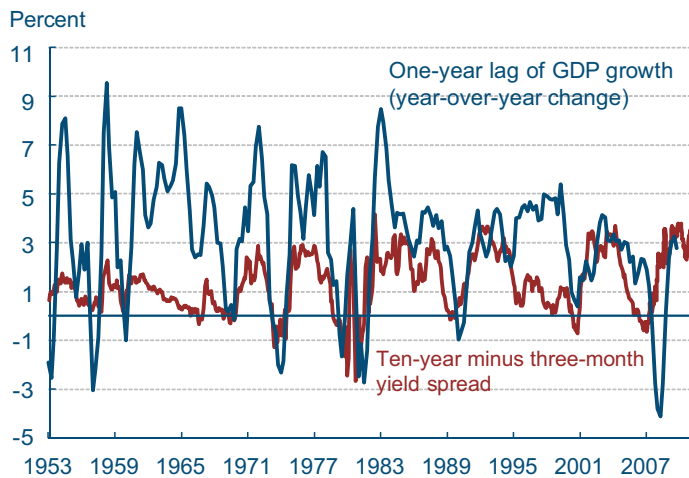
Sources: Bureau of Economic Analysis, Federal Reserve Board.

Yield Curve Predicted GDP Growth

Percent

GDP growth (year-over-year change)

Predicted GDP growth

Ten-year minus three-month yield spread
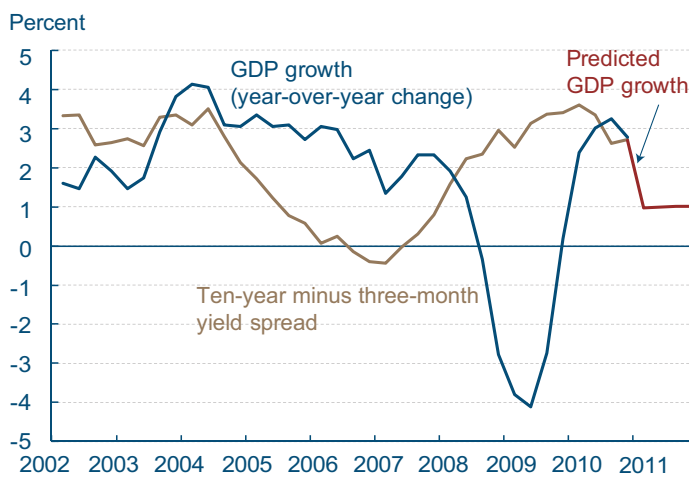
Sources: Bureau of Economic Analysis, Federal Reserve Board, authors' calculations.

Recession Probability from Yield Curve

Percent probability, as predicted by a probit model

Probability of recession

Forecast
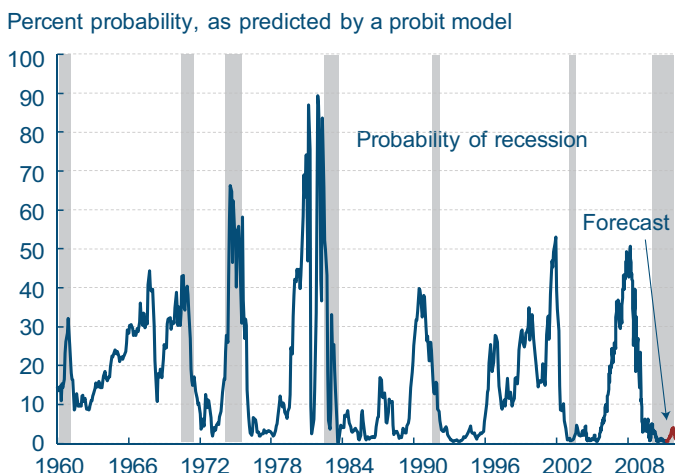
Note: Shaded bars indicate recessions.
Sources: Bureau of Economic Analysis, Federal Reserve Board, authors' calculations.

the recessions predicted by the yield curve was the most recent one. The yield curve inverted in August 2006, a bit more than a year before the current recession started in December 2007. There have been two notable false positives: an inversion in late 1966 and a very flat curve in late 1998.

More generally, a flat curve indicates weak growth, and conversely, a steep curve indicates strong growth. One measure of slope, the spread between ten-year Treasury bonds and three-month Treasury bills, bears out this relation, particularly when real GDP growth is lagged a year to line up growth with the spread that predicts it.

Predicting GDP Growth

We use past values of the yield spread and GDP growth to project what real GDP will be in the future. We typically calculate and post the prediction for real GDP growth one year forward.

Predicting the Probability of Recession

While we can use the yield curve to predict whether future GDP growth will be above or below average, it does not do so well in predicting an actual number, especially in the case of recessions. Alternatively, we can employ features of the yield curve to predict whether or not the economy will be in a recession at a given point in the future. Typically, we calculate and post the probability of recession one year forward.

Of course, it might not be advisable to take these number quite so literally, for two reasons. First, this probability is itself subject to error, as is the case with all statistical estimates. Second, other researchers have postulated that the underlying determinants of the yield spread today are materially different from the determinants that generated yield spreads during prior decades. Differences could arise from changes in international capital flows and inflation expectations, for example. The bottom line is that yield curves contain important information for business cycle analysis, but, like other indicators, should be interpreted with caution.

For more detail on these and other issues related to using the yield curve to predict recessions, see the Commentary "Does the Yield Curve Signal Recession?" The Federal Reserve Bank of New York also maintains a website with much useful information on the topic, including their own estimate of recession probabilities.

How Should We Measure Success?

10-Year Treasury Yields and FOMC Policy

Percent

First round of asset purchases
Expansion of asset purchases
Reinvestment strategy
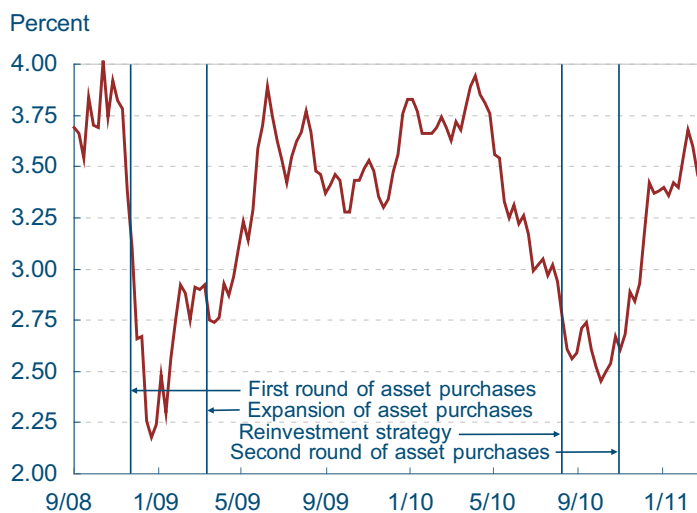Second round of asset purchases

Source: Federal Reserve Board.

03.24.11
by Todd Clark and John Lindner

In the nearly two and a half years since the onset of the financial crisis, the Fed has purchased over $2 trillion in long-term assets. Determining the effectiveness of such a policy is challenging for a number of reasons, including the lack of prior experience with this monetary policy tool. One approach is to examine changes in interest rates to assess how financial markets react to announcements related to and preceding policy decisions. A second approach is to look broadly at the overall effect that the purchases have had on macroeconomic conditions. This article uses both approaches to judge the effectiveness of the Federal Reserve's large-scale asset purchases.

A simple plot of the 10-year Treasury yield suggests that the Federal Reserve's asset purchases were effective in lowering bond yields. For example, yields declined sharply with the announcements of the first round of asset purchases in late 2008 and the most recent round in November 2010.

However, judging the effectiveness of asset purchases from broad movements in Treasury yields is complicated by several factors. First, compared to other financial assets such as mortgage-backed securities, Treasury bonds have a special function for investors as a highly liquid and safe investment. Times of stress in financial markets can induce what is known as a flight to safety, in which investors sell other assets and buy Treasuries. This rush to safe securities pushes the price of Treasuries up and yields down. For example, some portion of the fall in 10-year Treasury yields in late 2008 is almost certainly attributable to the rush to safe securities by foreign and domestic investors.

Because of this complexity in the Treasury market, other rates might provide a clearer picture about the effects of the purchases. The bulk of the first round of asset purchases was made in mortgage-backed securities, so the 30-year mortgage rate and the yield on a 30-year mortgage bond should reflect

30-Year Mortgage Rates and FOMC Policy

Percent

First round of asset purchases
Expansion of asset purchases
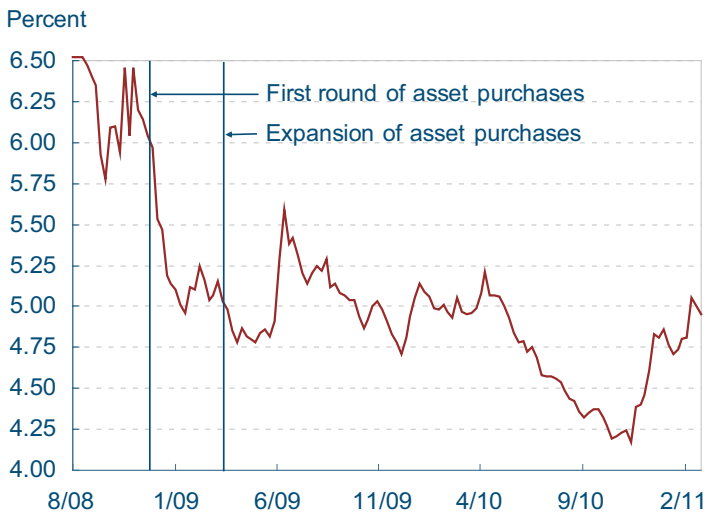
Source: Federal Reserve Board.

Mortgage Bond Rates and FOMC Policy

Percent

First round of asset purchases
Expansion of asset purchases
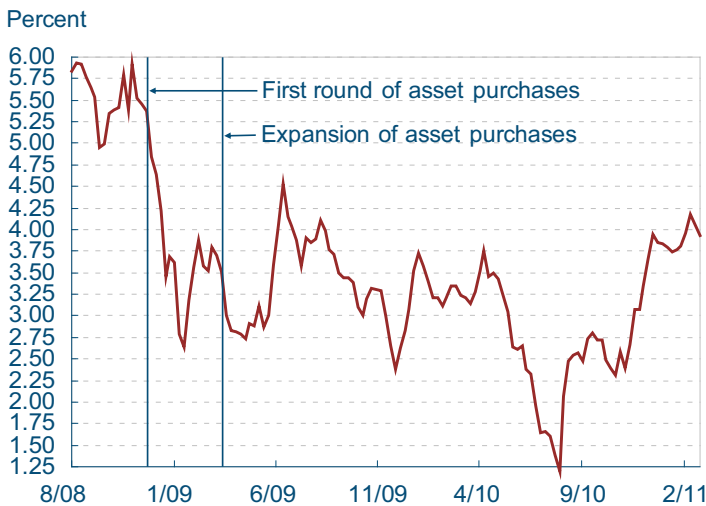
Sources: Bank of America, Merrill Lynch.

