

Prefatory Note

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Class II FOMC – Restricted (FR)

Report to the FOMC on Economic Conditions and Monetary Policy



Book A

Economic and Financial Conditions:
Outlook, Risks, and Policy Strategies

April 21, 2017

Prepared for the Federal Open Market Committee
by the staff of the Board of Governors of the Federal Reserve System

Authorized for Public Release

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Domestic Economic Developments and Outlook

The information that we have received since the March Tealbook suggests that resource utilization has continued to tighten. In particular, the labor market news, which includes the two most recent employment reports, was strong. The unemployment rate moved down to 4.5 percent in March even as the labor force participation rate (LFPR) moved a little further above its estimated trend, and the average pace of payroll growth in the first quarter remained solid. As a result, we now see the labor market as running a little tighter than we had earlier anticipated.¹ Although the incoming spending data for the first quarter have been disappointing, on balance, our assessment is that the weakness will be temporary. We now estimate that real GDP growth slowed to an annual rate of only 1 percent in the first quarter, but we expect it to bounce back to a pace of around 2½ percent this quarter, leaving the average over the first half unrevised from the March projection.

Beyond the near term, real GDP growth is marginally stronger in this projection, mostly reflecting a somewhat lower path for the dollar. We expect growth to average a bit above 2 percent this year and next, supported in part by the fiscal expansion that we expect will begin in 2018. We project growth to slow a bit in 2019, partly reflecting the ongoing gradual normalization of monetary policy assumed in our forecast. With real GDP growth expected to outpace our estimate of potential output growth, real economic activity further overshoots its sustainable level. As a result, the unemployment rate is projected to fall to 4 percent by the end of 2019, nearly 1 percentage point below our estimate of the natural rate, which we have edged down to 4.9 percent.

The March reading on the consumer price index (CPI) was considerably lower than we had anticipated. We now estimate that total PCE price inflation (measured on a 12-month change basis) was 1.9 percent in March, and that core inflation was 1.6 percent; both measures are 0.2 percentage point lower than we expected in our previous forecast. However, because we see the March CPI as having been somewhat anomalous, and in response to recent higher-than-expected import prices, we nudged up our projection for core inflation over the next few months, offsetting a portion of the negative March surprise. Our inflation projection beyond this year is not materially

¹ We judge the labor market to be tighter notwithstanding some small adjustments—discussed later—that we made to our supply-side assumptions this round.

Comparing the Staff Projection with Other Forecasts

The staff's projection for real GDP growth is below the projections from the Survey of Professional Forecasters (SPF) and the Blue Chip consensus forecast in 2017 and lower than the Blue Chip in 2018. The staff's forecast for the unemployment rate is a bit below the Blue Chip and SPF surveys in 2017 and below the Blue Chip in 2018. The staff's CPI inflation projection is below those of outside forecasters in 2017 and is the same as them in 2018. The staff's projections for both overall and core PCE price inflation are below the SPF forecasts in 2017 and 2018.

Comparison of Tealbook and Outside Forecasts

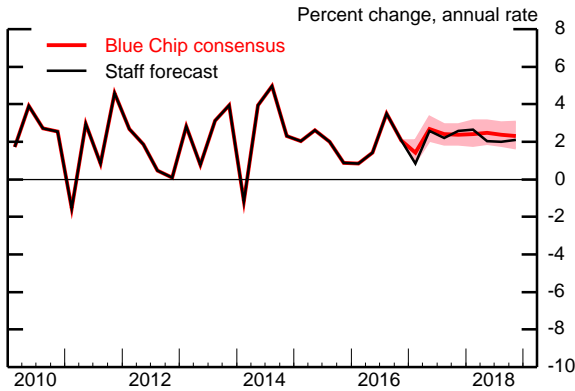
	2016	2017	2018
GDP (Q4/Q4 percent change)			
April Tealbook	2.0	2.1	2.2
Blue Chip (4/10/17)	2.0	2.2	2.4
SPF median (2/10/17)	1.9	2.3	n.a.
Unemployment rate (Q4 level)			
April Tealbook	4.7	4.4	4.1
Blue Chip (4/10/17)	4.7	4.5	4.3
SPF median (2/10/17)	4.7	4.5	n.a.
CPI inflation (Q4/Q4 percent change)			
April Tealbook	1.8	2.2	2.3
Blue Chip (4/10/17)	1.8	2.4	2.3
SPF median (2/10/17)	1.8	2.4	2.3
PCE price inflation (Q4/Q4 percent change)			
April Tealbook	1.4	1.7	1.8
SPF median (2/10/17)	1.5	2.0	2.0
Core PCE price inflation (Q4/Q4 percent change)			
April Tealbook	1.7	1.7	1.9
SPF median (2/10/17)	1.7	1.9	2.0

Note: SPF is the Survey of Professional Forecasters, CPI is the consumer price index, and PCE is personal consumption expenditures. Blue Chip does not provide results for PCE price inflation. The Blue Chip consensus forecast includes input from about 50 panelists, and the SPF about 40. Roughly 20 panelists contribute to both surveys.
n.a. Not available.

Source: Blue Chip Economic Indicators; Federal Reserve Bank of Philadelphia.

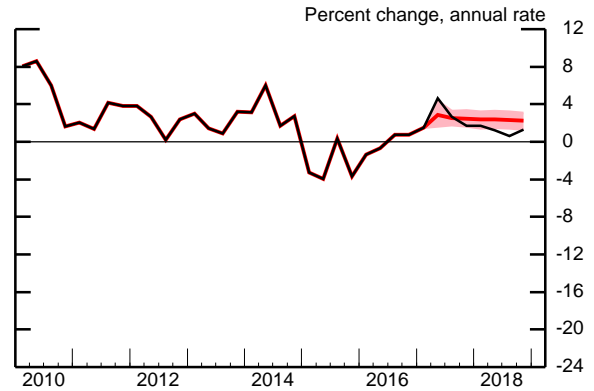
Tealbook Forecast Compared with Blue Chip (Blue Chip survey released April 10, 2017)

Real GDP

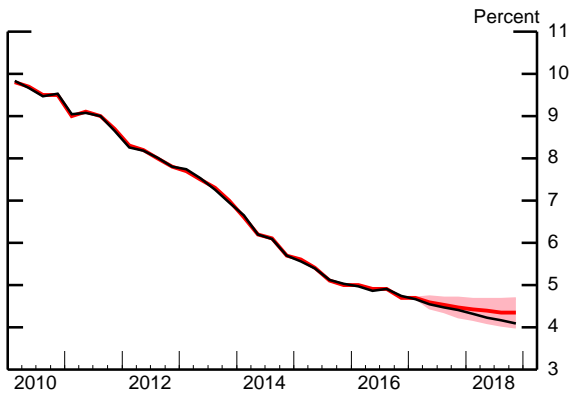


Note: The shaded area represents the area between the Blue Chip top 10 and bottom 10 averages.

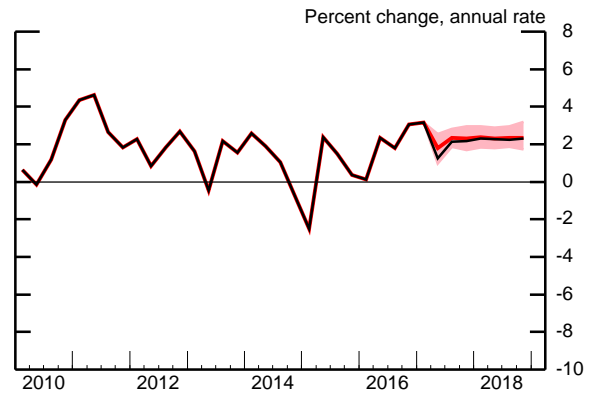
Industrial Production



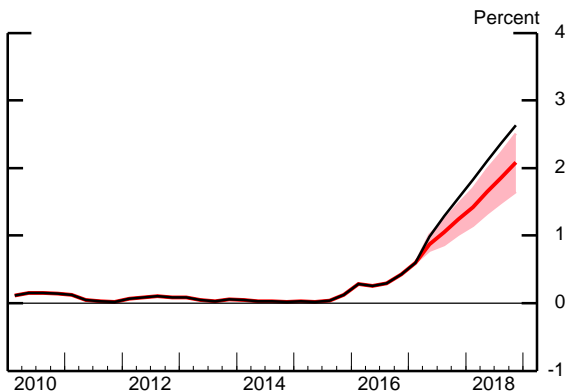
Unemployment Rate



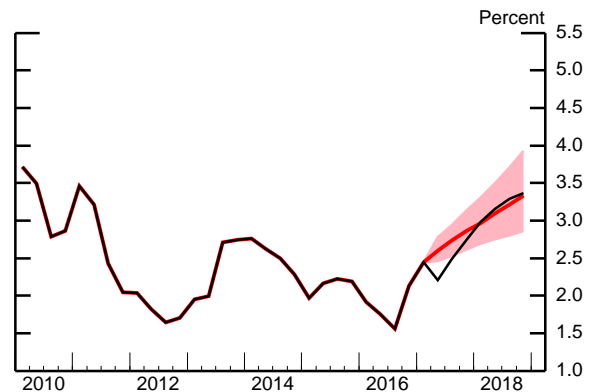
Consumer Price Index



Treasury Bill Rate



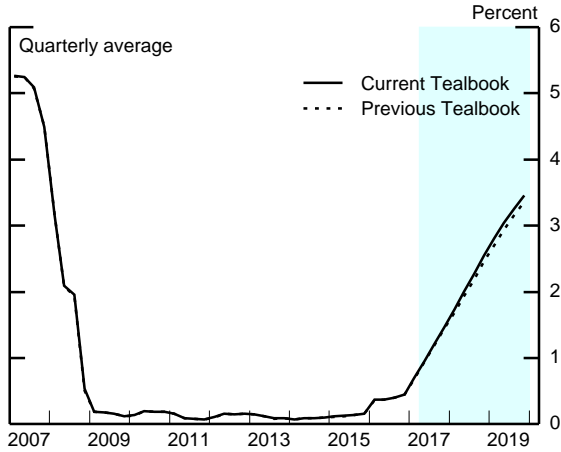
10-Year Treasury Yield



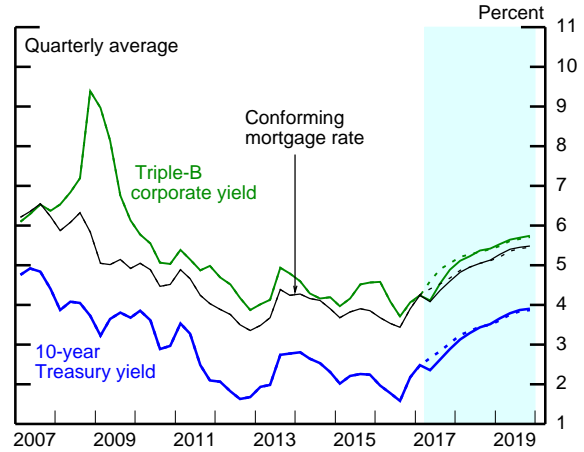
Note: The yield is for on-the-run Treasury securities. Over the forecast period, the staff's projected yield is assumed to be 15 basis points below the off-the-run yield.

Key Background Factors underlying the Baseline Staff Projection

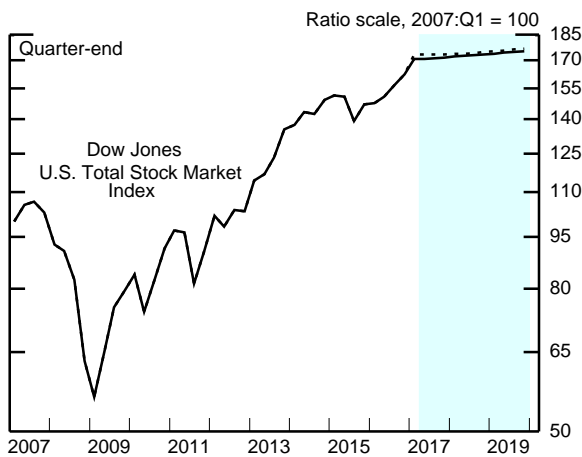
Federal Funds Rate



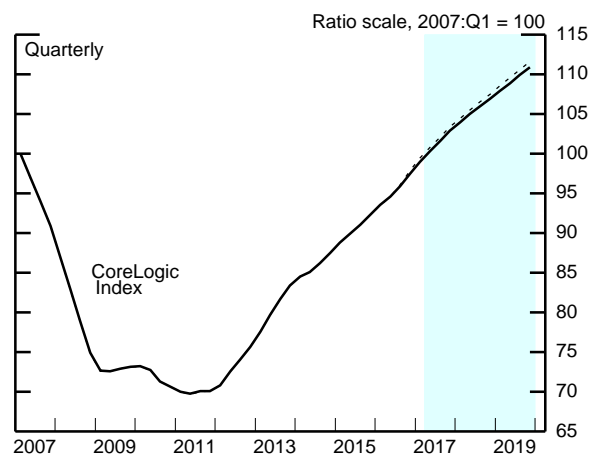
Long-Term Interest Rates



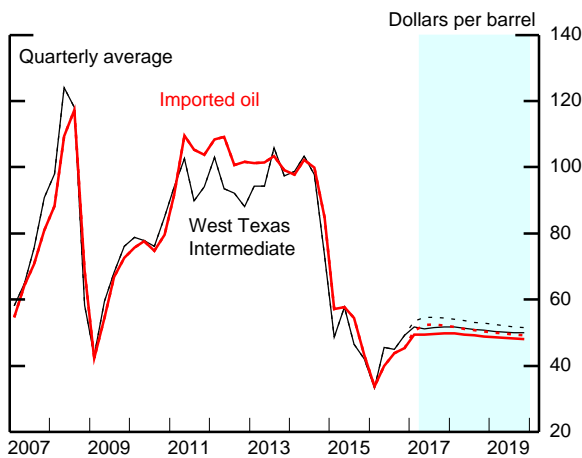
Equity Prices



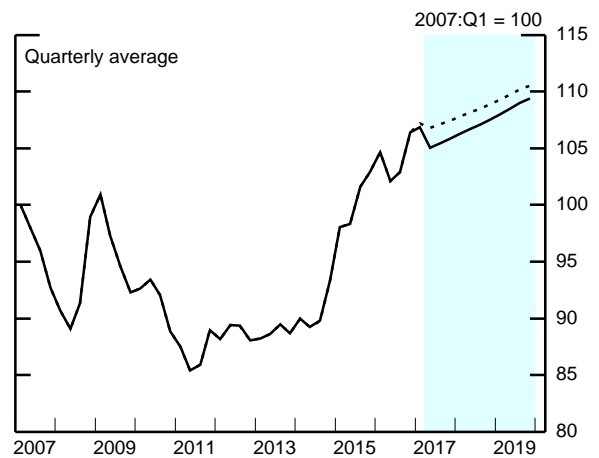
House Prices



Crude Oil Prices



Broad Real Dollar



different from what we showed in the March Tealbook. We continue to project that core PCE price inflation will move up to 2.0 percent in 2019, and that headline inflation will be 1.9 percent.

KEY BACKGROUND FACTORS

Fiscal Policy

- We have retained our placeholder assumption that adjustments to federal fiscal policy will increase the primary budget deficit (that is, the deficit excluding interest costs) by 1 percent of GDP, and that this fiscal expansion will take the form of a cut in personal income taxes starting in the first quarter of 2018. There is considerable uncertainty about the potential size, timing, and composition of these fiscal policy changes. Indeed, given that progress toward coalescing around a specific set of policy changes has been slow, we view this uncertainty as even greater than it was at the time of the March Tealbook.
- We project that discretionary policy actions across all levels of government will increase the rate of real GDP growth about $\frac{1}{4}$ percentage point in 2017, $\frac{1}{2}$ percentage point in 2018, and $\frac{1}{4}$ percentage point in 2019, about the same as in the March Tealbook.
- In the near term, funding for all discretionary federal government programs runs out on April 28. We assume that an agreement providing funding beyond that date will be reached with no major disruptions to government operations, and that the size and composition of spending will be little changed by the agreement.²

Monetary Policy

- The intercept-adjusted inertial Taylor (1999) rule that we use in our projection calls for the federal funds rate to increase about 1 percentage point per year, on average, over the projection period and to average 3.5 percent in the fourth quarter of 2019—just a touch higher than in the March Tealbook.

² We estimate that a one-week federal government shutdown starting at the end of April would subtract around $\frac{1}{4}$ percentage point (annual rate) from real GDP growth in 2017:Q2 and add a comparable amount to growth in 2017:Q3.

- We continue to assume that the SOMA portfolio will remain at its current level until the third quarter of 2017 and then begin to contract, as the proceeds from principal repayments on securities held in the portfolio are no longer reinvested.

Other Interest Rates

- Over the next few quarters, the 10-year Treasury yield is a little lower than in our March projection, as market rates have come in below our previous projection. The 10-year Treasury yield is projected to rise to 3.9 percent by the end of 2019—modestly above its assumed longer-run value of 3.5 percent.
- The path of 30-year fixed mortgage rates is revised mostly in line with the revisions to the path for the 10-year Treasury yield. However, triple-B corporate bond spreads are currently about 20 basis points narrower than we had projected in the March Tealbook, and our projection carries forward part of this narrower spread into next year.

Equity Prices and Home Prices

- Equity prices have declined around 1½ percent since the March Tealbook, whereas we had projected them to remain about flat. Nevertheless, notable valuation pressures remain implicit in our projection, and our view is that those pressures will limit the scope for further stock price appreciation over the medium term. As a result, equity prices are projected to rise at an average annual rate of only about 1 percent through 2019, similar to the projected rate of increase in the March Tealbook. (Implications of a decline in equity prices are explored in alternative scenarios included in the Risks and Uncertainty section.)
- Recent data on house prices have been slightly weaker than expected, and we have nudged down our forecast for house price appreciation this year to around 5½ percent. We estimate that house prices are somewhat above their normal historical relationship with rents and therefore continue to project that growth in home values will slow to around 4 percent in 2018 and 2019.

Foreign Economic Activity and the Dollar

- Incoming data suggest a bit greater near-term momentum in the foreign economies than we anticipated at the time of the March Tealbook. We now estimate total real foreign GDP growth in the first quarter of nearly 3 percent at an annual rate. We see growth abroad moderating to 2½ percent by the third quarter, largely reflecting a deceleration of economic activity in Canada, and we expect foreign growth to remain at this near-potential pace through the medium term.
- The broad nominal dollar has depreciated about 1½ percent since the time of the March Tealbook. Going forward, we expect the broad real dollar to appreciate at an annual rate of about 1½ percent over the forecast period, as market expectations for the federal funds rate move up toward the staff forecast. Reflecting recent dollar depreciation, our projection for the broad real dollar at the end of 2019 is 1 percent lower than in the March Tealbook.

Oil and Commodity Prices

- The spot price of Brent crude oil has fallen about \$3 per barrel since the time of the March Tealbook to \$53 per barrel. Spot prices have been volatile, falling about \$5 between the March Tealbook and the March FOMC meeting before mounting a recovery that persisted through the week ending April 14. Prices responded to both news about U.S. oil production and inventories as well as changing market conviction regarding OPEC's commitment to cut production. As in the March Tealbook, we project that oil prices will decline gradually over the projection period.
- Prices for industrial metals have fallen more than 5 percent since the March Tealbook, as short-term supply disruptions in the production of copper and nickel have been resolved. Even with these declines, metals prices are still notably higher than they were last October when they started rising on expectations for a pickup in global activity and slower growth in supply. Food and agricultural prices have fallen 6 percent since the March Tealbook, mainly reflecting upward revisions to the supply outlook for several crops.

Federal Reserve System Nowcasts of 2017:Q1 Real GDP Growth
(Percent change at annual rate from previous quarter)

Federal Reserve entity	Type of model	Nowcast as of Apr. 19, 2017
Federal Reserve Bank		
Boston	<ul style="list-style-type: none"> Mixed-frequency BVAR 	3.1
New York	<ul style="list-style-type: none"> Factor-augmented autoregressive model combination Factor-augmented autoregressive model combination, financial factors only Dynamic factor model 	1.6 1.6 2.7
Cleveland	<ul style="list-style-type: none"> Bayesian regressions with stochastic volatility Tracking model 	2.8 -0.3
Atlanta	<ul style="list-style-type: none"> Tracking model combined with Bayesian vector autoregressions (VARs), dynamic factor models, and factor-augmented autoregressions (known as GDPNow) 	.5
Chicago	<ul style="list-style-type: none"> Dynamic factor models Bayesian VARs 	2.7 1.2
St. Louis	<ul style="list-style-type: none"> Dynamic factor models News index model Let-the-data-decide regressions 	2.6 3.3 2.7
Kansas City	<ul style="list-style-type: none"> Accounting-based tracking estimate 	.5
Board of Governors	<ul style="list-style-type: none"> Board staff's forecast (judgmental tracking model) Monthly dynamic factor models (DFM-45) Mixed-frequency dynamic factor model (DFM-BM) 	.9 2.8 2.9
Memo: Median of Federal Reserve System nowcasts		2.7

THE OUTLOOK FOR REAL GDP

The news on spending since the March Tealbook has been negative, on balance, with downward surprises for PCE and federal defense purchases only partially offset by upside surprises in residential investment, oil drilling activity, and exports. We currently estimate that real GDP increased at an annual rate of only about 1 percent in the first quarter after increasing at a 2 percent pace in the fourth quarter; this deceleration mainly reflects a sharp slowdown in real PCE growth. However, we see the soft PCE reading as mostly temporary, and we project that real GDP growth will pick up to a 2½ percent pace in the current quarter.³

- Real PCE growth appears to have slowed to an annual rate of only ½ percent in the first quarter. As previously noted, we see much of this slowing as transitory. Spending on energy services was held down by unseasonably warm weather through February, and we expect it to pick up in the second quarter, assuming temperatures return to seasonal norms. Spending in some non-energy services categories, which is currently estimated to have been soft in the first quarter after rising strongly in the fourth, is also expected to rebound. Similarly, sales of motor vehicles stepped down in the first quarter from a very high level in the fourth, and we expect vehicle sales to decline only a little further this quarter. Finally, spending in the broad category covered by non-auto retail sales, which was especially weak in February, rebounded in March, albeit to a lower level than we had anticipated.⁴ With ongoing gains in employment and income as well as still-upbeat levels of sentiment, PCE growth is expected to step back up to a rate of 3 percent in the second quarter, about the same pace as we forecast in the previous Tealbook.
- Equipment and intangibles (E&I) investment is estimated to have increased at an annual rate of 2¼ percent in the first quarter, a little more than the 1½ percent gain in the fourth quarter of last year but less than we expected in the March Tealbook. Several indicators of business spending remain upbeat; for example, new orders of nondefense capital goods have posted net gains in recent months, and indexes of business sentiment and activity are still

³ The BEA's first estimate of GDP growth for 2017:Q1 will be released on Friday, April 28.

⁴ We think some of the decline in retail sales in February and the rebound in March reflected the temporary hold on federal tax refunds with an earned income tax credit or a child tax credit that was introduced this year.

Summary of the Near-Term Outlook
(Percent change at annual rate except as noted)

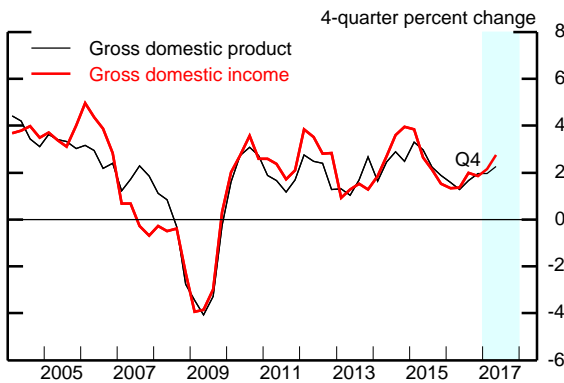
Domestic Econ Devel & Outlook

Measure	2016:Q4		2017:Q1		2017:Q2	
	Previous Tealbook	Current Tealbook	Previous Tealbook	Current Tealbook	Previous Tealbook	Current Tealbook
Real GDP	1.9	2.1	1.4	.9	2.1	2.6
Private domestic final purchases	3.1	3.4	2.4	1.8	2.8	3.0
Personal consumption expenditures	3.0	3.5	1.5	.6	3.0	3.1
Residential investment	9.4	9.6	8.0	11.4	-2.5	-1.3
Nonres. private fixed investment	1.9	.9	5.7	5.4	3.7	4.4
Government purchases	.0	.2	-.4	-1.8	1.8	2.4
<i>Contributions to change in real GDP</i>						
Inventory investment ¹	.9	1.0	.0	.0	.0	-.1
Net exports ¹	-1.7	-1.8	-.6	-.3	-.6	-.3
Unemployment rate	4.7	4.7	4.7	4.7	4.7	4.5
PCE chain price index	1.9	2.0	2.6	2.4	1.4	1.2
Ex. food and energy	1.2	1.3	2.3	2.0	1.7	1.6

1. Percentage points.

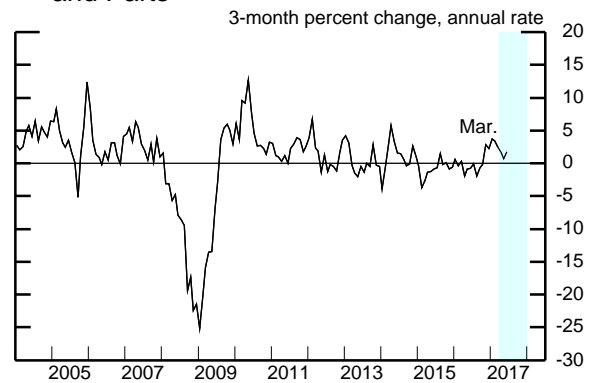
Recent Nonfinancial Developments (1)

Real GDP and GDI



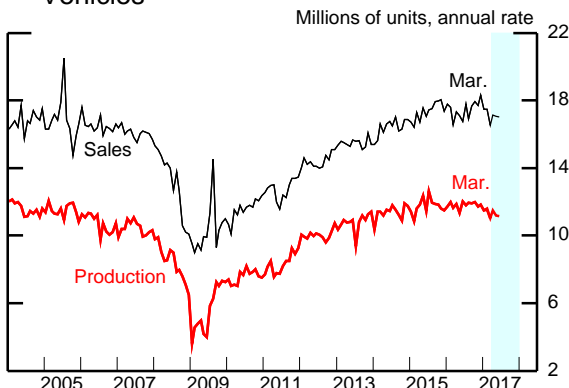
Source: U.S. Dept. of Commerce, Bureau of Economic Analysis.

Manufacturing IP ex. Motor Vehicles and Parts



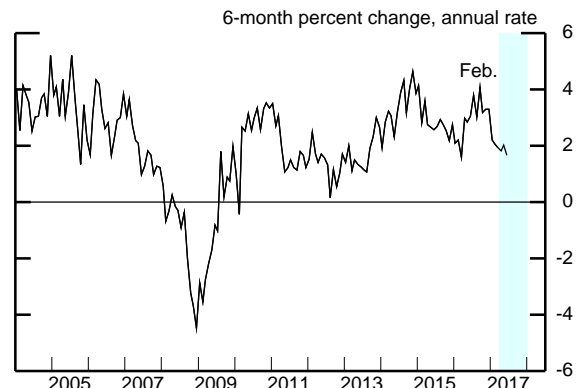
Source: Federal Reserve Board, G.17 Statistical Release, "Industrial Production and Capacity Utilization."

Sales and Production of Light Motor Vehicles



Source: Ward's Communications; Chrysler; General Motors; FRB seasonal adjustments.

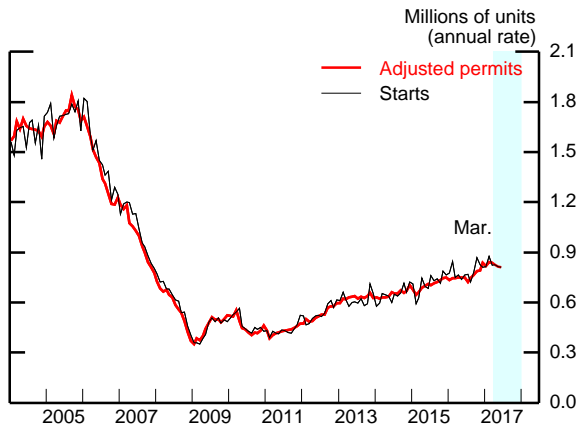
Real PCE Growth



Source: U.S. Dept. of Commerce, Bureau of Economic Analysis.

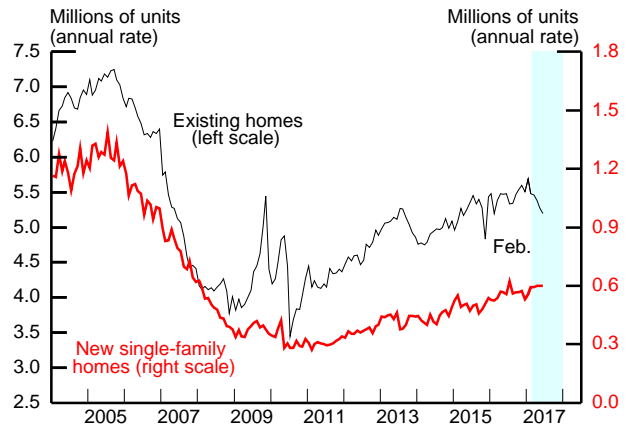
Recent Nonfinancial Developments (2)

Single-Family Housing Starts and Permits



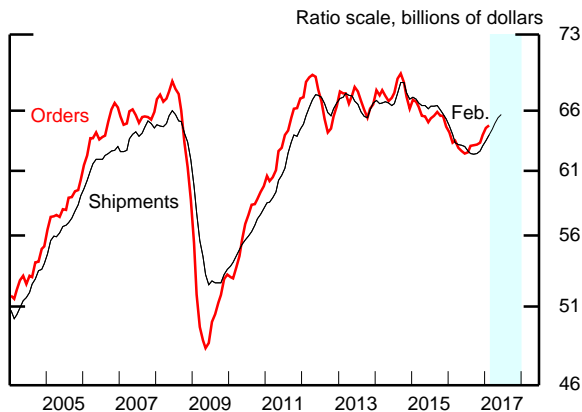
Note: Adjusted permits equal permit issuance plus total starts outside of permit-issuing areas.
Source: U.S. Census Bureau.

Home Sales



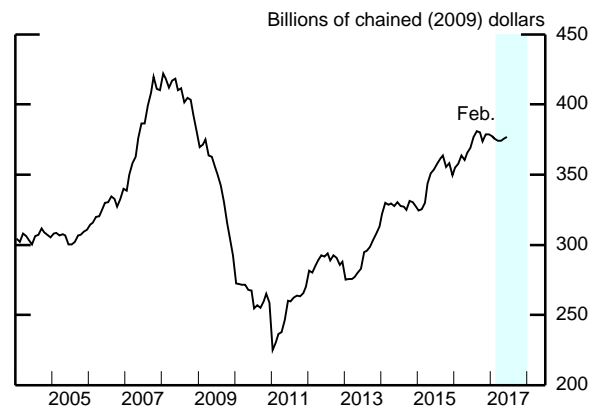
Source: For existing, National Association of Realtors; for new, U.S. Census Bureau.

Nondefense Capital Goods ex. Aircraft



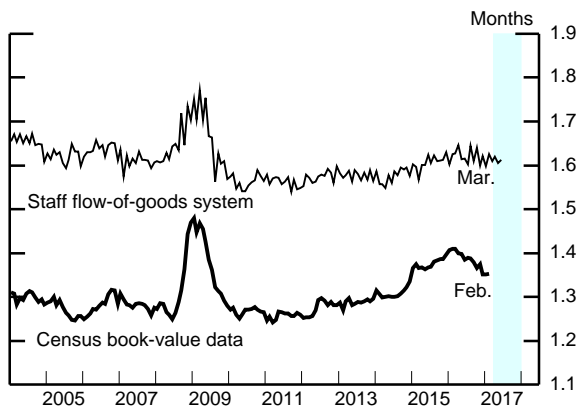
Note: Data are 3-month moving averages.
Source: U.S. Census Bureau.

Nonresidential Construction Put in Place



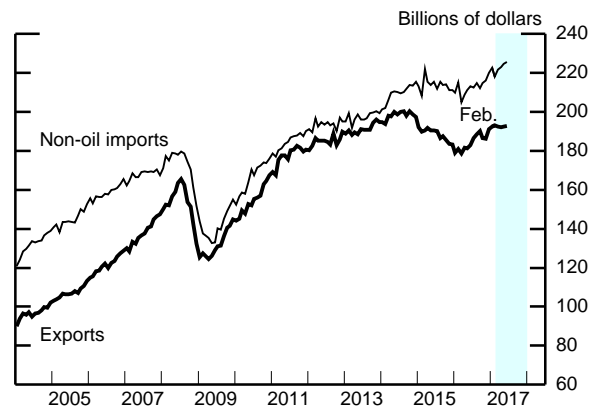
Note: Nominal CPIP deflated by BEA prices through 2016:Q4 and by the staff's estimated deflator thereafter.
Source: U.S. Census Bureau.

Inventory Ratios



Note: Flow-of-goods system inventories include manufacturing and mining industries and are relative to consumption. Census data cover manufacturing and trade, and inventories are relative to sales.
Source: U.S. Census Bureau; staff calculations.

Exports and Non-oil Imports



Note: Forecasts are linear interpolations of quarterly values.
Source: U.S. Dept. of Commerce, Bureau of Economic Analysis; U.S. Census Bureau.

elevated. However, in light of the persistent weakness in E&I spending through last year, we have somewhat downgraded our near-term E&I outlook in this projection and now have investment increasing at a more modest 2½ percent annual rate in the next couple of quarters.

- Indicators of oil drilling activity jumped in the first quarter and point to a much stronger level of investment in drilling and mining structures than we had been expecting. In contrast, spending on other nonresidential structures has edged down. All told, spending on nonresidential structures is now projected to rise at an annual rate of 14¼ percent over the first half of this year, well above our previous forecast.
- The recent data on housing activity have remained positive despite the rise in mortgage rates since last fall. Starts for single-family homes edged up in the first quarter, and permits strengthened. Sales of existing homes declined in February, but pending home sales, which tend to lead actual sales by a month or two, increased notably. Some of the recent strength in housing activity may reflect a pull-forward in response to the warmer-than-usual February weather, the anticipation of a further rise in interest rates, or both. As a result, we continue to expect that a jump in residential investment growth in the first quarter will give way to modest declines in the second and third quarters as higher mortgage rates start to weigh more heavily on housing demand.
- Export growth has been surprisingly strong in recent months; as a result, net exports are estimated to have been a smaller drag on first-quarter real GDP growth than we had been expecting. Export growth is expected to slow in the current quarter but to remain at a pace above that in the March Tealbook. On average, net exports are projected to subtract about ¼ percentage point from GDP growth in the first half of 2017, about half of the drag in the previous forecast.
- Manufacturing production recorded a moderate increase in the first quarter as a whole despite declining in March. The first-quarter increase, together with continued strength in the new orders indexes from the national and regional manufacturing surveys, suggests that factory output will increase modestly in coming months. We project that manufacturing production will increase at an

annual rate of 2 percent in the first half of this year—roughly the same as in the March Tealbook—after treading water, on net, during the past two years.

Real GDP growth is projected to be 2 percent in 2017, to pick up to 2¼ percent in 2018 as fiscal expansion kicks in, and then to slow to about 1¾ percent in 2019, in part reflecting the ongoing normalization of monetary policy.

- The medium-term GDP forecast is just a touch stronger than the March Tealbook. The level of real GDP at the end of the second quarter is little revised and the key conditioning factors are slightly more positive, mostly reflecting the somewhat lower projected path for the dollar.
- Over the medium term, real GDP growth is expected to outpace potential growth. (We assume that potential GDP growth will rise gradually from 1½ percent this year to 1¾ percent in 2019.) We forecast real GDP to be about 1¾ percent above potential at the end of 2019, a tenth more than in the March Tealbook.
- The box “Tealbook Forecast Errors: An Update through 2016” reviews recent errors in the staff’s forecast for GDP, unemployment, and inflation.

THE OUTLOOK FOR THE LABOR MARKET AND AGGREGATE SUPPLY

Taken together, the two employment reports since the March Tealbook suggest that labor market conditions continued to tighten through the first quarter and by somewhat more than we had previously expected.⁵

- Key indicators from the household survey were stronger than we projected in the March Tealbook. After edging down (as expected) to 4.7 percent in February, the unemployment rate fell to 4.5 percent in March, 0.2 percentage point lower than we anticipated. The LFPR unexpectedly increased to 63.0 percent in February and remained at that level in March, 0.2 percentage point above our March Tealbook forecast.
- We responded to the incoming data by lowering our projection for the unemployment rate in the current quarter 0.2 percentage point, to 4.5 percent.

⁵ The labor market report that was published in early March was available at the time of the FOMC meeting but not when we published the March Tealbook.

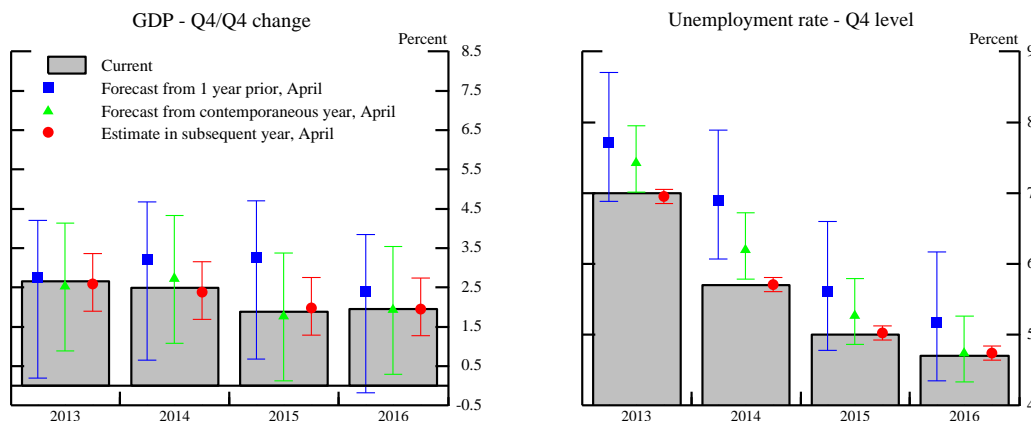
Tealbook Forecast Errors: An Update through 2016

The staff’s forecast errors for 2016 were relatively small. Real gross domestic product (GDP) growth in 2016, although still subject to sizable revisions, is currently estimated to be close to staff forecasts from one and two years ago. As was the case in recent years, the unemployment rate finished 2016 lower than the staff’s prior-year forecast, though it was in line with the staff forecast from April 2016. Tealbook forecasts of core personal consumption expenditures (PCE) price inflation in 2016 were slightly too low. Here we discuss these recent forecast errors.

In the left panel of figure 1, the gray bars show the currently published Q4/Q4 percent changes in real GDP from 2013 to 2016, the blue squares show the forecasts for GDP growth made in the April Tealbook one year prior, and the green triangles show the forecast from the April Tealbook in the contemporaneous year. The whisker bands demarcate 70 percent forecast error bands, so that unusually large forecast errors are represented by cases where the top edge of a gray bar falls outside of the whisker band.¹ The red dots show the GDP growth estimates for each year from mid-April of the subsequent year, along with 70 percent bands computed from past revisions to those estimates. Staff forecast errors for real GDP growth in 2016 are small, well within the 70 percent whisker bands, although the staff’s prior-year GDP projection was too high for the third consecutive year.

The right panel shows the same information for the unemployment rate. The April 2016 forecast was on the mark, a notable improvement over projections from earlier years.² However, the April 2015 Tealbook forecast of the unemployment rate in 2016:Q4 was too high, continuing a pattern of one-sided errors in forecasts. Unlike forecasts from earlier in the expansion, when the labor force participation rate was

Figure 1: Real Activity Forecast Errors



Source: Staff forecast and U.S. Dept. of Commerce, Bureau of Economic Analysis, Bureau of Labor Statistics.