Agency Debt Yields and FOMC Policy

Percent

First round of asset purchases
Expansion of asset purchases
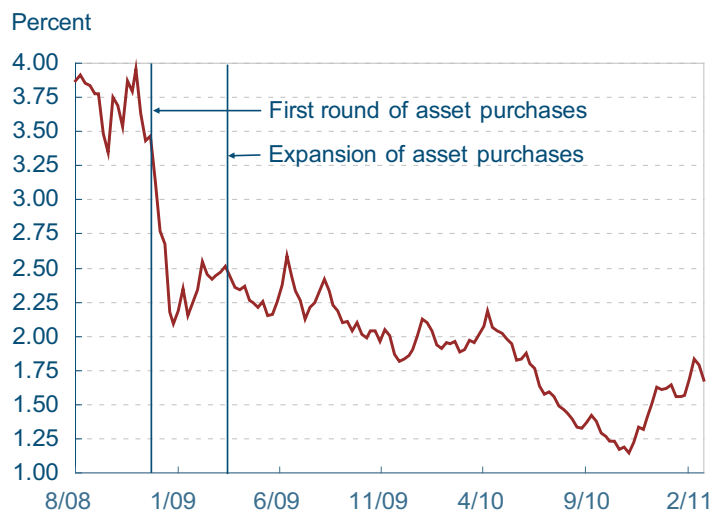
Sources: Bank of America, Merrill Lynch.

an impact if there was one, as might AAA-rated agency debt. Due to the general lack of liquidity in these securities during the financial crisis, their prices should have incorporated fewer market events. In the graphs for these rates, it is easier to see that the announcements on policy decisions and the announcements on policy direction seemed to help ease conditions. The interest rates associated with these securities all fell significantly on the initial announcement, and they also experienced smaller drops following later events.

Some other aspects of financial markets also complicate determining the effects of monetary policy changes on the yields of both Treasury bonds and mortgage-related securities. First, financial markets can anticipate some asset purchases before a formal announcement, particularly if policymakers use speeches to signal the possibility of a coming policy decision. For example, many observers believe that public comments by Federal Reserve Chairman Ben Bernanke in August 2010 led to some anticipation of the Treasury bond purchases—and a decline in Treasury bond rates—that the FOMC announced in November 2010.

Second, bond yields quickly react to news on the economy. Many of the ups and downs in Treasury yields reflect good (resulting in upward moves in yields) or bad (declines in yields) news on the economy. For example, as the outlook for the economy seemed to improve in late 2010 and early 2011, Treasury yields rose. This sensitivity can make it difficult to separate the influence of monetary policy from the effects of the economic outlook on bond yields, particularly since a monetary policy action can be seen as revealing information on the economic outlook.

To address these complications and carefully assess the effects of the Federal Reserve's asset purchases on bond yields, some researchers have used an approach known as an event study. This methodology involves assessing changes in bond yields over very short periods of time surrounding the announcements of asset purchases and controlling for other influences on bond yields.

In theory, because financial market participants are forward looking, markets should be able to immediately incorporate information into the prices of securities such as bonds. However, the immediate response to information requires that a market have high liquidity and trading volumes. Because of this condition, most studies of the effects of asset purchases have examined yields on Treasury securities rather than mortgage-backed securities or agency debt. Using this approach, several studies have all shown that the first round of security purchases by the Federal Reserve was successful in lowering bond yields (Gagnon et al. [2010], D'Amico and King [2010], and Hamilton and Wu [2010]).

So why do we care if the interest rates on Treasury bonds or mortgage-backed securities are lower? We care because reductions in these yields can help lower a broader array of interest rates. The effects of asset purchases on interest rates arise through what is known as the portfolio balance channel.

To understand this channel, it is easiest to think on a very large scale. Start by thinking about the entire supply of long-term securities, including all of the assets charted above, plus bonds backing all long-term investments in small businesses, car loans, student loans, and so on. With a given supply in the market, each of these types of bonds will have its own equilibrium price and its own equilibrium interest rate. This supply isn't necessarily fixed at any one amount, but it exists at any one point in time. When the Fed makes its asset purchases of government-backed securities, it removes a part of this supply. With less supply in the market for the government-backed assets, but presumably the same amount of demand, the market prices for these securities will rise and the rates will fall.

However, when the rates are falling, some investors will no longer find the reward large enough for taking on the risk of that particular security. This may lead some investors who had been demanding government-backed securities to shift their investments over to other long-term assets that back the previously mentioned sectors of the economy, like small business or car loans. This should in turn boost the prices of these other long-term assets and push down the associated interest rates.

Fed Funds Targets and Lagged GDP
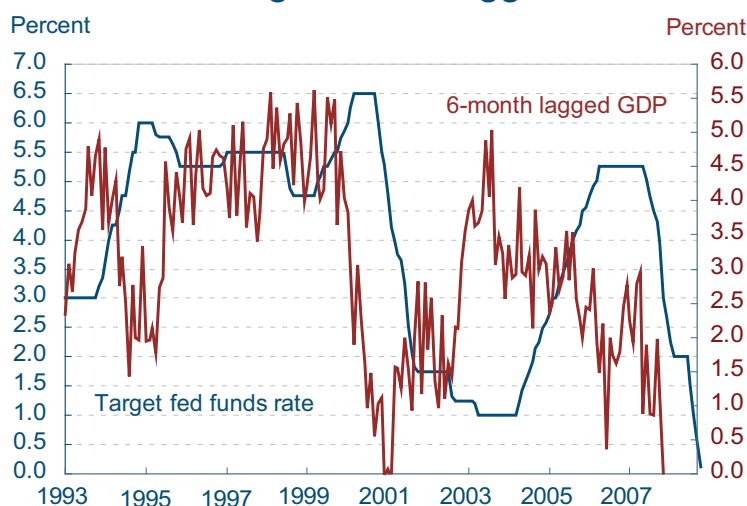
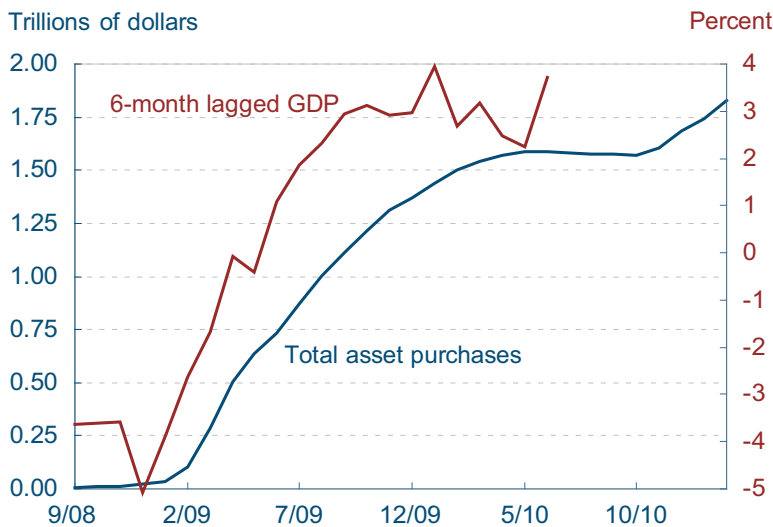Source: Federal Reserve Board, Macroeconomic Advisors.

If this portfolio balance channel is truly functioning, a number of interest rates other than those on Treasury bonds and mortgage-backed securities should have declined with the Federal Reserve's asset purchases. In particular, interest rates on private credit instruments should have dropped, and the value of other asset prices should generally be higher. Both of these events have occurred.

Over time, these easier financial conditions should translate into stronger macroeconomic conditions and growth in economic output. Lower rates on long-term assets should encourage parts of the real economy to expand by making cars, equipment, houses, and other business and household investments more affordable.

Unlike in the financial markets, however, it takes time for the effects of monetary policy changes to be evident in consumer spending, business investment, and employment. As one example, it takes time for consumers and businesses to regain confidence in the economy and to rebalance their finances. As another, it takes time for businesses to change their plans for investment in plant and equipment in response to changes in interest rates. Generally, economic theory and empirical evidence suggest the lag is approximately six months from the time policy is enacted to the time policy effects can be seen. As highlighted in the chart above, movements in the target federal funds rate are correlated with corresponding changes in GDP growth about two quarters later. For example, drops in the target interest rate are normally associated with subsequent increases in GDP growth.

The chart to the left suggests that the same lag has applied with the Federal Reserve's large-scale asset purchases. When the Fed made its asset purchases, which were meant to lower long-term interest rates, the rate at which the economy grew increased after a six-month period. There are clearly other factors that have impacted the path of gross domestic product, but the current trends in the data thus far are supportive of a successful monetary policy.
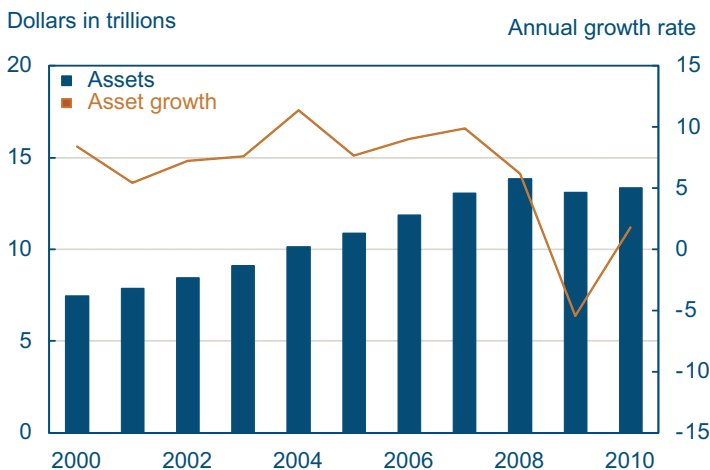
Asset Purchases and Lagged GDP