¹ The whisker bands for real activity variables are calculated using forecast errors since 1980; whisker bands around the inflation projections are calculated using forecast errors since 1998.

² The staff subsequently raised its unemployment rate forecast for 2016 in the next few Tealbooks, making them too high again. However, the resulting forecast errors (0.1 to 0.2 percentage point) are small by historical standards.

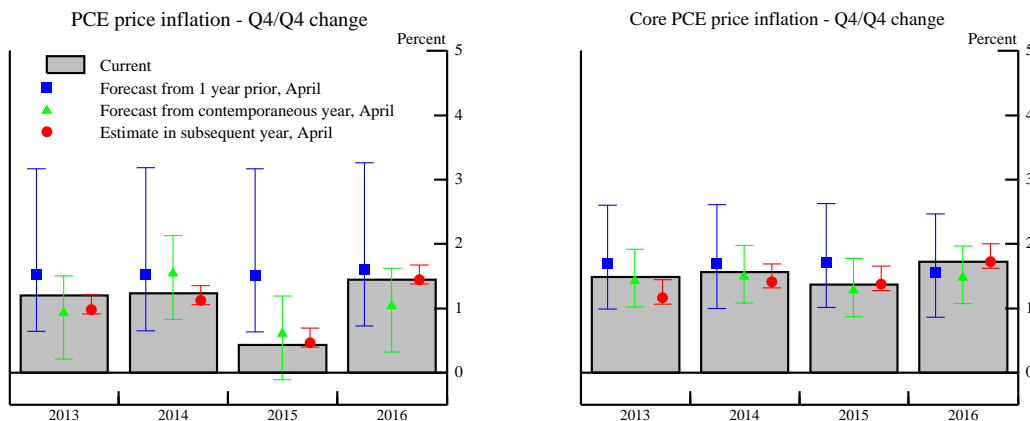
persistently lower than the staff expected (not shown), the labor force participation rate finished 2016 slightly higher than the staff anticipated in 2015. Accordingly, staff prior-year forecasts of the employment-to-population ratio (also not shown) were somewhat more accurate in the few preceding years than in 2016, as forecast errors in the unemployment and labor force participation rates were offsetting in 2013 through 2015 but not in 2016.

The combination of lower-than-expected GDP growth and a lower-than-expected unemployment rate over the past few years has prompted the staff to make a series of adjustments to its supply-side assumptions. Most notably, the staff has lowered its estimate of structural productivity growth on several occasions over this period.

Figure 2 shows the same information for the Q4/Q4 percent changes in total and core PCE prices. The staff’s prior-year forecast of 2016 total PCE price inflation was close to the currently published reading, whereas the forecast made in April 2016 was too low. The difference between the forecasts made in April 2015 and April 2016 importantly reflects the staff’s oil price projections. Oil prices unexpectedly fell early in 2016 and then rebounded later that year. The staff projection in April 2015 anticipated neither the early-2016 decline nor the later rebound and proved more accurate for oil price inflation than the staff projection in April 2016, which had taken onboard the early 2016 decline but had forecast a smaller rebound.

Staff forecasts for core PCE price inflation in 2016 were a couple of tenths of a percentage point too low. The misses were concentrated in services prices and, in particular, nonmarket prices, which wound up higher than expected. From 2013 to 2015, the staff’s year-ahead core inflation forecasts were slightly too high. As it turns out, those forecast errors can be explained by core goods import prices that came in lower than expected. Conditioning on the actual path of import prices and other observable factors, core inflation from 2013 to 2015 was, as in 2016, slightly higher than the staff can explain. These positive residuals might reflect, among other things, a higher inflation trend than the staff assumes or a larger contribution to core inflation from resource utilization, or they may simply be the result of idiosyncratic shocks.

Figure 2: Price Inflation Forecast Errors



Source: Staff forecast and U.S. Dept. of Commerce, Bureau of Economic Analysis.

In addition, we revised up our current-quarter projection of the LFPR 0.1 percentage point, to 62.8 percent.

- Overall payroll employment gains during the first quarter—an average of 178,000 per month—were somewhat softer than we had anticipated, though still well above the 90,000 to 120,000 range that we estimate to be consistent with unchanged labor market slack. In the second quarter, we expect payroll employment to rise at about the same pace as in the first quarter.
 - In the first quarter, private payrolls increased 171,000 per month, on average—about 30,000 less per month than expected in the March Tealbook. The March gain was only 89,000, but we think that much of the swing from February’s 221,000 increase was accounted for by weather-related influences.⁶
 - In contrast to private payrolls, total government employment came in somewhat above our expectation. This upside surprise, which was concentrated in federal employment, suggests that the federal hiring freeze was less binding than we had expected. We now assume that federal payrolls will be flat starting in May, rather than falling 5,000 per month as we had previously projected.

As we have discussed in previous Tealbooks, we have been surprised during the past few years by the extent of the improvement in labor market conditions given the pace of real GDP growth. In response to those earlier surprises, on several occasions we reduced our estimate of potential GDP growth and made less-significant changes to the natural rate of unemployment. This round, with productivity close to our estimate of its trend, a further reduction in potential output growth did not seem to be called for. Accordingly, we trimmed our estimate of the natural rate and raised our estimate of the trend LFPR.⁷ Specifically, we have slightly slowed the decline in the trend LFPR from

⁶ Private payroll gains in February and March were affected by the unusually warm weather in February, which boosted the increase in payrolls in that month and held it down in March. Separately, we estimate that the major winter storm that hit the Northeast during the March survey’s reference period held down private payroll gains in that month by about 20,000.

⁷ Our decision to revise up the trend LFPR also reflected a reevaluation of the trend for young persons and some evidence that some workers previously reporting themselves as disabled have returned to the workforce.

2016 through 2019, which raised our estimate of its level 0.1 percentage point in the current quarter and 0.2 percentage point by the end of 2019. In addition, we now assume that the natural rate continued to edge down last year, reaching 4.9 percent by the end of 2016, rather than remaining flat at 5.0 percent as in our recent projections.⁸

Even with these adjustments, we see the labor market as running a little tighter through the first half of the year than we anticipated in the March Tealbook.

- Our current-quarter projection of the unemployment rate (at 4.5 percent) is 0.4 percentage point below its natural rate, a 0.1 percentage point wider gap than in the March projection, while our forecast for the LFPR (62.8 percent) exceeds its trend by 0.1 percentage point, about the same as in the previous Tealbook.
- We continue to view some of the other indicators of labor market slack as slightly elevated. The share of individuals working part time for economic reasons and the long-term unemployment rate, while having declined further during the first three months of the year, remain above their average levels before the 2007–09 recession.

As in the March Tealbook, the labor market is projected to improve further over the medium term and is expected to be quite tight by the end of 2019.

- Average monthly total payroll gains are expected to slow from 180,000 in 2017 to 120,000 in 2019.
- After decreasing about 1 percentage point since early 2015, the unemployment rate is projected to decline another ½ percentage point over the medium term and to reach 4.0 percent at the end of 2019, 0.1 percentage point below the previous projection. The small revision at the end of the forecast period reflects the lower assumed natural rate of unemployment.
- Both the LFPR and the employment-to-population ratio continue to improve relative to their declining trends.

⁸ We prevented these adjustments from showing through to potential GDP by making a technical change pertaining to the ratio of the trends in business-sector hours and total-economy hours.

- We project that productivity will increase a little less than 1 percent per year over the forecast period, a bit slower than in 2016 (though still up from its average over the preceding several years) and slightly below our estimate of its structural pace.⁹
- The box “Immigration and Economic Growth” discusses the contribution of immigration to population growth and potential GDP.

THE OUTLOOK FOR INFLATION

Taken as a whole, the news bearing on consumer price inflation was softer than we expected in the March Tealbook and resulted in a lower near-term inflation outlook.

- The CPI declined 0.3 percent in March, and, strikingly, the core index declined 0.1 percent; the current vintage of the core CPI data shows only five other monthly declines since 1980. Our translation of these data, along with the March PPI, suggests that core PCE prices also declined 0.1 percent in March following a surprisingly large increase in core prices in January and a more modest increase in February.
- We think much of the softness in the March consumer price data reflects transitory or one-off factors.¹⁰ Based on that assessment and in light of the upward surprise in import prices (discussed later), we have marginally raised our projection for core inflation over the next few months, thereby offsetting a portion of the negative March surprise.¹¹ (In January, when the incoming inflation data were surprisingly strong, we similarly tempered the implications of the news for our forecast.)

⁹ Productivity typically declines relative to its structural level when the labor market becomes tight, possibly reflecting workers with lower-than-average productivity being drawn into the workforce.

¹⁰ For example, we view the relatively large declines in the CPI for lodging away from home (which fell 2.8 percent) and apparel (which fell 0.7 percent) as transitory movements, and we expect some of these declines to be reversed in the coming months. Separately, the CPI for wireless telephone services declined 7.0 percent in March (monthly rate), reducing the monthly change in the core CPI by about 0.15 percentage point; we view that decline as unlikely to repeat.

¹¹ Had we maintained our monthly assumptions for the remaining months of the year (and thus ignored the stronger import price information and not built in any bounceback from the downward surprise in the CPI in March), the news in the March CPI report would have lowered our 2017 core PCE inflation projection 0.2 percentage point instead of 0.1 percentage point.

- We now estimate that the 12-month change in core PCE prices moved down to 1.6 percent in March—0.2 percentage point lower than we had expected. Given the partial offset to the March surprise that we built into our near-term projection, we expect this measure to edge back up to 1.7 percent by June, 0.1 percentage point below the previous Tealbook. We expect the 12-month change in total PCE prices to be a bit below 2 percent over this period.
- The recent data on import prices have been stronger than we expected. Core import prices are now estimated to have risen at an annual rate of 1 percent in the first quarter, whereas in the March Tealbook we projected a slight decline. Recent dollar weakness is expected to push core import price inflation up to an annual rate of 1¾ percent over the next two quarters, higher than the average over the previous five years. Thereafter, import price inflation is expected to slow to a ¾ percent pace, consistent with moderate foreign inflation, a gradually appreciating dollar, and slowly declining commodity prices.
- The incoming data on longer-run inflation expectations have moved lower since the March Tealbook. Median expectations over the next 5 to 10 years from the University of Michigan Surveys of Consumers edged down to 2.4 percent in March and remained at that level in the preliminary April reading. The Federal Reserve Bank of New York’s Survey of Consumer Expectations reported that the median inflation expectation 3 years ahead declined to 2.7 percent in March after having increased since November. The TIPS-based measures for both 5-year and 5-to-10-year-forward inflation compensation, currently at 1.8 and 1.9 percent, respectively, have edged down from the 2 percent level seen at the time of the March Tealbook.

Our core inflation projection for 2017 is 0.1 percentage point lower than in the March Tealbook but is unrevised thereafter. Over the three-year period from 2016 to 2019, core inflation rises from 1.7 percent to 2.0 percent while total PCE price inflation is anticipated to move up from 1.4 percent to 1.9 percent. The ¼ percentage point acceleration in core inflation between 2016 and 2019 mainly reflects the diminishing pass-through from earlier declines in energy prices and core import prices, along with the further tightening of resource utilization. In addition, we continue to assume a small pickup (5 basis points in both 2018 and 2019) in the prevailing level of inflation expectations relevant for wage and price setting.

Immigration and Economic Growth

Immigration has historically been an important source of population growth in the United States. According to estimates by the Census Bureau, net immigration flows (both legal and unauthorized) accounted for about one-third of the roughly 1 percent average annual population growth rate over the past 50 years. In the latest year for which data are available, 2015, net immigration is estimated to have been about 1.15 million persons. Altogether, an estimated 43 million foreign-born individuals resided in the United States that year, of which about 11 million were unauthorized.¹

In the staff projection, potential output rises 1.7 percent per year over the next 10 to 15 years. As can be seen in the second bar from the right in figure 1 (labeled 2020s), about 0.9 percentage point of this growth is attributable to population growth (the sum of the blue and cross-hatched portions of the bar), of which about half (the blue portion) is due to net immigration.² Other sources of potential gross domestic product (GDP) growth (shown by the red portion of the bar) include the combined contribution of the trends in the labor force participation rate, the average workweek, and labor productivity.

In a standard “growth accounting” framework, such as the one used by the staff, a reduction in population growth reduces the growth rate of potential GDP by the same amount (holding productivity growth and other factors constant). In this framework, a change in immigration policy that reduced net immigration by 500,000 persons per year would, all else being equal, reduce the growth rate of potential GDP between 0.1 and 0.2 percentage point. If all unauthorized immigrants—who constitute roughly 5 percent of the U.S. labor force—were removed or emigrated, this change would have a substantial effect on the level of potential GDP.

Changes to immigration policy will have spillovers beyond the direct effect on the population, so the total effect may be larger or smaller than this simple calculation would suggest. For example, the immigrant population has, on average, a higher labor force participation rate than the native-born population; as a result, lower net immigration could reduce the trend participation rate a bit, all else being equal, implying a larger downward effect on potential GDP. Alternatively, a reduction in the number of immigrants would effectively raise the

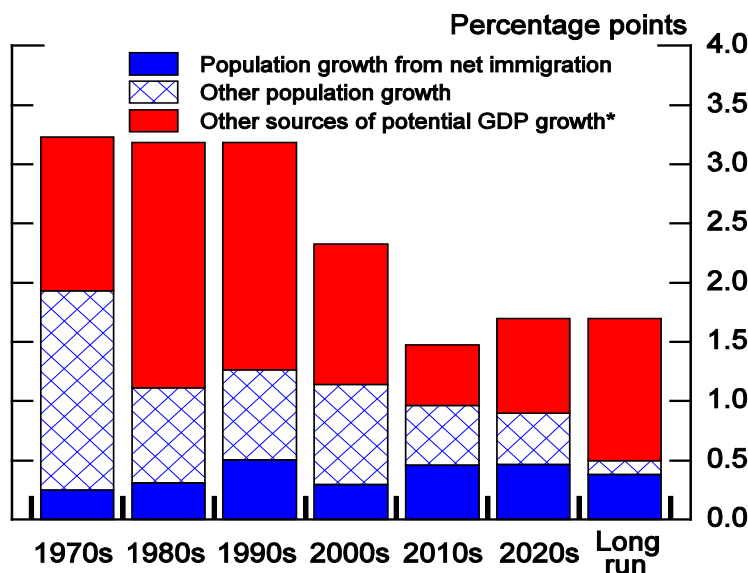
¹ Estimates of the number of unauthorized immigrants are from the Pew Research Center and are obtained by subtracting an estimate of the number of legal immigrants (derived from administrative records) from an estimate of the overall foreign-born population (derived from national surveys such as the American Community Survey).

² The staff uses the Census Bureau’s projections of population growth in its forecast of potential output. The numbers in figure 1 refer to the working-age population—the relevant population for thinking about potential output. Using the full population instead would yield a similar decomposition.

amount of capital available per worker, all else being equal, and might therefore boost average productivity, offsetting to some extent the negative effect on potential GDP from the lower population. Taking into account general equilibrium effects would further complicate the analysis. Of particular interest might be how changes in immigration policy affect capital investment, new firm creation, and the employment of non-immigrant workers.

Finally, it is worth noting that a change in immigration policy would likely have, at most, a small effect on the aggregate statistics used to measure slack in the economy. While labor force participation rates and unemployment rates among the foreign-born population differ somewhat from those of the native-born population, these differences are sufficiently small that a modest change in immigration would not generate large differences in these aggregate statistics.

Figure 1: Composition of Potential GDP Growth

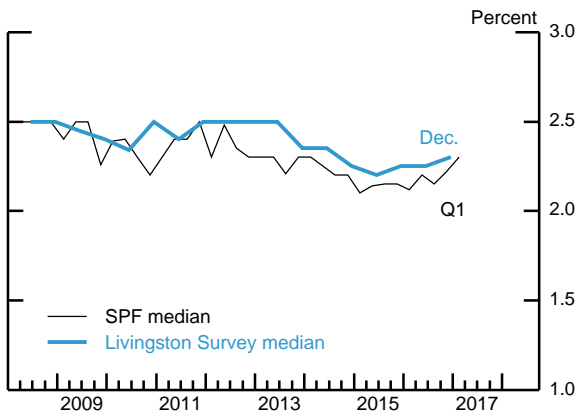


*Other sources of potential GDP growth include the combined contribution of the trends in the labor force participation rate, the average workweek, and labor productivity.

Source: Staff estimates based on Census Bureau data and projections.

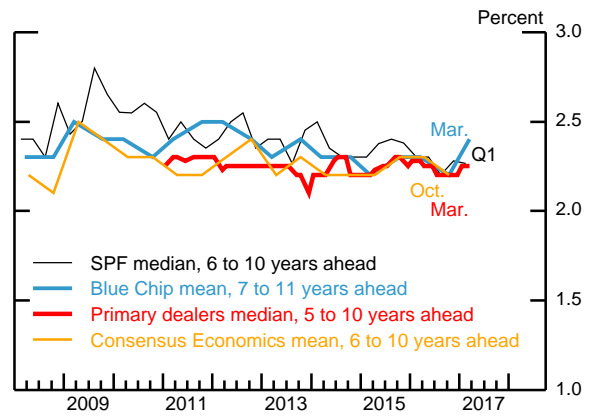
Survey Measures of Longer-Term Inflation Expectations

CPI Next 10 Years



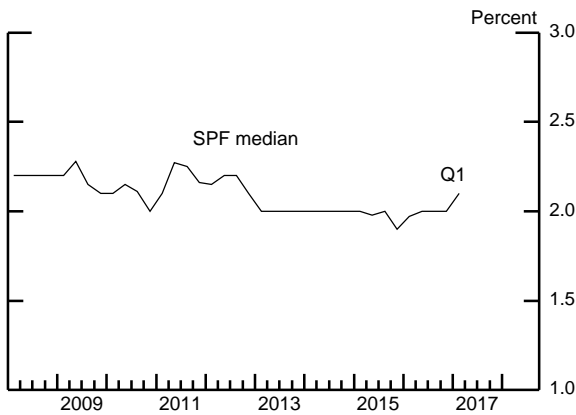
Note: SPF is Survey of Professional Forecasters.
Source: Federal Reserve Bank of Philadelphia.

CPI Forward Expectations



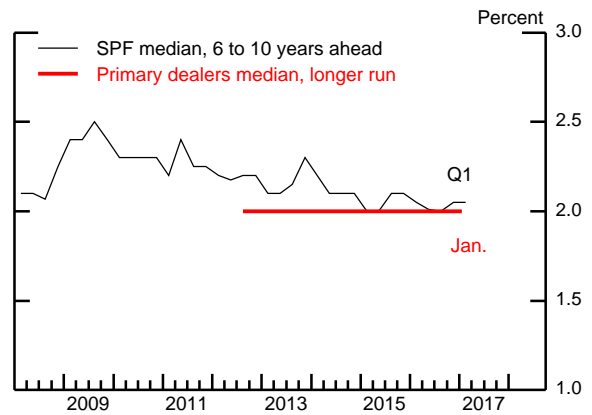
Source: Federal Reserve Bank of Philadelphia; Blue Chip Economic Indicators; Federal Reserve Bank of New York; Consensus Economics.

PCE Next 10 Years



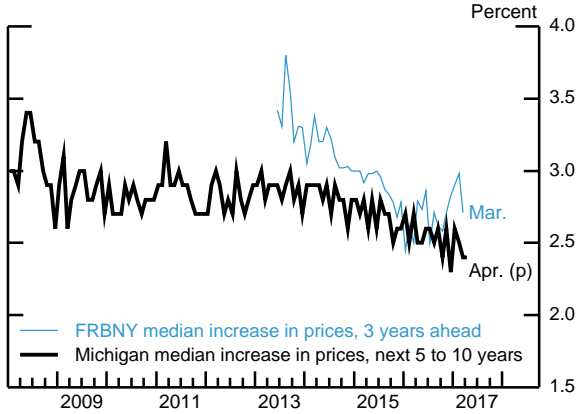
Source: Federal Reserve Bank of Philadelphia.

PCE Forward Expectations



Note: Primary dealers data begin in August 2012.
Source: Federal Reserve Bank of Philadelphia; Federal Reserve Bank of New York.

Surveys of Consumers

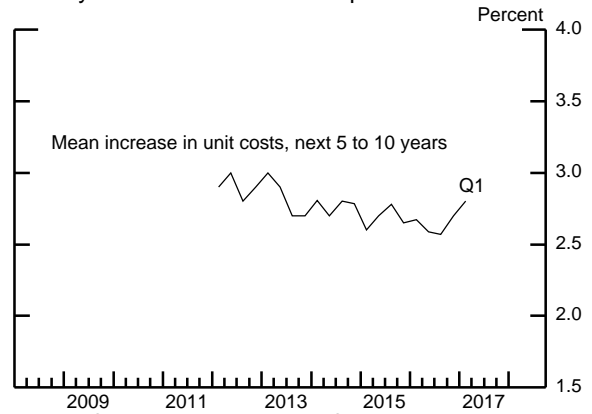


Note: Federal Reserve Bank of New York (FRBNY) Survey of Consumer Expectations reports expected 12-month inflation rate 3 years from the current survey date. FRBNY data begin in June 2013.

(p) Preliminary.

Source: University of Michigan Surveys of Consumers; Federal Reserve Bank of New York Survey of Consumer Expectations.

Survey of Business Inflation Expectations



Note: Survey of businesses in the Sixth Federal Reserve District. Data begin in February 2012.
Source: Federal Reserve Bank of Atlanta.

Average hourly earnings and business-sector compensation per hour (CPH) from the Productivity and Costs report have accelerated modestly over the past couple of years, while ECI growth has remained relatively flat.¹² Broadly speaking, we are not puzzled by recent compensation trends; we think the anemic trend in productivity growth plays an important role in explaining these trends.

- Average hourly earnings increased 2.7 percent over the 12 months ending in March, $\frac{1}{4}$ percentage point faster than over the preceding 12 months and $\frac{3}{4}$ percentage point above the rates observed through 2014. We anticipate this 12-month change will pick up to 2.9 percent over the next couple of months.
- The Federal Reserve Bank of Atlanta’s Wage Growth Tracker was 3.4 percent in March, below its recent highs but noticeably above the pace seen a few years ago.
- Business-sector CPH is currently estimated to have increased $3\frac{1}{4}$ percent in 2016—again, up from the rates that were typical of a few years ago. We expect CPH growth to edge up to $3\frac{1}{2}$ percent by 2019 as the labor market tightens further.

THE LONG-TERM OUTLOOK

- In the longer run, we continue to assume a growth rate of potential GDP of 1.7 percent. The natural rate of unemployment has been revised down from 5.0 percent to 4.9 percent.
- We expect that the Federal Reserve’s holdings of securities will continue to put downward pressure on longer-term interest rates, though to a diminishing extent over time. The SOMA portfolio is projected to have returned to a normal size by the end of 2021.
- With output above its potential and inflation slightly higher than the Committee’s 2 percent objective, the nominal federal funds rate is about 1 percentage point above its long-run value of 3 percent in 2021 and then moves back toward its long-run value thereafter.

¹² The ECI for March will be published on April 28.

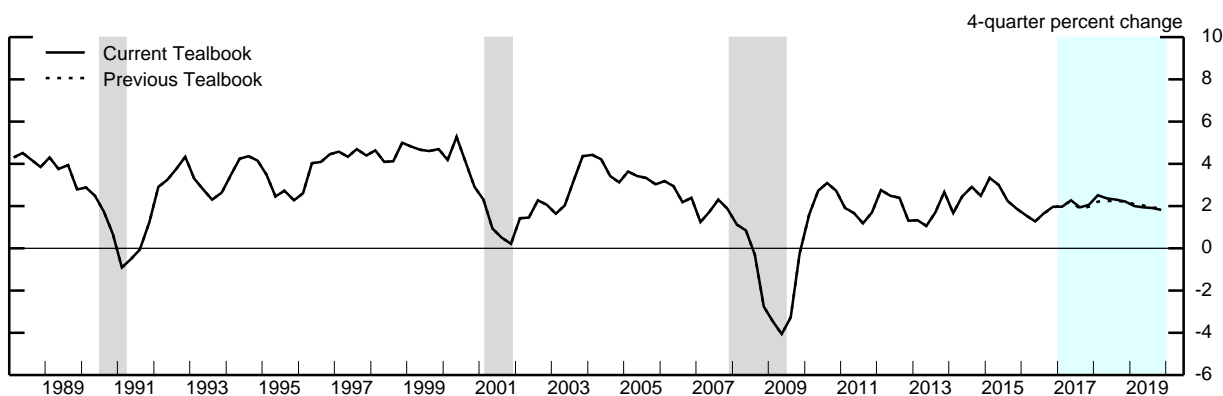
- Real GDP growth slows to 1½ percent in 2020 and 1¼ percent in 2021 as the federal funds rate is above its neutral level. The unemployment rate is 4.1 percent in 2020 and rises gradually toward its assumed natural rate in subsequent years.
- PCE price inflation moves up from 1.9 percent in 2019 and hovers slightly above the Committee’s long-run objective for a few years before moving back to 2 percent.

Projections of Real GDP and Related Components
 (Percent change at annual rate from final quarter
 of preceding period except as noted)

Measure	2016	2017		2017	2018	2019
		H1	H2			
Real GDP	2.0	1.7	2.4	2.1	2.2	1.8
Previous Tealbook	1.9	1.7	2.2	2.0	2.2	1.9
Final sales	2.0	1.8	2.5	2.1	2.2	1.9
Previous Tealbook	1.9	1.7	2.3	2.0	2.2	2.0
Personal consumption expenditures	3.1	1.8	2.9	2.4	2.9	2.5
Previous Tealbook	3.0	2.2	2.8	2.5	3.0	2.5
Residential investment	1.1	4.8	3.3	4.1	2.7	4.4
Previous Tealbook	1.1	2.6	1.1	1.9	4.6	5.5
Nonresidential structures	1.9	14.2	3.3	8.6	.2	-.6
Previous Tealbook	1.8	5.2	2.0	3.6	.3	.0
Equipment and intangibles	-.6	2.4	3.6	3.0	3.9	1.8
Previous Tealbook	-.3	4.5	4.3	4.4	3.7	2.3
Federal purchases	-.2	.2	2.0	1.1	.0	-.1
Previous Tealbook	-.2	1.1	.9	1.0	.0	-.1
State and local purchases	.4	.3	1.6	.9	.8	.9
Previous Tealbook	.4	.5	1.8	1.1	1.1	1.1
Exports	1.5	3.3	1.8	2.6	2.6	2.9
Previous Tealbook	1.6	1.2	1.3	1.3	2.3	2.8
Imports	2.6	4.8	4.0	4.4	4.7	4.2
Previous Tealbook	2.5	5.0	4.0	4.5	5.0	4.4
Contributions to change in real GDP (percentage points)						
Inventory change	.0	-.1	-.1	-.1	.0	-.1
Previous Tealbook	.0	.0	-.1	-.1	.0	-.1
Net exports	-.2	-.3	-.4	-.3	-.4	-.3
Previous Tealbook	-.2	-.6	-.4	-.5	-.5	-.3

Domestic Econ Devel & Outlook

Real GDP

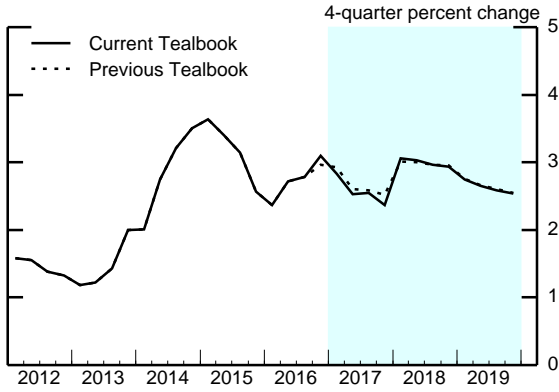


Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

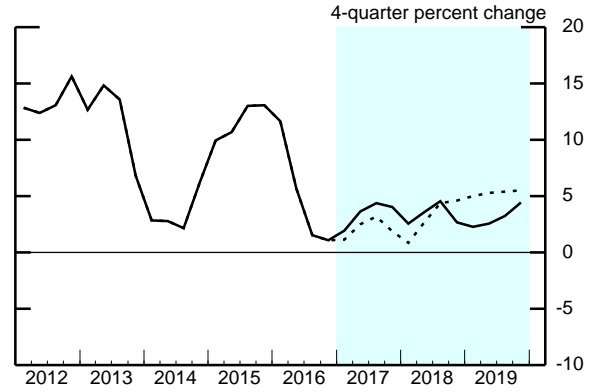
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Components of Final Demand

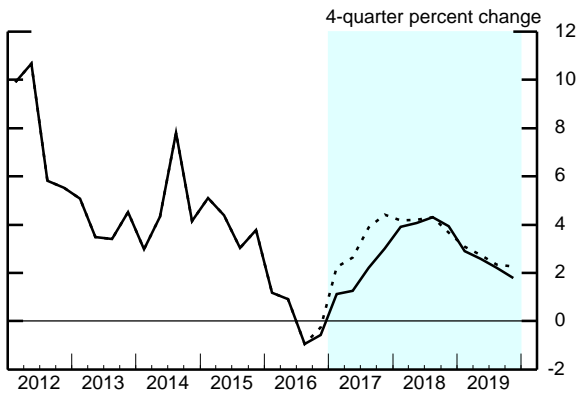
Personal Consumption Expenditures



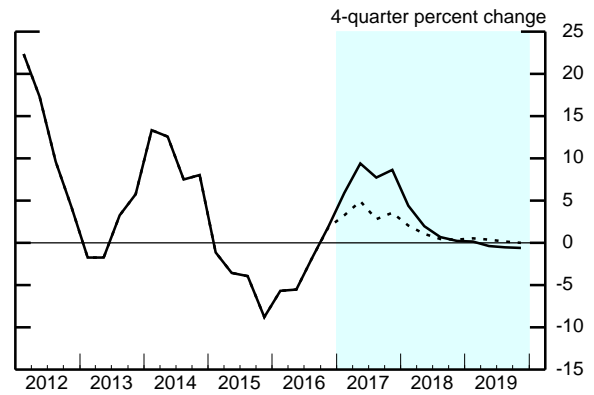
Residential Investment



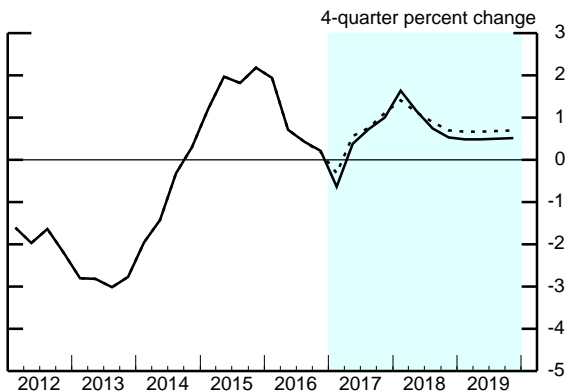
Equipment and Intangibles



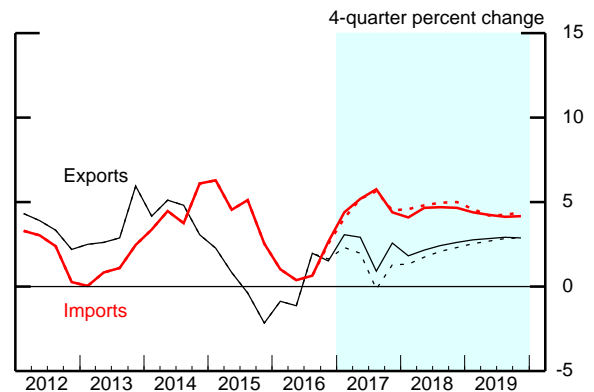
Nonresidential Structures



Government Consumption and Investment



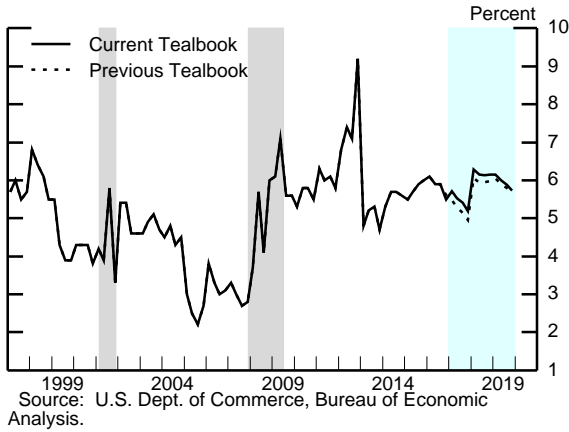
Exports and Imports



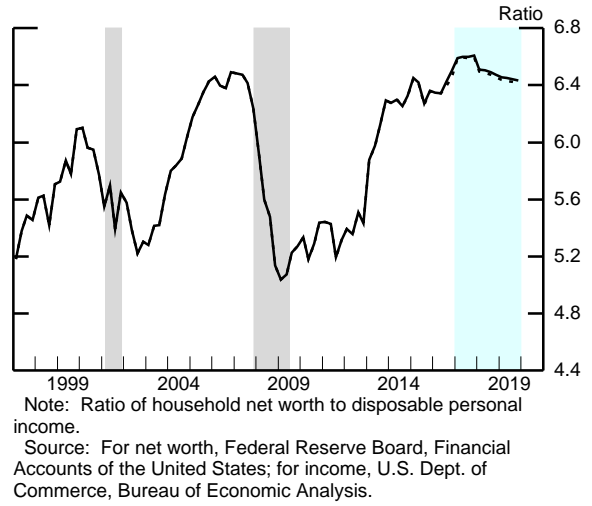
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Aspects of the Medium-Term Projection

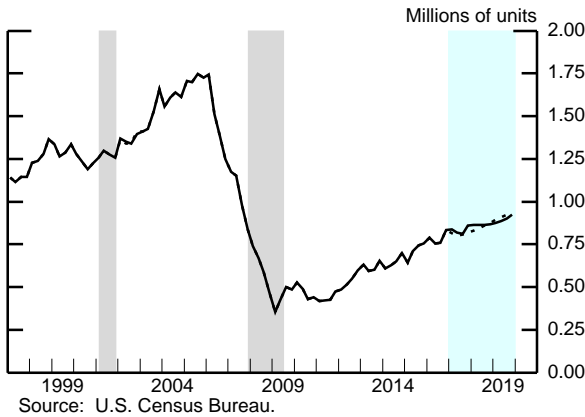
Personal Saving Rate



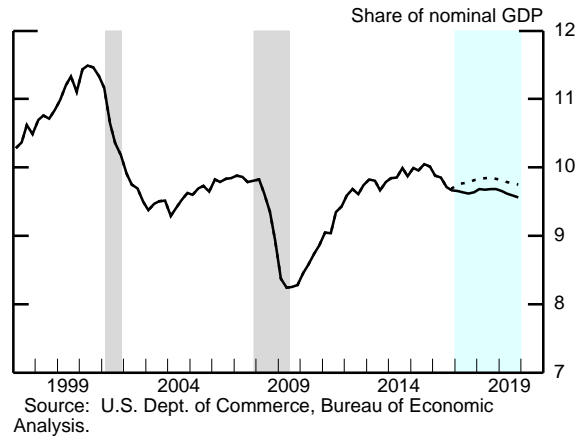
Wealth-to-Income Ratio



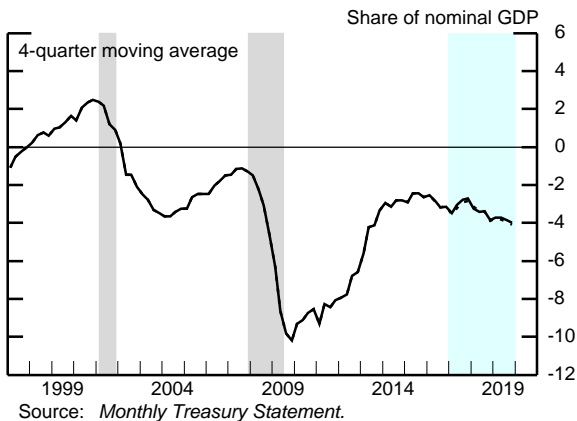
Single-Family Housing Starts



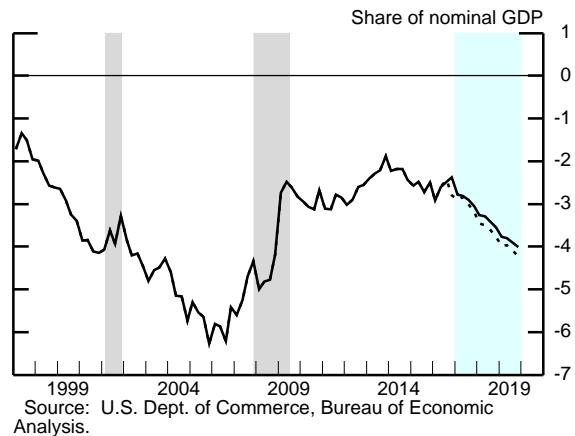
Equipment and Intangibles Spending



Federal Surplus/Deficit



Current Account Surplus/Deficit



Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

Decomposition of Potential GDP
(Percent change, Q4 to Q4, except as noted)

Measure	1974-95	1996-2000	2001-07	2008-10	2011-15	2016	2017	2018	2019
Potential real GDP	3.1	3.4	2.6	1.6	1.1	1.4	1.5	1.6	1.7
Previous Tealbook	3.1	3.4	2.6	1.6	1.1	1.4	1.5	1.6	1.7
<i>Selected contributions¹</i>									
Structural labor productivity ²	1.6	2.9	2.8	1.4	.8	.9	1.1	1.1	1.2
Previous Tealbook	1.6	2.9	2.8	1.4	.8	.9	1.1	1.1	1.2
Capital deepening	.6	1.5	1.0	.3	.5	.5	.4	.4	.4
Multifactor productivity	.6	1.0	1.5	.9	.0	.2	.5	.5	.7
Structural hours	1.6	1.2	.8	.0	.6	.7	.1	.4	.4
Previous Tealbook	1.6	1.2	.8	.1	.6	.6	.0	.3	.3
Labor force participation	.4	-.1	-.2	-.5	-.6	-.4	-.4	-.4	-.4
Previous Tealbook	.4	-.1	-.2	-.5	-.6	-.5	-.5	-.5	-.5
Memo:									
GDP gap ³	-1.9	2.4	.8	-4.2	.0	.5	1.0	1.6	1.8
Previous Tealbook	-1.9	2.4	.8	-4.2	.0	.4	.9	1.5	1.7

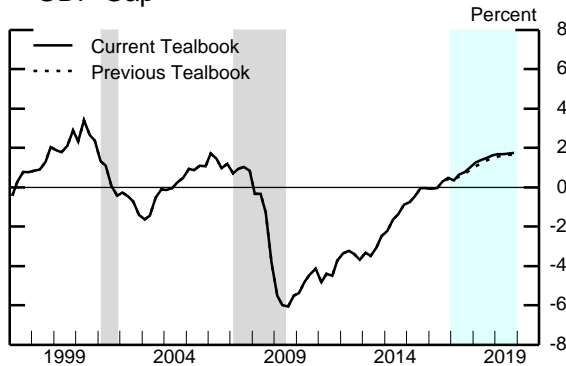
Note: For multiyear periods, the percent change is the annual average from Q4 of the year preceding the first year shown to Q4 of the last year shown.

1. Percentage points.

2. Total business sector.

3. Percent difference between actual and potential GDP in the final quarter of the period indicated. A negative number indicates that the economy is operating below potential.