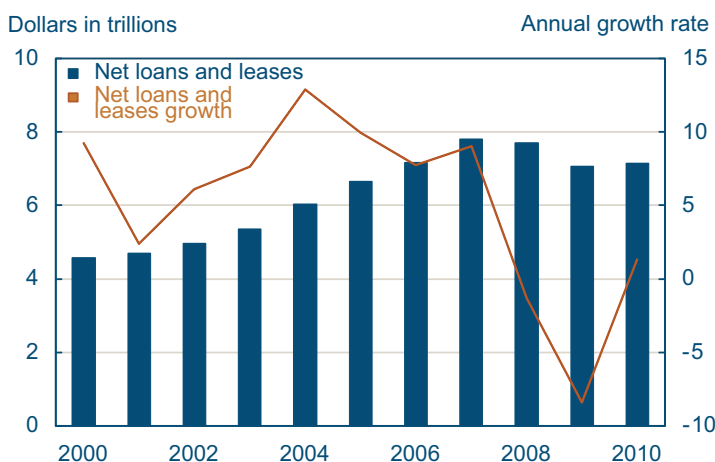Source: Federal Reserve Board, Macroeconomic Advisors.
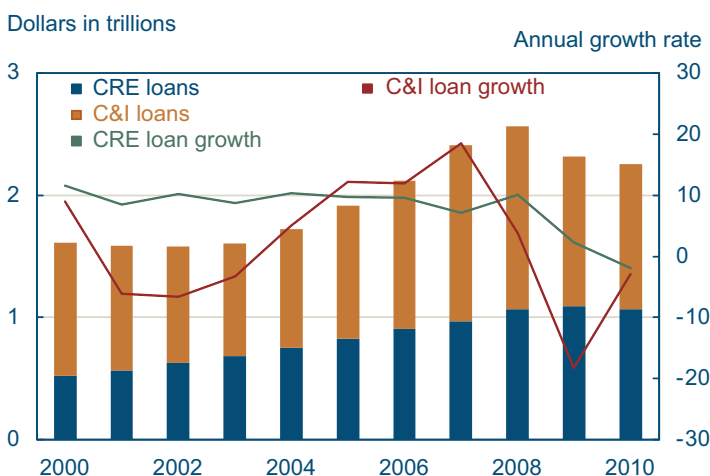
Bank Lending

Bank Assets

Dollars in trillions | Annual growth rate

Source: FDIC.

Net Loans and Leases

Dollars in trillions | Annual growth rate

Source: FDIC.

Commercial Credit

Dollars in trillions | Annual growth rate

Source: FDIC.

03.23.11

by Matthew Koepke and James B. Thomson

It has been nearly two years since the National Bureau of Economic Research called an end to the recession, but concerns still remain about the strength of the recovery in bank lending. The most recent data from the FDIC suggest that while some measures of credit flow are improving, other measures continue to show weakness.
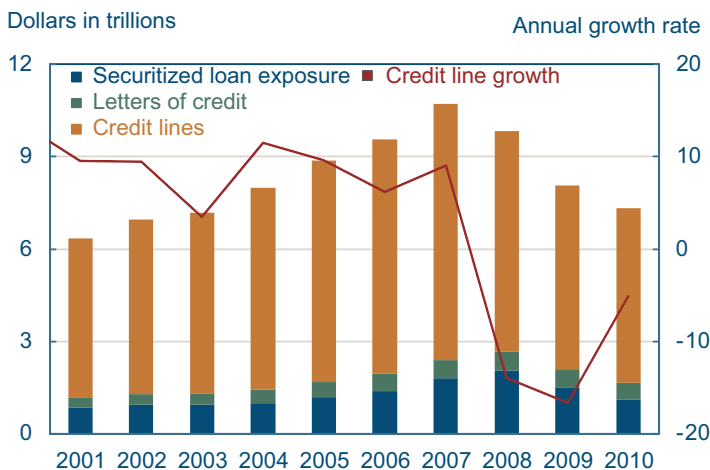
According to the FDIC, assets of all FDIC-insured institutions grew at an average rate of 8.1 percent from 2000 to 2008, with annual growth ranging from 5.4 percent in 2001 to 11.4 percent 2004. The banking system recorded two strong years of asset growth in 2006 and 2007, increasing 9.0 and 9.9 percent in those years before slowing to 6.2 percent growth in 2008. In 2009, bank assets of FDIC-insured institutions declined 5.4 percent to $13.1 trillion. Since then, asset growth has ticked up in 2010 to 1.8 percent, but it remains well below the average growth rate of 8.1 percent seen from 2000 to 2008.

Total bank assets, by themselves, do not completely explain credit flows. Over the past decade, lending, on average, accounted for 58.1 percent of total assets (lending consists of net loans and leases). Consequently, changes in bank assets may not fully reflect changes in bank credit.

Growth in net loans and leases has followed a similar pattern to growth in total assets. From 2000 to 2007, net loans and leases grew on average 8.1 percent. However, loans and leases started to decline earlier than total assets, declining 1.3 percent in 2008, while total assets grew 6.2 percent. Net loans and leases continued to decline in 2009 (8.4 percent). In 2010 they began to increase (1.3 percent) again, although the growth in lending still remains below the average growth rate of 7.1 percent seen over the last decade.
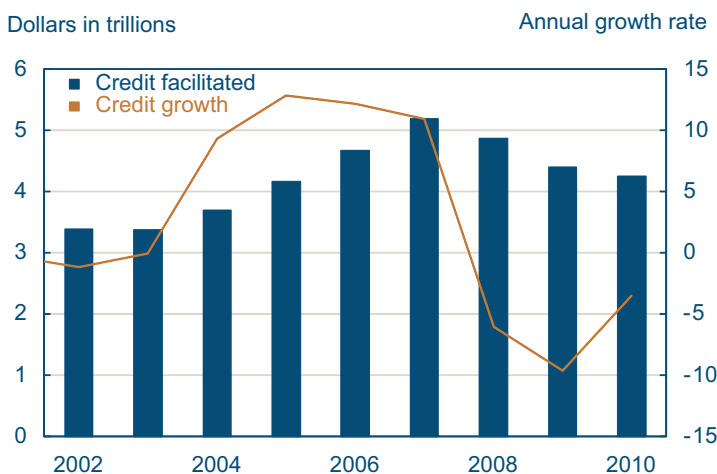
Commercial and industrial loans (C&I) and commercial real estate loans (CRE) are important sources of credit to businesses, particularly to
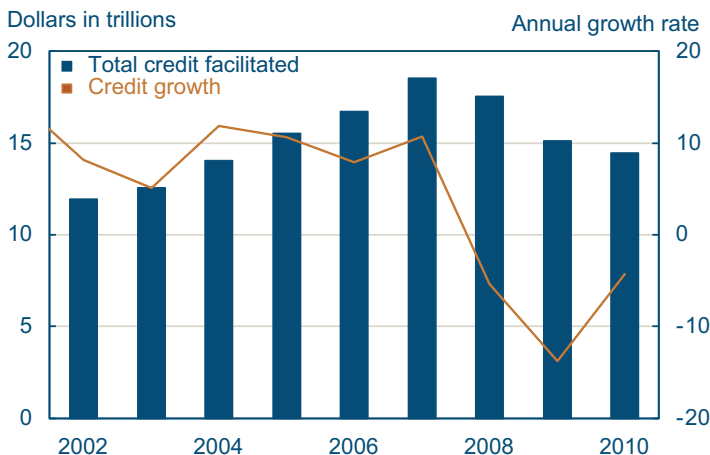
Off Balance Sheet Credit

Dollars in trillions

Annual growth rate

Source: FDIC.

Commercial Credit Facilitated

Dollars in trillions

Annual growth rate

Source: FDIC.

Total Bank Credit Facilities

Dollars in trillions

Annual growth rate

Source: FDIC.

small and medium size businesses. Consequently, growth in C&I and CRE lending will be essential for economic recovery. From 2000 to 2008, C&I loans grew, on average, 4.9 percent; however, C&I lending fell 18.2 percent and 2.9 percent in 2009 and 2010, respectively. While CRE loans have fared much better than C&I loans, signs of weakness in CRE lending persist. CRE loans increased 2.3 percent in 2009 but have declined 1.9 percent in 2010. As a result of weakness in C&I and CRE lending, total commercial credit growth has trailed growth in net loans and leases through the economic recovery.

On-balance-sheet measures, such as total assets and net loan and leases, can be used to describe a bank's credit channel; however, on-balance sheet measures may not describe all of a the credit facilitated by a bank, as some forms of credit do not appear on the balance sheet and some loans have been taken off the balance sheet.

Bank lines of credit are a form of short-term financing used by business customers of all sizes. They can be segmented into uncommitted lines of credit, committed lines of credit, and revolving credit facilities. Bank lines of credit serve as an additional source of financing and help companies and help companies obtain short-term funds at stable rates. Letters of credit are irrevocable guarantees from a bank that allow businesses to obtain additional forms of financing, such as trade credit from a supplier.

Both undrawn lines of credit and letters of credit represent an off-balance-sheet form of credit availability, but neither result in an on-balance-sheet asset when it is created. Credit lines become an on-balance-sheet asset only after they are drawn on, and a letter of credit only if a bank takes over the loan backed by the letter.

Banks also sell or securitize a number of loans they make, causing on-balance-sheet loans to understate the amount of credit being intermediated.

While net loans and leases have increased, off-balance sheet forms of credit have continued to decline through the economic recovery.

On-balance-sheet credit channels have improved, but their growth has been very slow; moreover, off-balance-sheet credit channels have continued to decline. Consequently, comprehensive measures of credit have fallen through the economic recovery.

Commercial credit facilitated by the banking system measures the on-balance sheet business loans and off-balance sheet commercial credit facilities. Total bank credit activities measures net loans and leases that are on the balance sheet and credit facilities that are off-balance-sheet. Given the small increases in net loans and leases and the continued weakness in off-balance-sheet credit channels, both commercial credit facilitated and total credit facilities have struggled to recover. Commercial credit facilitated fell 9.6 percent and 3.5 percent in 2009 and 2010, while total bank credit facilities fell 13.8 and 4.3 percent over the same period.

What to Make of Rising Gas Prices and Falling Household Energy Prices

03.11.11
by Brent Meyer

Yes, oil and commodity prices are increasing, and we are starting to see that increase expressed in retail prices. Motor fuel prices jumped up at an annualized rate of more than 50 percent in January, and they have risen nearly 14 percent over the past year. But why don't we hear about other dramatic changes in relative prices—in the opposite direction—like car and truck rentals (down 28.4 percent) and infants' and toddlers' apparel (down 20.5 percent)?

Perhaps it is because increasing prices at the pump are particularly painful for the average consumer. Motor fuel's share of the consumer market basket that is used to compute the Consumer Price Index (CPI) is about 5 percent, making it a comparatively large component. Or perhaps it is the frequency with which we purchase gasoline, making price increases somewhat maddening. Still, the big dive that piped household gas and electricity prices took in January was barely acknowledged, though their weight in the CPI, roughly 4 percent, is similar to motor fuels. Their prices fell 7.2 percent in January and they are actually down 0.7 percent over the past year (even though the winter was harsher than usual).

Lately, many are suggesting that the increase in the relative price of gasoline and other commodities is a sign of incipient hyperinflation. But that doesn't make sense given the decreases in other prices, like household energy prices. Why wouldn't they be some signal of deflation?

The current situation illustrates why it's not a good forecasting practice to track price changes of one or a few items and use them as a predictor of future inflation. For example, gasoline prices were also high in mid-2008, running at a year-over-year growth rate of 38.2 percent. Was this some sign that high inflation was on its way? Not really. By March 2009, the 12-month percent change in

the headline CPI was below zero, largely because energy prices had reversed course.

CPI Component Price Change Distribution

Annualized percentage change, past 12 months

Component	
Motor fuel oil	
Fuel oil and other fuels	
Public transportatation	
Jewelry and watches	
Meats, poultry, fish, and eggs	
Water/sewer/trash services	
Tobacco and smoking products	
Motor vehicle insurance	
Education	
Motor vehicle parts and equipment	
Fresh fruits and vegetables	
Medical care services	
Medical care commodities	
Used cars and trucks	
Miscellaneous personal services	
Lodging away from home	
Motor vehicle maintenance and repair	
Dairy and related products	
Tenants' and household insurance	
Food away from home	
Alcoholic beverages	
Motor vehicle fees	
Cereals and bakery products	
Rent of primary residence	
OER, South	
OER, Midwest	
Personal care services	
OER, Northwest	
Other food at home	
Nonalcoholic beverages and beverage mats	
Men's and boys' apparel	
New vehicles	
OER West	
Personal care products	
Processed fruits and vegetables	
Recreation	
Gas (piped) and electricity	
Women's and girls' apparel	
Communication	
Car and truck rental	
Household furnishings and operations	
Miscellaneous personal goods	
Infants' and toddlers' apparel	
Leased cars and trucks	

12-month percent change in the CPI= 1.6%

-4   -2   0   2   4   6   8   10   12   14

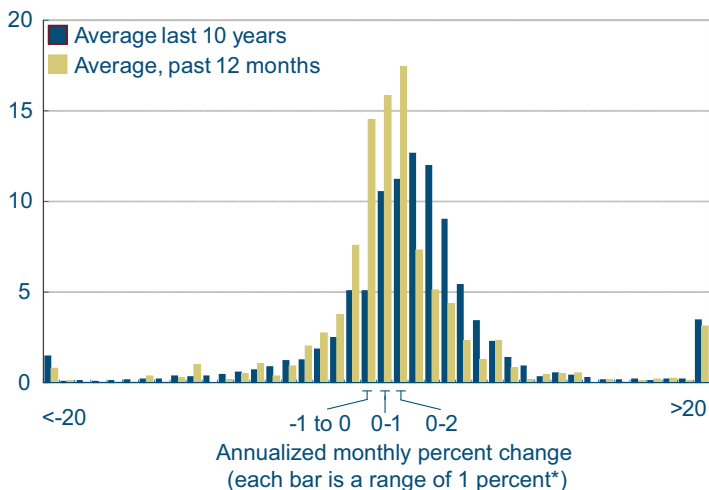Sources: Bureau of Labor Statistics, author's calculations.

Prices for individual items change for a variety of reasons—supply and demand conditions, excise taxes, and weather disturbances, to name a few. Inflation, unlike a relative price increase, is an impulse that affects all prices, not just some. So when trying to interpret the latest data, a look at the entire distribution of price changes may often be more informative than looking at just a few prices.

For example, comparing the average weighted price-change distribution over last 12 months with the past 10 years gives us a look at the shape of the distribution, whether or not there are some extreme outliers, and, importantly, where most of the mass is. Interestingly, price changes in the consumer market basket, if anything, looks more disinflationary over the past 12 months when compared to the 10-year average. On average over the past 12 months, roughly half of the overall index has exhibited price changes in the range of –1 percent and 2 percent, compared to about 30 percent on average over the last decade.

But eyeballing price-change distributions for an inflation signal is fairly messy. To characterize chang-

CPI Component Price Change Distribution

Weighted frequency

*Except for the lowest and highest bars.
Sources: U.S. Department of Labor, Bureau of Labor Statistics; author's calculations.

January Price Statistics

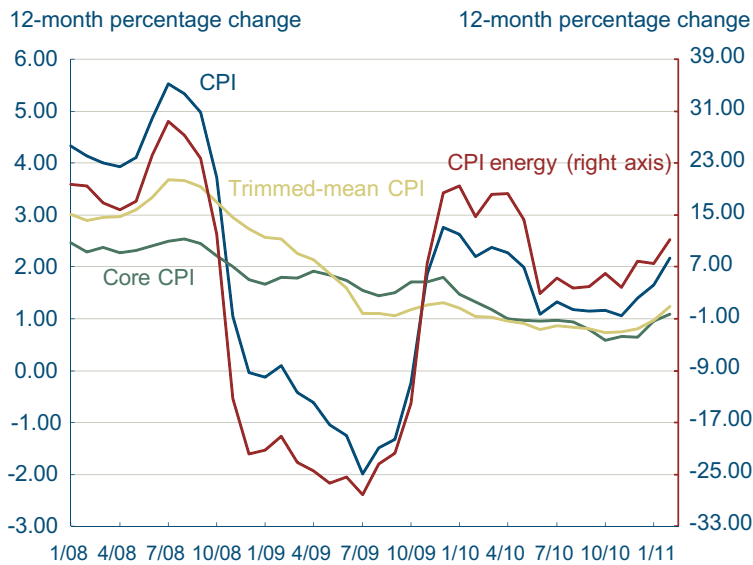|	Percent change, last					
	1mo.[a]	3mo.[a]	6mo.[a]	12mo.	5yr.[a]	2010 average
Consumer Price Index						
All items	4.9	3.9	3.2	1.6	2.1	1.4
Less food and energy	2.1	1.4	1.0	1.0	1.9	0.6
Median[b]	2.0	1.5	1.3	0.8	2.1	0.7
16% trimmed mean[b]	2.7	1.8	1.4	1.0	2.0	0.8

a. Annualized.
b. Calculated by the Federal Reserve Bank of Cleveland.
Sources: U.S. Department of Labor, Bureau of Labor Statistics; and Federal Reserve Bank of Cleveland.

es in consumer prices in the hope of seeing such a signal, there are a few statistics we could examine. First is the headline CPI, which is a weighted average of all the prices in the consumer market basket. However, the headline CPI is somewhat noisy and subject to the influence of volatile monthly price swings. In January, for example, energy commodities and food accounted for most—over two-thirds—of the CPI's increase, according to the Bureau of Labor Statistics.

Another set of price statistics that attempt to lessen the noise associated with volatile relative price changes is often referred to as "core" inflation measures or measures of underlying inflation. The BLS produces an "ex-food and energy" measure of consumer prices, as food and energy prices are historically the most volatile components. Some view this measure as unpalatable (especially when food and energy prices are on the rise). Measures of underlying inflation produced by the Federal Reserve Bank of Cleveland—the median CPI and 16 percent trimmed-mean CPI—attempt to "amplify" the inflation signal by eliminating the most volatile monthly price swings on either end of the price-change distribution (decreasing the noise).

Benefiting from a clearer signal, forecasts based on the median and 16 percent trimmed-mean measures outperform those that use the headline or "core" CPI. And lately these measures are telling us that underlying inflation still looks a little soft. Despite a modest uptick in January, the 12-month growth rates in the median and trimmed-mean measures are trending near 1.0 percent. While near-term (3-month) growth rates have edged up a little, they are still ranging below their respective longer-term (5-year) trends.

Recent Developments in Inflation Expectations

Various Inflation Measures

12-month percentage change | 12-month percentage change

Sources: Bureau of Labor Statistics; Federal Reserve Bank of Cleveland.

Various Inflation Measures

Annualized monthly percentage change

Sources: Bureau of Labor Statistics; Federal Reserve Bank of Cleveland.

04.01.11
by Mehmet Pasaogullari

Recent increases in energy and food prices have fed concerns about the prospect of inflation in the near future. While the rising prices of these important commodities are felt by everyone, as two prices among many, they do not necessarily signal impending inflation. For a better gauge of future inflation, we turn to various measures of inflation expectations. Inflation expectations are both a predictor and an important factor in future inflation, and as it happens, most of the short-term inflation expectation measures we have looked at have been rising lately.

Let's first take a look at recent developments. Though the energy-price component of the CPI increased 11.2 percent from February 2010 to February 2011, the 12-month change in the overall CPI was just 2.2 percent. The changes in underlying measures of inflation over the same period were more limited. For example, core inflation (CPI excluding food and energy prices) and the trimmed-mean CPI, a measure provided by Cleveland Fed, increased around 1.1 percent and 1.2 percent, respectively, over the same period. However, these increases in the underlying measures picked up in January and especially in February. In March, the median CPI increased 2.4 percent in annualized terms, and the trimmed-mean CPI increased 3.8 percent in annualized terms, a level it has not recorded since summer 2008. However, these developments have not yet proved to be persistent.
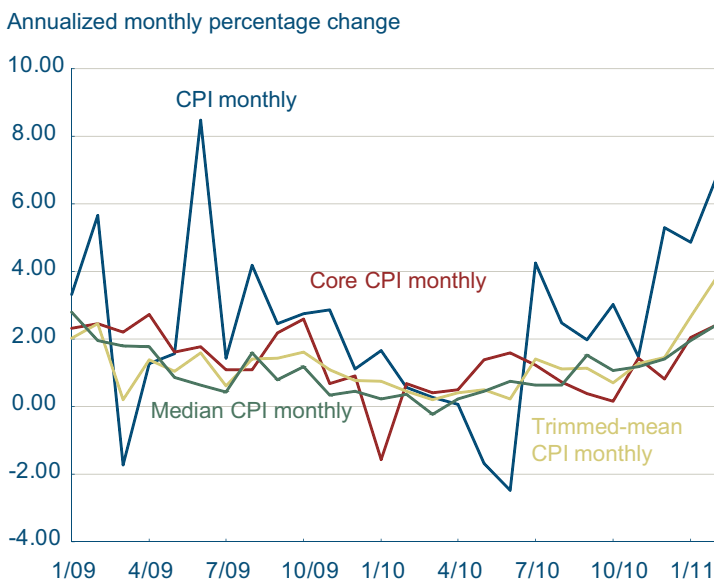
How have economic agents adjusted their expectations for the future following these increases? We check three types of measures: survey, market, and model measures. Survey measures include the inflation expectations from the University of Michigan's Survey of Consumer Attitudes and Behavior (UM expectations) and expectations from the Philadelphia Fed's Survey of Professional Forecasters (SPF expectations). The SPF survey is quarterly and the most recent data were released in February, whereas the monthly UM data is available through March.