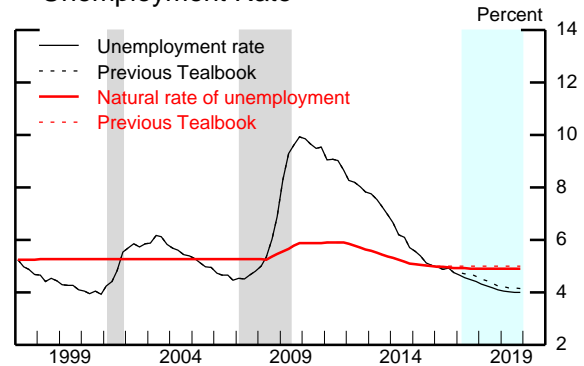
GDP Gap



Note: The GDP gap is the percent difference between actual and potential GDP; a negative number indicates that the economy is operating below potential.

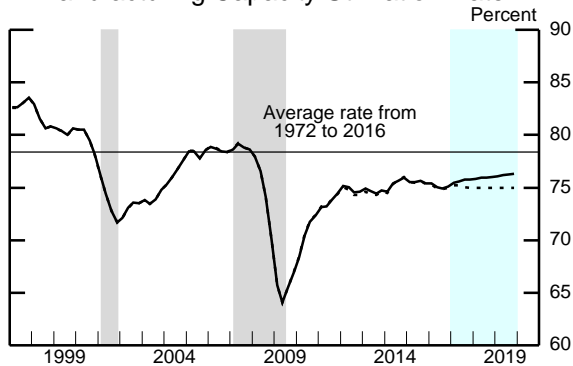
Source: U.S. Department of Commerce, Bureau of Economic Analysis; staff assumptions.

Unemployment Rate



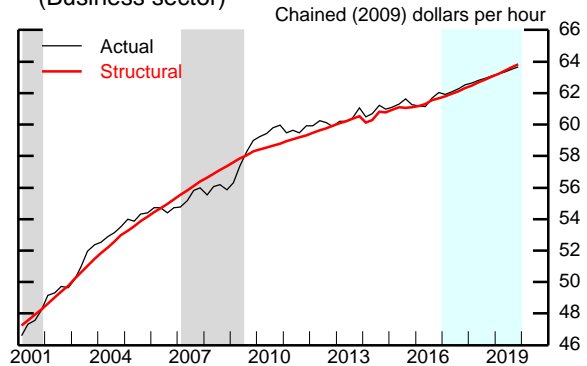
Source: U.S. Department of Labor, Bureau of Labor Statistics; staff assumptions.

Manufacturing Capacity Utilization Rate



Source: Federal Reserve Board, G.17 Statistical Release, "Industrial Production and Capacity Utilization."

Structural and Actual Labor Productivity (Business sector)



Source: U.S. Department of Labor, Bureau of Labor Statistics; U.S. Department of Commerce, Bureau of Economic Analysis; staff assumptions.

Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

The Outlook for the Labor Market

Measure	2016	2017		2017	2018	2019
		H1	H2			
Output per hour, business ¹	1.3	.1	1.5	.8	.9	.9
Previous Tealbook	1.3	.6	1.1	.9	.9	.9
Nonfarm payroll employment ²	187	179	174	176	169	122
Previous Tealbook	187	187	157	172	157	122
Private employment ²	170	172	165	168	160	113
Previous Tealbook	171	187	153	170	150	113
Labor force participation rate ³	62.7	62.8	62.7	62.7	62.5	62.3
Previous Tealbook	62.7	62.7	62.6	62.6	62.3	62.1
Civilian unemployment rate ³	4.7	4.5	4.4	4.4	4.1	4.0
Previous Tealbook	4.7	4.7	4.6	4.6	4.2	4.1

1. Percent change from final quarter of preceding period at annual rate.

2. Thousands, average monthly changes.

3. Percent, average for the final quarter in the period.

Source: U.S. Department of Labor, Bureau of Labor Statistics; staff assumptions.

Inflation Projections

Measure	2016	2017		2017	2018	2019
		H1	H2			
<i>Percent change at annual rate from final quarter of preceding period</i>						
PCE chain-weighted price index	1.4	1.8	1.6	1.7	1.8	1.9
Previous Tealbook	1.4	2.0	1.5	1.7	1.8	1.9
Food and beverages	-1.7	1.3	2.0	1.7	2.1	2.2
Previous Tealbook	-1.7	1.0	2.2	1.6	2.1	2.2
Energy	.8	2.6	.2	1.4	.3	.7
Previous Tealbook	.8	3.8	-.7	1.5	.2	.6
Excluding food and energy	1.7	1.8	1.6	1.7	1.9	2.0
Previous Tealbook	1.7	2.0	1.5	1.8	1.9	2.0
Prices of core goods imports ¹	.0	1.4	1.3	1.3	.7	.7
Previous Tealbook	.0	.9	1.4	1.2	.8	.7
	Mar. 2017 ²	Apr. 2017 ²	May 2017 ²	June 2017 ²	July 2017 ²	Aug. 2017 ²
<i>12-month percent change</i>						
PCE chain-weighted price index	1.9	1.7	1.8	1.8	1.9	1.8
Previous Tealbook	2.1	1.9	1.8	1.8		
Excluding food and energy	1.6	1.6	1.6	1.7	1.7	1.6
Previous Tealbook	1.8	1.7	1.7	1.8		

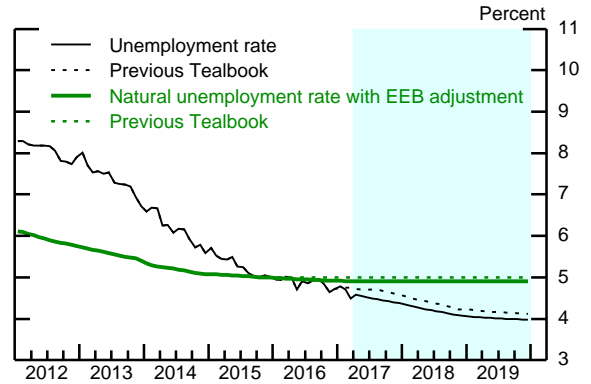
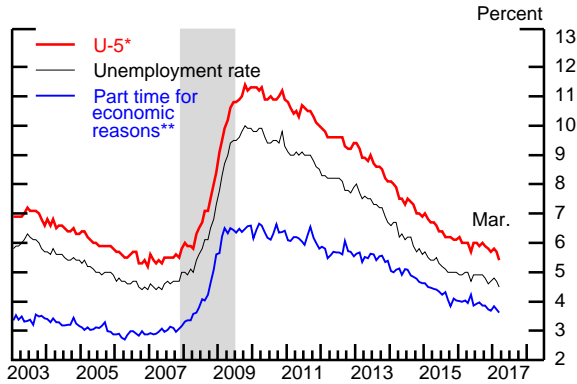
1. Core goods imports exclude computers, semiconductors, oil, and natural gas.

2. Staff forecast.

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

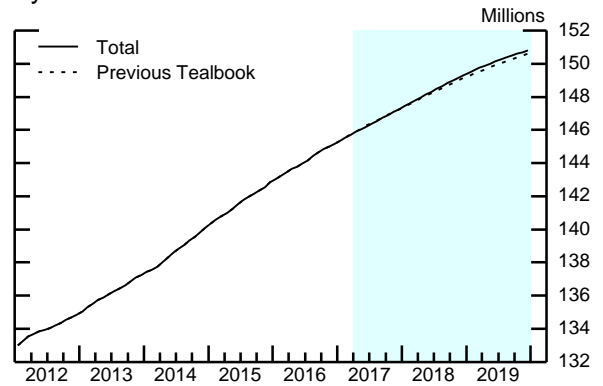
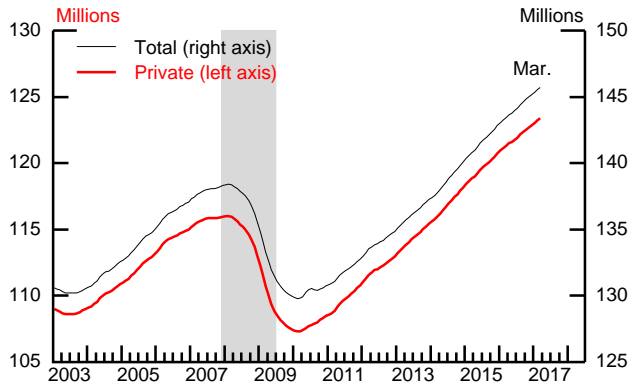
Labor Market Developments and Outlook (1)

Measures of Labor Underutilization



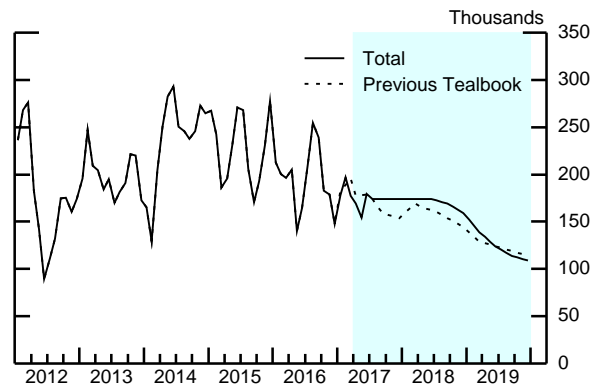
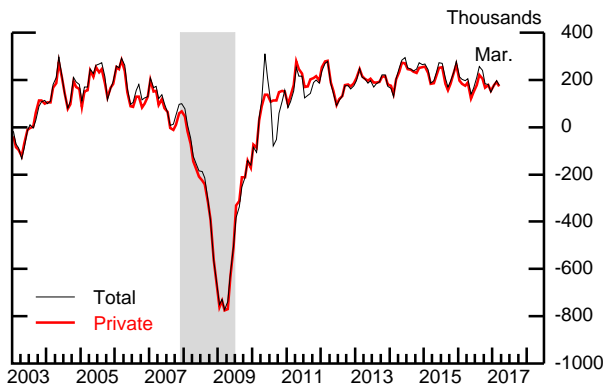
* U-5 measures total unemployed persons plus all marginally attached to the labor force, as a percent of the labor force plus persons marginally attached to the labor force.
 ** Percent of Current Population Survey employment.
 EEB Extended and emergency unemployment benefits.
 Source: U.S. Department of Labor, Bureau of Labor Statistics.

Level of Payroll Employment*



* 3-month moving averages.
 Source: U.S. Department of Labor, Bureau of Labor Statistics.

Change in Payroll Employment*

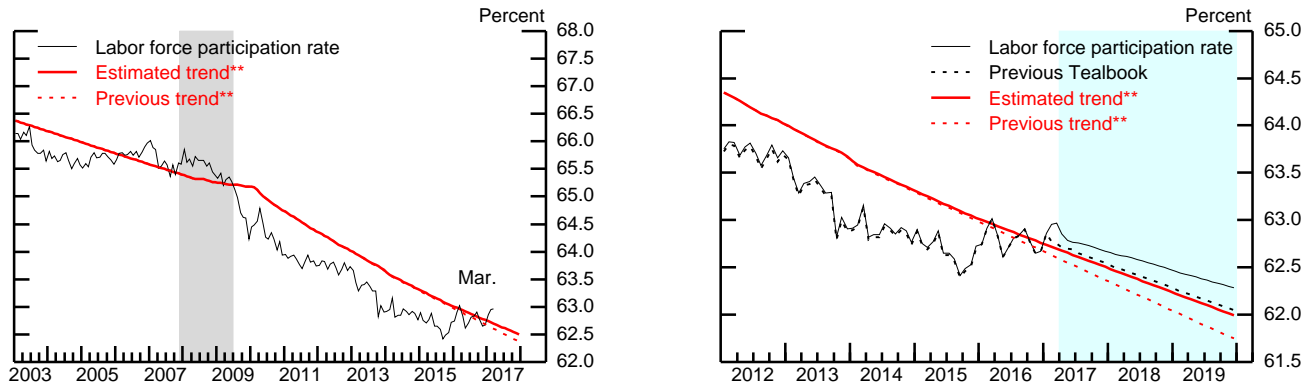


* 3-month moving averages.
 Source: U.S. Department of Labor, Bureau of Labor Statistics.

Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

Labor Market Developments and Outlook (2)

Labor Force Participation Rate*

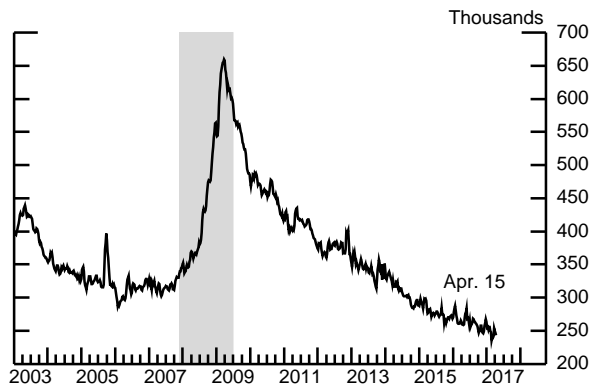


* Published data adjusted by staff to account for changes in population weights.

** Includes staff estimate of the effect of extended and emergency unemployment benefits.

Source: U.S. Department of Labor, Bureau of Labor Statistics; staff assumptions.

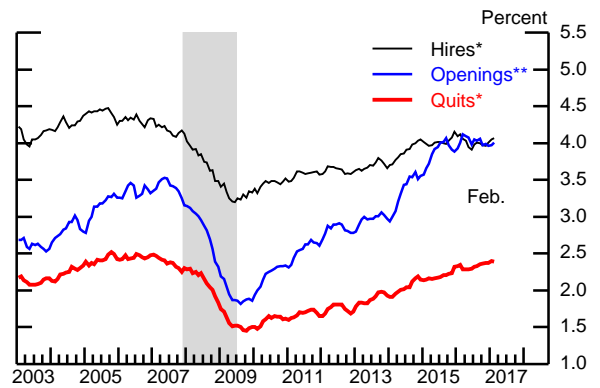
Initial Unemployment Insurance Claims*



* 4-week moving average.

Source: U.S. Department of Labor, Employment and Training Administration.

Hires, Quits, and Job Openings

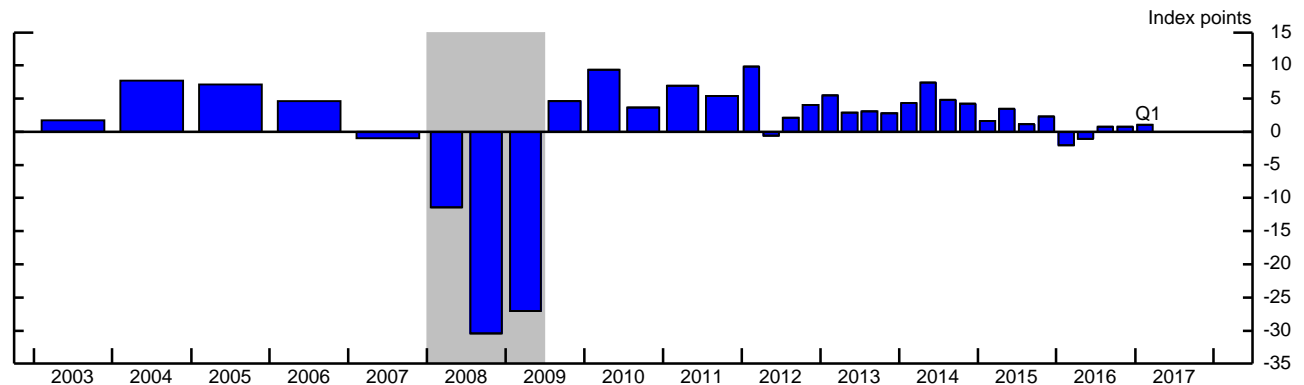


* Percent of private nonfarm payroll employment, 3-month moving average.

** Percent of private nonfarm payroll employment plus unfilled jobs, 3-month moving average.

Source: Job Openings and Labor Turnover Survey.

Average Monthly Change in Labor Market Conditions Index



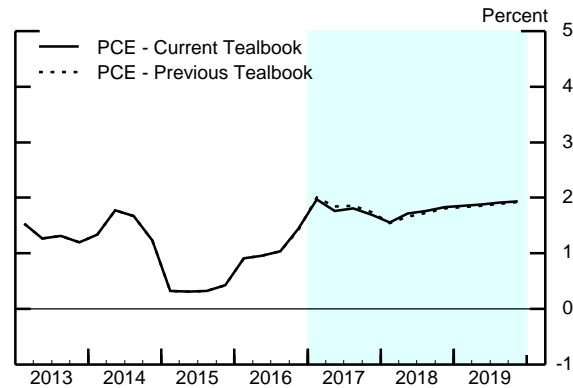
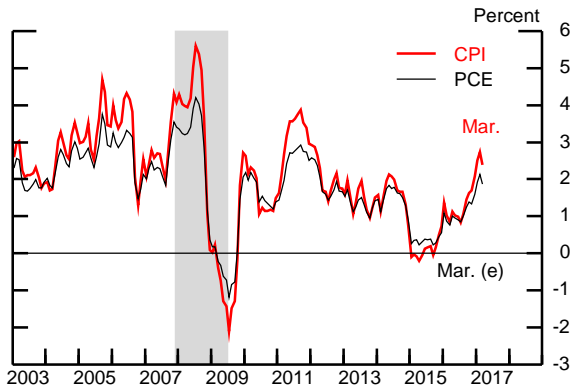
Source: Labor market conditions index estimated by staff.

Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

Inflation Developments and Outlook (1)

(Percent change from year-earlier period)

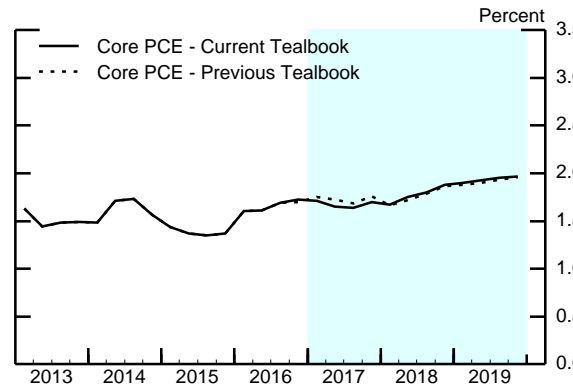
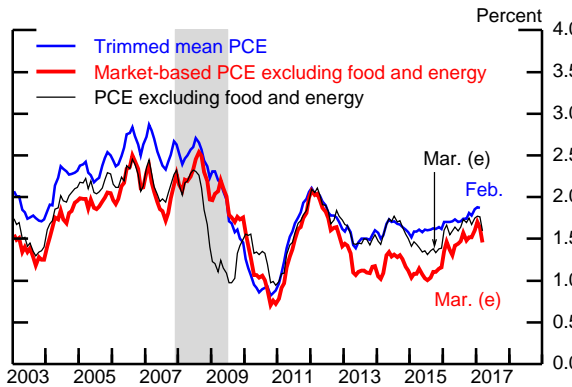
Headline Consumer Price Inflation



Note: PCE prices from January to March 2017 are staff estimates (e).

Source: For CPI, U.S. Department of Labor, Bureau of Labor Statistics; for PCE, U.S. Department of Commerce, Bureau of Economic Analysis.

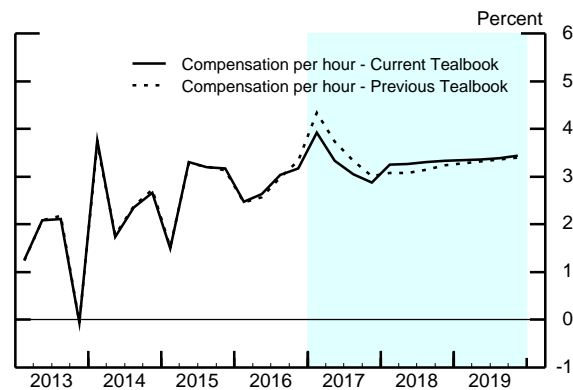
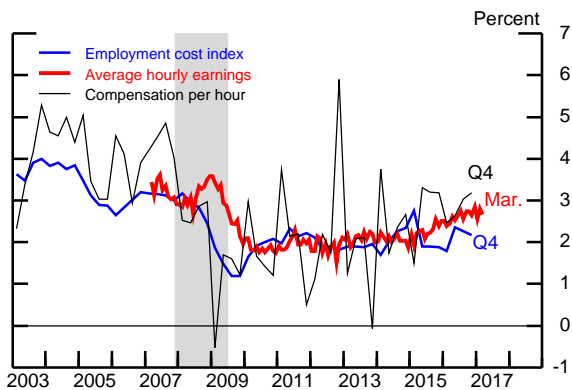
Measures of Underlying PCE Price Inflation



Note: Core PCE prices from January to March 2017 are staff estimates (e).

Source: For trimmed mean PCE, Federal Reserve Bank of Dallas; otherwise, U.S. Department of Commerce, Bureau of Economic Analysis.

Labor Cost Growth



Note: Compensation per hour is for the business sector. Average hourly earnings are for the private nonfarm sector. The employment cost index is for the private sector.

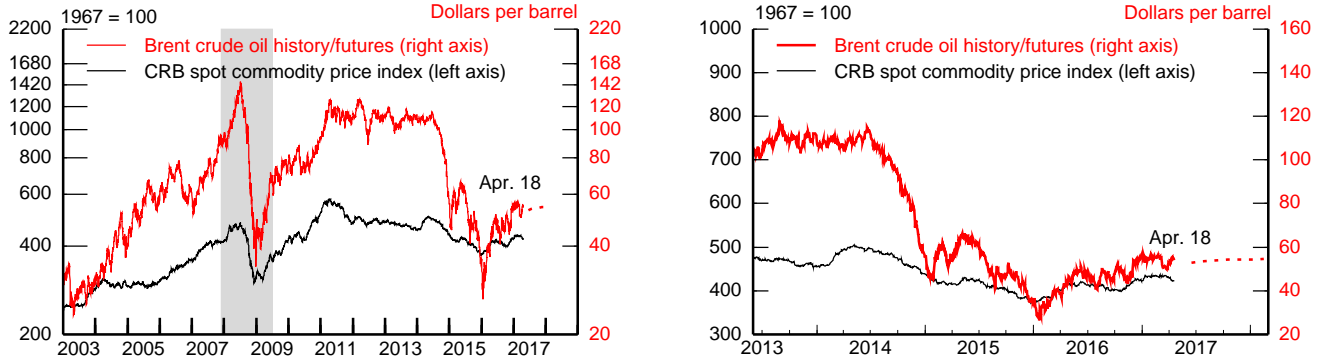
Source: U.S. Department of Labor, Bureau of Labor Statistics.

Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

Inflation Developments and Outlook (2)

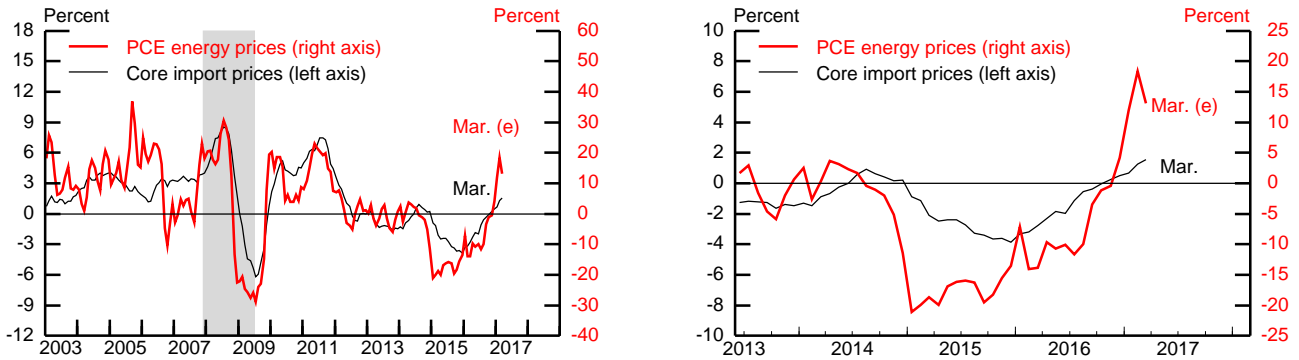
(Percent change from year-earlier period, except as noted)

Commodity and Oil Price Levels



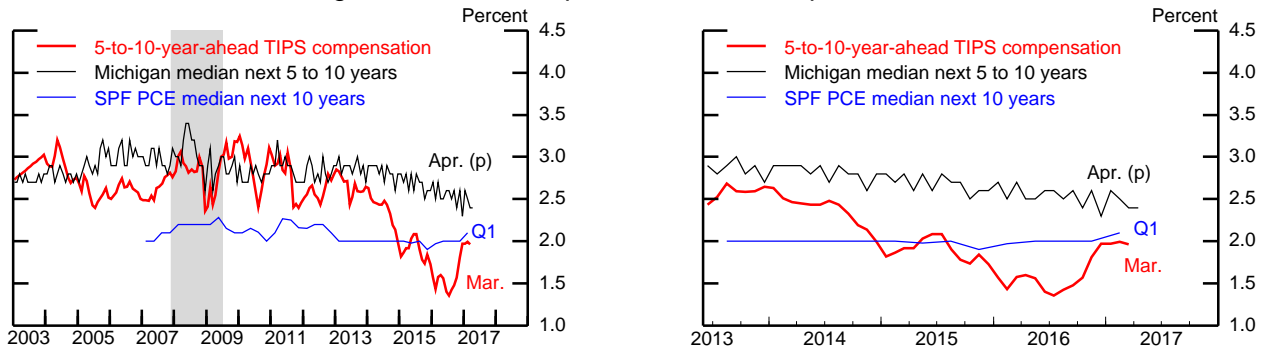
Note: Futures prices (dotted lines) are the latest observations on monthly futures contracts.
 Source: For oil prices, U.S. Department of Energy, Energy Information Agency; for commodity prices, Commodity Research Bureau (CRB).

Energy and Import Price Inflation



(e) Estimate.
 Source: For core import prices, U.S. Dept. of Labor, Bureau of Labor Statistics; for PCE, U.S. Dept. of Commerce, Bureau of Economic Analysis.

Long-Term Inflation Expectations and Compensation



Note: Based on a comparison of an estimated TIPS (Treasury Inflation-Protected Securities) yield curve with an estimated nominal off-the-run Treasury yield curve, with an adjustment for the indexation-lag effect.
 (p) Preliminary.
 SPF Survey of Professional Forecasters.
 Source: For Michigan, University of Michigan Surveys of Consumers; for SPF, Federal Reserve Bank of Philadelphia; for TIPS, Federal Reserve Board staff calculations.

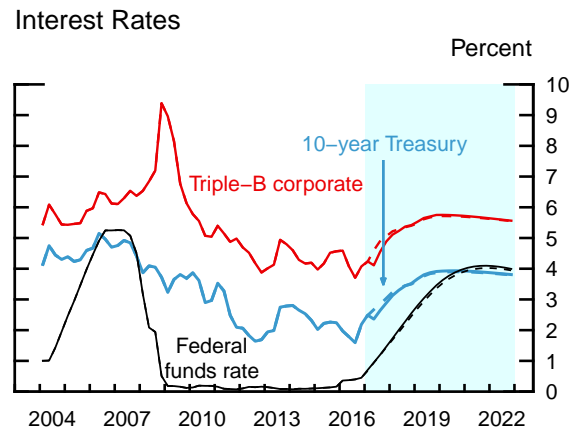
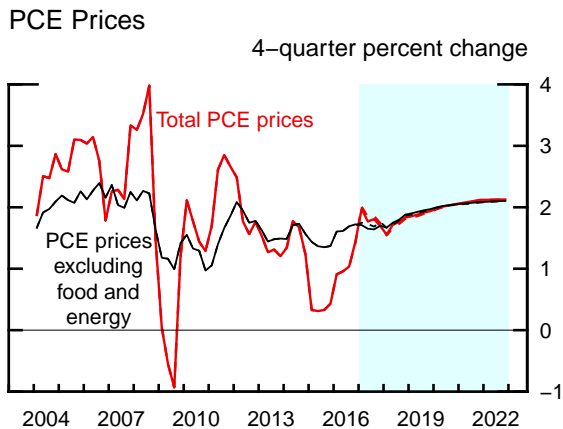
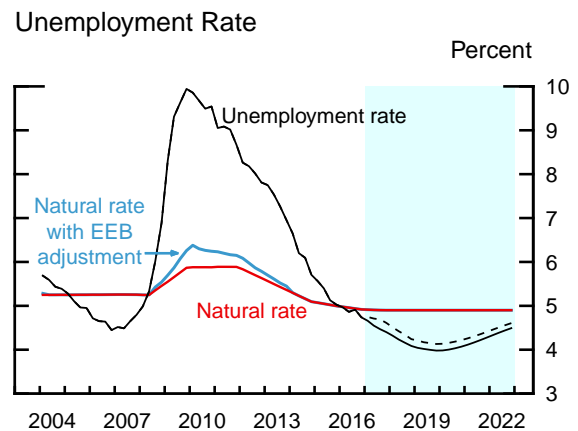
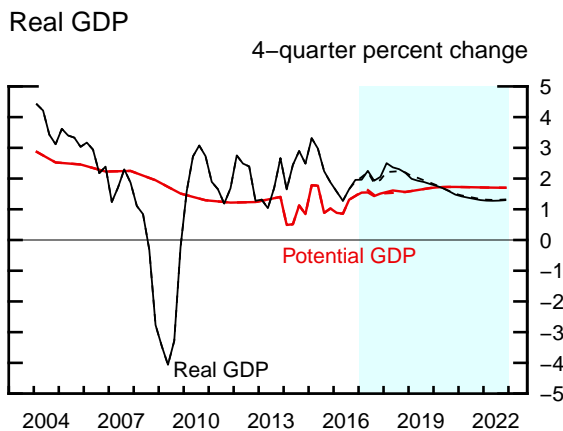
Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

The Long-Term Outlook

(Percent change, Q4 to Q4, except as noted)

Measure	2017	2018	2019	2020	2021	2022	Longer run
Real GDP	2.1	2.2	1.8	1.5	1.3	1.3	1.7
Previous Tealbook	2.0	2.2	1.9	1.5	1.3	1.3	1.7
Civilian unemployment rate ¹	4.4	4.1	4.0	4.1	4.3	4.5	4.9
Previous Tealbook	4.6	4.2	4.1	4.2	4.4	4.6	5.0
PCE prices, total	1.7	1.8	1.9	2.1	2.1	2.1	2.0
Previous Tealbook	1.7	1.8	1.9	2.0	2.1	2.1	2.0
Core PCE prices	1.7	1.9	2.0	2.0	2.1	2.1	2.0
Previous Tealbook	1.8	1.9	2.0	2.0	2.1	2.1	2.0
Federal funds rate ¹	1.47	2.55	3.46	3.97	4.10	3.99	3.00
Previous Tealbook	1.45	2.46	3.36	3.87	4.02	3.95	3.00
10-year Treasury yield ¹	2.9	3.5	3.9	3.9	3.9	3.8	3.5
Previous Tealbook	3.0	3.5	3.9	3.9	3.9	3.8	3.5

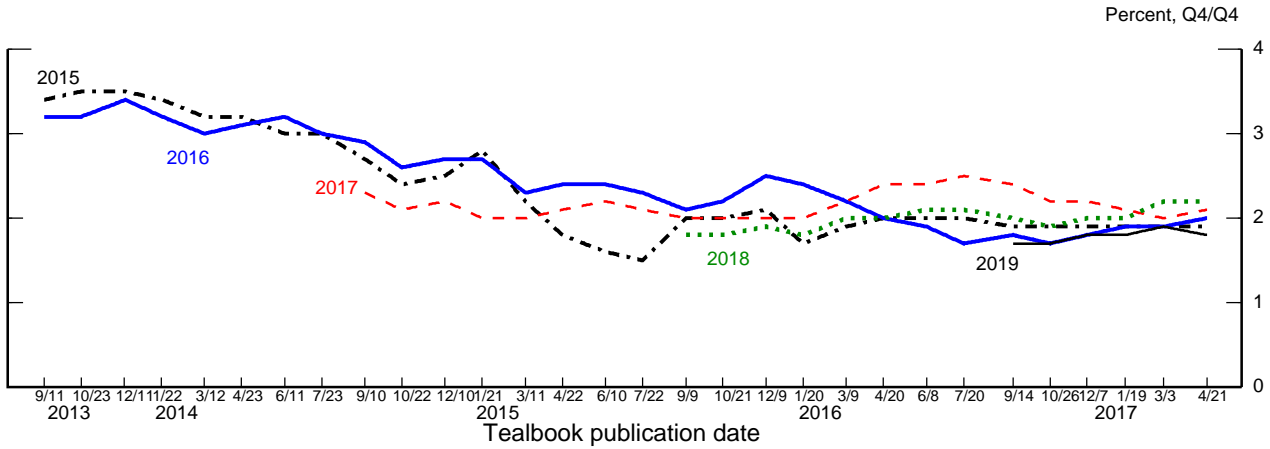
1. Percent, average for the final quarter of the period.



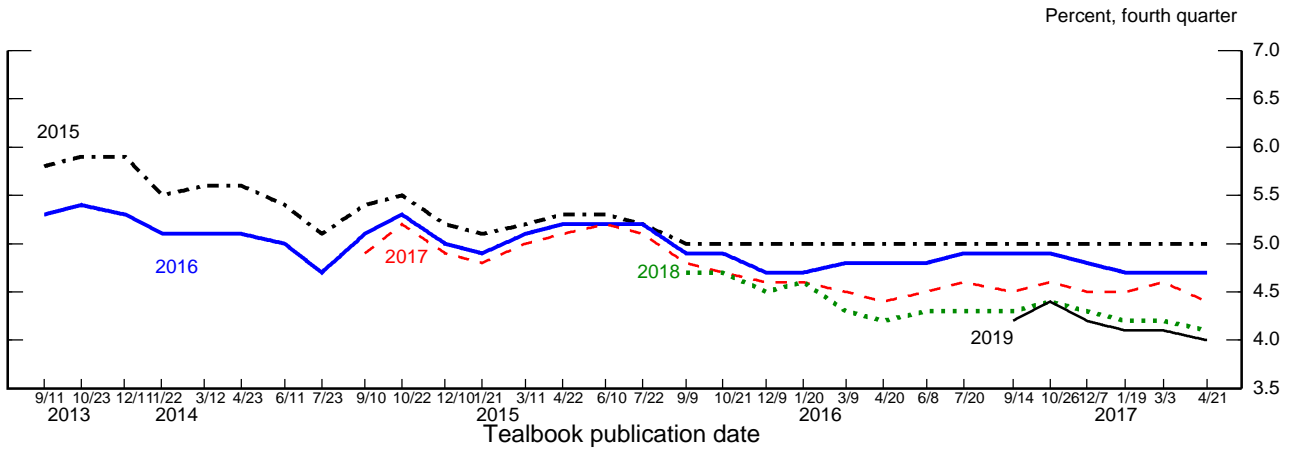
Note: In each panel, shading represents the projection period, and dashed lines are the previous Tealbook.

Evolution of the Staff Forecast

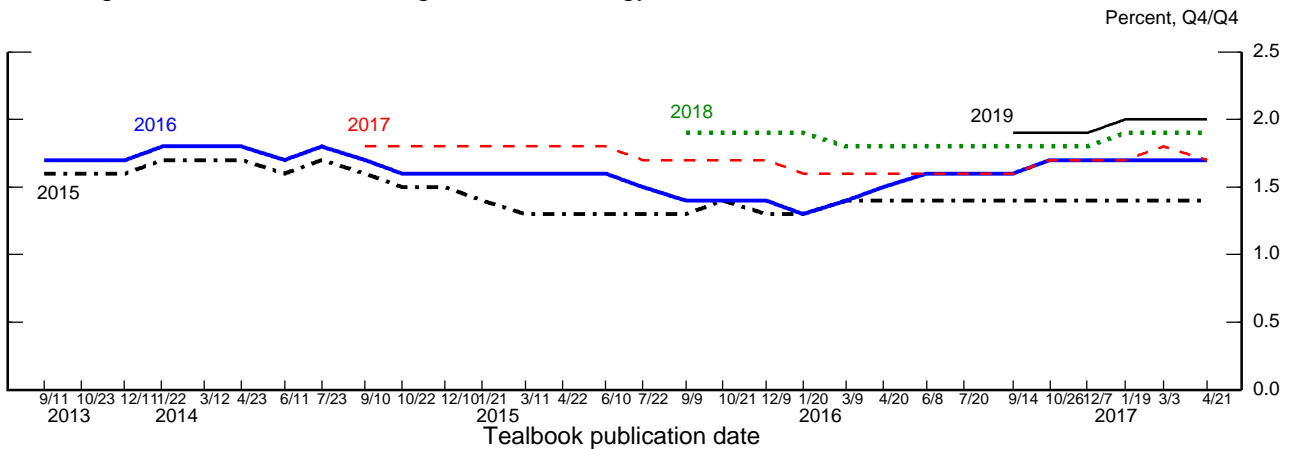
Change in Real GDP



Unemployment Rate



Change in PCE Prices excluding Food and Energy



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International Economic Developments and Outlook

We estimate that total foreign growth edged up to nearly 3 percent in the first quarter instead of the step-down that we had envisaged in the March Tealbook. Although this pickup is mostly driven by stronger-than-expected activity in Brazil, Canada, and China, PMIs and trade data from many other advanced and emerging market economies have also been more upbeat than we had expected. Moreover, surprisingly robust demand in China led its first-quarter real GDP growth to exceed 7 percent. That said, we continue to expect foreign growth to moderate to 2½ percent by the third quarter, largely reflecting a deceleration of activity in Canada to a more sustainable pace. We expect foreign growth to remain at about 2½ percent—close to potential—through 2019 as a pickup in Latin America roughly offsets a slight moderation in growth elsewhere.

Altogether, we have revised up our estimate for growth abroad in the first half about ¼ percentage point. Our forecast is little changed after that. After having consistently marked down our forecast for foreign growth in 2017 during the past two years, we are encouraged that our forecast is now up relative to late last year.

Headline inflation in the advanced foreign economies (AFEs) jumped to an annual rate of 2½ percent in the first quarter from 1¾ percent in the fourth. This jump largely reflected pass-through from higher energy prices and currency depreciation to retail energy prices. AFE inflation falls back to 1½ percent by midyear as these effects wane before beginning to edge up toward authorities' 2 percent inflation target. In our baseline forecast, economic recovery and an improved inflation outlook should lead AFE central banks to begin the slow process of dialing back their monetary stimulus later in the forecast period, with Canada moving first in early 2018. But overall, monetary policy remains generally accommodative.

Inflation in the emerging market economies (EMEs) stepped up to 3½ percent in the first quarter, as a steep increase in Mexican inflation more than offset a sharp drop in food prices in China. The acceleration of prices in Mexico largely reflected the effects of past currency depreciation and large hikes in fuel prices. As these pressures fade, and given considerable policy tightening by the Bank of Mexico, we see Mexican inflation beginning to ease toward the 3 percent inflation target later this year.

The encouraging tone of the recent data—particularly sentiment and survey indicators—highlights upside risks to foreign economic activity. A stronger pickup in activity abroad could lead to an aggressive removal of monetary stimulus. We explore the consequences of such an outcome in the alternative scenario “Stronger Foreign Growth and Tighter Policy” in the Risks and Uncertainty section.

That said, downside risks to the outlook remain. Among the geopolitical risks we are monitoring—including North Korea, Syria, and Turkey—the upcoming elections in France, where two anti-EU candidates have been polling strongly, figure prominently. We continue to be concerned about the persistent buildup of debt in China and the possibility of a financial crisis. U.S. policy normalization could also generate financial strains in some EMEs if rising U.S. rates and an appreciating dollar increase dollar debt burdens. We consider an alternative scenario along these lines, “EME Turbulence and Stronger Dollar,” in the Risks and Uncertainty section.

ADVANCED FOREIGN ECONOMIES

- **Canada.** Following rapid growth of 3¼ percent in the second half of 2016, recent indicators, such as the monthly GDP for January and the manufacturing PMI through March, suggest that real GDP grew a solid 3 percent last quarter, ¾ percentage point more than what we had in the March Tealbook. Household demand was unusually strong as a result of a temporary boost from the Canada Child Benefit program, and investment in the oil and gas sector resumed after a long period of steep declines. We expect growth to average around 2 percent over the rest of this year and edge down further to its 1¾ percent rate of potential growth by mid-2018. Growth will continue to be supported by accommodative monetary and fiscal policies.
- **Euro Area.** Recent data suggest that first-quarter GDP growth was just below 2 percent, the same pace as in the fourth quarter. We project that GDP growth will edge down to 1¾ percent this quarter and remain there over the forecast period, supported by accommodative monetary policy. The forecast for the remainder of 2017 is a touch higher than in the March Tealbook, as strong survey indicators suggest slightly greater momentum than previously anticipated. With support for anti-EU candidates elevated in several countries, including in France, where the two rounds of the presidential election will be held on April 23 and May 7, an escalation of fears about the future of the currency union remains a significant downside risk to the outlook.

Inflation jumped to 3 percent in the first quarter from 1.9 percent in the fourth, pushed up by higher energy and food prices. With core inflation running around 1 percent and projected to creep up to only 1½ percent by 2018, we still expect the European Central Bank (ECB) to remove accommodation very gradually. We see the ECB beginning to taper its asset purchases over the first half of 2018 and ceasing these purchases by the middle of the year. But we now have the ECB raising its deposit rate at the beginning rather than at the end of 2019. As a result, we see the deposit rate, currently negative 0.40 percent, touching zero by the end of 2019. This slightly less accommodative stance of monetary policy importantly reflects our response to more hawkish communications by some ECB policymakers that suggest less patience in removing stimulus as inflation rises.

- **United Kingdom.** We have real GDP growth slowing to 2 percent in the first quarter from 2.7 percent in the fourth, in line with some recent weakening in industrial production, services output, and exports. With softer real income growth squeezing consumer demand and with the prospect of reduced trade after Brexit restraining investment, we see growth declining further to 1¾ percent by the end of 2017 and to 1½ percent thereafter.

Inflation jumped to 4 percent in the first quarter from 2 percent the quarter before, mainly as a result of past sterling depreciation. As the exchange rate stabilizes, this effect should dissipate, and inflation should move back to the Bank of England's (BOE) 2 percent target by the end of 2019. We still think that the projected slowdown in economic growth and sluggish real wage gains will dissuade the BOE from raising its policy rate before the second half of 2018.

- **Japan.** Industrial production, manufacturing PMI, and consumer confidence readings show increased momentum in the Japanese economy, and we have revised up GDP growth slightly to 1¼ percent in the first half of this year, well above the estimated ½ percent growth rate of potential GDP. We continue to see GDP growth edging down to 1 percent in 2018 as the output gap closes before growth stalls in 2019 as a result of a planned consumption tax hike. Economic growth should be supported by highly accommodative monetary policy. We expect the Bank of Japan (BOJ) to continue aggressive asset purchases and to keep its deposit rate slightly negative throughout the forecast period. Inflation is projected to rise from zero in the first quarter to 1¼ percent by 2019 (excluding the effects of the consumption tax hike), but to remain well short of the BOJ's 2 percent target.

EMERGING MARKET ECONOMIES

- **China.** Real GDP growth climbed to 7.1 percent in the first quarter, $\frac{1}{2}$ percentage point above our March Tealbook estimate. Growth was boosted by a pickup in manufacturing, partly due to strength in export-oriented industries, consistent with upbeat export orders and strong imports of high-tech components. Residential real estate and infrastructure investment also continued to support growth, even as property prices and sales have begun to cool in the wake of last year's tighter macroprudential measures. We took some signal from China's near-term strength and revised up growth in the second quarter $\frac{1}{2}$ percentage point to $6\frac{1}{2}$ percent. We nonetheless still expect growth to slow as the authorities tighten the reins on credit and as potential growth falls, and to settle to a more sustainable pace of $5\frac{3}{4}$ percent by late 2018. However, we remain concerned about the possibility of a much sharper adjustment as financial vulnerabilities, especially corporate debt, continue to mount.

Headline consumer price inflation fell to negative 0.6 percent in the first quarter from 2.6 percent in the fourth quarter, pulled down by a sharp fall in food prices, particularly vegetables. After the influence of these temporary factors fades, consumer price inflation should settle at about $2\frac{1}{2}$ percent by late 2017.

- **Other Emerging Asia.** Incoming data suggest that real GDP growth in the region stepped up to 4 percent in the first quarter from $3\frac{1}{2}$ percent in the fourth, $\frac{1}{4}$ percentage point higher than projected in the previous Tealbook. This step-up is largely the result of signs that the Indian economy is recovering from the disruptions suffered during the demonetization drive in late 2017. But growth in several other countries in the region also picked up, supported by surprisingly robust export demand. Strength in the region's exports appears to be coming both from a pickup in demand for high-tech goods and stronger Chinese demand for commodities. As Chinese growth slows, we see exports of the region losing some steam with growth in emerging Asia ex. China declining a bit to $3\frac{1}{2}$ percent by the end of 2017.
- **Mexico.** Data since the March Tealbook suggest that Mexican growth decelerated to just under 2 percent in the first quarter from 3 percent in the fourth. We have revised up our first-quarter estimate $\frac{3}{4}$ percentage point, as the incoming data have not been as dire as we had feared at the time of the March Tealbook. Importantly, indicators for household demand held up, and export growth was solid in the first quarter. We see Mexican growth gradually moving up to $2\frac{1}{2}$ percent by 2018, supported by the

improved near-term outlook for U.S. manufacturing activity, reduced drag from fiscal consolidation, and a weaker peso, as well as by past reforms in the energy sector.

Inflation surged to nearly 10 percent in the first quarter, fueled by peso depreciation and a hike in fuel prices. We see the effects of these developments waning and inflation declining to near the 3 percent inflation target by 2018. To keep inflationary pressures at bay, the Bank of Mexico continued to tighten in late March, raising the policy rate 25 basis points to 6.5 percent, 350 basis points above its level at the start of its tightening phase in late 2015.

- **Brazil.** Brazil's economy likely exited the deepest recession in its history in the first quarter, and we have penciled in first-quarter growth of 2½ percent. Record soybean and corn harvests led exports to skyrocket, driving a surge in the monthly GDP proxy through February. We expect the export strength to taper off later this year, with Brazil's recovery then being increasingly underpinned by domestic demand. Consistent with this view, consumer and business confidence readings continued to improve. We nonetheless envision Brazil's economic recovery to be slow and protracted, with activity restrained by tight monetary policy, household deleveraging, and lingering investor doubts about whether the government can tackle the country's fiscal and structural problems.

Amid double-digit unemployment and tight monetary policy, inflation fell to 4.6 percent in March on a 12-month basis, just above the government's target. This decline, coupled with still-weak economic activity, led the Brazilian central bank to slash its policy rate 100 basis points in mid-April to 11.25 percent.

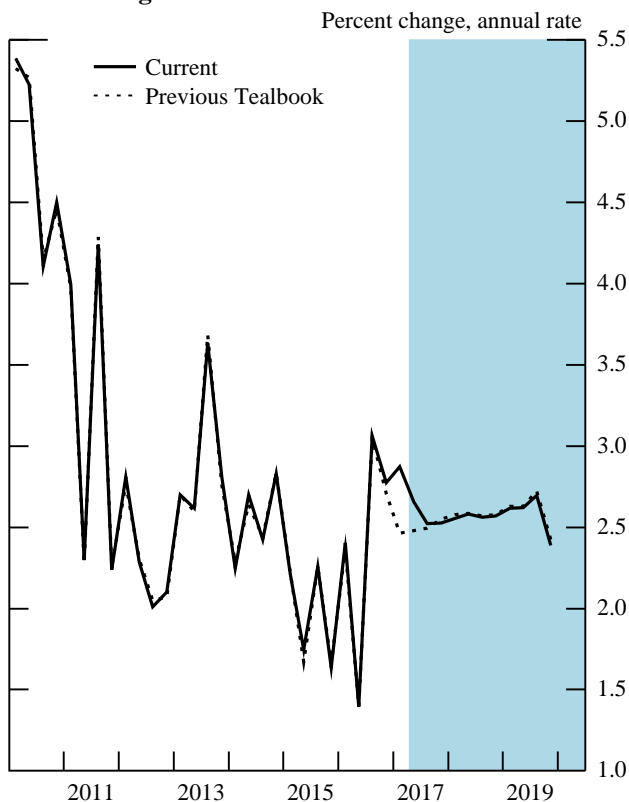
The Foreign GDP Outlook

Real GDP*	Percent change, annual rate							
	2016			2017			2018	2019
	H1	Q3	Q4	Q1	Q2	H2		
1. Total Foreign	1.9	3.1	2.8	2.9	2.7	2.5	2.6	2.6
Previous Tealbook	1.9	3.1	2.7	2.5	2.5	2.5	2.6	2.6
2. Advanced Foreign Economies	1.4	2.4	2.3	2.4	2.0	1.8	1.8	1.7
Previous Tealbook	1.3	2.5	2.2	2.1	1.9	1.8	1.8	1.7
3. Canada	0.7	3.8	2.6	3.0	2.3	1.9	1.8	1.8
4. Euro Area	1.8	1.7	1.9	1.9	1.8	1.8	1.8	1.8
5. Japan	2.0	1.2	1.2	1.3	1.3	1.1	0.9	0.1
6. United Kingdom	1.5	2.0	2.7	2.0	1.9	1.8	1.6	1.6
7. Emerging Market Economies	2.4	3.7	3.3	3.4	3.3	3.2	3.4	3.5
Previous Tealbook	2.4	3.6	3.2	2.8	3.1	3.3	3.4	3.5
8. China	6.8	6.8	6.6	7.1	6.6	6.0	5.8	5.7
9. Emerging Asia ex. China	3.6	3.7	3.6	3.9	4.0	3.6	3.6	3.5
10. Mexico	1.1	4.4	2.9	1.9	1.8	2.3	2.4	2.6
11. Brazil	-1.8	-2.9	-3.4	2.5	2.3	2.0	2.1	2.2

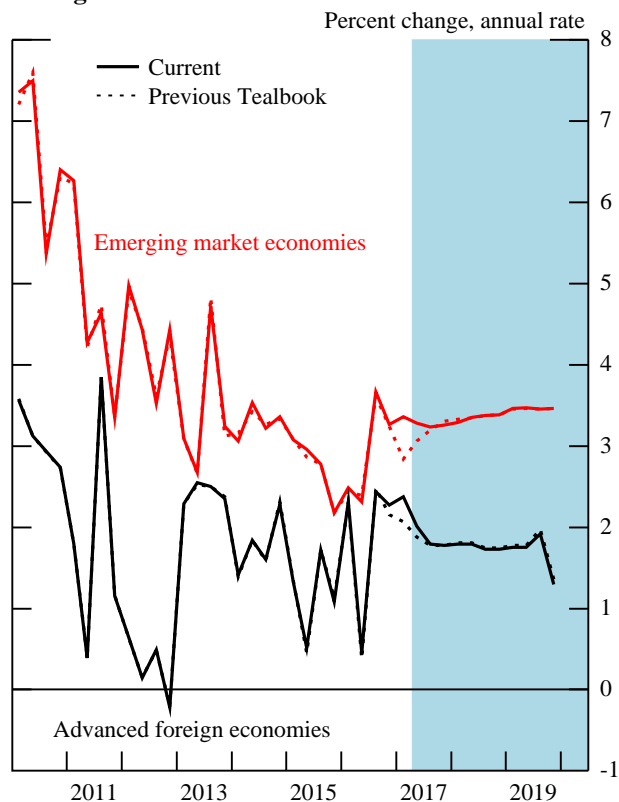
* GDP aggregates weighted by shares of U.S. merchandise exports.

Int'l Econ Devel & Outlook

Total Foreign GDP



Foreign GDP



The Foreign Inflation Outlook

Consumer Prices*

Percent change, annual rate

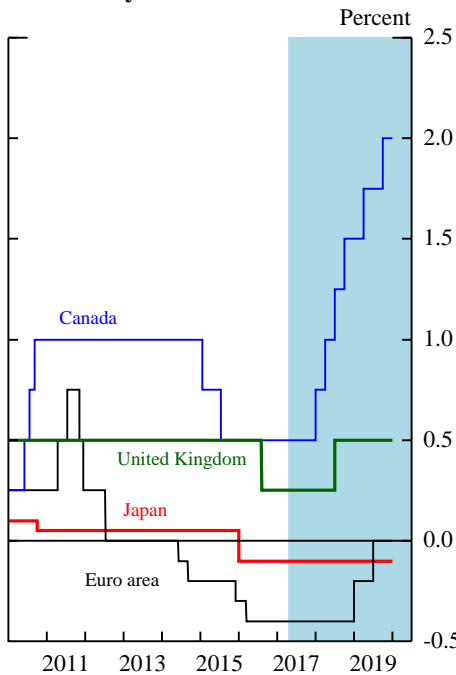
	2016			2017			2018	2019
	H1	Q3	Q4	Q1	Q2	H2		
1. Total Foreign	1.7	1.6	2.6	3.0	2.4	2.4	2.4	2.6
Previous Tealbook	1.7	1.6	2.6	3.6	2.6	2.4	2.5	2.6
2. Advanced Foreign Economies	0.4	0.9	1.8	2.5	1.4	1.4	1.6	1.9
Previous Tealbook	0.4	0.8	1.8	2.4	1.5	1.4	1.6	1.9
3. Canada	1.4	1.0	1.7	2.9	2.0	1.7	1.9	2.0
4. Euro Area	-0.0	1.2	1.9	3.0	1.3	1.3	1.4	1.6
5. Japan	-0.3	-0.5	2.4	0.0	0.4	0.7	1.1	2.5
6. United Kingdom	0.4	2.0	2.0	4.0	2.8	2.4	2.2	2.1
7. Emerging Market Economies	2.7	2.2	3.1	3.4	3.0	3.2	3.1	3.1
Previous Tealbook	2.7	2.2	3.1	4.4	3.4	3.2	3.1	3.1
8. China	2.4	1.3	2.6	-0.6	1.5	2.5	2.5	2.5
9. Emerging Asia ex. China	1.7	1.1	2.7	3.6	3.1	3.0	3.2	3.4
10. Mexico	2.6	3.6	4.1	9.9	5.0	3.6	3.2	3.2
11. Brazil	9.6	6.5	2.6	3.2	4.3	4.9	4.4	4.4

* CPI aggregates weighted by shares of U.S. non-oil imports.

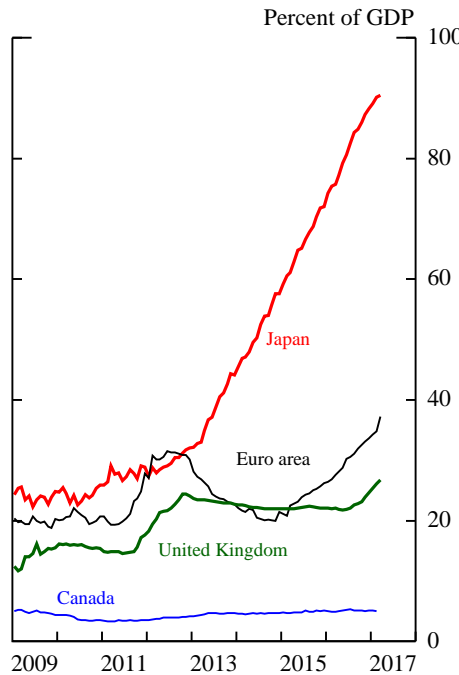
Int'l Econ Devel & Outlook

Foreign Monetary Policy

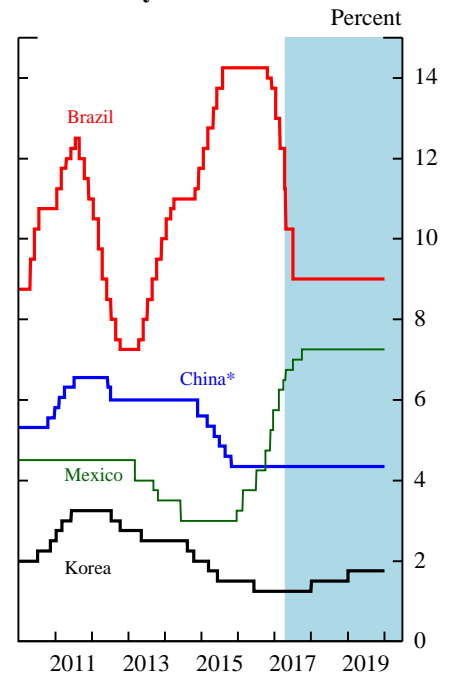
AFE Policy Rates



AFE Central Bank Balance Sheets



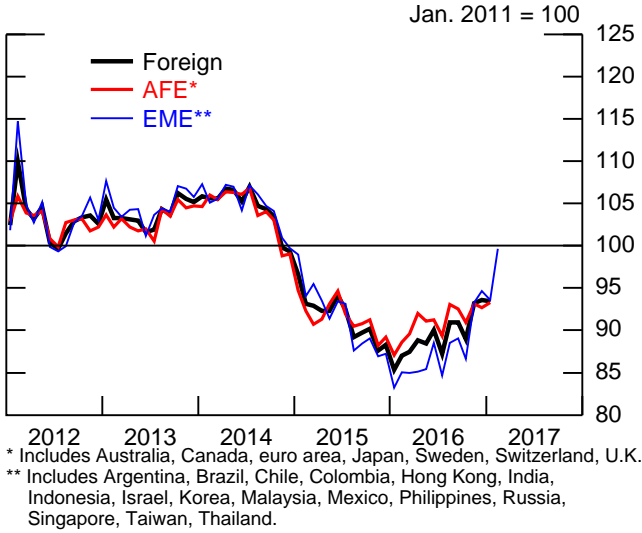
EME Policy Rates



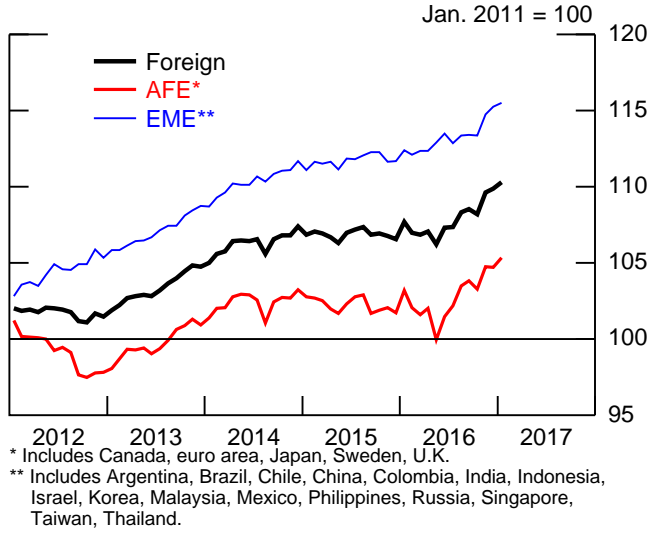
* 1-year benchmark lending rate.

Recent Foreign Indicators

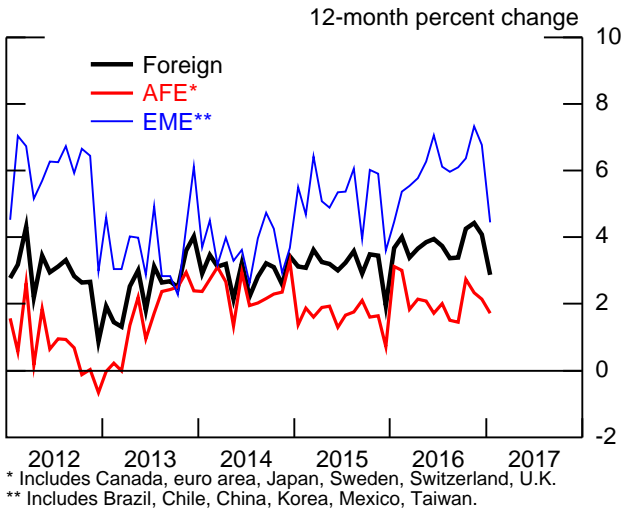
Nominal Exports



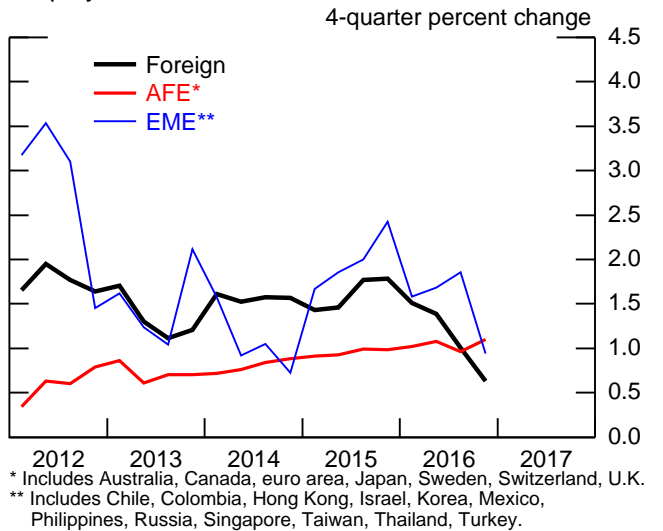
Industrial Production



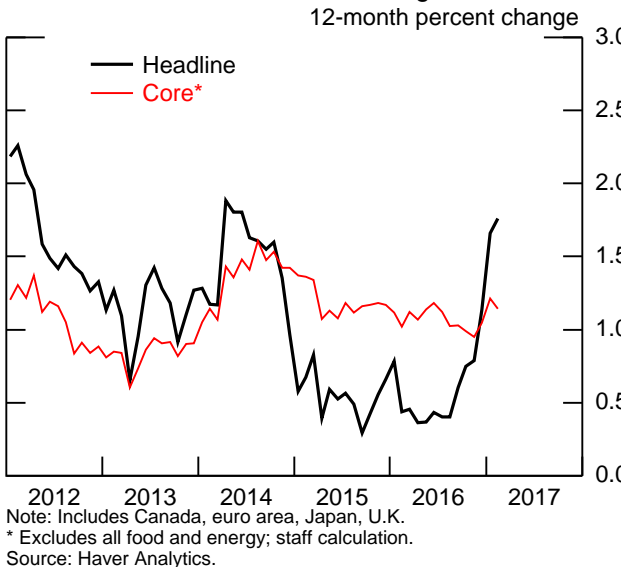
Retail Sales



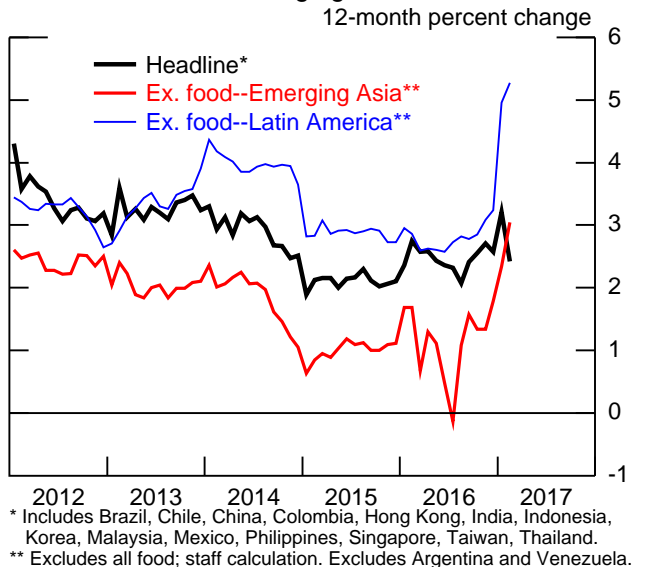
Employment



Consumer Prices: Advanced Foreign Economies

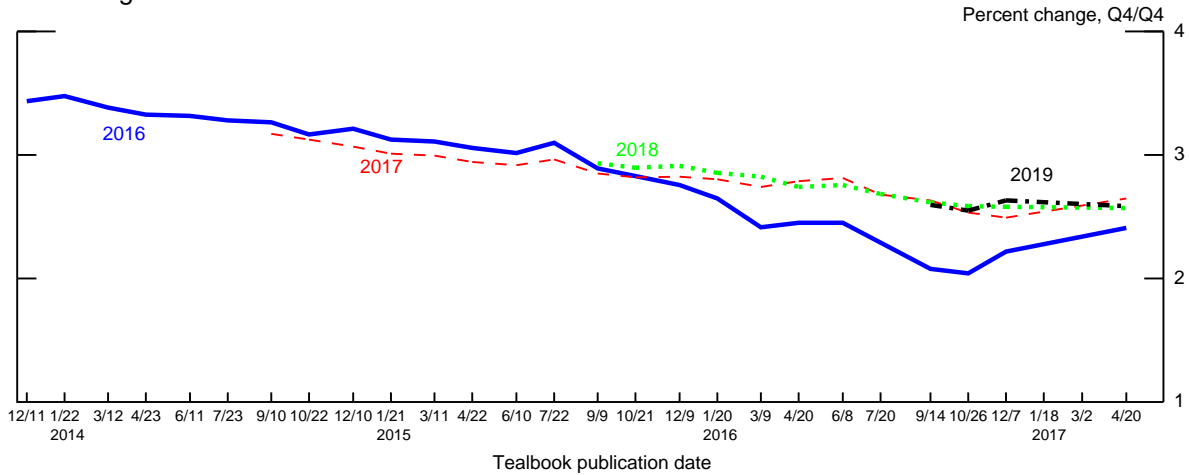


Consumer Prices: Emerging Market Economies

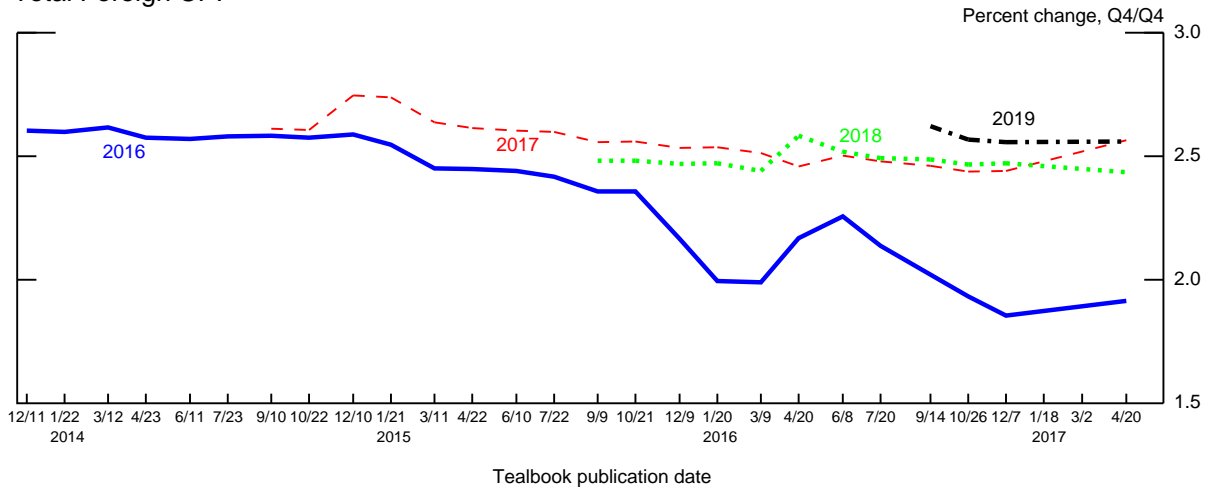


Evolution of Staff's International Forecast

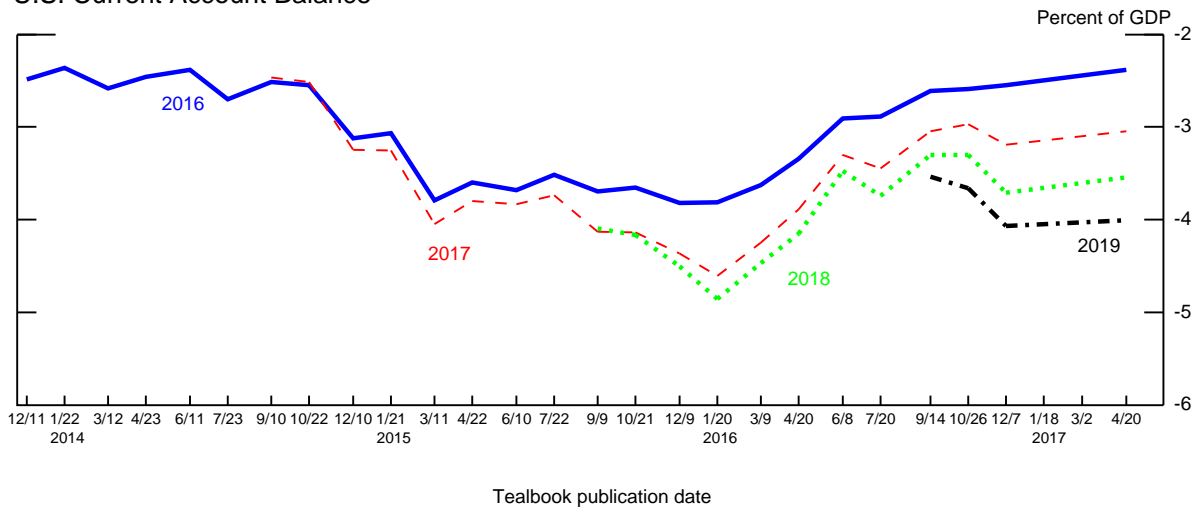
Total Foreign GDP



Total Foreign CPI



U.S. Current Account Balance



Int'l Econ Devel & Outlook

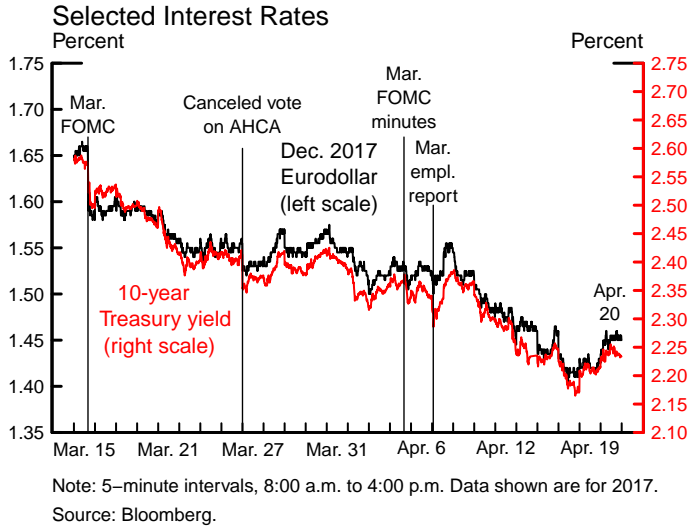
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Financial Market Developments

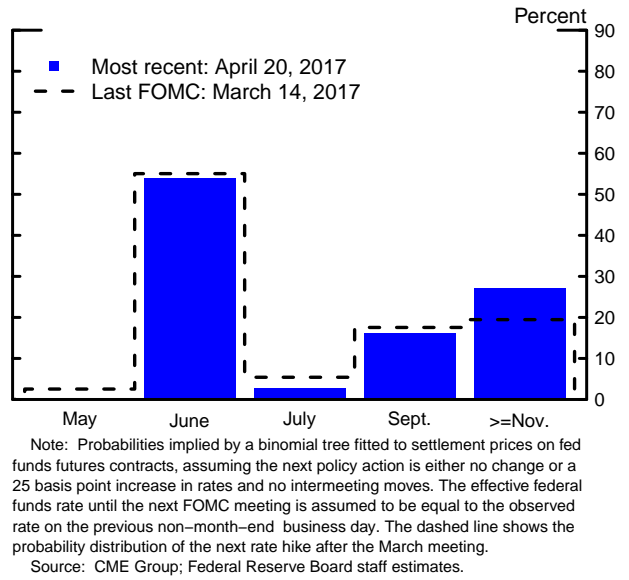
Treasury yields declined and the dollar depreciated over the intermeeting period, apparently driven by investor expectations for a slower pace of policy rate increases following FOMC communications after the March meeting, waning investor optimism about the prospect of more expansive fiscal policies, and adverse geopolitical developments. Risky asset prices were little changed on net.

- Based on a straight read of market quotes, investors continued to attach near-zero probability to an increase in the target range for the federal funds rate at the May meeting, while the probability of an increase at the June meeting was little changed at 54 percent. Market-based expectations of the level of the federal funds rate for early 2018 through the end of 2020 declined about 15 to 45 basis points.
- Results from private surveys suggested that market participants pulled forward their modal expectations for when the FOMC will start normalizing the size of its balance sheet. The effect of this change on asset prices appeared to be fairly limited.
- Yields on nominal Treasury securities with maturities of 5 years and 10 years declined 36 basis points. For the most part, these declines reflected lower real yields, but 5-year and 5-to-10-year-ahead inflation compensation also decreased—16 basis points and 10 basis points, respectively.
- Broad U.S. equity price indexes were little changed, on net, while bank equity indexes declined a fair bit. Near-term option-implied stock price volatility increased to its highest level since the U.S. elections in November but remained near the middle of its range over the past few years. Corporate bond spreads were little changed on net.
- In the AFEs, sovereign benchmark yields declined, while major equity indexes were mixed. EME equity prices generally rose.
- The broad dollar index declined about 1¾ percent.

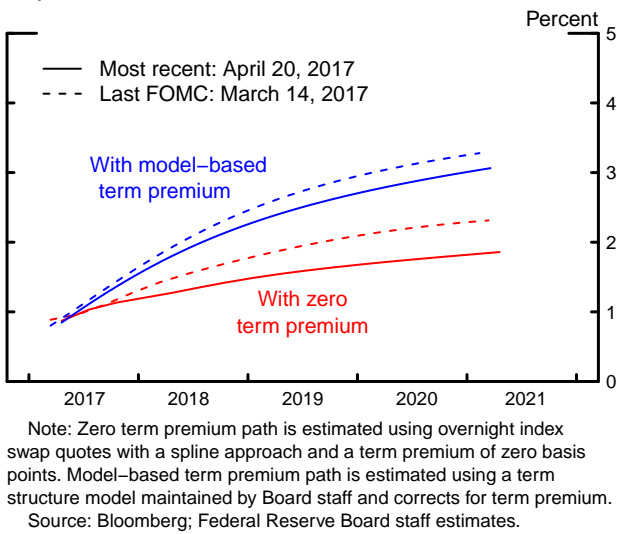
Policy Expectations and Treasury Yields



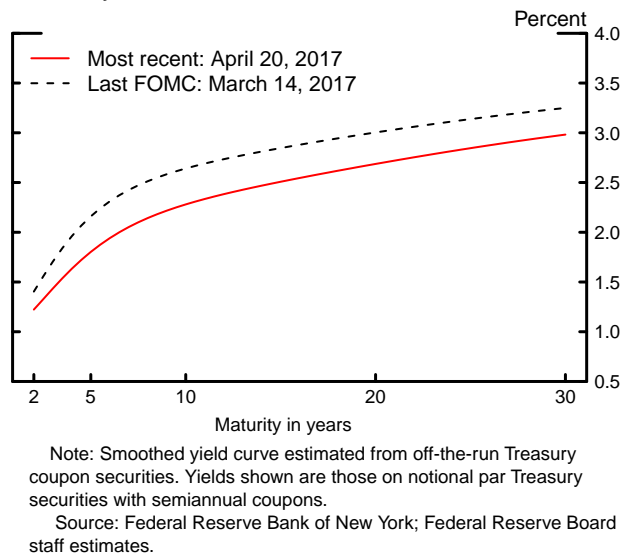
Market-Implied Probability Distribution of the Timing of Next Rate Increase



Implied Federal Funds Rate



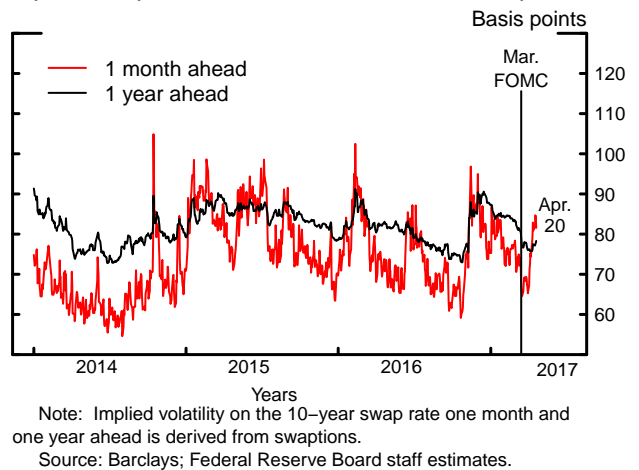
Treasury Yield Curve



Inflation Compensation



Option-Implied Volatilities on 10-Year Swap Rate



Financial Markets

- U.S. overnight market interest rates fully incorporated the FOMC’s March rate increase, and conditions in short-term funding markets remained stable. Quarter-end dynamics were, for the most part, typical of recent non-year-end quarter-ends.

POLICY EXPECTATIONS AND ASSET MARKET DEVELOPMENTS

Domestic Developments

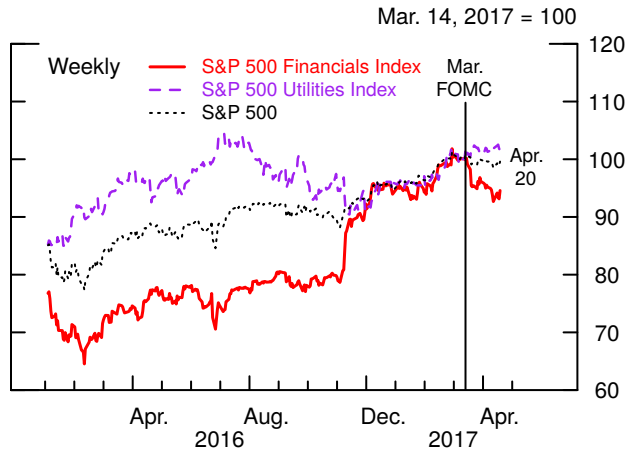
On net, FOMC communications over the intermeeting period were reportedly interpreted as indicating a somewhat slower pace of policy rate increases but an earlier date of potential changes to the Committee’s reinvestment policy than investors had expected. Although the Committee’s decision to raise the target range for the federal funds rate at the March meeting was widely anticipated, some of the accompanying communications were interpreted as more accommodative than expected. In particular, market participants highlighted the fact that the Committee’s median SEP projections for the federal funds rate for 2017 and 2018 were unchanged from December, while some investors had reportedly anticipated an upward revision following strong economic data releases and Federal Reserve communications in early March signaling additional near-term rate increases.

Subsequently, investors reportedly took note of the mention in the March FOMC minutes that “most participants . . . judged that a change to the Committee’s reinvestment policy would likely be appropriate later this year,” and some market participants appeared to have pulled forward their modal expectation for when the FOMC will either announce or start to implement a change to its reinvestment policy. For example, in response to one recent survey conducted by the *Wall Street Journal*, nearly 70 percent of the participants reported expecting the FOMC to begin normalizing its balance sheet in 2017, up from around 20 percent from the same survey last month. Market participants also highlighted the statement in the minutes that FOMC participants generally preferred to phase out or cease reinvestments of “both Treasury securities and agency MBS.” Overall, market reaction over the intermeeting period to news related to potential reinvestment policy changes appeared to be fairly limited.