Survey Measures of Short-term Inflation Expectations and CPI Energy Inflation

Percentage change   Annualized monthly percentage change
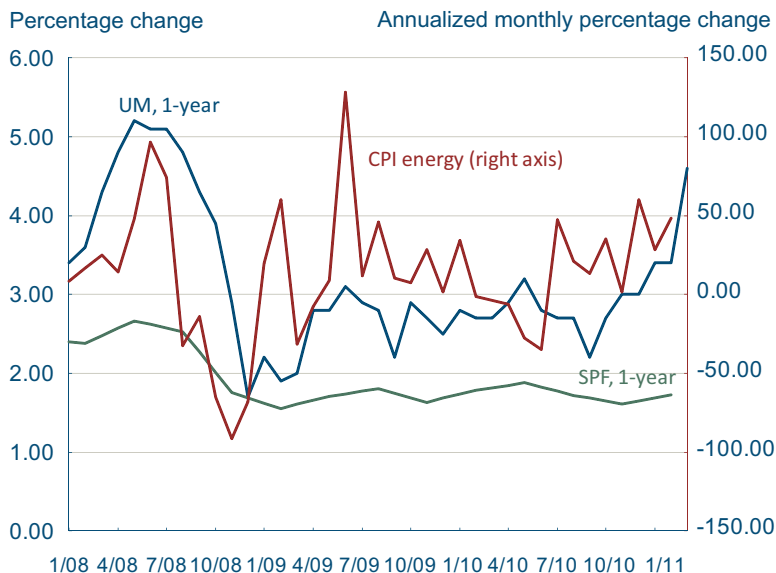
Sources: Federal Reserve Bank of Cleveland; Federal Reserve Bank of Philadelphia; University of Michigan.

Market and Model-based Measures of Short-term Inflation Expectations
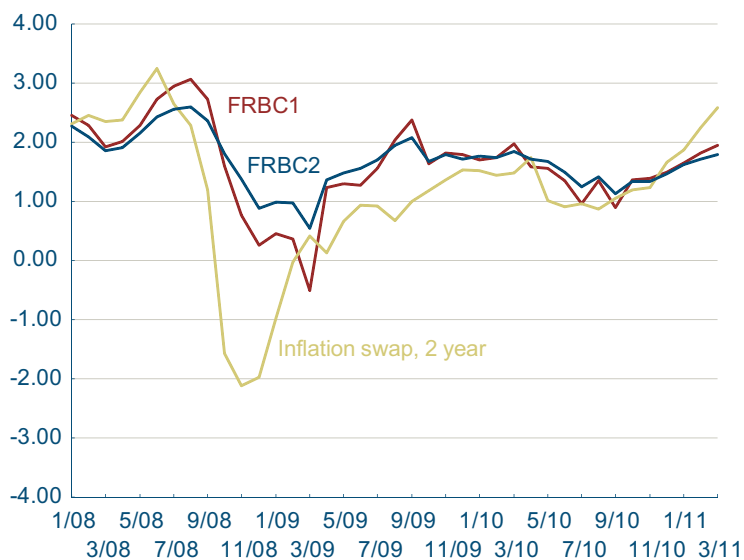
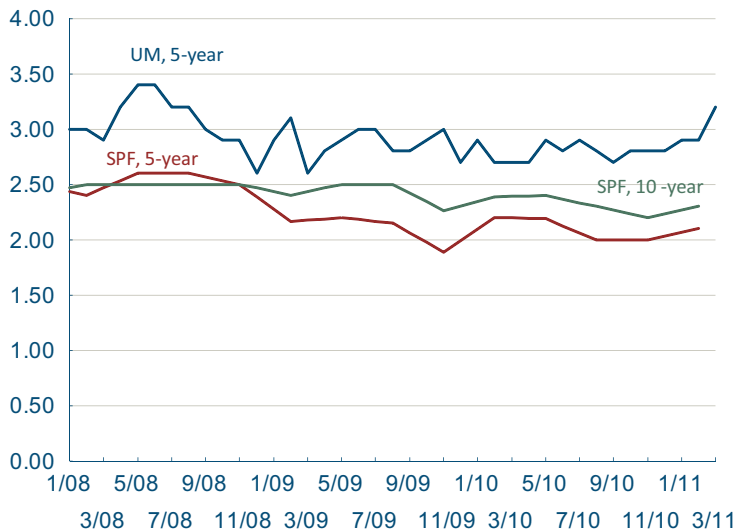Sources: Federal Reserve Bank of Cleveland; Bloomberg.

For the survey measures, we report the median of survey responses. The market measures come from inflation swap data as well as nominal and inflation-indexed Treasury securities. We document the end-of-month figures for these and use the data on March 28, 2011, for March 2011. Finally, model measures are estimated from the Federal Reserve Bank of Cleveland's (FRBC) model, which utilizes the information in the term structure of nominal Treasuries along with the information from inflation swaps and surveys.

Survey measures are divided. One-year-ahead inflation expectations from the UM Survey increased in March to 4.6 percent from 3.0 percent in December 2010. On the other hand, the SPF 1-year-ahead expectations rose only modestly, 0.1 percent, in the first survey of 2011. It seems that consumers pay much more attention to rising energy prices when changing their expectations, as a similar split occurred between the UM and SPF surveys during the summer 2008, when oil prices experienced record highs. The UM Survey's 1-year expectations recorded a 1.2 percent increase between February 2008 and August 2008, arriving at 4.8 percent, whereas the SPF survey increased only marginally from 2.4 to 2.5 percent in the same period. We have to note that CPI inflation in summer 2009, the period for which previous expectations were formed, turned out to be negative.

Market and model-based measures have all increased. The two-year inflation swap rate has been steadily increasing since summer 2010. It was just below 0.9 percent at the end of August 2010, and it ended the year at 1.7 percent. It continued to increase further in 2011 and read 2.6 percent by the end of March. The 1- and 2-year inflation expectations from the FRBC model also increased during the same period, although the change in expectations has been much limited than the swaps data. One-year inflation expectations from the FRBC model rose from 1.4 percent in August 2010 to 2 percent in March 2011. Two-year expectations rose from 1.4 percent to 1.8 percent.

What about longer-term expectations? The expectation for long-term (5 to 10-year) inflation from the UM Survey rose 0.3 percent in March and is

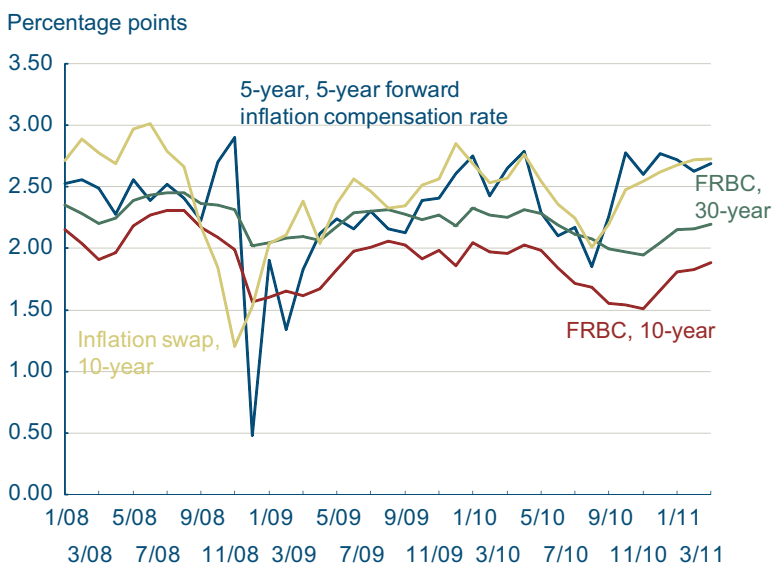## Survey Measures of Long-term Inflation Expectations

Sources: Federal Reserve Bank of Philadelphia; University of Michigan.

Market and Model-based Measures of Long-term Inflation Expectations

Percentage points

Sources: Federal Reserve Board; Federal Reserve Bank of Cleveland; Bloomberg.

now at 3.2 percent, the first time it has been above 3 percent since February 2009. However the 5- and 10-year expectations from the SPF have been quite steady; 5-year expectations increased only 0.1 percent in the last six months and are now at 2.1 percent, whereas 10-year expectations increased 0.1 percent in the February 2011 survey, reversing the decline of November 2010 and resulting in zero change over the course of the last two surveys.

The 10- and 30-year inflation expectations from the FRBC model reversed their downward trends last December and rose to 1.9 and 2.2 percent in March 2011. On the other hand, the market-based measures have showed a significant increase since August 2010. The 5-year, 5-year-forward inflation compensation rate, a proxy for average inflation expectations for the periods between five and ten years in the future, rose from 1.9 percent in August 2010 to 2.8 in October 2010 and has been hovering around that level since then. The rise in the 10-year inflation swap rate has been steadier. It increased around 50 basis points in September and October 2010. It has increased another 25 basis points since then and stood at 2.7 percent at the end of March.

Two important points for these market-based measures should be noted: First, the bigger part of the increase in expectations came between August 2010 and October 2010, around the time the Fed announced that it would reinvest payments of principal on agency and mortgage-backed securities into longer-term Treasuries and there was talk of a possible second round of large-scale asset purchases. In addition, the improved outlook on economic conditions probably accounts for some of the rise in inflation expectations. Hence, it is likely that the recent increases in food and energy prices have had a very limited, if any, effect on these long-term expectations.

The second important point for the market-based measures is that even though they have increased over the last six months, they are currently not far from their historical averages. On the higher end, the 5-year, 5-year forward inflation compensation rate averaged 2.43 percent between August 2004 and December 2007, lower than its level of 2.7

percent at the end of March 2011. However, the average 10-year inflation swap rate was 2.8 percent between August 2004 and December 2007. This average drops to 2.64 percent when one includes the rest of the sample, an effect that is mainly due to the very low swap rates around the height of the financial crisis and the recession. At the end of March 2011 the rate is 2.7 percent. Furthermore, the SPF measures and the estimates from the FRBC model are also lower than their historical averages.