Based on a straight read of quotes on federal funds futures contracts, the probability of the next rate increase occurring at the June meeting was little changed at 54 percent. The expected path of the federal funds rate further out through the end of 2020, implied by a straight read from OIS quotes, rotated down by up to 47 basis points

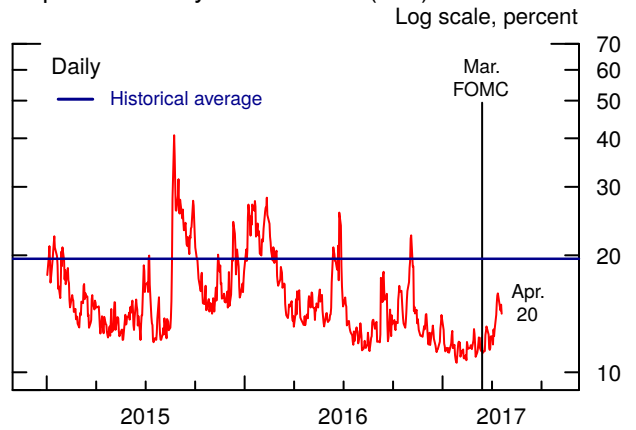
Corporate Asset Markets and Banking Developments

S&P 500 Sectors



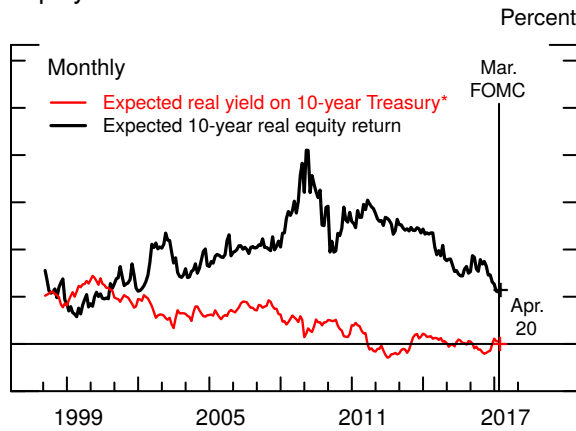
Source: Bloomberg.

Implied Volatility on S&P 500 (VIX)



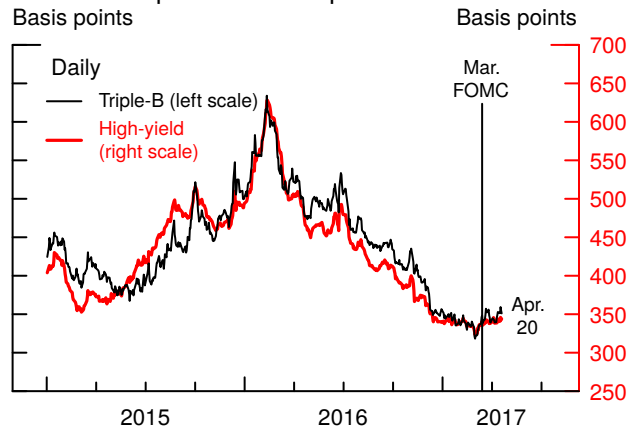
Note: Historical average is taken from 1990 onward.
Source: Chicago Board Options Exchange.

Equity Risk Premium



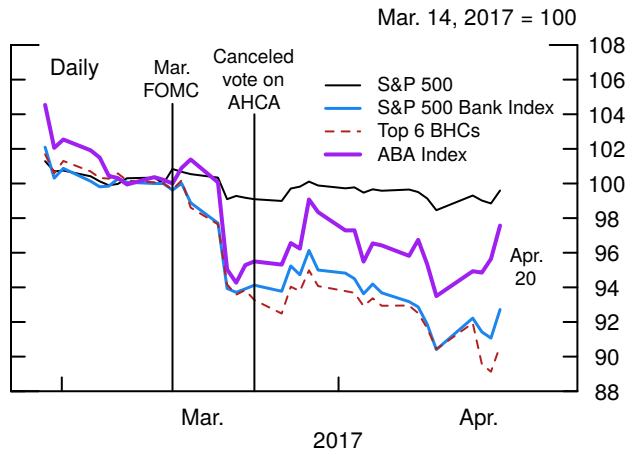
* Off-the-run 10-year Treasury yield less Philadelphia Fed 10-year expected inflation.
+ Denotes latest observation using daily interest rates and stock prices as well as staff forecast of corporate profits.
Source: Staff projections.

10-Year Corporate Bond Spreads



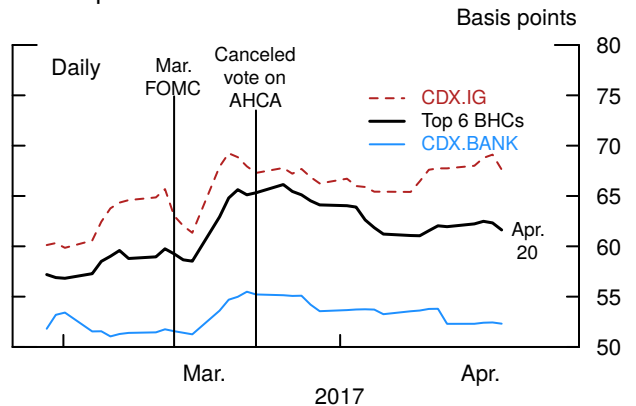
Note: Spreads over 10-year Treasury yield.
Source: Staff estimates of smoothed yield curves based on Merrill Lynch bond data and smoothed Treasury yield curve.

S&P 500 and ABA Indexes



Note: Top 6 bank holding companies (BHCs) are Bank of America, Citigroup, Goldman Sachs, Morgan Stanley, JPMorgan Chase, and Wells Fargo. ABA is the American Bankers Association. AHCA is the American Health Care Act.
Source: Bloomberg, Google Finance.

CDS Spreads



Note: Top 6 bank holding companies (BHCs) are Bank of America, Citigroup, Goldman Sachs, Morgan Stanley, JPMorgan Chase, and Wells Fargo. Dashed curve plots the median 5-year spread. CDX.IG is the on-the-run investment-grade credit default swap (CDS) index. CDX.BANK is the median of all available quotes. AHCA is the American Health Care Act.
Source: Markit.

on net. However, a staff model suggested that more negative term premiums accounted for about half of this decline.

Yields on intermediate- and longer-maturity nominal Treasury securities were about 36 basis points lower over the intermeeting period, with a more-accommodative-than-expected interpretation of the FOMC communications, the reduced outlook for domestic fiscal and regulatory policy changes, and geopolitical developments all placing downward pressure on yields. In particular, Treasury yields fell noticeably following the March FOMC meeting and on the news of the canceled vote on the American Health Care Act (AHCA), with the latter reportedly raising investor uncertainty about the Administration's ability to implement its broader economic policy agenda. Geopolitical developments, including increased uncertainty about the outcome of the French elections and tensions surrounding North Korea, reportedly also weighed on yields later in the period.¹ Meanwhile, Treasury yields exhibited only limited reaction to domestic economic data releases, which came in slightly weaker than investors expected on net. The staff's term structure model attributed about one-third of the decline in the 10-year yield to a decrease in the average expected future short rate and the remaining two-thirds to a lower term premium. Both components remained above their levels prior to the November elections. One-year-ahead option-implied volatility on 10-year swap rates—an indicator of uncertainty about future Treasury yields—was little changed over the intermeeting period. In contrast, one-month-ahead option-implied volatility rose sharply, once the expiration of these option contracts extended beyond the date of the upcoming French elections.

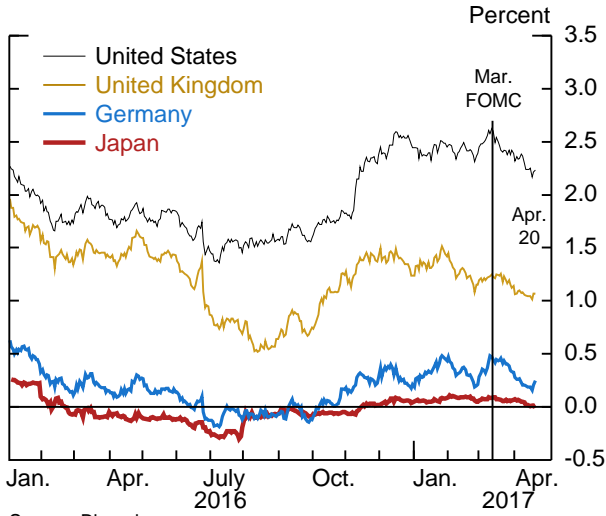
On net, 5-year TIPS-based inflation compensation has declined 16 basis points since the March FOMC meeting, partly reflecting the lower-than-expected March CPI release, and is now little changed relative to its level prior to the November elections. The 5-to-10-year forward measures of inflation compensation also edged lower over the same period. MBS yields fell in line with comparable-maturity Treasury yields.

Broad U.S. equity price indexes have been little changed, on net, since the March FOMC meeting despite the drop in interest rates, as investors reportedly became less optimistic about the prospects of tax and regulatory reforms. Share prices of firms in the financial sector decreased a fair bit, while those of firms in the utilities and real estate

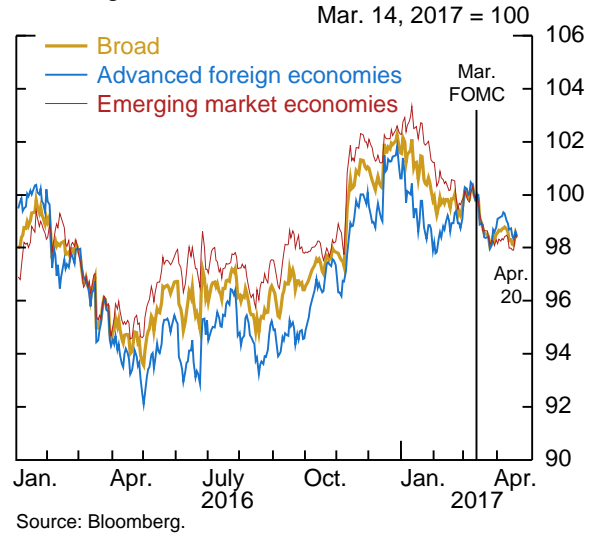
¹Treasury yields fell immediately following the U.S. missile strike on Syria but quickly rebounded.

Foreign Developments

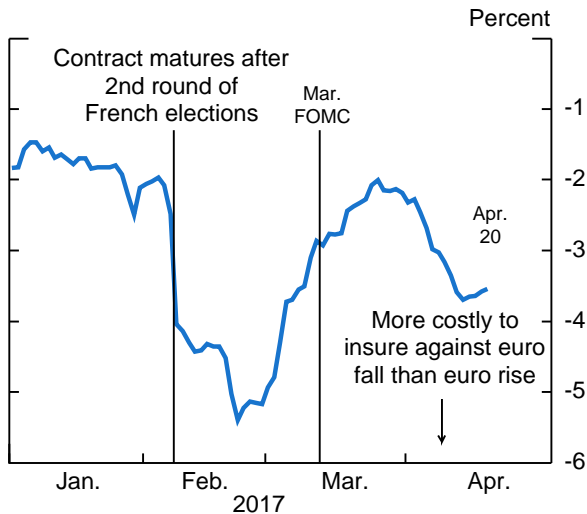
10-Year Nominal Yields



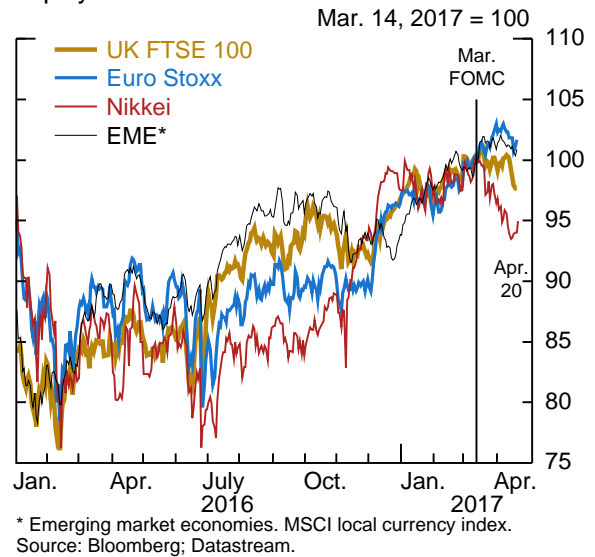
Exchange Rates



Euro-USD Risk Reversals

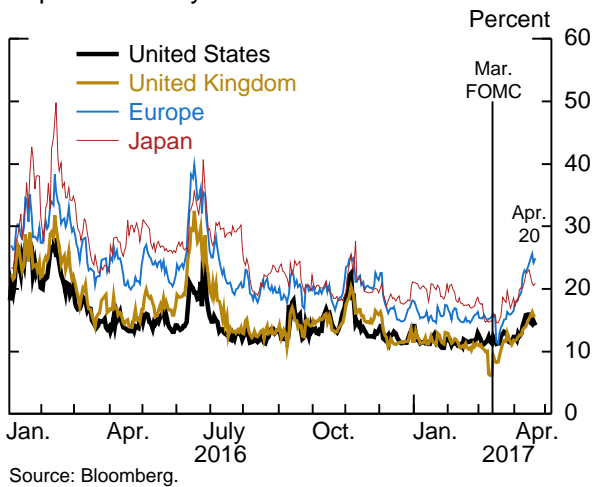


Equity Market Indexes

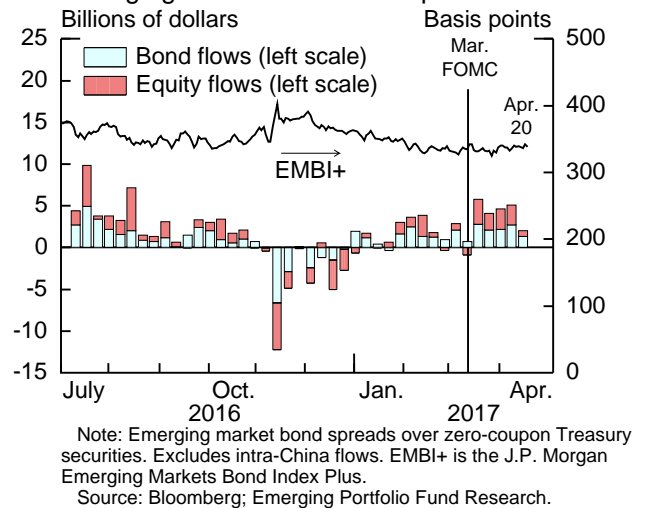


Financial Markets

Implied Volatility



Emerging Market Flows and Spreads



sectors, which tend to benefit more than some other sectors from lower interest rates, increased somewhat. One-month-ahead option-implied volatility on the S&P 500 index—the VIX—increased to its highest level since the U.S. elections in November, likely reflecting concerns about increased geopolitical risks, although it remained near the middle of its range over the past few years. Over the intermeeting period, spreads of yields on investment- and speculative-grade nonfinancial corporate bonds over comparable-maturity Treasury securities were little changed on net. Private-sector analysts continued to project robust profit growth for S&P 500 firms over 2017 even as first-quarter earnings were estimated to be a bit lower relative to the fourth quarter on a seasonally adjusted basis.

Equity prices of the six largest bank holding companies (BHCs) declined around 9 percent over the intermeeting period, partly reversing their large post-election gains, amid mixed earnings reports and reduced investor expectations for the Administration’s tax and regulatory reforms. CDS spreads for the top six BHCs ticked up a bit but still remained below their pre-election levels.

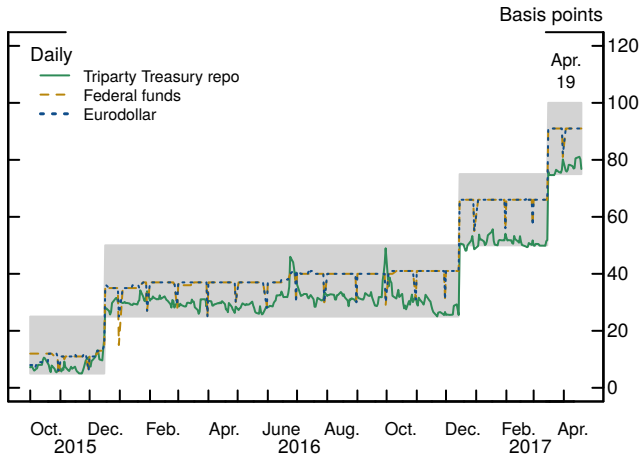
Foreign Developments

Since the March FOMC meeting, movements in foreign financial markets have been driven by changes in investors’ perceptions about future U.S. fiscal policy, central bank communications in the United States and abroad, and geopolitical risks.

During the intermeeting period, 10-year sovereign yields declined across all of the advanced economies. Dovish communication from ECB officials, along with slightly lower-than-expected euro-area inflation, pushed German 10-year yields down 20 basis points. Concerns about the outcome of the French presidential elections contributed to a slight widening of French sovereign spreads and led to a notable increase in the cost of insuring against a euro depreciation relative to a euro appreciation. In the United Kingdom, weaker-than-expected activity data contributed to a 16 basis point decline in 10-year gilt yields. On March 29, the U.K. government formally invoked Article 50, beginning the process of negotiating the United Kingdom’s departure from the EU. This event was widely anticipated, and it resulted in little price action. Later in the period, U.K. Prime Minister May called for early parliamentary elections on June 8, seeking to gain a larger majority for the Conservative Party ahead of the Brexit negotiations. Increased tensions in Syria and in the Korean peninsula reportedly also contributed to the decline in AFE yields later in the period.

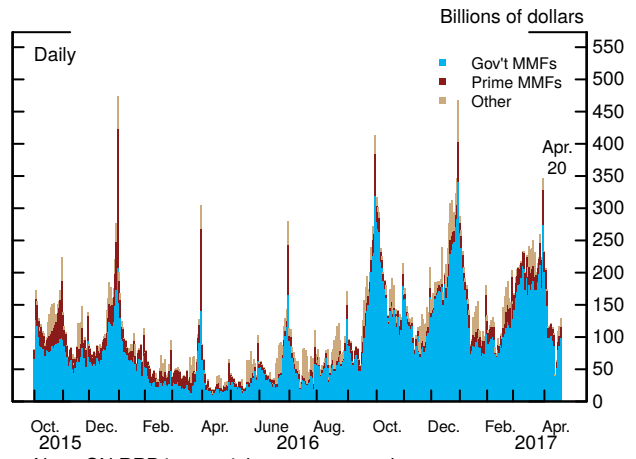
Short-Term Funding Markets and Federal Reserve Operations

Selected Money Market Rates



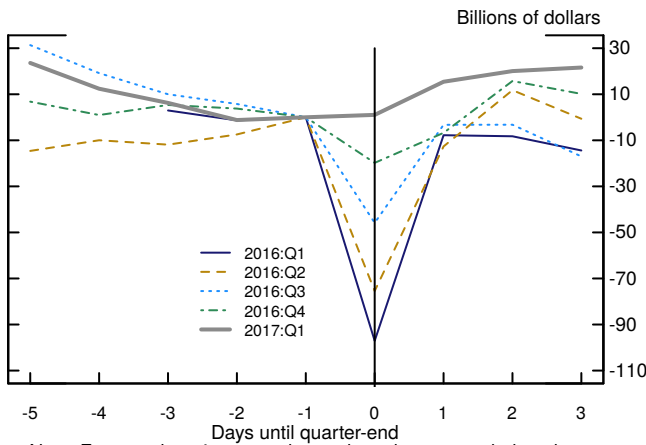
Note: Federal funds rate is a weighted median, and shaded area is the target range for the federal funds rate. Repo is repurchase agreement.
 Source: Federal Reserve Bank of New York; Federal Reserve Board, Form FR 2420, Report of Selected Money Market Rates.

ON RRP Take-Up, by Type



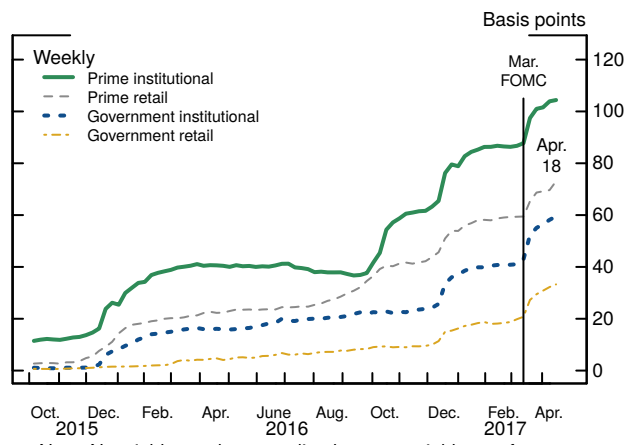
Note: ON RRP is overnight reverse repurchase agreement; MMFs are money market funds.
 Source: Federal Reserve Bank of New York.

Eurodollar Volumes



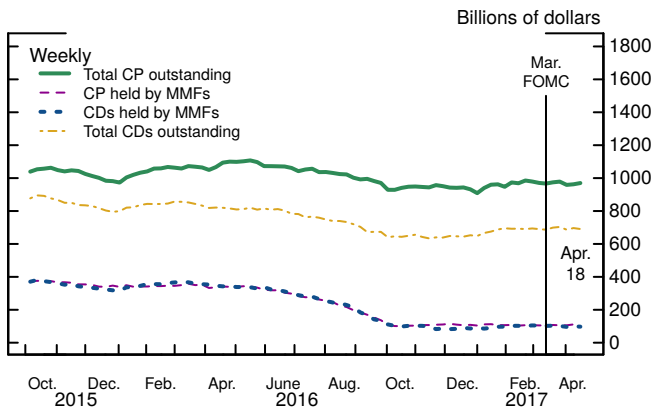
Note: From each series, we subtract the volume recorded on the day prior to quarter-end.
 Source: Federal Reserve Board, Form FR 2420, Report of Selected Money Market Rates.

MMF Net Yields



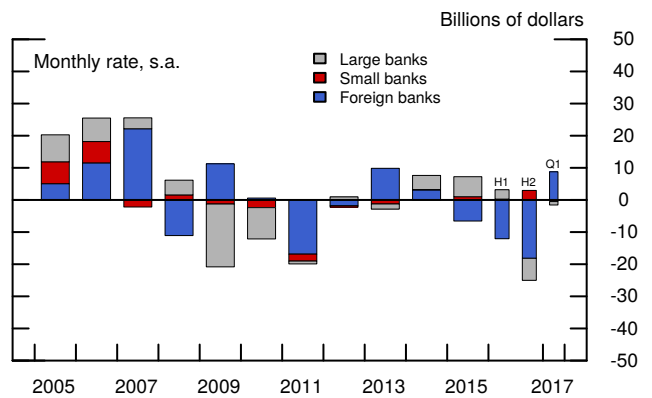
Note: Net yields are the annualized average yield, net of expense ratio, earned over the past 7 days without reinvesting dividends.
 Source: iMoneyNet.

CP and CDs: Totals and Amounts Held by MMFs



Note: Commercial paper (CP) includes asset-backed commercial paper. MMF is money market fund; CD is certificate of deposit.
 Source: Depository Trust & Clearing Corporation; iMoneyNet.

Change in Large Time Deposits



Note: Yearly rates are Q4 to Q4. Half-years are based on Q4 and Q2 average levels, and quarterly and monthly annual rates use corresponding average levels.
 Source: Federal Reserve Board, Form FR 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

The broad dollar index declined 1¾ percent, with most of the decline occurring in the week following the March FOMC meeting. The dollar also depreciated after the cancellation of the vote on the AHCA, which reportedly damped expectations for expansionary U.S. fiscal policy. Among AFE currencies over the period, the dollar depreciated about 5 percent against the yen amid concerns about geopolitical developments and consistent with U.S. yields declining substantially more than Japanese yields. The dollar also depreciated 5¼ percent against sterling, with much of the decline occurring after the call for early elections in the United Kingdom.

Major equity indexes in the AFEs were mixed, and measures of implied volatility rose sharply. Share prices rose slightly in the euro area, supported by strong manufacturing PMI data. In Japan, the stronger yen weighed on equity prices.

Investor sentiment toward the emerging market economies (EMEs) continued to be positive amid strong data on activity and low rates in advanced economies. EME equity prices generally rose, flows to EME mutual funds remained strong, and EME currencies appreciated against the dollar. Notably, the Mexican peso appreciated about 4½ percent against the dollar and is now near its level prior to the U.S. presidential election. EME sovereign bond spreads were little changed over the period.

SHORT-TERM FUNDING MARKETS AND FEDERAL RESERVE OPERATIONS

Overnight rates reflected a smooth transmission of the March increase in the federal funds target range and remained stable over the intermeeting period. The effective federal funds rate printed at 91 basis points except for typical softness at quarter-end. Overnight Eurodollar rates closely tracked the effective federal funds rate.

The reduction in Treasury bill supply prior to the end of the debt limit suspension period on March 15 pushed overnight secured money market rates to the lower end of the target range and led to an increase in ON RRP take-up.² As net bill issuance picked up again beginning on March 16, overnight secured spreads to the ON RRP rate widened slightly and ON RRP take-up declined.

² Legislation passed in 2015 suspended the debt limit through March 15, 2017, at which point the debt limit of the United States was reset at the amount of debt outstanding on that date. On March 16, the Treasury Department began using extraordinary measures that would likely keep the debt from breaching the limit through the fall.

Quarter-end dynamics in overnight money markets largely followed the pattern of recent non-year-end quarter-ends. One exception was Eurodollar volumes, which displayed a more gradual and less pronounced decline ahead of quarter-end instead of the usual sharp one-day drop. At the March quarter-end, ON RRP take-up increased \$123 billion from the prior day to \$347 billion, in line with recent non-year-end quarter-ends.

Abroad, quarter-end dynamics in most foreign money markets were generally orderly. Very short-term FX swap bases widened, but not as much as during recent quarter ends, and the bases quickly returned to levels closer to recent norms. There were modest take-ups of dollar auctions at the Bank of Japan and the ECB.

Conditions in other short-term funding markets were also stable over the intermeeting period. Reflecting the March rate increase, net yields on money market funds (MMFs) rose. Total outstanding levels of commercial paper, certificates of deposit, and assets under management of MMFs remained about unchanged.

Following the large deposit outflows induced by the mid-October MMF reform, large time deposits and core deposits at foreign banks increased in the first quarter. Domestic banks experienced some large time deposit outflows in early 2017, while core deposit inflows remained stable.

Financing Conditions for Businesses and Households

Financing conditions for nonfinancial businesses and households have been roughly unchanged, on net, in recent months and have continued to be supportive of economic activity. Nevertheless, the overall pace of financing of large businesses picked up in the first quarter but remained modest compared with the very strong pace seen early last year. Overall household debt growth also continued to be modest.

- Market-based lending to large nonfinancial firms remained solid, with particularly strong investment-grade bond issuance and a pickup in bond issuance by lower-rated firms. By contrast, bank loan growth slowed noticeably, apparently driven by a weakening in the demand for commercial and industrial (C&I) and commercial real estate (CRE) loans.
- Credit continued to be largely available for small businesses, although the demand for credit by these firms reportedly remained weak.
- Financing conditions for households continued to be accommodative on balance. Growth of consumer loans moderated but remained relatively strong, while demand for residential real estate loans was little changed amid still-tight lending conditions for households with lower credit scores or harder-to-document incomes.

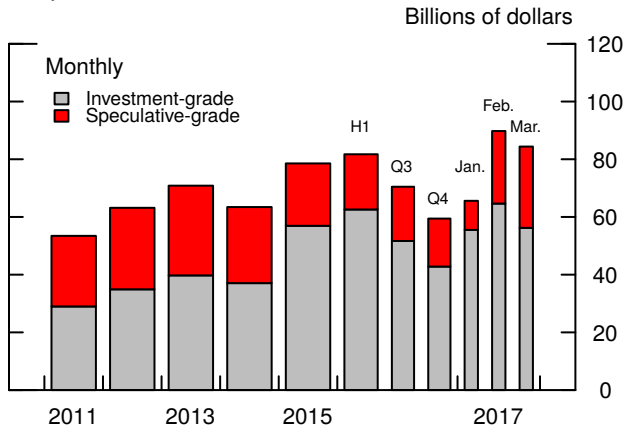
BUSINESS FINANCING CONDITIONS

Nonfinancial Corporate Debt and Equity

Over the intermeeting period, financing conditions for large nonfinancial firms stayed accommodative. Gross issuance of corporate bonds remained strong in March, reflecting robust issuance by investment-grade firms. In addition, issuance by lower-rated firms picked up, with a large share of the proceeds reportedly earmarked for refinancing existing debt. Gross equity issuance by large nonfinancial firms was also solid in March, reflecting a robust pace of seasoned offerings as well as a pickup in initial public offerings. Share repurchase and mergers and acquisitions (M&A) activity remained relatively solid overall, although announcements of new share repurchase programs and M&A activity in the first quarter were lower than a year ago.

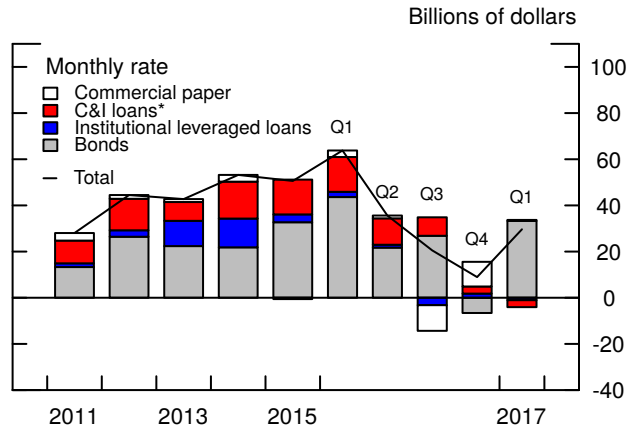
Business Finance

Gross Issuance of Nonfinancial Corporate Bonds



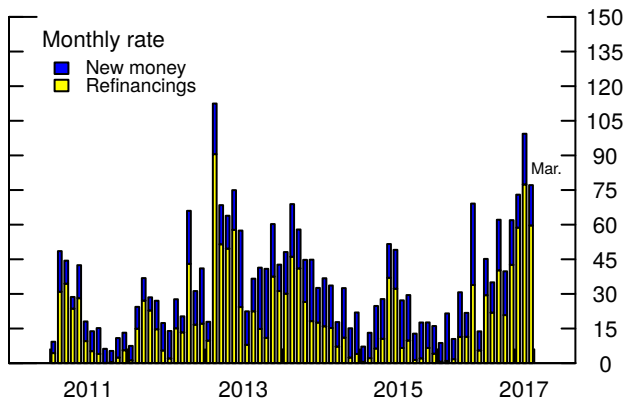
Note: Bonds are categorized by Moody's, Standard & Poor's, and Fitch.
Source: Mergent Fixed Income Securities Database.

Selected Components of Net Debt Financing, Nonfinancial Firms



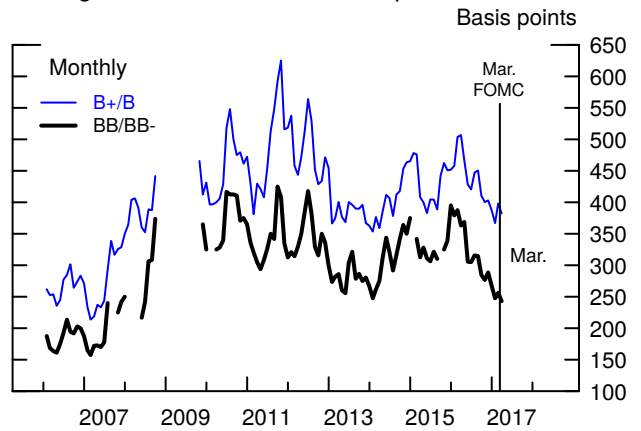
Note: C&I is commercial and industrial.
* Period-end basis, seasonally adjusted.
Source: Depository Trust & Clearing Corporation; Mergent Fixed Income Securities Database; Federal Reserve Board; Thomson Reuters LPC.

Institutional Leveraged Loan Issuance, by Purpose



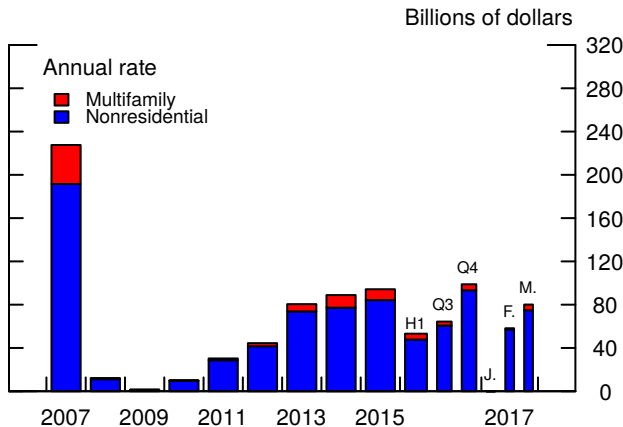
Source: Thomson Reuters LPC LoanConnector.

Average New-Issue Institutional Spreads



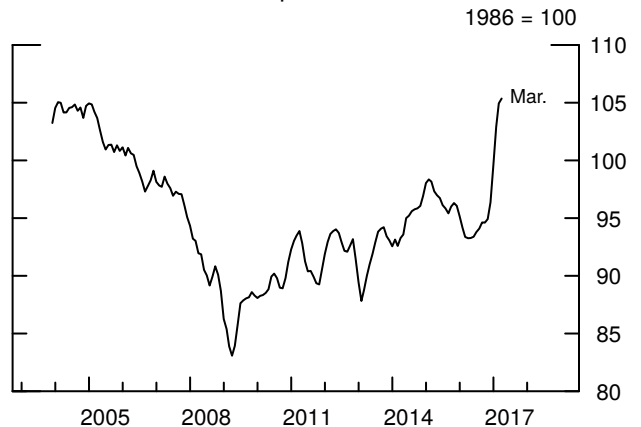
Note: Breaks in the series represent periods with no issuance. Spreads are calculated against 3-month LIBOR. The spreads do not include upfront fees.
Source: S&P LCD.

CMBS Issuance



Note: Multifamily excludes agency issuance.
Source: Consumer Mortgage Alert.

NFIB Small Business Optimism Index



Note: NFIB (National Federation of Independent Business) data are monthly and seasonally adjusted; a 3-month moving average is reported.
Source: National Federation of Independent Business (NFIB), Small Business Economic Trends Data.

Net debt financing to nonfinancial businesses increased in the first quarter but remained noticeably below the pace of early 2016. Net debt financing was particularly weak during the second half of 2016, led by softer C&I loan growth and bond issuance net of retirements. While bond issuance rebounded in the first quarter to its pace of early 2016, C&I lending continued to be soft last quarter.

According to the April Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS), both foreign and domestic banks reported weaker demand for C&I loans, on net, in the first quarter.¹ Regarding their credit policies on such loans, banks reportedly left standards for approving C&I loans unchanged; however, they have eased several loan terms, including loan rate spreads and covenants for large and middle-market firms, citing more aggressive competition from other banks or nonbank lenders as an important reason for doing so. (Nonbank lenders appear to have increased lending to medium-sized firms with limited access to corporate bond markets; see the box “Direct-Lending Investment Funds: The ‘New Kid’ in Middle-Market Lending.”) Of note, the recent slowdown in C&I loan growth was attributed in part to loan paydowns at large domestic and foreign banks, two types of institutions that tend to serve large firms with access to the institutional leveraged loan and corporate bond markets.

Gross issuance of institutional leveraged loans was quite strong last quarter; however, with the majority of those loans reportedly being used for refinancing purposes, net issuance continued to be fairly light. Refinancing activity was boosted by favorable financing conditions, as evidenced by continued strong inflows to leveraged loan mutual funds and tight spreads on newly issued loans. These developments partly reflected institutional investors’ strong demand for floating-rate loans given expectations of further increases in short-term interest rates.

Commercial Real Estate

Financing conditions for CRE were broadly unchanged on net. Commercial mortgage-backed securities (CMBS) spreads widened slightly since the March FOMC but remained near the lower end of the range seen since the financial crisis. CMBS issuance picked up in March, reportedly reflecting a return to a more-normal level after

¹ For each loan category, SLOOS results are calculated by weighting each bank’s response by the size of its loan portfolio in that category. For detailed information on the results of the April survey, see Judit Temesvary (forthcoming), “April 2017 Senior Loan Officer Opinion Survey on Bank Lending Practices,” memorandum to the FOMC, Board of Governors of the Federal Reserve System, Monetary Affairs.

Direct-Lending Investment Funds: The “New Kid” in Middle-Market Lending

A new class of nonbank lenders to middle-market firms has emerged since the financial crisis—the so-called direct-lending investment funds, or direct-lending funds. Middle-market firms—medium-sized firms with revenue roughly between \$10 million and \$1 billion—reportedly account for nearly one-third of U.S. private-sector GDP and employment.¹ Many middle-market firms do not have access to corporate bond markets and struggle to borrow from institutional leveraged loan investors such as loan mutual funds or issuers of collateralized loan obligations. As a result, middle-market businesses have historically relied mainly on commercial banks for credit. Since the financial crisis, however, new direct-lending investment funds have carved out a sizable and growing niche to meet the demand for credit from medium-sized firms.²

Direct-lending funds are sponsored by private equity firms and alternative asset managers.³ These funds raise capital from institutional investors including foundations, endowments, pensions, high-net-worth individuals, and sovereign wealth funds. Investors commit capital for the life of each fund, which usually lasts close to 10 years. Investors are compensated for the long lockup periods with relatively high yields, a business model that is particularly attractive to institutional investors, which tend to reach for yield in a low interest rate environment. These nonbank loans are attractive to many medium-sized firms despite higher costs because they would not otherwise receive enough financing from traditional banks, particularly at longer maturities.

Figure 1 shows an estimate of the total amount of capital deployed by direct-lending funds annually since 2008. These funds deployed \$32 billion to medium-sized firms over the past four years—with individual deal sizes typically not exceeding \$1 billion—of a total of at least \$35 billion raised from investors over that time.⁴ As of the end of 2016, these funds are estimated to have had nearly \$10 billion of uncalled capital (or “dry powder”) available to be deployed in future deals (figure 2).

The increasing presence of these nonbank lenders has coincided with publicly traded middle-market firms’ growing appetite for credit.⁵ Of these firms, those without a long-term bond rating increased their long-term debt \$78 billion over the past four years, as shown in figure 3, a period during which direct-lending funds deployed over \$30 billion, suggesting that this new class of nonbank lenders has become a nontrivial supplier of credit to the middle-market segment of the corporate sector.⁶ In addition, a growing fraction of these firms newly entered long-term debt

¹ These statistics have been compiled by the National Center for the Middle Market, www.middlemarketcenter.org.

² Goldman Sachs noted in a March 29, 2013 SEC filing that it “believes [middle-market companies] have been underserved in recent years by banks and have difficulty accessing the public debt markets.”

³ Examples of alternative asset managers include hedge funds, various debt strategy funds, and real asset funds.

⁴ KKR provided loans of close to \$1 billion to Mills Fleet Farm Group for an acquisition when it otherwise could not acquire financing.

⁵ In this analysis, middle-market firms are defined as nonfinancial firms with three-year rolling average annual revenues between \$10 million and \$1 billion.

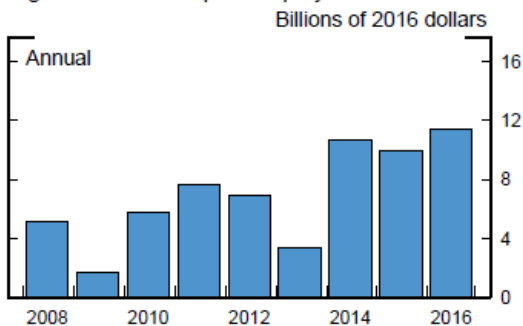
⁶ Because loan holdings are not separated from bond holdings in the data, the analysis excludes firms with long-term bond ratings, which account for about 5 percent of these 2,000 firms, to get a more accurate measurement of loan holdings.

markets in recent years. According to figure 4, close to 6 percent of these firms started to carry long-term debt on their books between 2011 and 2015; in sharp contrast, less than 1 percent of their non-middle-market counterparts started to carry long-term debt during this period.⁷

While the analysis is limited to public firms because of data availability, it has a broad application, as publicly traded firms constitute about half of nonfinancial domestic firms in terms of total assets.⁸ In addition, the trend in credit demand is likely to hold for private firms as well: Direct-lending funds are likely more important for private firms because such firms generally are smaller, are more financially constrained, and have a narrower spectrum of credit sources.

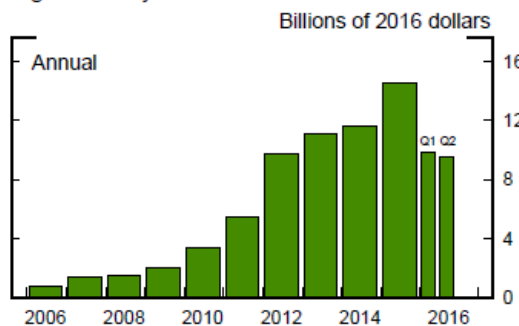
Taken together, recent developments indicate that direct-lending funds are becoming an important source of funding for middle-market firms, which appear to have increasing demand for credit. These nonbank lenders, which typically extend longer-term loans than commercial banks, add to the pool of long-term liquidity for middle-market firms, helping them diversify their sources of credit and possibly become less dependent on bank-intermediated credit.

Figure 1: Total Capital Deployed



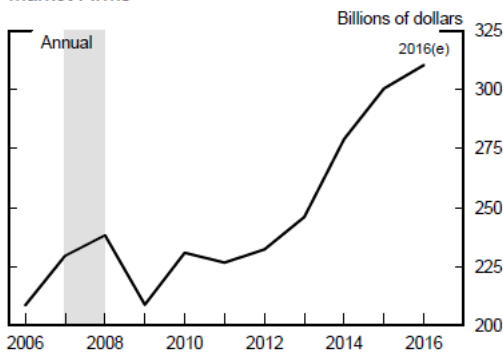
Source: Pitchbook.

Figure 2: Dry Powder



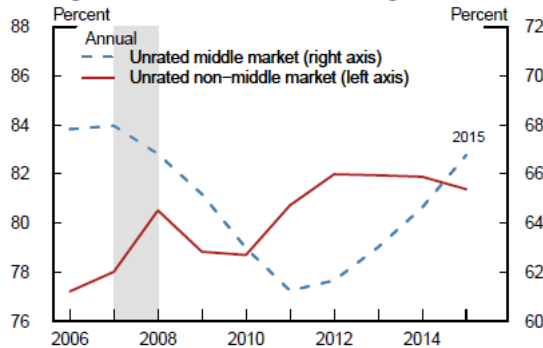
Source: Pitchbook.

Figure 3: Long-Term Debt of Unrated Middle-Market Firms



Note: Data are inflation-adjusted to 2016 dollars. Annual data for 2016 are estimated from total assets. The shaded bar indicates a period of business recession as defined by the National Bureau of Economic Research.
Source: Compustat.

Figure 4: Fraction of Firms with Long-Term Debt



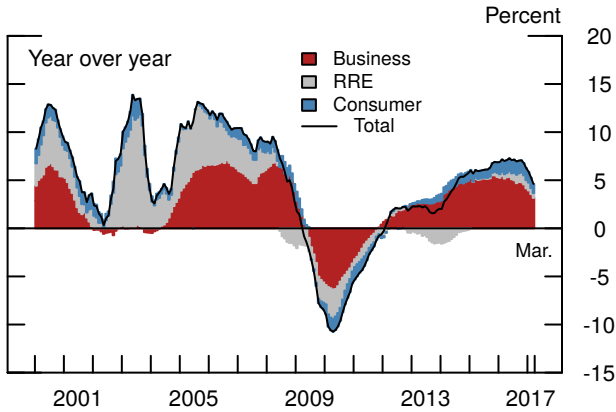
Note: The shaded bar indicates a period of business recession as defined by the National Bureau of Economic Research.
Source: Compustat.

⁷ Among unrated firms, middle-market firms constitute about 70 percent of publicly traded firms.

⁸ For instance, in 2013, publicly traded firms held about \$25 trillion in assets, while the Financial Accounts of the United States report nonfinancial domestic firms in aggregate held about \$50 trillion.

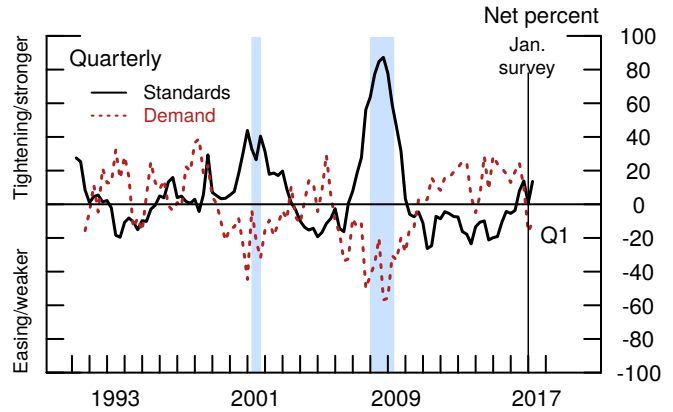
Bank Lending Conditions

Core Loan Growth



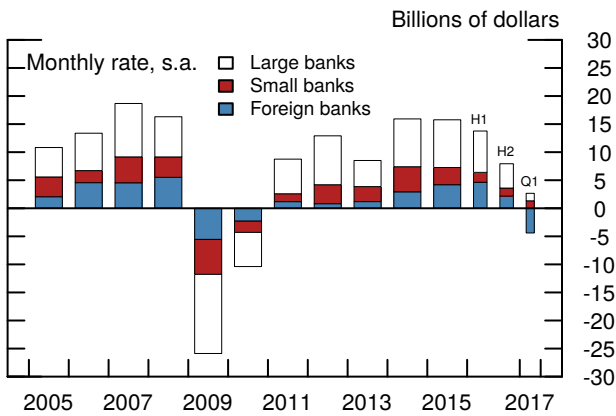
Note: Business loans include commercial and industrial as well as commercial real estate. Consumer loans include credit card, auto, and other consumer loans. RRE is residential real estate.
 Source: Federal Reserve Board, Form 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

Weighted Changes in Standards and Demand across All Loan Categories for Domestic Respondents



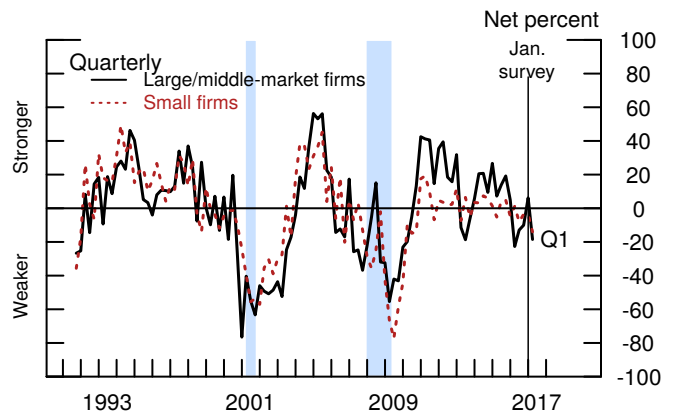
Note: Shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research.
 Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Commercial and Industrial Loans



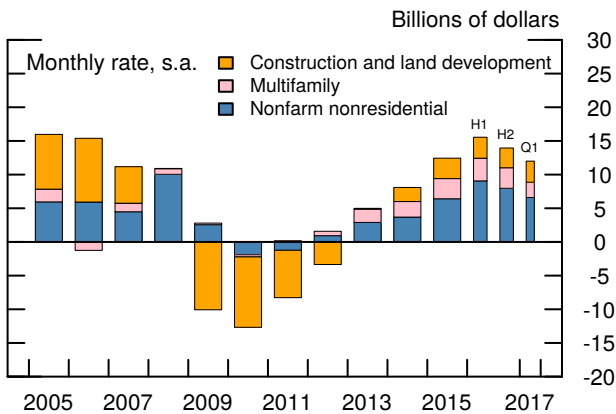
Note: Yearly rates are Q4 to Q4. Half-years are based on Q4 and Q2 average levels, and quarterly and monthly annual rates use corresponding average levels. Large banks are defined as the largest 25 banks by assets.
 Source: Federal Reserve Board, Form 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

Demand for C&I Loans



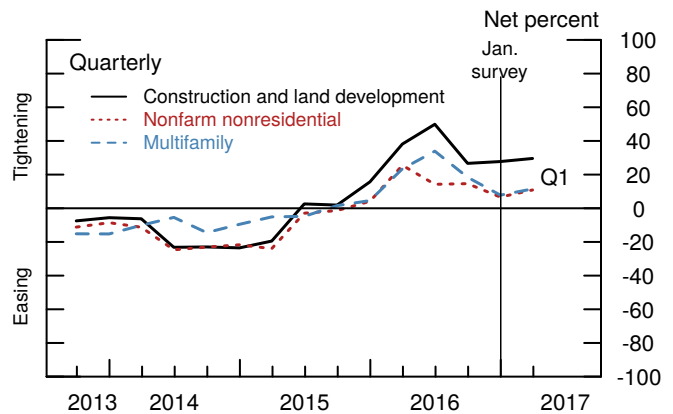
Note: Shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research. C&I is commercial and industrial.
 Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Commercial Real Estate Loans



Note: Yearly rates are Q4 to Q4. Half-years are based on Q4 and Q2 average levels, and quarterly and monthly annual rates use corresponding average levels.
 Source: Federal Reserve Board, Form 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

Standards for CRE Loans



Note: CRE is commercial real estate.
 Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

the adoption of the risk-retention rule in late December caused some issuance to be shifted from January and February into the fourth quarter. CRE loan growth on banks' books slowed in the first quarter but continued to be robust overall. Domestic respondents to the April SLOOS generally reported tightening their lending standards and seeing weaker loan demand across all major CRE loan categories during the first quarter.

Small Businesses

Overall, since the March Tealbook, indicators point to credit market conditions for small businesses having improved somewhat. Data from the most recent Wells Fargo/Gallup Small Business Index survey indicated that credit supply eased somewhat from already accommodative levels, although results from the April SLOOS suggested that demand for credit among small businesses weakened over the first quarter.

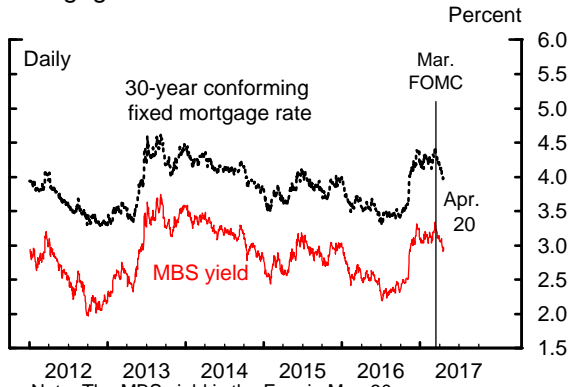
The National Federation of Independent Business (NFIB) index of small business optimism, which rose sharply following the November elections, remained elevated at levels last observed in 2004, likely reflecting expected changes in the regulatory and tax environment under the new Administration. This optimism has not translated into stronger loan demand from small businesses thus far; anecdotal evidence points to small business bank deposits that are near record-high levels, which might be suppressing demand for credit. Indicators of recent small business loan performance have remained strong, and credit quality concerns are not expected to constrain the growth of small business credit going forward.

MUNICIPAL GOVERNMENT FINANCING CONDITIONS

Credit conditions in municipal bond markets remained accommodative, on balance, and gross issuance of bonds by state and local governments was solid in March. Since the March FOMC meeting, yields on 20-year municipal bonds moved down roughly in line with the decline in comparable-maturity Treasury securities, leaving their ratios over Treasury yields little changed on net. On balance, the credit quality of state and local governments appeared to improve further, as the number of ratings upgrades continued to outpace the number of downgrades in March.

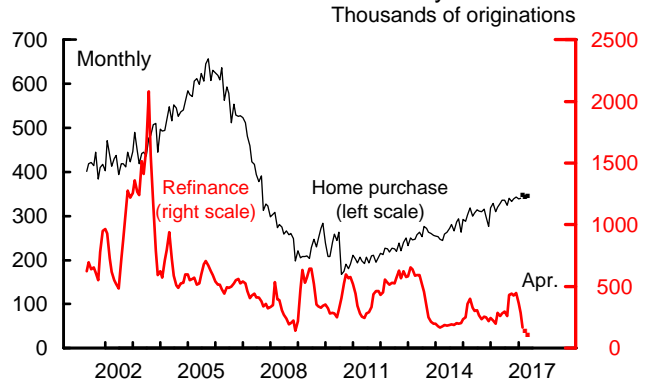
Household Finance

Mortgage Rate and MBS Yield



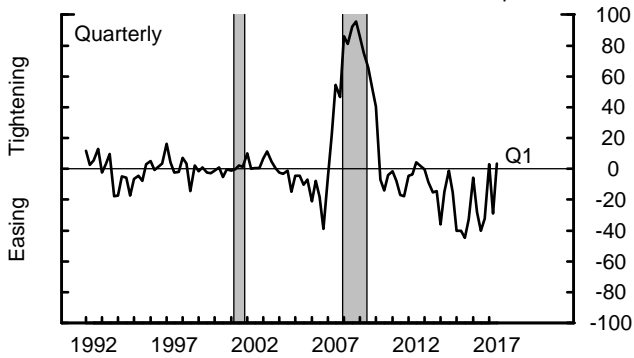
Note: The MBS yield is the Fannie Mae 30-year current-coupon rate.
Source: For MBS yield, Barclays; for mortgage rate, Loansifter.

Purchase and Refinance Activity



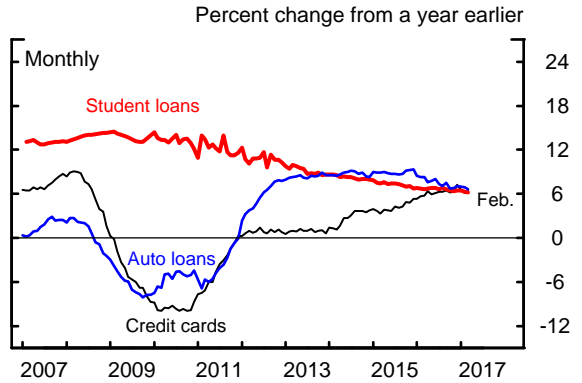
Note: The data are seasonally adjusted by Federal Reserve Board staff. Points represent staff projections.
Source: For values prior to 2016, data reported under the Home Mortgage Disclosure Act of 1975; for values in 2016 and 2017, staff estimates.

Changes in Standards for Residential Real Estate Loans at Banks



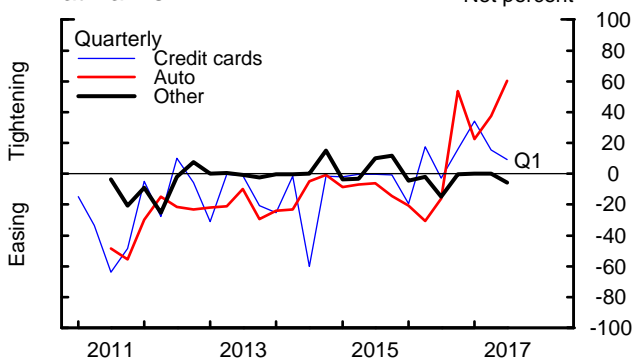
Note: Series constructed by taking an average of net percentages across all residential real estate asked about in each quarter. Shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research.
Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Consumer Credit



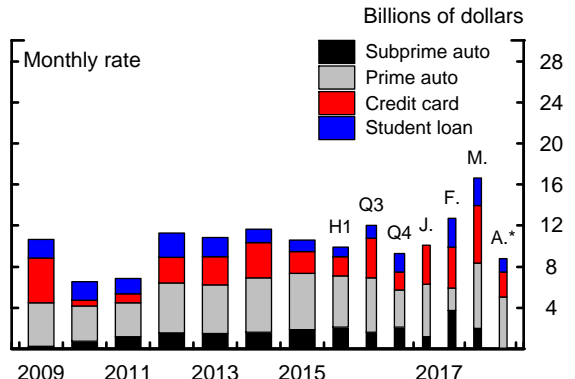
Note: The data are not seasonally adjusted.
Source: Federal Reserve Board.

Changes in Standards for Consumer Loans at Banks



Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Gross Consumer ABS Issuance



* Month to date.
Source: Inside MBS & ABS; Merrill Lynch; Bloomberg.

HOUSEHOLD FINANCING CONDITIONS

Residential Real Estate

Financing conditions in the residential mortgage market were little changed over the intermeeting period, as credit availability continued to be relatively tight for households with low credit scores or harder-to-document incomes. Mortgage rates declined in line with yields on longer-term Treasury securities and mortgage-backed securities, but they remained elevated relative to the third quarter of 2016. Consistent with these developments, refinance originations have slowed considerably since the third quarter. In the April SLOOS, banks reported roughly unchanged standards on residential real estate loans on average; that said, they reported a tightening of standards on non-QM (non-qualified mortgage) loans and an easing of standards on GSE-eligible (government-sponsored enterprise-eligible) and government loans. Banks also reported that demand for GSE-eligible and government loans weakened during the first quarter. In line with lower reported demand, residential real estate lending at banks declined.

Consumer Credit

Financing conditions in consumer credit markets remained accommodative over the past few months on balance. Growth in consumer loan balances moderated a bit further from the relatively strong pace seen during the past few years, although year-over-year growth in credit card balances, student loans, and auto loans stayed in the 6 to 7 percent range through February. Consumer credit appeared to be broadly available, even as interest rates charged on credit card balances and new auto loans drifted up in line with their benchmark shorter-term interest rates. In the April SLOOS, banks reported that they had tightened standards on credit card and auto loans, on net, while noting that they had experienced little change in the demand for consumer loans on the whole.

New issuance of consumer asset-backed securities (ABS) picked up over the first quarter and was quite strong in March. Some lenders appeared to have stepped up their issuance of credit card ABS, likely reflecting the tight interest rate spreads on such securities.

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Risks and Uncertainty

ASSESSMENT OF RISKS

As in the March Tealbook, we see the uncertainty around our forecast of economic activity as being somewhat greater than it was before the recent U.S. elections but still in line with the average over the past 20 years (the benchmark used by the FOMC). We based this judgment largely on a view that greater uncertainty prevails about the future direction of government policy. Empirical indexes of uncertainty are mixed: The Baker, Bloom, and Davis index of economic policy uncertainty remains at a higher level than in the months before the elections, but options-based indexes of expected stock market volatility (such as the VIX) and corporate bond spreads remain at subdued levels.

We continue to judge the risks to our medium-term GDP projection as tilted to the downside, primarily because monetary policy is likely better positioned to offset large positive shocks than substantial adverse ones. (For more discussion of this downside risk, see the box “A Guidepost for Dropping Effective Lower Bound Risk from the Assessment of Risks.”) Nevertheless, we see the downward skew as less pronounced than it was late last year, reflecting both that risks to the foreign outlook have subsided somewhat and that consumer and business confidence in the United States has moved up. We see the risks around our unemployment rate projection as aligned with those for GDP and, therefore, as skewed to the upside.

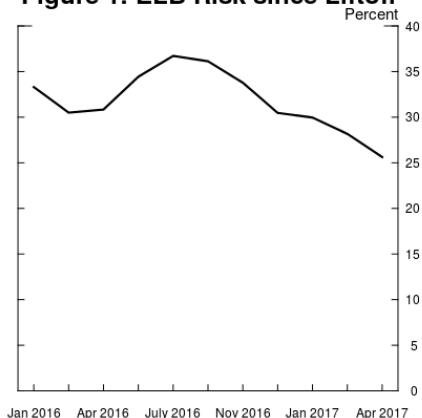
With regard to inflation, we do not think that the current level of uncertainty is unusually high. We see important risks to inflation on both the downside and the upside, and we consider those risks to be roughly balanced. To the downside, some survey-based measures of longer-term inflation expectations remain at relatively low levels. In addition, U.S. monetary policy normalization could generate a greater appreciation of the dollar than we have anticipated in the baseline forecast, as is illustrated in one of the alternative scenarios. To the upside, with the economy projected to be operating above its long-run potential, inflation may increase more than the staff expects, consistent with the predictions of models that emphasize nonlinear effects of economic slack on inflation, another possibility that is explored in one of the alternative scenarios.

A Guidepost for Dropping Effective Lower Bound Risk from the Assessment of Risks

The staff has, for some time, judged that the risks to the projection for real activity are skewed to the downside due to the effective lower bound (ELB) constraint on the federal funds rate. All else being equal, a higher expected path for the federal funds rate lowers the probability that policymakers will be constrained by the ELB in the near future, which reduces downside macroeconomic risks. With the federal funds rate having risen to the range of $\frac{3}{4}$ to 1 percent and expected to rise further going forward, we will face a decision about when to drop the ELB reference from the Tealbook’s assessment of risks. In this discussion, we describe how one specific measure of ELB risk has evolved since liftoff and is expected to evolve in the future. We then lay out one possible way to use this measure to inform our decision on when to drop our reference to the downside economic risk stemming from the ELB.

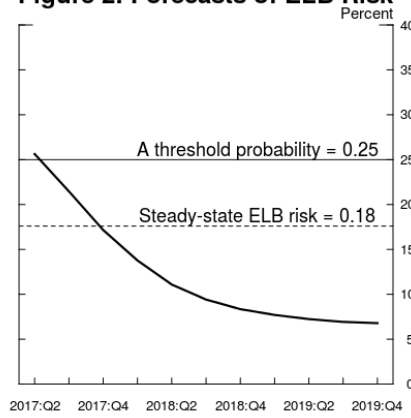
Figure 1 shows a measure of ELB risk—the probability that the federal funds rate will be at the ELB for at least one quarter during the next three years—computed from 20,000 stochastic simulations of FRB/US around the Tealbook baseline projection using the non-inertial version of the Taylor rule.¹ According to figure 1, the ELB risk measure was above 30 percent throughout 2016 but then moved below 30 percent early this year. The ELB risk measure based on the April 2017 Tealbook projection is 26 percent.²

Figure 1: ELB Risk since Liftoff



Source: Staff calculation based on FRB/US stochastic simulations.

Figure 2: Forecasts of ELB Risk



Source: Staff calculation based on FRB/US stochastic simulations.

¹ We use the non-inertial Taylor rule to capture the fact that policymakers typically cut interest rates aggressively in the face of a looming recession, even though they often increase interest rates gradually in the aftermath of a recession. In sticky-price models that account for the ELB, this asymmetric behavior is consistent with the prescription of optimal commitment policy and other well-performing rules, such as the price-level targeting rule and the rule proposed in David Reifschneider and John C. Williams (2000), “Three Lessons for Monetary Policy in a Low-Inflation Era,” *Journal of Money, Credit and Banking*, vol. 32 (November), pp. 936–66.

² In the stochastic simulation, many of the ELB episodes are short lived, with the federal funds rate touching the ELB in only one or two quarters. According to the April 2017 Tealbook projection, the probability that the federal funds rate will be at the ELB for at least *four quarters* (not necessarily consecutive) during the next three years is about 10 percent.

Note that ELB risk fluctuated during 2016 even though the actual federal funds rate remained constant in the range of $\frac{1}{4}$ to $\frac{1}{2}$ percent. These movements reflect the fact that the ELB risk measure depends not only on the current federal funds rate, but also on the projected path of the federal funds rate. When the projected path of the federal funds rate becomes flatter (steeper), ELB risk increases (decreases). For example, when the staff reduced its estimate of the long-run equilibrium value of the federal funds rate—the intercept in the Taylor rule—in the June 2016 Tealbook projection, the projected path of the federal funds rate flattened appreciably. As a result, the ELB risk increased, from about 31 percent in April 2016 to more than 34 percent in June 2016.

Figure 2 shows the projected path of the ELB risk according to the current Tealbook forecast. In this figure, the ELB risk at any given date shows the model-implied probability that the federal funds rate will be at the ELB for at least one quarter during the subsequent three years if the economy has evolved according to the current Tealbook projection up to that time. Because the federal funds rate is expected to rise, ELB risk is expected to decline further from its current level. It declines even below its steady-state value of 18 percent—shown by the dashed line—reflecting the projected overshooting of the federal funds rate above its long-run value of 3 percent.³ Indeed, as a result of the forward-looking nature of the ELB risk measure, the ELB risk is expected to decline below its steady-state value in early 2018, when the federal funds rate is still expected to be substantially below its long-run value of 3 percent.

We plan to consult this ELB risk measure to inform our decision about when to drop the ELB reference in our assessment of risks in the Tealbook. Our provisional plan is to stop highlighting the ELB risk sometime after our measure of ELB risk is below 25 percent. The choice of 25 percent is somewhat arbitrary, and others may see a different threshold level as more appropriate. As can be seen in figure 2, according to the April Tealbook projection, the ELB risk measure is likely to dip below 25 percent for the first time in 2017:Q3, when the federal funds rate is projected to be a little above 1 percent. The date when this measure moves below 25 percent will depend on the actual evolution of the economy as well as the evolution of the staff projection. If the federal funds rate rises more slowly or the staff projection of the funds rate path becomes flatter than anticipated by the current Tealbook projection—possibly because the staff further lowers its estimate of the long-run equilibrium natural rate—the threshold will be breached later than 2017:Q3.

³ The steady-state value of the ELB risk is the model-implied probability that the federal funds rate will be at the ELB for at least one quarter during the next three years, conditional on the economy being at its steady state today. This concept is distinct from the unconditional probability that the federal funds rate is at the ELB. To compute the steady-state ELB risk shown in figure 2, we begin stochastic simulations from a steady state consistent with that shown in the Long-Term Outlook exhibit of the April Tealbook projection.

Alternative Scenarios

(Percent change, annual rate, from end of preceding period except as noted)

Measure and scenario	2017		2018	2019	2020	2021-22
	H1	H2				
<i>Real GDP</i>						
Extended Tealbook baseline	1.7	2.4	2.2	1.8	1.5	1.3
Steeper wage Phillips curve	1.7	2.4	2.1	1.7	1.4	1.2
Lower valuation pressures	1.7	2.4	2.1	1.7	1.4	1.2
Broad policy disappointment	1.7	2.4	1.1	1.6	1.6	1.6
Lower natural rate, no misperception	1.7	2.5	2.4	2.1	1.7	1.4
Lower natural rate, misperception	1.7	2.4	2.2	1.8	1.5	1.4
EME turbulence and stronger dollar	1.6	1.7	1.5	1.8	1.7	1.5
Stronger foreign growth and tighter policy	1.8	2.7	2.6	1.9	1.2	1.1
<i>Unemployment rate¹</i>						
Extended Tealbook baseline	4.5	4.4	4.1	4.0	4.1	4.5
Steeper wage Phillips curve	4.5	4.4	4.1	4.1	4.2	4.8
Lower valuation pressures	4.5	4.4	4.1	4.0	4.2	4.6
Broad policy disappointment	4.5	4.4	4.6	4.6	4.7	4.8
Lower natural rate, no misperception	4.5	4.2	3.6	3.3	3.2	3.5
Lower natural rate, misperception	4.5	4.2	3.8	3.6	3.6	3.8
EME turbulence and stronger dollar	4.6	4.5	4.5	4.6	4.6	4.9
Stronger foreign growth and tighter policy	4.5	4.3	3.9	3.6	3.8	4.3
<i>Total PCE prices</i>						
Extended Tealbook baseline	1.8	1.6	1.8	1.9	2.1	2.1
Steeper wage Phillips curve	1.9	1.9	2.2	2.5	2.8	3.0
Lower valuation pressures	1.8	1.6	1.9	2.0	2.1	2.1
Broad policy disappointment	1.8	1.6	1.8	1.8	1.9	2.0
Lower natural rate, no misperception	1.8	1.6	1.9	2.0	2.1	2.1
Lower natural rate, misperception	1.8	1.6	1.8	1.9	2.0	2.0
EME turbulence and stronger dollar	1.5	.9	1.2	1.7	2.0	2.0
Stronger foreign growth and tighter policy	1.9	2.1	2.4	2.1	2.0	2.1
<i>Core PCE prices</i>						
Extended Tealbook baseline	1.8	1.6	1.9	2.0	2.0	2.1
Steeper wage Phillips curve	1.9	1.9	2.3	2.6	2.8	3.0
Lower valuation pressures	1.8	1.6	1.9	2.0	2.1	2.1
Broad policy disappointment	1.8	1.6	1.8	1.9	1.9	1.9
Lower natural rate, no misperception	1.8	1.6	1.9	2.0	2.1	2.1
Lower natural rate, misperception	1.8	1.6	1.9	1.9	2.0	2.0
EME turbulence and stronger dollar	1.6	1.1	1.4	1.7	1.9	2.0
Stronger foreign growth and tighter policy	1.8	1.9	2.3	2.2	2.1	2.2
<i>Federal funds rate¹</i>						
Extended Tealbook baseline	.9	1.5	2.6	3.5	4.0	4.0
Steeper wage Phillips curve	1.0	1.5	2.8	3.9	4.6	4.7
Lower valuation pressures	1.0	1.5	2.5	3.4	3.9	3.8
Broad policy disappointment	.9	1.5	2.1	2.6	2.8	3.0
Lower natural rate, no misperception	.8	1.2	2.2	3.1	3.8	4.0
Lower natural rate, misperception	1.0	1.5	2.8	3.6	4.0	3.8
EME turbulence and stronger dollar	.9	1.3	1.9	2.5	3.1	3.5
Stronger foreign growth and tighter policy	1.0	1.6	3.0	4.1	4.5	4.3

1. Percent, average for the final quarter of the period.

Our view of the risks to the economic outlook is informed by the staff's quarterly quantitative surveillance assessment, which judges the vulnerabilities in the U.S. financial system as moderate. The rise in asset prices in equity and commercial real estate markets since the previous QS assessment, coupled with a further narrowing of corporate bond spreads, points to notable and increasing valuation pressures. But the stability implications of these valuation pressures are counterbalanced by a number of factors. First, the evidently high appetite for risk suggested by stretched valuations has not as of yet led to increased borrowing in the nonfinancial sector, leaving vulnerabilities associated with leverage at a moderate level. Moreover, vulnerabilities from leverage in the financial system continue to be low, owing, in part, to bank capital ratios that are high by historical standards. Finally, vulnerabilities from liquidity and maturity transformation remain low. Liquidity coverage ratios for all large domestic bank holding companies are above regulatory requirements. Last year's reforms have, to date, reduced run risk in money market funds. Adjustments in short-term funding markets in response to these reforms are, however, still ongoing, and run risks have the potential to reemerge.

ALTERNATIVE SCENARIOS

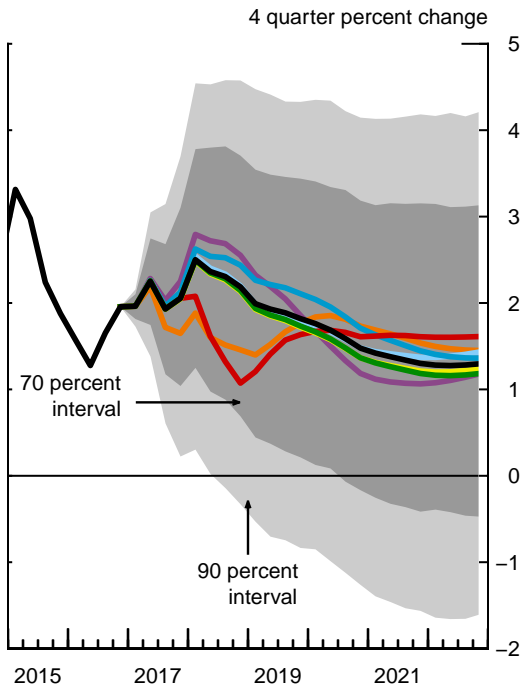
To illustrate some of the risks to the outlook, we construct alternatives to the baseline projection using simulations of staff models. The first scenario explores the consequences of a stronger response of wages to labor market slack and a more pronounced reaction of long-run inflation expectations to realized inflation. The second scenario presents an economy in which the path of the interest rate and equity prices are both lower, leaving the equity premium wider and relieving valuation pressures somewhat. The third scenario illustrates the possible economic consequences of a broad policy disappointment in which consumer, business, and investor expectations deteriorate markedly as the anticipated fiscal expansion and reduction in regulatory burdens do not materialize. In the fourth and fifth scenarios, we assume a lower natural rate of unemployment, both without and with policymakers' misperceptions about the level of the natural rate. In the sixth scenario, we consider the possibility that U.S. monetary policy normalization leads to emerging market turbulence and a much stronger appreciation of the dollar. The last scenario analyzes the effects of stronger foreign economic growth in combination with a faster normalization of monetary policy in the AFEs.

Forecast Confidence Intervals and Alternative Scenarios

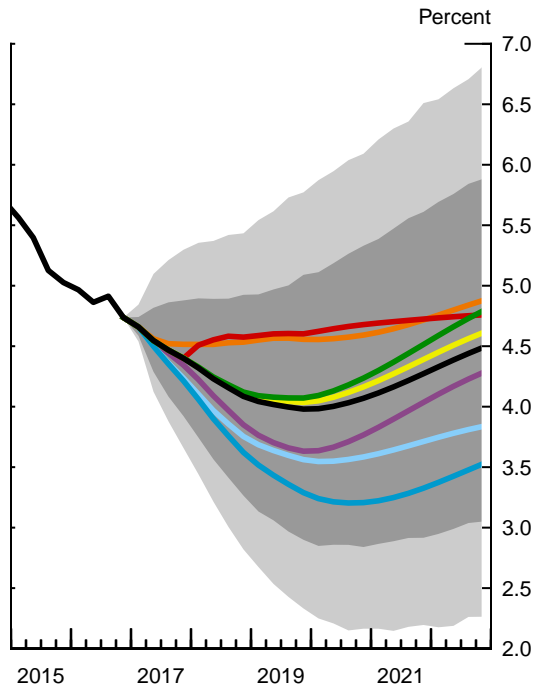
Confidence Intervals Based on FRB/US Stochastic Simulations

- Extended Tealbook baseline
- Steeper wage Phillips curve
- Lower valuation pressures
- Broad policy disappointment
- Lower natural rate, no misperception
- Lower natural rate, misperception
- EME turbulence and stronger dollar
- Stronger foreign growth and tighter policy

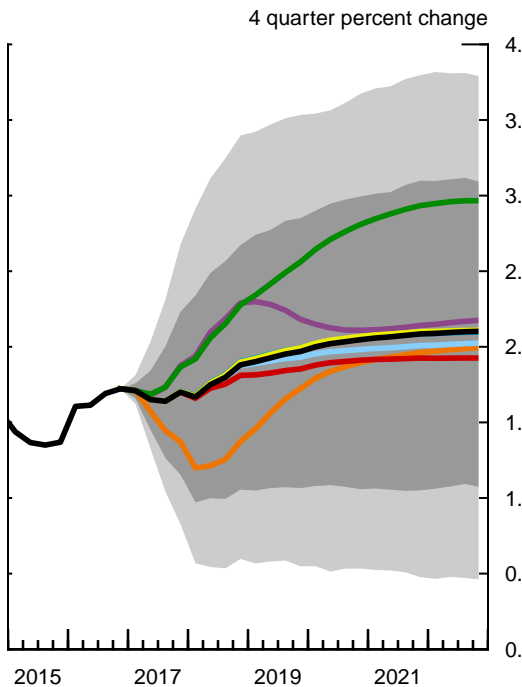
Real GDP



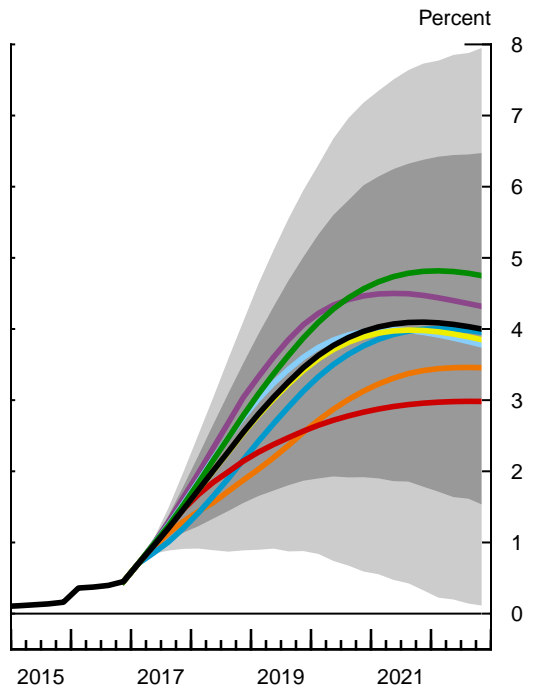
Unemployment Rate



PCE Prices excluding Food and Energy



Federal Funds Rate



We simulate these scenarios using two staff models.¹ In all but one scenario, the federal funds rate is governed by the same rule as in the baseline. The exception is the Broad Policy Disappointment scenario, in which we assume an alternative adjustment to the intercept in the baseline rule. The size and composition of the SOMA portfolio are assumed to follow the baseline paths in all of the scenarios.

Steeper Wage Phillips Curve and More Sensitive Long-Run Inflation Expectations (simulated with FRB/US)

Despite tight labor and product markets in the Tealbook baseline, core PCE price inflation is projected to pick up only slowly over the medium term, reaching 2 percent in 2019. This outlook is consistent with the relatively muted sensitivity of inflation to economic slack that has characterized recent experience and with tightly anchored long-run inflation expectations—features that are also present in the FRB/US model. A natural way to generate larger responses in inflation from the state of economic conditions in the FRB/US model is to loosen these assumptions. In this scenario, we postulate that wages (and therefore, in FRB/US, prices) become more sensitive to labor market slack and long-run inflation expectations become more sensitive to realized inflation.²

Under these circumstances, inflation increases to 2½ percent by 2019 and is close to 3 percent by 2022. To counteract higher inflation, the federal funds rate increases more rapidly than in the baseline, reaching 3¾ percent by the end of 2019 and 4¾ percent at the end of 2022, about ¾ percentage point higher than in the baseline projection. As a consequence of slightly higher longer-term real interest rates, real GDP growth is a bit slower and the trajectory for the unemployment rate is ¼ percentage point higher by the end of 2022.

Lower Valuation Pressures (FRB/US)

In the baseline forecast, equity prices edge up a little further and the 10-year Treasury yield rises relatively steeply, reflecting both the ongoing increase in short rates

¹ The models used are FRB/US, which is a large-scale macroeconomic model of the U.S. economy, and SIGMA, which is a calibrated multicountry DSGE model.

² In the calibration of this scenario, we assume that both the slope of the wage Phillips curve and the sensitivity of long-run inflation expectations to realized inflation are four times larger than in the current version of the FRB/US model. The magnitude of the increase reflects a comparison between estimates of the recent past and those from a sample that covers the late 1980s to the late 1990s. Nevertheless, the magnitudes of the coefficients used in this scenario are well below those representing inflation dynamics in the 1970s.