To sum up, all measures of short-term inflation expectations we have looked at show an upward trend since last summer. Some measures showed higher increases (swap and UM survey), and others were much more limited (FRBC model and the SPF survey). Measures of longer-term inflation expectations have also risen in the last six months—UM expectations significantly, SPF expectations marginally, and market-based measures also a lot. However, most of the increase in the market-based measures happened in September and October 2010. The recent increases in food and energy prices have had limited, if any, effect on the long-term expectations. They seem to be well-anchored and are in line with their averages of the previous decade.

# The Cost of Food and Energy across Consumers

03.14.11
by Daniel Carroll

Rising food and energy prices have been getting considerable attention recently. The latest report from the Bureau of Labor Statistics (BLS) shows that both of these components of the CPI outpaced the average for the index. Energy rose by 2.1 percent (7.3 percent year-over-year), which is consistent with its longer trend over the past six months. Curiously, given the focus it has received, the rise in food prices has been much more modest, just 0.5 percent (1.8 percent year-over-year). In particular, "food at home," which excludes changes in the price of dining out, rose by only two-tenths of a percent more than overall food prices (0.3 percent more year-over-year). In fact, food at home is up only 2.7 percent from its lowest point in the past two years. Meanwhile, the CPI rose 0.4 percent in January, implying a 1.6 percent annual increase in the broad measure of prices.

It should not come as a surprise that people are particularly concerned about increases in food and energy prices, whether the increases are large or small. Not only do energy prices pass through to other prices, but household expenditures on food and energy make up a significant fraction of total household expenditures. Data from the BLS Consumer Expenditure Survey show that on average from 1999 to 2009, energy (including motor fuel) and food at home accounted for more than 15 percent of total expenditures and 13 percent of after-tax income.

The importance of food and energy prices to households' bottom lines is not evenly distributed across the income distribution either. For the median household, food and energy are roughly 17 percent of both expenditures and after-tax income. Households in the top 20 percent of the income distribution spend 11.6 percent of total expenditures on food and energy, which adds up to 7.9 percent of disposable income. For the bottom 20 percent these shares rise to 20.4 percent of expenditures and a whopping 44.1 percent of after-tax income!

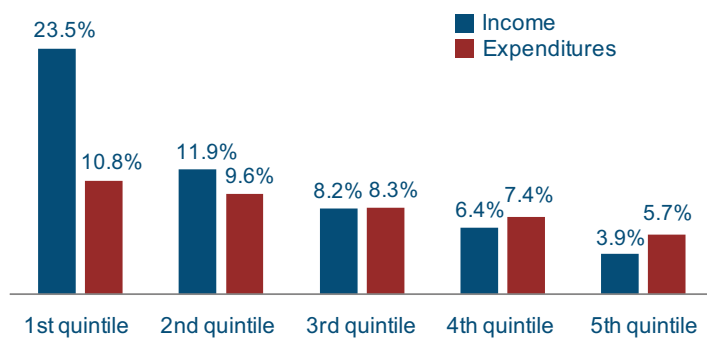## Change in Prices from July 2010 to January 2011

Percent change from previous month
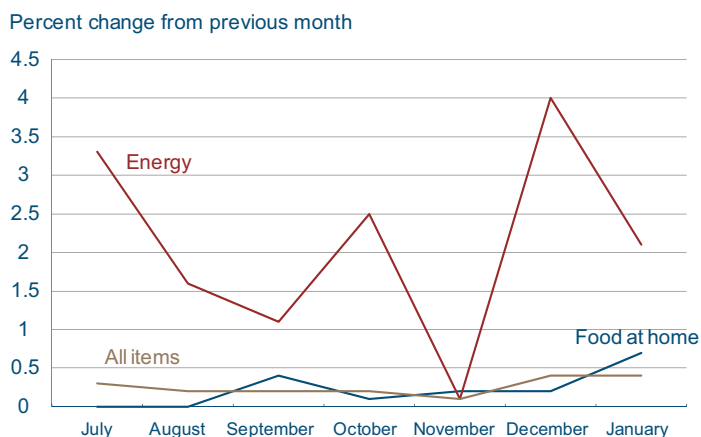
Source: Bureau of Labor Statistics.

Energy Expenditures as a Share of Income and Expenditures
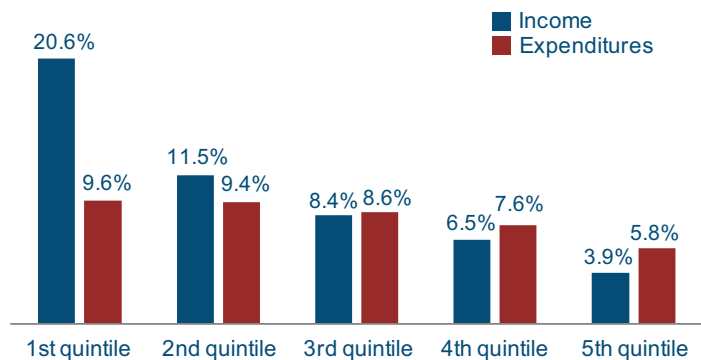
Source: Bureau of Labor Statistics.

Food at Home as a Share of Income and Expenditures

Legend: ■ Income ■ Expenditures

Quintile	Income	Expenditures
1st quintile	23.5%	10.8%
2nd quintile	11.9%	9.6%
3rd quintile	8.2%	8.3%
4th quintile	6.4%	7.4%
5th quintile	3.9%	5.7%

Source: Bureau of Labor Statistics.

For those astutely wondering why food and energy expenditures are a larger fraction of total expenditures than of total income for the bottom 20 percent, there is a much higher fraction of households in this quintile which may be using savings and credit markets to consume above their annual income. Likely categories are the unemployed, business owners with temporary losses, students living on loans, and retirees drawing down their nest eggs.

Fourth-Quarter GDP Growth and a Look Forward

Real GDP and Components

	Quarterly change (billions of 2000$)	Annualized percent change, last:	
		Quarter	Four quarters
Real GDP	102.2	3.1	2.8
Personal consumption	92.3	4.0	2.6
Durables	57.9	21.1	10.9
Nondurables	21.2	4.1	3.2
Services	22.3	1.5	1.2
Business fixed investment	25.9	7.7	10.6
Equipment	20.3	7.7	16.9
Structures	5.9	7.7	−4.0
Residential investment	2.6	3.3	−4.6
Government spending	−10.8	−1.7	1.1
National defense	−4.1	−2.2	3.4
Net exports	107.3	—	—
Exports	35.0	8.6	8.9
Imports	−72.3	−12.6	10.9
Change in private inventories	16.2	—	—

Source: Bureau of Economic Analysis.

04.06.11
by Ken Beauchemin and John Lindner

Real GDP growth in the fourth quarter of 2010, originally reported in January as 3.2 percent, settled in at 3.1 percent following the two usual revisions. For the year, real GDP grew 2.9 percent, beating out the January Blue Chip consensus projection of 2.8 percent growth, but falling short of Blue Chip's 3.1 percent midyear estimate.

Digging into the expenditure details, fourth-quarter growth was supported in large part by a 4.0 percent rise in personal consumption spending, which contributed 2.8 percentage points of growth. This jump was maily due to a 21.1 percent increase in durables spending—the strongest single quarter of growth in this component since the fourth quarter of 2001. Net exports also made a large contribution (3.3 percentage points), as imports plunged 12.6 percent following three consecutive double-digit increases.

The reversal in the trade contribution is quite likely connected to the huge 3.4 percentage point drag on GDP growth arising from inventory accumulation. Although inventories rose, they did so at a much slower pace in the third quarter. After months of inventory building, which not only boosted domestic production but also pulled in sizeable quantities of imported goods, wholesalers and retailers slowed the pace of restocking in the fourth quarter, curtailing imports. Combined, the contributions from net exports and inventories nearly cancel, providing a net reduction of only 0.1 percentage point.

Business fixed investment also provided some lift to fourth-quarter growth. Although not the double-digit increase recorded earlier in the year, spending on equipment and software rose a respectable 7.7 percent, and spending on structures rose 7.7 percent for its first increase since the second quarter of 2008. Residential investment eked out a small 3.3 percent increase in the fourth quarter, which contributed 0.1 percentage point to the total. Finally, government spending declined 1.6 percent
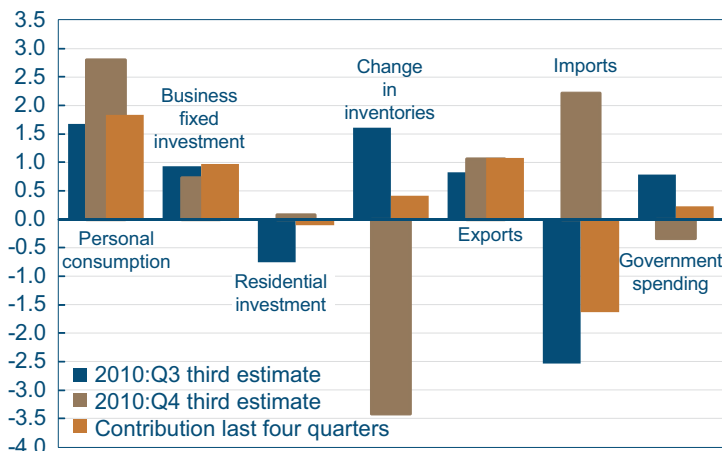
Contribution to Percent Change in Real GDP

Percentage points

Legend:
- 2010:Q3 third estimate
- 2010:Q4 third estimate
- Contribution last four quarters

Categories shown: Personal consumption, Business fixed investment, Residential investment, Change in inventories, Exports, Imports, Government spending

Source: Bureau of Economic Analysis.

(subtracting 0.3 percentage point), following two consecutive increases of roughly 4 percent.

The short-run outlook for GDP growth is clouded by a series of first-quarter shocks, whose effects will be of uncertain size and duration. The hit to output due to the atypically widespread and severe winter storms of January is likely to be confined to the first quarter. Political unrest in the Middle East and North African nations have driven oil prices higher due both to minor supply disruptions and the potential of more severe disruptions down the road. These events continue to play out.

Supply shocks of these sorts partly manifest as weaker labor productivity, or output per labor hour. Both winter storms and major earthquakes, for example, curtail productivity by creating bottlenecks in the supply chain that leave workers short of material for periods of uncertain length. The political unrest in the Middle East that raises the price of crude oil causes firms to economize on related energy and material inputs, which slows production and weakens productivity.

Gauging the overall damage to U.S. labor productivity that will follow from the shocks is difficult. As macroeconomists we typically lack the counterexample—we do not observe the world in the absence of the shocks. But following back-of-the-envelope calculations to forecast first-quarter productivity growth offers a way to think about the problem. First, we need an estimate of real GDP, and although the "advance" estimate for the first quarter will not be available until the end of April, a good deal of the monthly information that will eventually comprise the real GDP estimate has already come in. Our "bean-counting" suggests real GDP growth of a bit more than 2 percent in the first quarter, so let's stick with 2 percent as a convenient placeholder.

The output concept used by the Bureau of Labor Statistics (BLS) to compute the most widely used and reported measure of labor productivity, however, is drawn more narrowly and includes only the nonfarm business sector (currently about 75 percent of GDP). Sectors in which obtaining an accurate labor input measure is especially problem

Nonfarm Business Productivity Growth
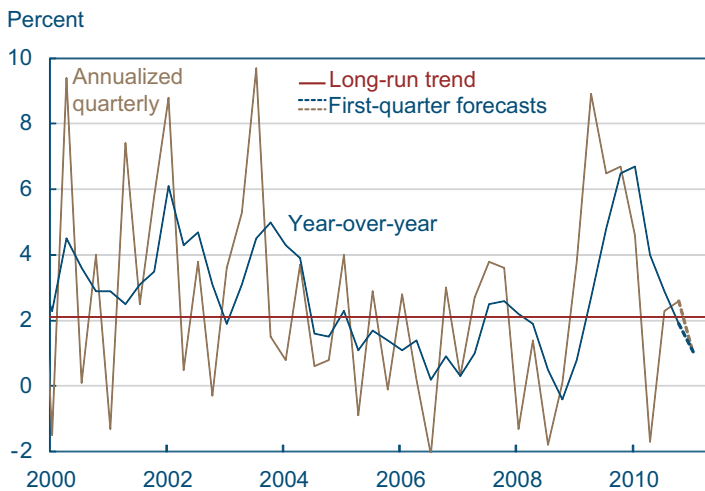
Percent

Source: Bureau of Labor Statistics.

atic (including the government), are excluded. Our calculations imply that nonfarm business output grows a half percentage point faster than total output, which in our current scenario would be 2.5 percent. Much of the difference between the two output estimates is due to slower growth in the government sector, which is excluded from nonfarm business output.

Next, we consider the labor input. The monthly record on private, nonfarm labor hours as part of the BLS's establishment survey on payroll employment is now complete through March. The BLS will eventually adjust these numbers so that they more accurately reflect the labor input. For example, they must not only measure hours of work in business establishments, but also those of the self-employed in nonincorporated businesses. We estimate that nonfarm business labor hours rose 1.5 percent in the first quarter, which, together with our 2.5 percent rise in output, implies a 1.0 percent rise in labor productivity.

That is a lot lower than productivity growth in the previous quarter and considerablly lower than trend productivity growth, which could range between 2 percent and 2½ percent. Do these gaps reflect the disturbance to labor productivity caused by the shocks? To some extent, yes. Assuming that labor hours were mostly unaffected by the shocks, an answer to this question ultimately depends on what one believes output growth would have been in the absence of the shocks, and the degree to which that belief is held. There are a lot of moving parts here, but it's a start.
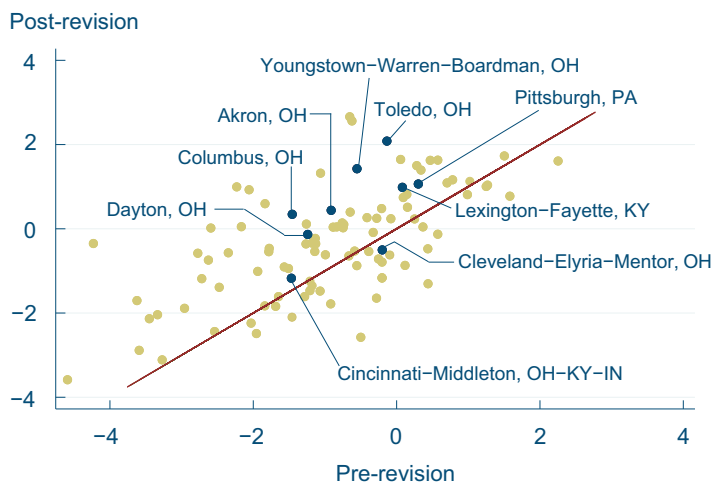
The Recovery, Revised

The Labor Department recently released updated employment estimates for U.S. metropolitan areas (MSAs). These revisions primarily reflect the incorporation of information from unemployment insurance filings, which nearly all employers are required to submit quarterly. Accordingly, these data provide an almost complete count of employment in a metro area. For the current cycle, this new information replaces the reported employment totals for the period from April 2009 to September 2010. The previous totals had been estimated by sampling a set of employers every month.

These revised data alter our assessment of how MSAs have fared throughout the recovery. To understand the impact of these revisions, let's consider the 100 largest MSAs in terms of employment, at the time the recovery began in June 2009. Employment levels in these MSAs range from about 200,000 to over 8 million. The largest area is the New York City MSA, and an example of a smaller area is the Youngstown MSA. Collectively, these 100 MSAs employ nearly 90 million workers, and account for about 70 percent of the total U.S. workforce.

Among these 100 MSAs, most (69) saw greater growth over the course of the recovery than was initially reported. Almost a third (31) saw downward revisions to their estimates of employment growth for the first 18 months of the recovery. This is shown in the chart below. Points falling on the 45-degree line would indicate no revision to their initial estimate, while those above and below the line reflect upward and downward revisions, respectively. The vertical distance from a point to the 45-degree line reflects the magnitude of revision.

Within the Fourth District, employment in every MSA except Cleveland is now thought to have grown more over the first 18 months of the recovery than was initially reported. Some of the revisions were relatively substantial. For instance, from

MSA Employment Revisions: Percent Change in Employment since 2009

Note: The 100 largest MSAs (in terms of employment at the start of the expansion) , through December 2010.
Source: Bureau of Labor Statistics.

the time the recovery began to the end of 2010, employment growth for the Toledo and Columbus MSAs was revised up roughly 2 percentage points. This put Toledo in the top decile in terms of the change from the initial estimate, and Columbus in the top quintile.

As a consequence, relative growth rankings for these 100 MSAs have changed considerably. Both Toledo and Youngstown, which were previously showing declines, now boast gains that are in the top 10 (see the table below). Akron, Columbus, and Dayton also experienced a substantial increase in their rankings. Notably, Columbus moved from the bottom third of the distribution to the top third. Finally, Cleveland fell from 29th to 55th, which isn't surprising given its downward revision. But for the more recent part of the recovery (December 2009 to December 2010), the change was even greater: Cleveland fell from 11th in terms of growth over this period to 51st. The lesson here is to be cautious when interpreting the initial data, remembering that it is a best estimate.

Employment Growth during the Recovery, Largest Fourth District Metro Areas

MSA	Post-revision		Pre-revision		Change	
	Rank[a]	Growth (percent)	Rank[a]	Growth (percent)	Rank[a]	Growth (percentage points)
Toledo, OH	3	2.1	28	−0.1	25	2.2
Youngstown-Warren-Boardman, OH	10	1.4	41	−0.6	31	2.0
Pittsburgh, PA	16	1.1	17	0.3	1	0.8
Youngstown-Warren-Boardman, OH	20	1.0	24	0.1	4	0.9
Akron, OH	29	0.4	53	−0.9	24	1.4
Columbus, OH	31	0.3	69	−1.5	38	1.8
Dayton, OH	47	−0.1	65	−1.2	18	1.1
Cleveland-Elyria-Mentor, OH	55	−0.5	29	−0.2	−26	−0.3
Cincinnati-Middletown, OH-KY-IN	75	−1.2	71	−1.5	−4	0.3

a. Among the 100 largest MSAs in terms of employment at the start of the expansion.
Source: Bureau of Labor Statistics.

Given these revisions, where do Fourth District metro areas stand through the first year and a half of recovery? Nearly all appear to be experiencing about average or above-average growth, when compared to the median outcome for our 100 metro areas. (The median outcome is shown as a dashed line in the middle of the chart below; the top-most and bottom-most dashed lines depict the 10th best and worst outcomes, respectively, at any given point.)

Employment Growth during the 2001 Recovery, Largest Fourth District Metro Areas

MSA	In initial 18 months		Entire expansion[a]	
	Rank[b]	Growth (percent)	Rank[b]	Growth[a] (percent)
Cincinnati-Middletown, OH-KY-IN	21	1.0	62	4.4
Akron, OH	30	0.4	58	5.0
Columbus, OH	50	−0.4	70	3.3
Lexington-Fayette, KY	62	−0.8	51	5.4
Youngstown-Warren-Boardman, OH	64	−0.9	94	−3.5
Pittsburgh, PA	69	−1.2	86	0.2
Dayton, OH	79	−1.7	98	−5.5
Cleveland-Elyria-Mentor, OH	86	−2.1	92	−2.9
Toledo, OH	94	−2.6	96	−4.2

a. Through December 2007.
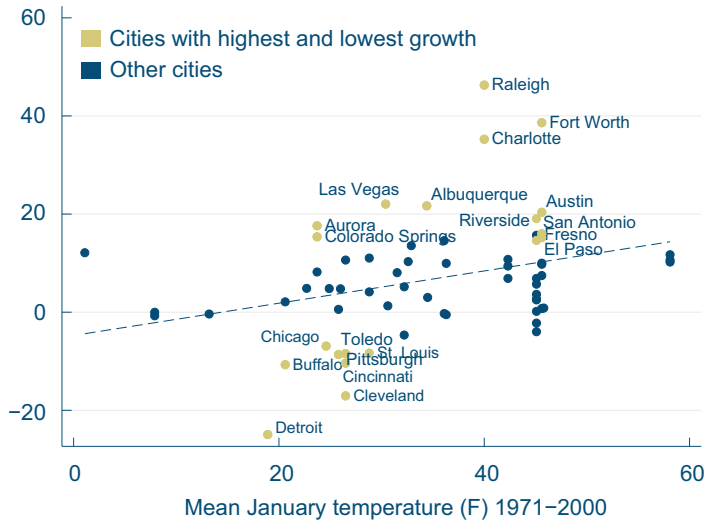b. Among the 100 largest MSAs in terms of employment at the start of the expansion.
Source: Bureau of Labor Statistics.

The exception to this pattern is the Cincinnati MSA, which is at the bottom of the third quartile.

This is something of a reversal from the last business cycle. Across all 100 large MSAs, the amount and range of employment growth during this recovery are surprisingly similar to what we experienced up to this point in the last recovery—surprising because of the very different recessions that preceded each recovery—but employment-growth patterns of indivicual Fourth District MSAs have differed considerably in the two episodes.