**Selected Tealbook Projections and 70 Percent Confidence Intervals Derived
from Historical Tealbook Forecast Errors and FRB/US Simulations**

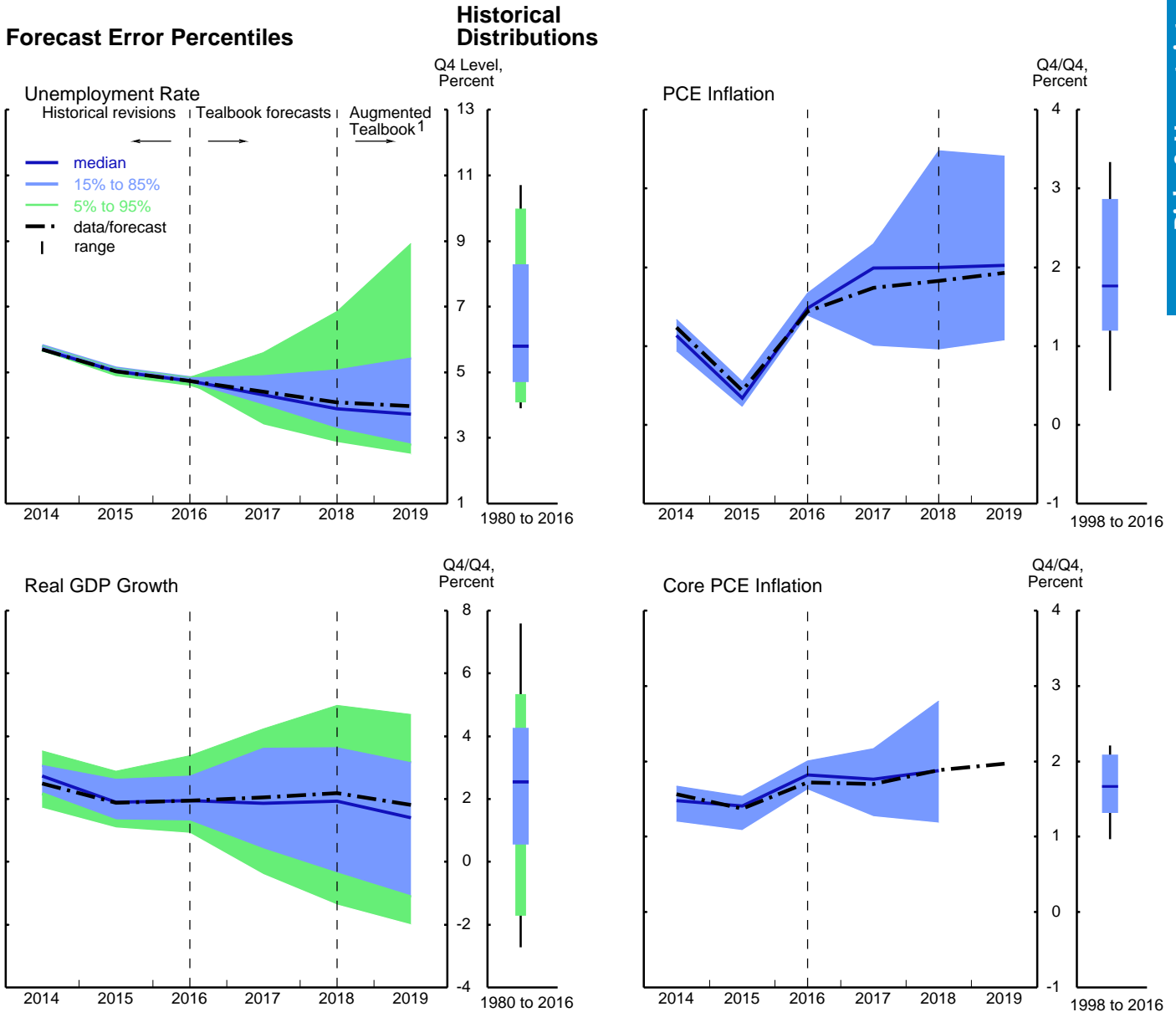
Measure	2017	2018	2019	2020	2021	2022
<i>Real GDP</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	2.1	2.2	1.8	1.5	1.3	1.3
Confidence interval						
Tealbook forecast errors	.4–3.6	-.4–3.6	-1.1–3.2	...	...	...
FRB/US stochastic simulations	1.0–3.1	.7–3.7	.2–3.4	-.2–3.2	-.4–3.2	-.5–3.1
<i>Civilian unemployment rate</i>						
<i>(percent, Q4)</i>						
Projection	4.4	4.1	4.0	4.1	4.3	4.5
Confidence interval						
Tealbook forecast errors	4.0–4.9	3.3–5.1	2.8–5.4	...	...	...
FRB/US stochastic simulations	3.9–4.9	3.3–4.9	2.9–5.1	2.8–5.3	2.9–5.6	3.1–5.9
<i>PCE prices, total</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	1.7	1.8	1.9	2.1	2.1	2.1
Confidence interval						
Tealbook forecast errors	1.0–2.2	1.0–3.5	1.1–3.4	...	...	...
FRB/US stochastic simulations	1.1–2.3	.9–2.8	.9–2.9	1.0–3.1	1.0–3.3	1.0–3.2
<i>PCE prices excluding food and energy</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	1.7	1.9	2.0	2.0	2.1	2.1
Confidence interval						
Tealbook forecast errors	1.3–2.2	1.2–2.8	...	...	...	...
FRB/US stochastic simulations	1.2–2.2	1.1–2.7	1.1–2.9	1.1–3.0	1.1–3.1	1.1–3.1
<i>Federal funds rate</i>						
<i>(percent, Q4)</i>						
Projection	1.5	2.6	3.5	4.0	4.1	4.0
Confidence interval						
FRB/US stochastic simulations	1.1–1.8	1.6–3.5	1.9–5.0	1.9–6.0	1.8–6.4	1.5–6.5

Note: Shocks underlying FRB/US stochastic simulations are randomly drawn from the 1969–2016 set of model equation residuals. Intervals derived from Tealbook forecast errors are based on projections made from 1980 to 2016 for real GDP and unemployment and from 1998 to 2016 for PCE prices. The intervals for real GDP, unemployment, and total PCE prices are extended into 2019 using information from the Blue Chip survey and forecasts from the CBO and CEA.

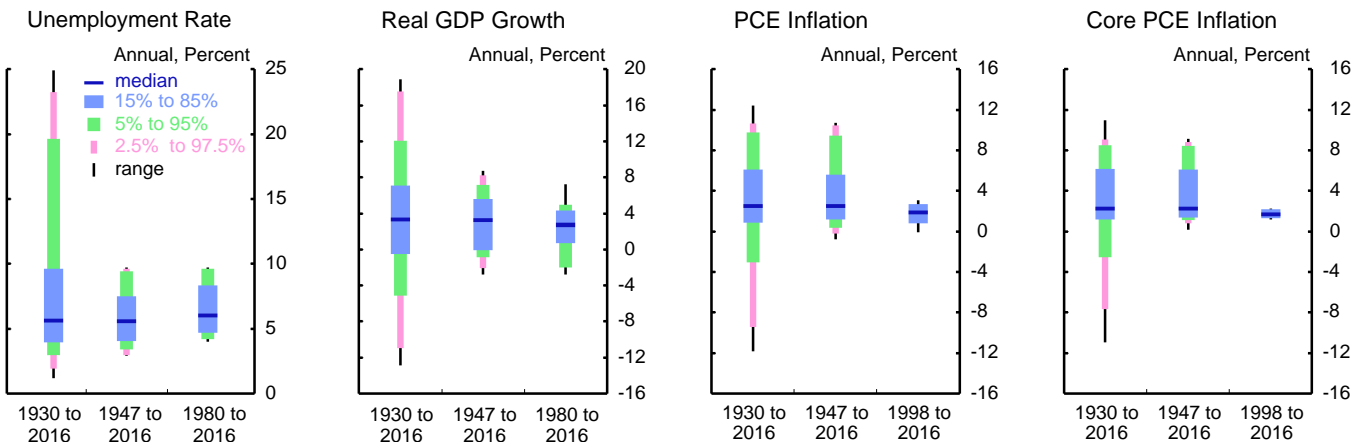
... Not applicable.

Prediction Intervals Derived from Historical Tealbook Forecast Errors

Risks & Uncertainty



Historical Distributions



Note: See the technical note in the appendix for more information on this exhibit.

1. Augmented Tealbook prediction intervals use 1- and 2-year-ahead forecast errors from Blue Chip, CBO, and CEA to extend the Tealbook prediction intervals through 2019.

and our assumption that the term premium will trend up toward levels more typical of the pre-crisis experience. This projection implies an equity premium that gradually declines to 2.35 percentage points, between the 15th and 20th percentiles of its unconditional distribution over the past three decades—an indication of notable overvaluation in the equity market.

In this scenario, we explore the possible consequences of those valuation pressures being relieved somewhat. In particular, we assume that the 10-year Treasury term premium increases 30 basis points less than in the baseline (and, hence, the 10-year Treasury yield does likewise). This lower trajectory for longer-term interest rates is more consistent with current market expectations. Importantly, we assume that the lower term premium reflects weaker demand conditions; thus, the lower trajectory for the Treasury yield does not provide any incremental support for economic activity. We also assume a gradual decline of 5 percent in equity prices rather than the small increase built into the staff forecast. Under these alternative conditions, the equity premium is 75 basis points higher than in the baseline by the end of 2019, bringing market valuations more in balance with the strength of the economy projected in the baseline.³ However, in the model simulation, the implications of these financial changes for real economic activity and inflation are slight, partly because the decline in equity prices is smooth and gradual (reaching 5 percent relative to the baseline only at the end of 2019) and partly because it has no repercussions for business or household confidence or for the lending capacity of the financial system.

Broad Policy Disappointment (FRB/US)

In this scenario, we assume that the federal government not only fails to implement the fiscal expansion assumed in the baseline, but also is unable for the most part to enact other policies that financial markets may have priced in, such as an easing of regulatory burdens.⁴ Moreover, this scenario assumes that the staff has not fully appreciated the positive effects of more buoyant consumer and business sentiment on spending in the baseline projection. As a result, in addition to the restraint on aggregate

³ This upward adjustment in the equity premium brings it near the 25th percentile of its historical distribution.

⁴ To be clear, we have not built into the baseline any increment to growth stemming from regulatory relief. In this scenario, we unwind the adjustments to the rule for setting the federal funds rate and to the long-term interest rate term premium that were made in the baseline projection to account for the assumed fiscal expansion.

demand because the fiscal expansion does not materialize, economic activity is also curtailed by an erosion in consumer sentiment and an increase in perceived risk by businesses and financial markets. In particular, the triple-B corporate bond spread rises about 40 basis points above the baseline in 2018 and the stock market falls almost 10 percent from peak to trough.

As a result, real GDP decelerates substantially, growing less than 1½ percent per year, on average, during 2018 and 2019, about ½ percentage point less than in the baseline. The unemployment rate rises slightly from its current level rather than declining as in the baseline and hovers at around 4¾ percent from 2018 to 2022—close to its longer-term sustainable level. With the labor market less tight and inflation lower, the federal funds rate rises more gradually and is about 1 percentage point below the baseline rate of 3½ percent at the end of 2019.⁵

Lower Natural Rate of Unemployment (FRB/US)

The baseline forecast anticipates that the unemployment rate will fall to 4 percent by the end of 2019, almost 1 percentage point below the staff's baseline estimate of the natural rate of unemployment. However, the natural rate is estimated with considerable uncertainty and could be lower than the staff's estimate of 4.9 percent. In this scenario, we assume that the natural rate of unemployment has been 4 percent for the past few years and remains at that level in the future.

For purposes of illustration, this scenario unrealistically assumes that policymakers and the staff are already fully aware of the lower natural rate and have adjusted their estimate of the unemployment gap downward about 0.9 percentage point at the beginning of the simulation. Under these conditions, the inertial Taylor rule calls for a slightly more gradual rise in the federal funds rate, leaving it a bit less than ½ percentage point below the baseline by the end of 2018. (The deviation from the baseline would be larger with a non-inertial version of the policy rule.) The unemployment rate falls faster than in the baseline as a result of both the lower natural

⁵ Without the change in sentiment, the failure to implement the fiscal expansion implies that real GDP growth is ¼ percentage point lower than in the baseline in 2018 and slightly lower in 2019, while the unemployment rate is ¼ percentage point higher at the end of 2019. In addition, inflation is a touch lower than in the baseline. These developments, together with the adjustment to the rule for setting the federal funds rate, result in a federal funds rate that is ½ percentage point below the baseline at the end of 2020.

rate and a more accommodative stance of policy, which generates modestly stronger job creation and GDP growth. Inflation remains close to the baseline.

Lower Natural Rate of Unemployment with Misperception (FRB/US)

This scenario is the same as the previous one but makes the more realistic assumption that policymakers and the staff learn gradually about the true state of the economy. More specifically, policymakers and the staff initially perceive that the natural rate of unemployment is 4.9 percent and learn only slowly that the true natural rate is 4 percent; the gap between the actual and perceived natural rate is assumed to be almost completely eliminated by the end of 2022.

Because unemployment in the next few quarters is mistakenly judged to be below its natural rate (rather than still above it, as in the previous scenario without misperception), and because output is perceived to be correspondingly above its potential, the path for the federal funds rate is higher than in the previous scenario—by about $\frac{1}{2}$ percentage point, on average, in 2019. The tighter stance of policy reduces GDP growth $\frac{1}{4}$ percentage point by the end of 2018 compared with the scenario without misperception. The trajectory of GDP growth is close to the baseline. The unemployment rate is $\frac{1}{4}$ percentage point above the scenario without misperception by the end of 2022. The relatively modest effect on real economic activity in this scenario reflects in large part the relatively low interest rate sensitivity embedded in FRB/US; hence, simulations with other models could yield results that are less benign. Inflation runs slightly below the baseline.

EME Turbulence and Stronger Dollar (SIGMA)

The reaction of financial markets to the FOMC's decisions to hike policy rates in December and March has thus far been quite benign and likely reflects that foreign growth prospects appear to be on a more solid footing. However, many emerging market economies, including but not limited to China, have high levels of corporate debt, sovereign debt, or both, and they remain vulnerable to higher interest rates and currency depreciation. Accordingly, there is a risk that ongoing U.S. monetary policy normalization could lead to heightened financial pressures abroad, triggering market volatility, reduced economic activity, and flight-to-safety flows that further boost the dollar. In this scenario, we assume that EME corporate borrowing spreads rise substantially in the face of persistent capital outflows from these economies and that the broad real dollar appreciates an additional 10 percent by the middle of 2018. Despite

weakening macroeconomic conditions, EME central banks are assumed to tighten monetary policy to mitigate upward pressure on inflation arising from the depreciation of their currencies. All told, foreign GDP growth runs, on average, about $\frac{3}{4}$ percentage point below the baseline in 2017 and 2018.

The stronger dollar and weaker foreign growth depress U.S. real net exports. Consequently, U.S. real GDP growth moderates to $1\frac{1}{2}$ percent in 2018, nearly $\frac{3}{4}$ percentage point less than in the baseline. Lower import prices and weaker economic activity cause core PCE inflation to be below $1\frac{1}{2}$ percent through 2018. The federal funds rate follows a shallower path than in the baseline, rising to $2\frac{1}{2}$ percent by the end of 2019.

Stronger Foreign Growth and Tighter Policy (SIGMA)

In our baseline forecast, we expect policy normalization abroad—especially in the major AFEs—to occur very slowly as headwinds diminish only gradually and central banks remain attentive to downside risks to activity and inflation. However, a stronger output expansion than in the baseline could induce foreign central banks to downweight these risk-management considerations and embark on markedly faster policy tightening. In this scenario, we assume that foreign GDP growth runs at over 3 percent per year over 2017 and 2018, about 1 percentage point above the baseline, and that the improved outlook prompts AFE central banks to tighten their policy rates more aggressively than what is prescribed by the baseline policy rule. The stronger foreign growth, higher interest rates—including from some rise in term premiums—and reversal of earlier flight-to-safety flows into U.S. assets contribute to a 10 percent depreciation of the broad real dollar.

Despite the sharp tightening of monetary policy abroad and some spillovers of that tightening into U.S. interest rates, U.S. activity benefits as stronger foreign growth and the weaker dollar boost net exports. U.S. real GDP expands, on average, $2\frac{1}{2}$ percent in 2017 and 2018, about $\frac{1}{4}$ percentage point more than in the baseline. The unemployment rate falls to around $3\frac{1}{2}$ percent by the end of 2019. Higher import prices and heightened resource pressures cause core PCE inflation to move persistently above $2\frac{1}{4}$ percent in 2018 and 2019. The federal funds rate rises more quickly than in the baseline, increasing to 4 percent by the end of 2019.

Assessment of Key Macroeconomic Risks (1)**Probability of Inflation Events**

(4 quarters ahead)

Probability that the 4-quarter change in total PCE prices will be . . .	Staff	FRB/US	EDO	BVAR
<i>Greater than 3 percent</i>				
Current Tealbook	.05	.07	.12	.06
Previous Tealbook	.05	.08	.13	.07
<i>Less than 1 percent</i>				
Current Tealbook	.24	.14	.02	.16
Previous Tealbook	.24	.13	.02	.16

Probability of Unemployment Events

(4 quarters ahead)

Probability that the unemployment rate will . . .	Staff	FRB/US	EDO	BVAR
<i>Increase by 1 percentage point</i>				
Current Tealbook	.02	.02	.14	.05
Previous Tealbook	.03	.04	.14	.06
<i>Decrease by 1 percentage point</i>				
Current Tealbook	.11	.09	.11	.03
Previous Tealbook	.08	.06	.12	.03

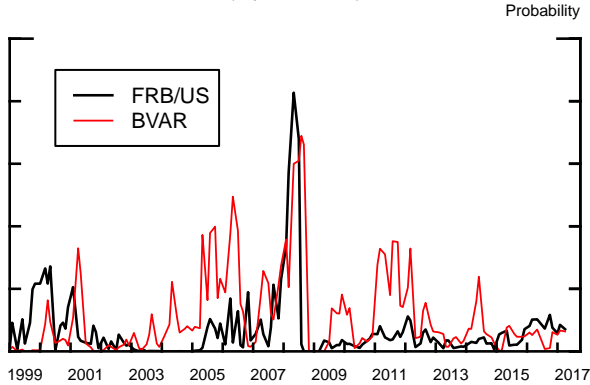
Probability of Near-Term Recession

Probability that real GDP declines in the next two quarters	Staff	FRB/US	EDO	BVAR	Factor Model
Current Tealbook	.02	.02	.04	.12	.01
Previous Tealbook	.02	.03	.04	.10	.00

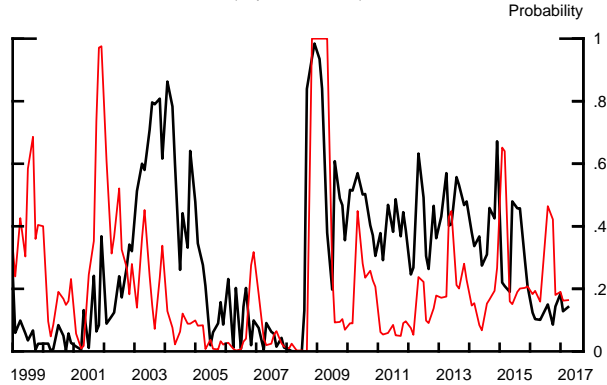
Note: “Staff” represents stochastic simulations in FRB/US around the staff baseline; baselines for FRB/US, BVAR, EDO, and the factor model are generated by those models themselves, up to the current-quarter estimate. Data for the current quarter are taken from the staff estimate for the second Tealbook in each quarter; if the second Tealbook for the current quarter has not yet been published, the preceding quarter is taken as the latest historical observation.

Assessment of Key Macroeconomic Risks (2)

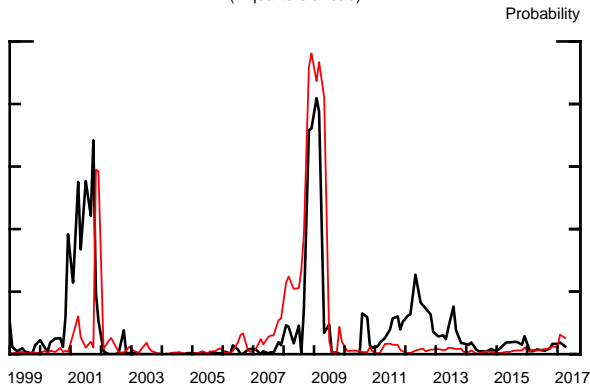
Probability that Total PCE Inflation Is above 3 Percent
(4 quarters ahead)



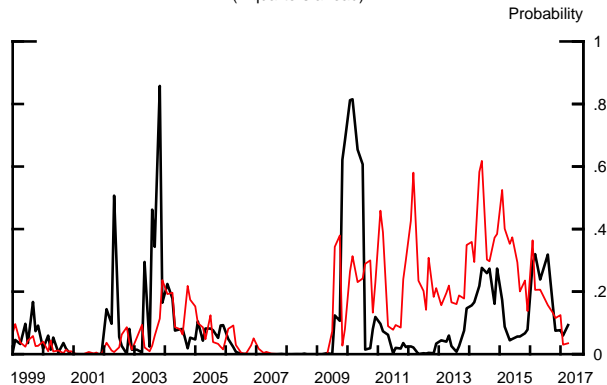
Probability that Total PCE Inflation Is below 1 Percent
(4 quarters ahead)



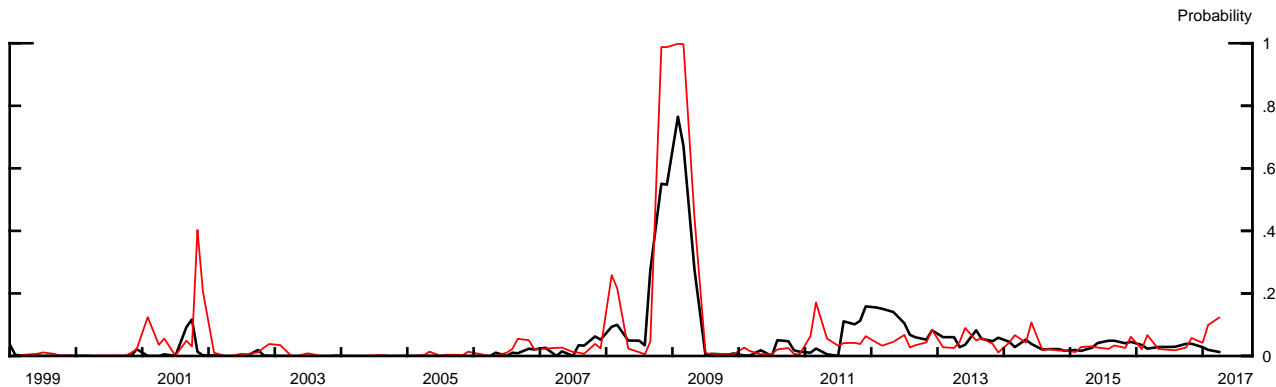
Probability that the Unemployment Rate Increases 1 ppt
(4 quarters ahead)



Probability that the Unemployment Rate Decreases 1 ppt
(4 quarters ahead)



Probability that Real GDP Declines in Each of the Next Two Quarters



Note: See notes on facing page. Recession and inflation probabilities for FRB/US and the BVAR are real-time estimates. See Robert J. Tetlow and Brian Ironside (2007), "Real-Time Model Uncertainty in the United States: The Fed, 1996–2003," *Journal of Money, Credit and Banking*, vol. 39 (October), pp. 1533–61.

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Appendix

Technical Note on “Prediction Intervals Derived from Historical Tealbook Forecast Errors”

This technical note provides additional details about the exhibit “Prediction Intervals Derived from Historical Tealbook Forecast Errors.” In the four large fan charts, the black dotted lines show staff projections and current estimates of recent values of four key economic variables: average unemployment rate in the fourth quarter of each year and the Q4/Q4 percent change for real GDP, total PCE prices, and core PCE prices. (The GDP series is adjusted to use GNP for those years when the staff forecast GNP and to strip out software and intellectual property products from the currently published data for years preceding their introduction. Similarly, the core PCE inflation series is adjusted to strip out the “food away from home” component for years before it was included in core.)

The historical distributions of the corresponding series (with the adjustments described above) are plotted immediately to the right of each of the fan charts. The thin black lines show the highest and lowest values of the series during the indicated time period. At the bottom of the page, the distributions over three different time periods are plotted for each series. To enable the use of data for years prior to 1947, we report annual-average data in this section. The annual data going back to 1930 for GDP growth, PCE inflation, and core PCE inflation are available in the conventional national accounts; we used estimates from Lebergott (1957) for the unemployment rate from 1930 to 1946.¹

The prediction intervals around the current and one-year-ahead forecasts are derived from historical staff forecast errors, comparing staff forecasts with the latest published data. For the unemployment rate and real GDP growth, errors were calculated for 1980 through 2014, yielding percentiles of the sizes of the forecast errors. For PCE and core PCE inflation, errors for 1998 through 2014 were used. This shorter range reflects both more limited data on staff forecasts of PCE inflation and the staff judgment that the distribution of inflation since the mid-1990s is more appropriate for the projection period than distributions of inflation reaching further back. In all cases, the prediction intervals are computed by adding the percentile bands of the errors onto the forecast. The blue bands encompass 70 percent prediction-interval ranges; adding the green bands expands this range to 90 percent. The dark blue line plots the median of the prediction intervals. There is not enough historical forecast data to calculate meaningful 90 percent ranges for the two inflation series. A median line above the staff forecast means that forecast errors were positive more than half of the time.

¹ Stanley Lebergott (1957), “Annual Estimates of Unemployment in the United States, 1900–1954,” in National Bureau of Economic Research, *The Measurement and Behavior of Unemployment* (Princeton, N.J.: Princeton University Press), pp. 213–41.

Because the staff has produced two-year-ahead forecasts for only a few years, the intervals around the two-year-ahead forecasts are constructed by augmenting the staff projection errors with information from outside forecasters: the Blue Chip consensus, the Council of Economic Advisers, and the Congressional Budget Office. Specifically, we calculate prediction intervals for outside forecasts in the same manner as for the staff forecasts. We then calculate the change in the error bands from outside forecasts from one year ahead to two years ahead and apply the average change to the staff's one-year-ahead error bands. That is, we assume that any deterioration in the performance between the one- and two-year-ahead projections of the outside forecasters would also apply to the Tealbook projections. Limitations on the availability of data mean that a slightly shorter sample is used for GDP and unemployment, and the outside projections may only be for a similar series, such as total CPI instead of total PCE prices or annual growth rates of GDP instead of four-quarter changes. In particular, because data on forecasts for core inflation by these outside forecasters are much more limited, we did not extrapolate the staff's errors for core PCE inflation two years ahead.

The intervals around the historical data in the four fan charts are based on the history of data revisions for each series. The previous-year, two-year-back, and three-year-back values as of the current Tealbook forecast are subtracted from the corresponding currently published estimates (adjusted as described earlier) to produce revisions, which are then combined into distributions and revision intervals in the same way that the prediction intervals are created.

Monetary Policy Strategies

In this section, we consider a selection of strategies for setting the federal funds rate and compare the associated interest rate paths and macroeconomic outcomes with those in the Tealbook baseline. The prescriptions of simple rules are generally little different from those in the March Tealbook because the baseline paths for the output gap and inflation are little changed. The optimal control policy rate paths are somewhat higher than those in the March Tealbook. This change reflects the staff’s projection of a slightly larger undershooting of the natural rate of unemployment in coming years with essentially no change in the staff’s projection for inflation.¹ Most simple rules and optimal control exercises prescribe a more rapid increase in the federal funds rate than assumed in the staff forecast. In a special exhibit, we examine policy prescriptions and macroeconomic outcomes under a number of policy rules in a setting in which wages, and thus prices, are more responsive to labor market tightness than in the FRB/US model.

NEAR-TERM PRESCRIPTIONS OF SELECTED SIMPLE POLICY RULES

The top panel of the first exhibit shows near-term prescriptions for the federal funds rate from four policy rules: the Taylor (1993) rule, the Taylor (1999) rule (also known as the “balanced approach” rule), an inertial version of the Taylor (1999) rule, and a first-difference rule.² These prescriptions take as given the staff’s baseline projections for the output gap and inflation in the near term, shown in the middle panels. The top and middle panels also provide the path for the federal funds rate used in the staff baseline.

- The prescriptions of the Taylor-type policy rules in the second and third quarters of 2017 are little changed since the March Tealbook.
- The Taylor (1993) and Taylor (1999) rules, which do not feature an interest rate smoothing term, prescribe substantially higher federal funds rates in the near term than the inertial Taylor (1999) rule and the Tealbook baseline.

¹ The staff revised down its estimate of the natural rate of unemployment 0.1 percentage point and its projection for the unemployment rate about 0.2 percentage point through the second quarter of 2018 and about 0.1 percentage point for several years thereafter. As a result, in the Tealbook baseline, the unemployment rate undershoots its natural rate by a little more than in March.

² We provide details on each of these four simple rules in the appendix to this section.

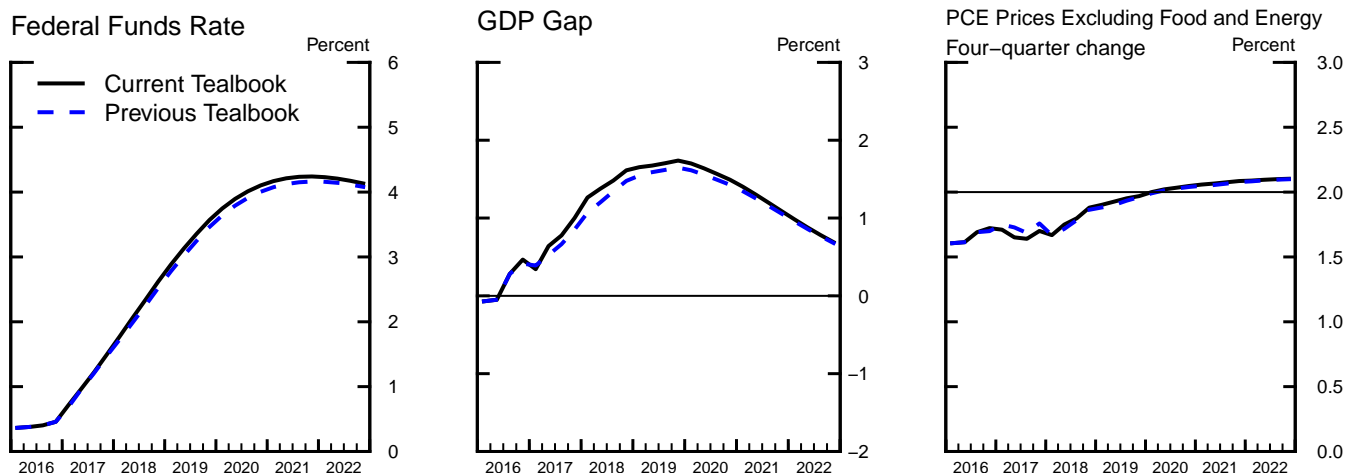
Policy Rules and the Staff Projection

Near-Term Prescriptions of Selected Simple Policy Rules¹

	2017:Q2	2017:Q3
Taylor (1993) rule	2.79	2.85
<i>Previous Tealbook</i>	2.85	2.87
Taylor (1999) rule	3.10	3.22
<i>Previous Tealbook</i>	3.11	3.19
Inertial Taylor (1999) rule	1.07	1.39
<i>Previous Tealbook projection</i>	1.07	1.39
First-difference rule	1.00	1.24
<i>Previous Tealbook projection</i>	0.88	1.07
<i>Addendum:</i>		
Tealbook baseline	0.95	1.20

Monetary Policy Strategies

Key Elements of the Staff Projection



A Medium-Term Equilibrium Real Federal Funds Rate²

	Current Tealbook	Current-Quarter Estimate Based on Previous Tealbook	Previous Tealbook
Tealbook-consistent FRB/US r^*	1.76	1.62	1.42
Average projected real federal funds rate	0.56	0.49	0.27

1. For rules that have a lagged policy rate as a right-hand-side variable, the lines denoted "Previous Tealbook projection" report prescriptions based on the previous Tealbook's staff outlook for inflation and the output gap, but conditional on the current-Tealbook value of the lagged policy rate.

2. The "Tealbook-consistent FRB/US r^* " is the level of the real federal funds rate that, if maintained over a 12-quarter period (beginning in the current quarter) in the FRB/US model, sets the output gap equal to zero in the final quarter of that period. The "average projected real federal funds rate" is calculated under the Tealbook baseline projection over the same 12-quarter period as the Tealbook-consistent FRB/US r^* .

- The near-term prescriptions of the first-difference rule are a little higher than in March, reflecting the staff’s projection of a somewhat faster rise in output relative to its potential level later this year compared with the projection in the previous Tealbook.

A MEDIUM-TERM EQUILIBRIUM REAL FEDERAL FUNDS RATE

The bottom panel of the exhibit reports the estimate of a medium-term notion of the equilibrium real federal funds rate that is generated using the FRB/US model, given the staff’s baseline projection. This Tealbook-consistent FRB/US r^* corresponds to the level of the real federal funds rate that, if maintained over a 12-quarter period, would bring the output gap to zero in the final quarter of that period.

- The current-quarter estimate of Tealbook-consistent FRB/US r^* is 14 basis points higher than projected in the March Tealbook, reflecting the small upward revisions to the output gap, while the real federal funds rate path is little revised.
- At 1.76 percent, Tealbook-consistent FRB/US r^* is more than 1 percentage point above the average projected real federal funds rate in the staff forecast for the same 12-quarter period and 76 basis points above the staff’s estimate of the real federal funds rate in the longer run.
- The average projected real federal funds rate in the Tealbook baseline is below the Tealbook-consistent FRB/US r^* because the policy reaction function assumed by the staff includes an interest rate smoothing term, reacts to both the output gap and inflation deviations from 2 percent, and does not insist on closing the output gap over a particular time horizon.

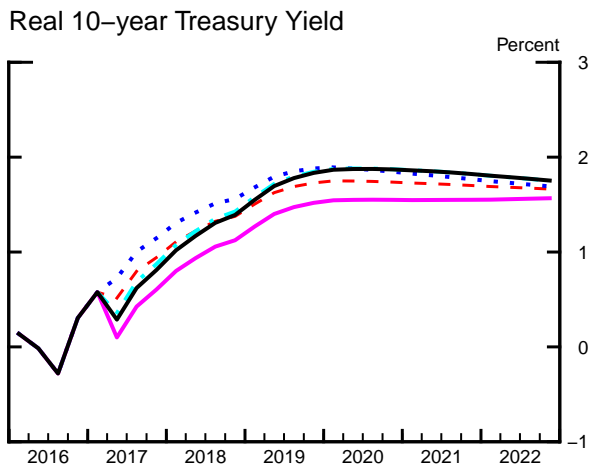
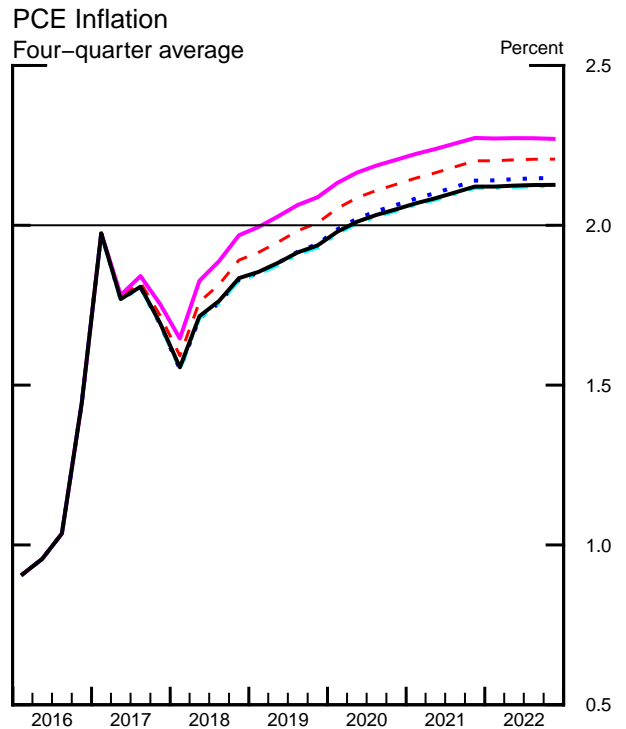
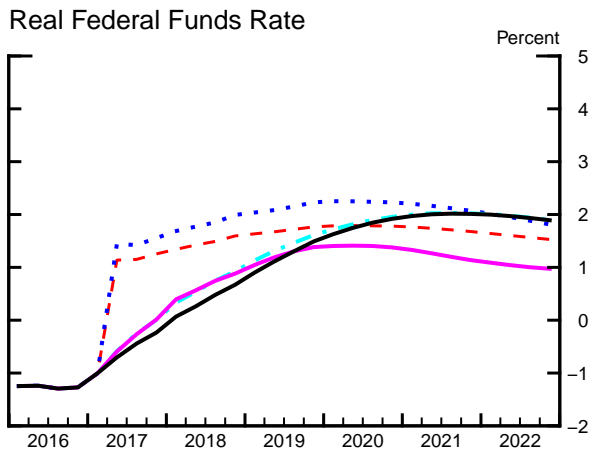
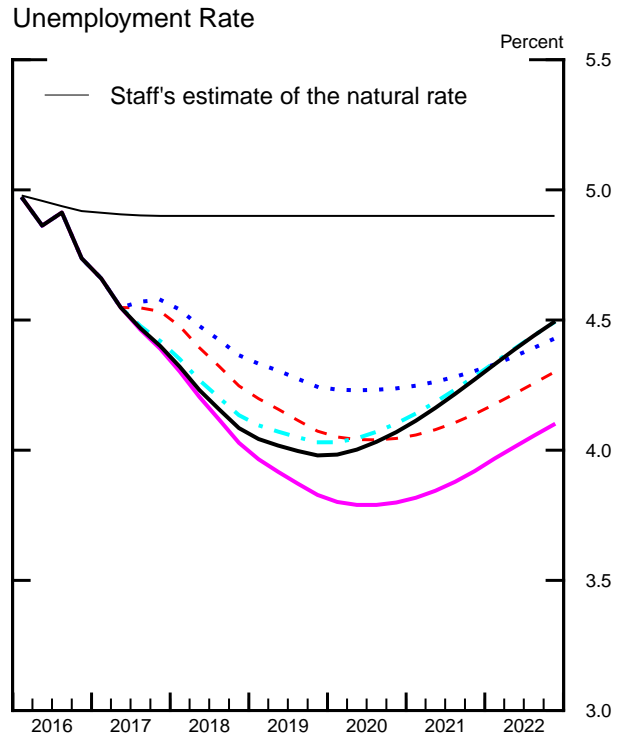
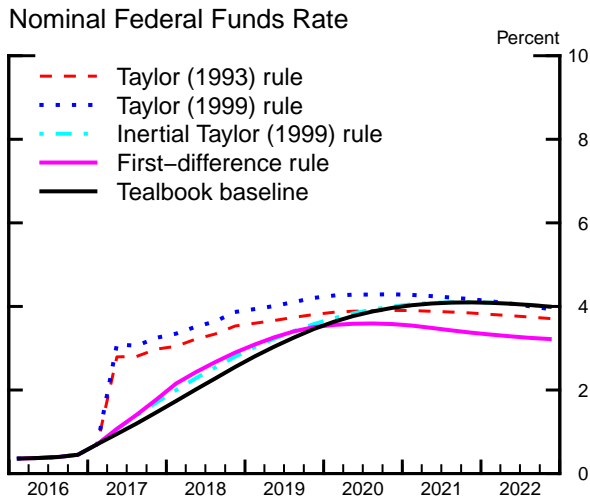
SIMPLE POLICY RULE SIMULATIONS

The second exhibit reports dynamic simulations of the FRB/US model under the Taylor (1993) rule, the Taylor (1999) rule, the inertial version of the Taylor (1999) rule, and the first-difference rule.³ These simulations reflect the endogenous responses of the

³ Unless otherwise noted, the simulated policy rules are obtained under the assumption that policymakers are committed to following the prescriptions of each rule in the future and that financial

Simple Policy Rule Simulations

Monetary Policy Strategies



Note: The policy rule simulations in this exhibit are based on rules that respond to core inflation. This choice of rule specification was made in light of a tendency for current and near-term core inflation rates to outperform headline inflation rates as predictors of the medium-term behavior of headline inflation.

output gap and inflation when the federal funds rate follows the paths implied by the different policy rules.⁴ The policy rate paths prescribed by each rule are only slightly higher than in the March Tealbook, reflecting the small upward revision to the staff's projection of the output gap.