Through the first 18 months of the previous recovery, for example, the Cincinnati MSA experienced above-average growth. In fact, it saw the strongest growth of any other District MSA within our set of 100 large MSAs. Moreover, nearly all of the other District MSAs were in the bottom half of the growth distribution up to this point in the previous recovery. That turned out to be an ominous sign: By the time the expansion was over in December 2007, all of the District's MSAs were in the bottom half of the employment-growth distribution. Four of these nine metro areas were within the bottom decile and actually experienced employment declines over the entire expansion.

Growing Cities, Shrinking Cities

Weather and Population Growth

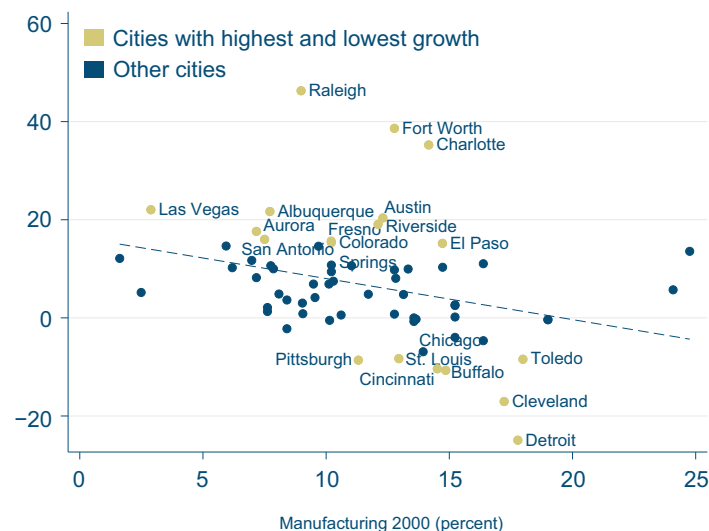Population growth 2000−2010 (percent)

Note: Cities with lowest growth are those with population losses of more than 5 percent, and cities with highest growth are those with gains of more than 15 percent. Sources: U.S. Census, 2000 and 2010; National Oceanic and Atmospheric Administration.

Manufacturing Employment and Population Growth
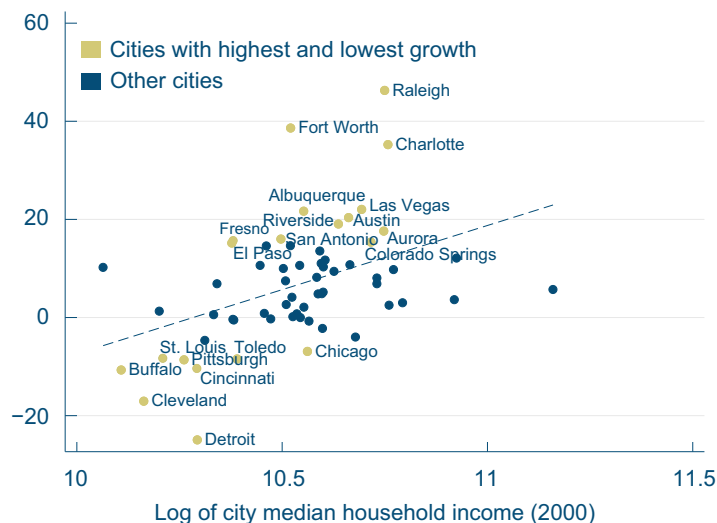
Population growth 2000−2010 (percent)

Note: Cities with lowest growth are those with population losses of more than 5 percent, and cities with highest growth are those with gains of more than 15 percent. Sources: U.S. Census, 2000 and 2010.

04.14.11
by Kyle Fee and Daniel Hartley

As the 2010 census data rolls out, researchers will be conducting extensive analysis on a variety of issues. So far we have only been privy to the re-apportionment (population) data, which have generated their fair share of media coverage. Regardless of the media spin, a clearer picture of how cities' populations have changed from 2000 to 2010 is emerging. What are some of the characteristics of the cities that grew, and how do they compare to those of the cities that shrank?

First, a lot of attention has been devoted to the fact that cities in warmer climates have been growing faster than those in colder climates. Examining the 64 cities in the United States with a population over 250,000 (excluding New Orleans, which lost a large percentage of its population after Hurricane Katrina), shows that cities located in states that experience warmer weather during the month of January grew more on average than cities located in colder states. Average January temperature explains 11 percent of the variation in population growth. It is interesting to note that the cities losing the most people (Detroit, Cleveland, Buffalo, Cincinnati, Pittsburgh, Toledo, St. Louis, and Chicago, all with population losses of more than 5 percent) are located in the Midwest or Great Lakes regions. The fastest-growing cities (Raleigh, Fort Worth, Charlotte, Las Vegas, Albuquerque, Austin, Riverside, Aurora, San Antonio, Fresno, Colorado Springs, and El Paso, with growth of more than 15 percent) are located in the South or West.

Another factor related to population trends is the decline in manufacturing employment in the U.S. On average, cities with large concentrations of employment in the manufacturing sector at the beginning of the decade experienced less population growth. The fraction of employment in the manufacturing sector in 2000 explains 10 percent of the variation in population growth.

Income and Population Growth

Population growth 2000−2010 (percent)

- Cities with highest and lowest growth
- Other cities

Raleigh
Fort Worth
Charlotte
Albuquerque
Las Vegas
Riverside
Fresno
Austin
San Antonio
El Paso
Aurora
Colorado Springs
St. Louis Toledo
Pittsburgh
Chicago
Buffalo
Cincinnati
Cleveland
Detroit

Log of city median household income (2000)

Note: Cities with lowest growth are those with population losses of more than 5 percent, and cities with highest growth are those with gains of more than 15 percent.
Sources: U.S. Census, 2000 and 2010.

Education and Population Growth

Population growth 2000−2010 (percent)

- Cities with highest and lowest growth
- Other cities

Raleigh
Fort Worth
Charlotte
Las Vegas
Fresno
Riverside
Aurora
Albuquerque
Austin
San Antonio
El Paso
Colorado Springs
Toledo
Chicago
St. Louis
Pittsburgh
Buffalo
Cincinnati
Cleveland
Detroit

Bachelor degree or higher 2000 (percent)

Note: Cities with lowest growth are those with population losses of more than 5 percent, and cities with highest growth are those with gains of more than 15 percent.
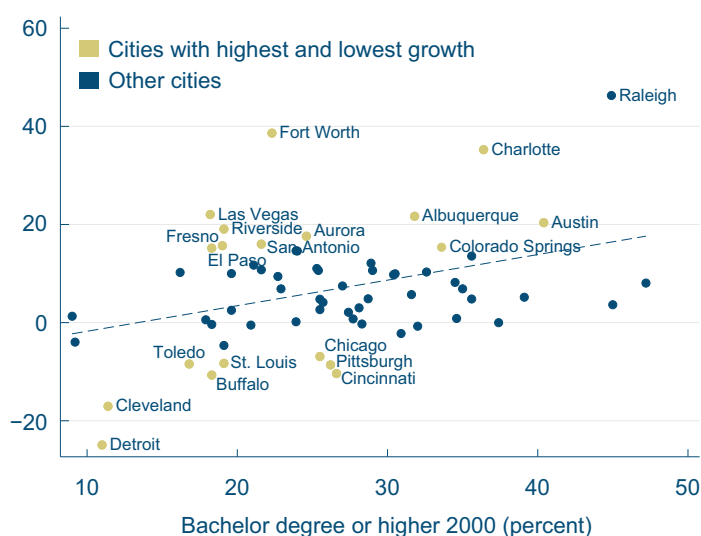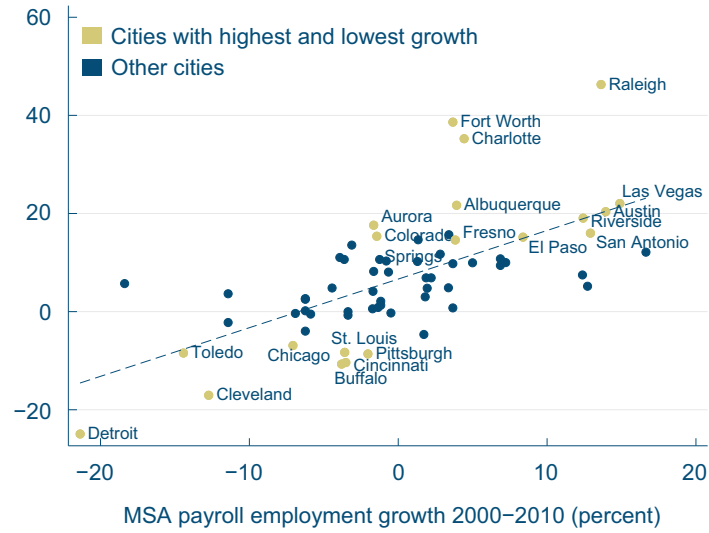Sources: U.S. Census, 2000 and 2010.

On average, cities that had a higher median household income in 2000 saw larger population growth from 2000 to 2010. The log of median household income in 2000 explains 19 percent of the variation in population growth.

On average, more highly educated cities experienced more growth. The fraction of residents with a bachelor's degree or higher in 2000 explains 13 percent of the variation in population growth.

Together, the four factors mentioned above explain about 33 percent of the variation in population growth. However, the education variable does not add much explanatory power to the other three variables. Temperature, manufacturing employment, and household incomes explain 32 percent of the variation in population growth. Furthermore, each of the above three factors is related to population growth even when the other two factors are held constant.

As one would expect, growth in the number of jobs in the MSA in which the city is located is correlated with population growth. In fact, MSA payroll employment growth can explain about 42 percent of the variation of city population growth. However, it is interesting to note that two of the other four variables mentioned—temperature and household incomes—explain an additional 15 percentage points of the variation in city population growth on top what is explained by MSA payroll employment growth (manufacturing employment and education do not add much explanatory power).

While it may be tempting to conclude that people are moving to places with job growth, it is equally possible to conclude that jobs are moving to places where city population is growing. Most likely it is a combination of both. What is interesting is that even controlling for job growth in the MSA, warmer cities grew more than colder cities. If retirees are more likely to move to warmer climes, the growth of these cities could be due to the growing fraction of retirees in the population. Another possible explanation is that the populations of colder MSAs are becoming more concentrated in the suburbs relative to warmer MSAs. Finally, the fact that cities with low household incomes in 2000 had population losses, even controlling for job growth in the

Job Growth and Population Growth

Population growth 2000−2010 (percent)

Note: Cities with lowest growth are those with population losses of more than 5 percent, and cities with highest growth are those with gains of more than 15 percent.
Sources: U.S. Census, 2000 and 2010.

MSA, may be due to a deterioration public goods such as safety and high-quality schools stemming from a diminished tax-base.