- The policy rate path in the staff forecast is constructed using a version of the inertial Taylor (1999) rule with a temporary downward adjustment to the intercept. The federal funds rate increases, on average, about 1 percentage point per year in 2017 and 2018 and reaches 3 percent in 2019. The pace of tightening subsequently slows, and the federal funds rate peaks at 4.1 percent in 2021 before moving toward its longer-run level of 3 percent.
- The prescriptions of the inertial Taylor (1999) rule with a constant intercept imply a slightly higher path for the federal funds rate over the next few years than the path associated with the Tealbook baseline, which incorporates a judgmental intercept adjustment. The difference in policy rates arising from this alternative treatment of the intercept is small and dissipates too rapidly to have marked effects on the real longer-term interest rates that influence economic activity in the FRB/US model. Thus, macroeconomic outcomes under the inertial Taylor (1999) rule are similar to those in the Tealbook baseline.
- The Taylor (1993) and Taylor (1999) rules call for an immediate sharp tightening in policy and produce paths for the real federal funds rate that lie significantly above the Tealbook baseline path over the next few years. This initially more rapid tightening of policy is followed by a period extending well beyond 2022 during which the federal funds rate is lower than in the Tealbook projection. Under the maintained assumption that market participants have perfect foresight, the paths for the real 10-year Treasury yield under these two rules are, on net, not far from that under the Tealbook baseline. Economic activity in the FRB/US model is tightly linked to the real 10-year Treasury yield, and thus the differences in the paths for unemployment and inflation

market participants, price setters, and wage setters believe that policymakers will follow through on this commitment and understand its macroeconomic implications.

⁴ Because of these endogenous responses, the near-term prescriptions from the dynamic simulations can differ from those shown in the top panel of the first exhibit.

between the two rules are relatively small in relation to the initially large differences in the paths of the federal funds rate.⁵

- The first-difference rule prescribes a slightly higher path for the federal funds rate through 2019 than the Tealbook baseline, followed by a lower path for some years thereafter. This divergence occurs because the first-difference rule, which responds to the expected change in the output gap rather than to its level, reacts to the projected narrowing of the output gap late in the decade and beyond. The lower path of the federal funds rate after 2019, in conjunction with expectations of higher price and wage inflation in the future, implies lower longer-term real rates over the entire projection period relative to the Tealbook baseline as well as higher levels of resource utilization and of inflation. Thus, the first-difference rule generates outcomes for the unemployment rate that are markedly below the unemployment rate paths generated under the baseline policy rule, leading to inflation outcomes that are somewhat above the Tealbook baseline projection.

OPTIMAL CONTROL SIMULATIONS UNDER COMMITMENT

The third exhibit displays optimal control simulations under various assumptions about policymakers' preferences, as captured by four specifications of the loss function.⁶ The concept of optimal control employed here corresponds to a commitment policy under which the plans that policymakers make today constrain future policy choices in a way that improves current and future economic outcomes.⁷

- The first simulation, "Equal weights," presents the case in which policymakers are assumed to place the same weights on keeping headline PCE inflation close to the Committee's 2 percent objective, on keeping the unemployment rate close to the staff's estimate of the natural rate of

⁵ The Taylor (1993) rule calls for slightly lower policy rates than the Taylor (1999) rule over the period shown because it does not respond as strongly to the projected rise in output above its potential level over the next several years. As a consequence, the Taylor (1993) rule generates a lower trajectory for the unemployment rate and a slightly higher trajectory for inflation than does the Taylor (1999) rule.

⁶ The box "Optimal Control and the Loss Function" in the Monetary Policy Strategies section of the June 2016 Tealbook B offers motivations for these specifications; the appendix provides technical details on the optimal control simulations.

⁷ Under the optimal control policies shown in the exhibit, policymakers improve economic outcomes by making promises that bind future policymakers' actions; however, the simulations are not conditioned on policy commitments that might have been made in the past.

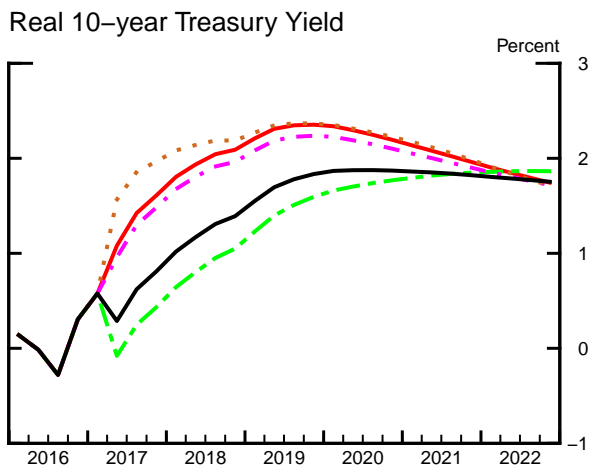
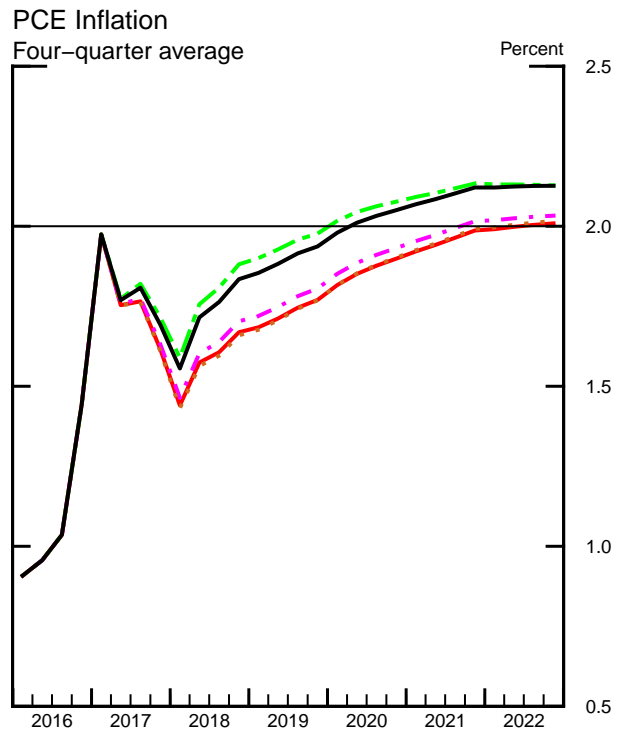
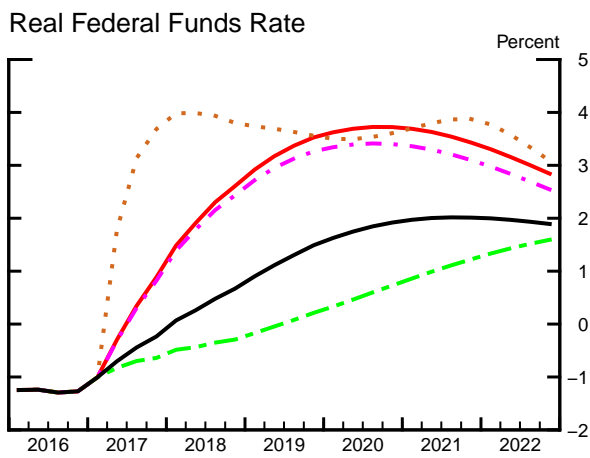
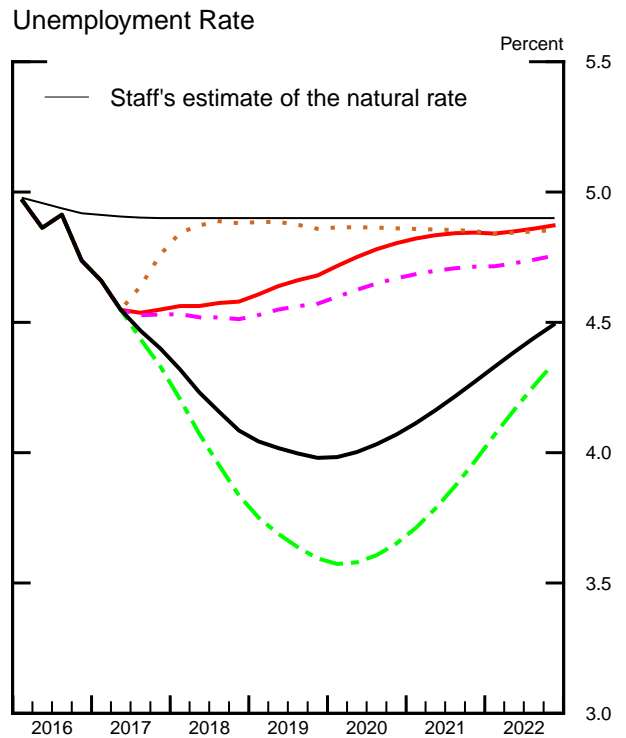
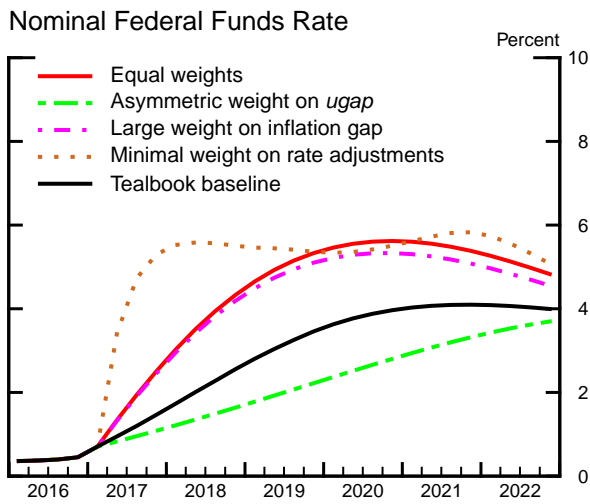
unemployment, and on avoiding changes in the federal funds rate. Under this strategy, the path for the federal funds rate is significantly higher than the Tealbook baseline policy rate path. This higher path arises because, in the current baseline projection, the unemployment rate falls well below the staff's estimate of the natural rate over the next several years, an outcome that policymakers with an "Equal weights" loss function judge to be costly. A tighter policy results in a path of the unemployment rate that is substantially closer to the staff's estimate of the natural rate; headline PCE inflation is somewhat lower than in the Tealbook baseline forecast over the period shown, consistent with a limited response of inflation to lower levels of resource utilization in the FRB/US model.

- The second simulation, "Asymmetric weight on *ugap*," uses a loss function that assigns no cost to deviations of the unemployment rate from the natural rate when the unemployment rate is running below the natural rate, but that is identical to the specification with equal weights when the unemployment rate is above the natural rate. Under this strategy, the path of the federal funds rate is considerably below both the path for the case of equal weights and the Tealbook baseline path. With the asymmetric loss function, policymakers choose this relatively accommodative path for the policy rate because their desire to raise inflation to 2 percent is not tempered by an aversion to the undershooting of the natural rate of unemployment that helps achieve this outcome. Because private agents believe that policymakers will follow this policy rate path if the economy evolves as projected, the tighter labor market brings inflation to 2 percent more quickly than in the case of equal weights; inflation then edges above the Committee's longer-run objective for the next decade.⁸
- The third simulation, "Large weight on inflation gap," is based on a loss function that assigns a cost to deviations of inflation from 2 percent that is five

⁸ The simultaneous overshooting of the longer-run inflation objective and undershooting of the natural rate of unemployment over the medium term under "asymmetric weight on *ugap*" preferences is time inconsistent in the sense that, given the opportunity to reoptimize the path of the federal funds rate without regard to past policy commitments, policymakers in the future would choose to pursue a tighter monetary policy. Under the alternative assumption of optimal control under discretion, policy rates and macroeconomic outcomes are between those under the Tealbook baseline and optimal control under commitment. For the other three specifications of the loss function, the simulation results under commitment and discretion are not much different from each other.

Optimal Control Simulations under Commitment

Monetary Policy Strategies



Note: Each set of lines corresponds to an optimal control policy under commitment in which policymakers minimize a discounted weighted sum of squared deviations of four-quarter headline PCE inflation from the Committee's 2 percent objective, of squared deviations of the unemployment rate from the staff's estimate of the natural rate, and of squared changes in the federal funds rate. The weights vary across simulations. See the appendix for technical details and the box "Optimal Control and the Loss Function" in the June 2016 Tealbook B for a motivation.

times larger than the specification with equal weights but is otherwise identical. The resulting optimal strategy is only slightly more accommodative than in the “Equal weights” case, even though the losses associated with undershooting the inflation objective in coming years are larger. The reason is that, in the FRB/US model, policymakers face an unappealing tradeoff because inflation responds little to resource utilization. Hence, policymakers would need to engineer a substantial undershooting of the natural rate of unemployment, which this specification of the loss function sees as costly, in order to raise inflation in the near term by a modest amount.

- The fourth simulation, “Minimal weight on rate adjustments,” uses a loss function that assigns a very small cost to changes in the federal funds rate but is otherwise identical to the loss function with equal weights. In the resulting optimal strategy, the federal funds rate rises much faster than under the specification with equal weights in 2017 in an effort to contain the projected undershooting of the natural rate of unemployment and remains around 5½ percent over the remainder of the period shown. The paths for the real federal funds rate and the real 10-year Treasury yield are also noticeably higher for a couple of years than in the case of equal weights. While this policy leaves the trajectory for inflation almost unaffected, it keeps the unemployment rate close to the staff’s estimate of the natural rate.
- Compared with the March Tealbook, the federal funds rate paths prescribed by optimal control under each of the four loss functions are one- to three-tenths of a percentage point higher in the final years of the period shown, reflecting continued improvements in the labor market and the modestly higher inflation generated by the tighter labor market later in the decade. In addition, the simulation “Minimal weight on rate adjustments” also features a rise in the federal funds rate that is about 70 basis points higher at the end of 2017 than in the previous Tealbook because policymakers in the model move aggressively in response to further declines in the unemployment rate relative to its natural rate.

POLICY RULES PERFORMANCE UNDER A STEEPER WAGE PHILLIPS CURVE

In the FRB/US model, wages and prices are not very responsive to labor market conditions—a pattern consistent with the behavior of wages and prices during the period

of changing labor market slack over most of the past decade. However, as the labor market continues to tighten and the unemployment rate moves further below its natural rate, there is a risk that wages could rise by more than the staff currently assumes, leading to higher consumer price inflation. In the fourth exhibit, we illustrate how several simple rules perform under a scenario in which the slope of the wage Phillips curve is four times the assumed value in the FRB/US model.⁹ We consider both the inertial and non-inertial versions of the Taylor (1999) rule, along with a rule for the change in the federal funds rate (rather than its level).¹⁰ The simulations are carried out using the FRB/US model and represent versions of an alternative scenario that appears in the Risks and Uncertainty section of this Tealbook.¹¹

- Under the inertial Taylor (1999) rule, inflation outcomes are appreciably higher with the steeper wage Phillips curve than in the Tealbook baseline, which is constructed using a similar policy rule. Inflation outcomes are higher because the undershooting of the natural rate of unemployment produces, all else being equal, a larger inflation response than in the Tealbook baseline. This higher rate of inflation leads to a higher path for the federal funds rate

⁹ Four times the size of the slope of the wage Phillips curve in the FRB/US model falls within the range of estimates for a period that covers the late 1980s to the late 1990s but is below estimates derived using data from the 1970s.

¹⁰ This “change rule” is specified so that $R_t - R_{t-1} = 1.2(\pi_t - 2) + 2(4.9 - U_t)$, where R_t is the federal funds rate, π_t is four-quarter core PCE price inflation, and U_t is the unemployment rate. For an analysis of a similar rule, see John B. Taylor (1999), “The Robustness and Efficiency of Monetary Policy Rules as Guidelines for Interest Rate Setting by the European Central Bank,” *Journal of Monetary Economics*, vol. 43 (June), pp. 655–79. For a recent application, see Janet L. Yellen (2017), “The Economic Outlook and the Conduct of Monetary Policy,” speech delivered at the Stanford Institute for Economic Policy Research, Stanford University, Stanford, California, January 19, <https://www.federalreserve.gov/newsevents/speech/yellen20170119a.htm>. The change rule has different coefficient values than the first-difference rule shown in the second exhibit and, importantly, it uses the current deviations of the unemployment rate from its natural rate and of inflation from 2 percent rather than expectations about future changes in the output gap and expected deviations of inflation from 2 percent. All else being equal, the change rule’s focus on absolute deviations, rather than on expected changes, tends to accentuate tightening and easing cycles relative to the first-difference rule.

¹¹ Unlike the similar alternative scenario in the Risks and Uncertainty section of Tealbook A, we do not adjust the way that inflation expectations are formed, but instead isolate the effects of a change in the policy rule under a steeper wage Phillips curve. Moreover, as in the other simulations in the Monetary Policy Strategies section of Tealbook A, the simulations are conducted under the assumption that market participants, as well as price and wage setters, have perfect foresight. By contrast, the alternative scenario in the Risks and Uncertainty section that considers a steeper wage Phillips curve embeds the assumption that all expectations are formed using projections based solely on past outcomes.

and, in turn, a somewhat higher unemployment rate than in the Tealbook baseline.

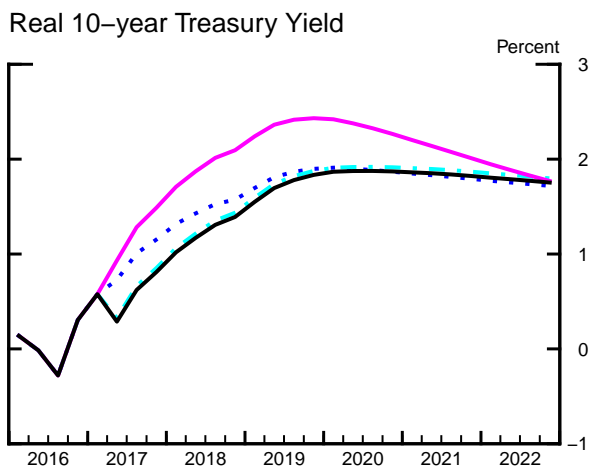
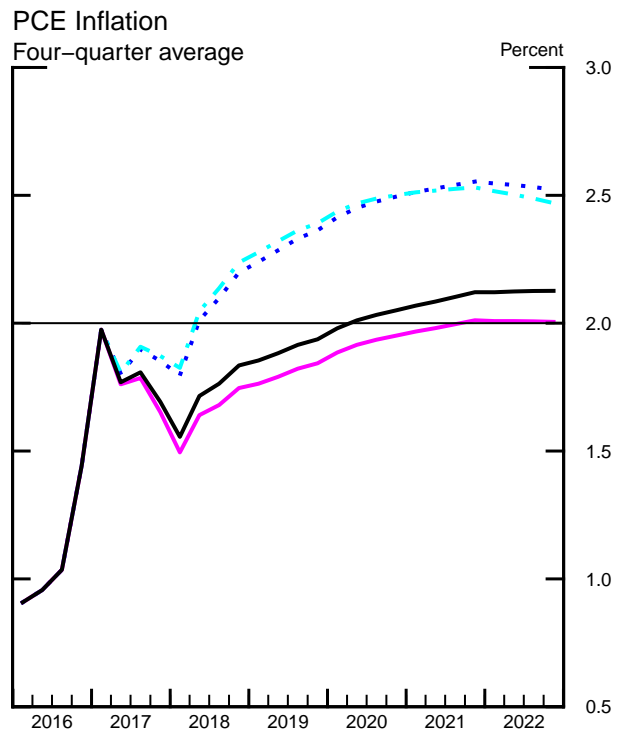
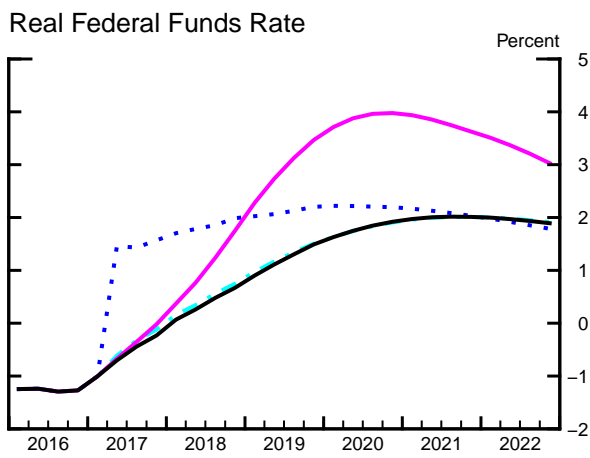
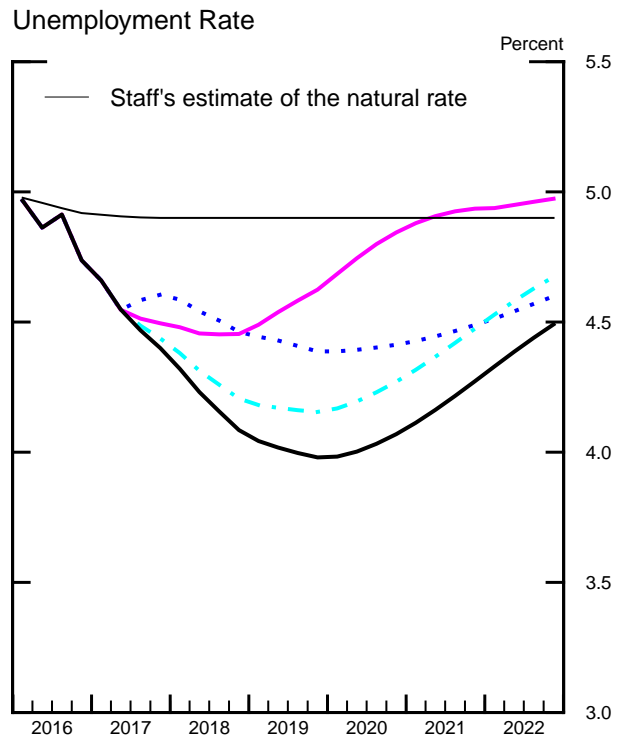
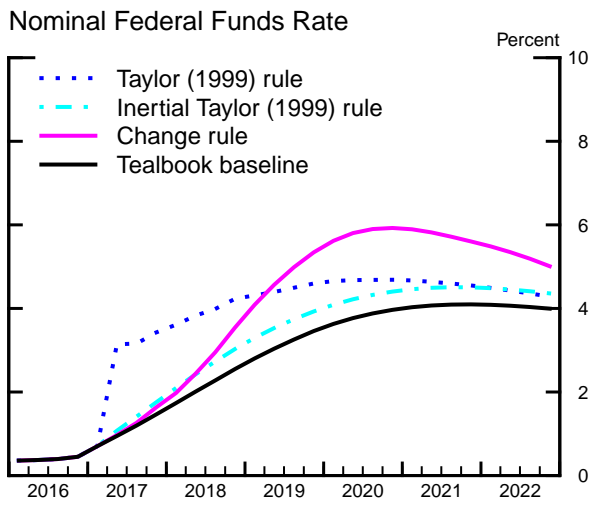
- Under the Taylor (1999) rule, the federal funds rate rises much more quickly in response to the higher inflation than under the inertial version of that rule. As a result, unemployment is initially higher than under the inertial version of the rule, whereas inflation outcomes are similar.
- The change rule has different properties than Taylor-type rules. For example, when the unemployment rate is below its natural rate and inflation is above 2 percent, it prescribes continual increases in the federal funds rate at least until inflation returns to 2 percent or the unemployment rate returns to its natural rate.¹² By contrast, Taylor-type rules would prescribe decreases in the federal funds rate as inflation declines to 2 percent and the unemployment rate rises toward its natural rate.¹³
- In the Tealbook baseline, core PCE price inflation is somewhat below 2 percent in the current and subsequent quarters; however, the unemployment rate is currently 0.4 percentage point below its natural rate and projected to fall further. On net, the change rule calls for increases to the federal funds rate until the unemployment rate has almost risen to its natural rate. The prescribed policy rate path remains above the prescriptions of the inertial Taylor (1999) rule from the second half of 2018 through 2022, leading to a more rapid return of the unemployment rate to its natural level and keeping inflation at or below 2 percent through 2022 despite the steeper wage Phillips curve.
- In sum, the model simulations indicate that both the Taylor (1999) rule and the inertial version of that rule would lead to a persistent overshooting of the Committee's 2 percent inflation objective if wages turn out to be more

¹² Similarly, if the unemployment rate is above its natural rate and inflation is below 2 percent, the change rule will prescribe decreases in the federal funds rate until inflation returns to 2 percent or the unemployment rate returns to its natural rate.

¹³ The change rule, like the first-difference rule, does not specify the long-run value of the real federal funds rate; it nonetheless achieves this value in the long run through its response to inflation deviations from 2 percent and to unemployment rate deviations from its natural rate. By contrast, Taylor-type rules include an intercept term that is assumed to correspond to the long-run value of the real federal funds rate.

Simulations with a Steeper Wage Phillips Curve

Monetary Policy Strategies



responsive to labor market tightness over the next few years than assumed in the staff projection. This overshooting occurs because the tightening in the stance of policy prescribed by these rules arrives too late to fully contain the inflation pressures brought about by substantial unemployment rate undershooting in combination with a steeper wage Phillips curve. By contrast, the relatively aggressive response of monetary policy embedded in the change rule is able to forestall the rise in inflation—provided this future stance is fully anticipated by price and wage setters, as we assume in the simulation.

The next four exhibits tabulate the simulation results for key variables under the policy rules and optimal control simulations described previously.

Outcomes of Simple Policy Rule Simulations

(Percent change, annual rate, from end of preceding period except as noted)

Measure and policy	2017	2018	2019	2020	2021
<i>Nominal federal funds rate¹</i>					
Taylor (1993)	3.0	3.5	3.8	3.9	3.8
Taylor (1999)	3.3	3.9	4.2	4.3	4.2
Inertial Taylor (1999)	1.7	2.8	3.6	4.0	4.1
First-difference	1.8	2.9	3.5	3.6	3.4
Extended Tealbook baseline	1.5	2.6	3.5	4.0	4.1
<i>Real GDP</i>					
Taylor (1993)	1.9	2.1	2.0	1.7	1.5
Taylor (1999)	1.8	1.9	1.9	1.7	1.5
Inertial Taylor (1999)	2.0	2.1	1.8	1.5	1.3
First-difference	2.1	2.3	2.0	1.7	1.5
Extended Tealbook baseline	2.1	2.2	1.8	1.5	1.3
<i>Unemployment rate¹</i>					
Taylor (1993)	4.5	4.2	4.1	4.0	4.1
Taylor (1999)	4.6	4.4	4.2	4.2	4.3
Inertial Taylor (1999)	4.4	4.1	4.0	4.1	4.3
First-difference	4.4	4.0	3.8	3.8	3.9
Extended Tealbook baseline	4.4	4.1	4.0	4.1	4.3
<i>Total PCE prices</i>					
Taylor (1993)	1.7	1.9	2.0	2.1	2.2
Taylor (1999)	1.7	1.8	1.9	2.1	2.1
Inertial Taylor (1999)	1.7	1.8	1.9	2.0	2.1
First-difference	1.8	2.0	2.1	2.2	2.3
Extended Tealbook baseline	1.7	1.8	1.9	2.1	2.1
<i>Core PCE prices</i>					
Taylor (1993)	1.7	1.9	2.0	2.1	2.2
Taylor (1999)	1.7	1.9	2.0	2.1	2.1
Inertial Taylor (1999)	1.7	1.9	2.0	2.0	2.1
First-difference	1.8	2.0	2.1	2.2	2.2
Extended Tealbook baseline	1.7	1.9	2.0	2.0	2.1

1. Percent, average for the final quarter of the period.

Outcomes of Simple Policy Rule Simulations, Quarterly

(Four-quarter percent change, except as noted)

Measure and policy	2017				2018			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Nominal federal funds rate¹</i>								
Taylor (1993)	0.7	2.8	2.8	3.0	3.0	3.2	3.3	3.5
Taylor (1999)	0.7	3.1	3.1	3.3	3.3	3.5	3.6	3.9
Inertial Taylor (1999)	0.7	1.1	1.4	1.7	2.0	2.3	2.5	2.8
First-difference	0.7	1.1	1.4	1.8	2.2	2.4	2.7	2.9
Extended Tealbook baseline	0.7	0.9	1.2	1.5	1.7	2.0	2.3	2.6
<i>Real GDP</i>								
Taylor (1993)	2.0	2.3	1.8	1.9	2.3	2.1	2.1	2.1
Taylor (1999)	2.0	2.3	1.8	1.8	2.1	1.9	1.9	1.9
Inertial Taylor (1999)	2.0	2.3	1.9	2.0	2.4	2.3	2.2	2.1
First-difference	2.0	2.3	2.0	2.1	2.6	2.5	2.4	2.3
Extended Tealbook baseline	2.0	2.3	1.9	2.1	2.5	2.4	2.3	2.2
<i>Unemployment rate¹</i>								
Taylor (1993)	4.7	4.5	4.5	4.5	4.5	4.4	4.3	4.2
Taylor (1999)	4.7	4.5	4.6	4.6	4.5	4.5	4.4	4.4
Inertial Taylor (1999)	4.7	4.5	4.5	4.4	4.3	4.3	4.2	4.1
First-difference	4.7	4.5	4.5	4.4	4.3	4.2	4.1	4.0
Extended Tealbook baseline	4.7	4.5	4.5	4.4	4.3	4.2	4.2	4.1
<i>Total PCE prices</i>								
Taylor (1993)	2.0	1.8	1.8	1.7	1.6	1.8	1.8	1.9
Taylor (1999)	2.0	1.8	1.8	1.7	1.5	1.7	1.8	1.8
Inertial Taylor (1999)	2.0	1.8	1.8	1.7	1.6	1.7	1.8	1.8
First-difference	2.0	1.8	1.8	1.8	1.6	1.8	1.9	2.0
Extended Tealbook baseline	2.0	1.8	1.8	1.7	1.6	1.7	1.8	1.8
<i>Core PCE prices</i>								
Taylor (1993)	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.9
Taylor (1999)	1.7	1.6	1.6	1.7	1.7	1.7	1.8	1.9
Inertial Taylor (1999)	1.7	1.7	1.6	1.7	1.7	1.7	1.8	1.9
First-difference	1.7	1.7	1.7	1.8	1.8	1.9	1.9	2.0
Extended Tealbook baseline	1.7	1.7	1.6	1.7	1.7	1.7	1.8	1.9

1. Percent, average for the quarter.

Outcomes of Optimal Control Simulations under Commitment

(Percent change, annual rate, from end of preceding period except as noted)

Measure and policy	2017	2018	2019	2020	2021
<i>Nominal federal funds rate¹</i>					
Equal weights	2.5	4.3	5.3	5.6	5.4
Aymmetric weight on <i>ugap</i>	1.1	1.6	2.2	2.8	3.3
Large weight on inflation gap	2.5	4.2	5.1	5.3	5.1
Minimal weight on rate adjustments	5.3	5.5	5.4	5.5	5.8
Extended Tealbook baseline	1.5	2.6	3.5	4.0	4.1
<i>Real GDP</i>					
Equal weights	1.7	1.5	1.4	1.5	1.5
Aymmetric weight on <i>ugap</i>	2.2	2.6	2.0	1.5	1.1
Large weight on inflation gap	1.8	1.6	1.5	1.5	1.5
Minimal weight on rate adjustments	1.4	1.2	1.6	1.7	1.6
Extended Tealbook baseline	2.1	2.2	1.8	1.5	1.3
<i>Unemployment rate¹</i>					
Equal weights	4.5	4.6	4.7	4.8	4.8
Aymmetric weight on <i>ugap</i>	4.3	3.8	3.6	3.7	4.0
Large weight on inflation gap	4.5	4.5	4.6	4.7	4.7
Minimal weight on rate adjustments	4.8	4.9	4.9	4.9	4.8
Extended Tealbook baseline	4.4	4.1	4.0	4.1	4.3
<i>Total PCE prices</i>					
Equal weights	1.6	1.7	1.8	1.9	2.0
Aymmetric weight on <i>ugap</i>	1.7	1.9	2.0	2.1	2.1
Large weight on inflation gap	1.6	1.7	1.8	1.9	2.0
Minimal weight on rate adjustments	1.6	1.7	1.8	1.9	2.0
Extended Tealbook baseline	1.7	1.8	1.9	2.1	2.1
<i>Core PCE prices</i>					
Equal weights	1.6	1.7	1.8	1.9	2.0
Aymmetric weight on <i>ugap</i>	1.7	1.9	2.0	2.1	2.1
Large weight on inflation gap	1.6	1.7	1.8	1.9	2.0
Minimal weight on rate adjustments	1.6	1.7	1.8	1.9	2.0
Extended Tealbook baseline	1.7	1.9	2.0	2.0	2.1

1. Percent, average for the final quarter of the period.

Outcomes of Optimal Control Simulations under Commitment, Quarterly

(Four-quarter percent change, except as noted)

Measure and policy	2017				2018			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Nominal federal funds rate¹</i>								
Equal weights	0.7	1.3	1.9	2.5	3.0	3.5	3.9	4.3
Asymmetric weight on <i>ugap</i>	0.7	0.8	1.0	1.1	1.2	1.4	1.5	1.6
Large weight on inflation gap	0.7	1.3	1.9	2.5	3.0	3.4	3.8	4.2
Minimal weight on rate adjustments	0.7	3.4	4.7	5.3	5.5	5.6	5.6	5.5
Extended Tealbook baseline	0.7	0.9	1.2	1.5	1.7	2.0	2.3	2.6
<i>Real GDP</i>								
Equal weights	2.0	2.3	1.8	1.7	2.0	1.6	1.6	1.5
Asymmetric weight on <i>ugap</i>	2.0	2.3	2.0	2.2	2.8	2.7	2.7	2.6
Large weight on inflation gap	2.0	2.3	1.8	1.8	2.0	1.7	1.7	1.6
Minimal weight on rate adjustments	2.0	2.3	1.6	1.4	1.5	1.1	1.2	1.2
Extended Tealbook baseline	2.0	2.3	1.9	2.1	2.5	2.4	2.3	2.2
<i>Unemployment rate¹</i>								
Equal weights	4.7	4.5	4.5	4.5	4.6	4.6	4.6	4.6
Asymmetric weight on <i>ugap</i>	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.8
Large weight on inflation gap	4.7	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Minimal weight on rate adjustments	4.7	4.5	4.6	4.8	4.8	4.9	4.9	4.9
Extended Tealbook baseline	4.7	4.5	4.5	4.4	4.3	4.2	4.2	4.1
<i>Total PCE prices</i>								
Equal weights	2.0	1.8	1.8	1.6	1.4	1.6	1.6	1.7
Asymmetric weight on <i>ugap</i>	2.0	1.8	1.8	1.7	1.6	1.8	1.8	1.9
Large weight on inflation gap	2.0	1.8	1.8	1.6	1.5	1.6	1.6	1.7
Minimal weight on rate adjustments	2.0	1.8	1.8	1.6	1.4	1.6	1.6	1.7
Extended Tealbook baseline	2.0	1.8	1.8	1.7	1.6	1.7	1.8	1.8
<i>Core PCE prices</i>								
Equal weights	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.7
Asymmetric weight on <i>ugap</i>	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.9
Large weight on inflation gap	1.7	1.6	1.6	1.6	1.6	1.6	1.7	1.7
Minimal weight on rate adjustments	1.7	1.6	1.6	1.6	1.5	1.6	1.6	1.7
Extended Tealbook baseline	1.7	1.7	1.6	1.7	1.7	1.7	1.8	1.9

1. Percent, average for the quarter.

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Appendix

Implementation of the Simple Rules and Optimal Control Simulations

The monetary policy strategies considered in this section of Tealbook A typically fall into one of two categories. Under simple policy rules, policymakers set the federal funds rate according to a reaction function that includes a small number of macroeconomic factors. Under optimal control policies, policymakers compute a path for the federal funds rate that minimizes a loss function meant to capture policymakers' preferences over macroeconomic outcomes. Both approaches recognize the Federal Reserve's dual mandate. Unless otherwise noted, the simulations embed the assumption that policymakers will adhere to the policy strategy in the future and that financial market participants, price setters, and wage setters not only believe that policymakers will follow through with their strategy but also fully understand the macroeconomic implications of policymakers doing so. Such policy strategies are described as commitment strategies.

The two approaches have different merits and limitations. The parsimony of simple rules makes them relatively easy to communicate to the public, and because they respond only to variables that are central to a range of models, proponents argue that they may be more robust to uncertainty about the structure of the economy. However, simple rules omit, by construction, other potential influences on policy decisions; thus, strict adherence to such rules may, at times, lead to unsatisfactory outcomes. By comparison, optimal control policies respond to a broader set of economic factors; their prescriptions optimally balance various policy objectives. And, although this section focuses on policies under commitment, optimal control policies can more generally be derived under various assumptions about the degree to which policymakers can commit. That said, optimal control policies assume substantial knowledge on the part of policymakers and are sensitive to the assumed loss function and the specifics of the particular model.

Given the different strengths and weaknesses of the two approaches, they are probably best considered together as a means to assess the various tradeoffs policymakers may face when pursuing their mandated objectives.

POLICY RULES USED IN “MONETARY POLICY STRATEGIES”

The table “Simple Rules” gives the expressions for the four simple policy rules reported in the Monetary Policy Strategies section. R_t denotes the nominal federal funds rate for quarter t . The right-hand-side variables include the staff's projection of trailing four-quarter core PCE price inflation for the current quarter and three quarters ahead (π_t and $\pi_{t+3|t}$), the output gap estimate for the current period ($ygap_t$), and the forecast of the three-quarter-ahead annual change in the output gap ($\Delta^4 ygap_{t+3|t}$). The value of policymakers' longer-run inflation objective, denoted π^{LR} , is 2 percent.

Simple Rules

Taylor (1993) rule	$R_t = r^{LR} + \pi_t + 0.5(\pi_t - \pi^{LR}) + 0.5ygap_t$
Taylor (1999) rule	$R_t = r^{LR} + \pi_t + 0.5(\pi_t - \pi^{LR}) + ygap_t$
Inertial Taylor (1999) rule	$R_t = 0.85R_{t-1} + 0.15(r^{LR} + \pi_t + 0.5(\pi_t - \pi^{LR}) + ygap_t)$
First-difference rule	$R_t = R_{t-1} + 0.5(\pi_{t+3|t} - \pi^{LR}) + 0.5\Delta^4 ygap_{t+3|t}$

The first two of the selected rules were studied by Taylor (1993, 1999), whereas the inertial version of the Taylor (1999) rule has been featured prominently in analysis by Board staff.¹ The intercepts of these rules, denoted r^{LR} , are constant and chosen so that they are consistent with a 2 percent longer-run inflation objective and a longer-run real federal funds rate of 1 percent, a value used in the FRB/US model.² The prescriptions of the first-difference rule do not depend on the level of the output gap or the longer-run real interest rate; see Orphanides (2003).

Near-term prescriptions from the four policy rules are calculated taking as given the Tealbook projections for inflation and the output gap. When the Tealbook is published early in a quarter, the prescriptions are shown for the current and next quarters. When the Tealbook is published late in a quarter, the prescriptions are shown for the next two quarters. Rules that include a lagged policy rate as a right-hand-side variable are conditioned on the lagged federal funds rate in the Tealbook projection for the first quarter shown and then conditioned on their simulated lagged federal funds rate for the second quarter shown. To isolate the effects of changes in macroeconomic projections on the prescriptions of these inertial rules, the lines labeled “Previous Tealbook projection” report prescriptions that are conditional on the previous Tealbook projections for inflation and the output gap but that use the value of the lagged federal funds rate in the current Tealbook for the first quarter shown.

REAL FEDERAL FUNDS RATE ESTIMATES

The bottom panel of the exhibit “Policy Rules and the Staff Projection” provides an estimate of one notion of the equilibrium real federal funds rate. The “Tealbook-consistent FRB/US r^* ” is an estimate of the real federal funds rate that, if maintained over a 12-quarter period (beginning in the current quarter), makes the output gap equal to zero in the final quarter of that period using the output projection from FRB/US, the staff’s large-scale econometric model

¹ See, for example, Erceg and others (2012).

² All nominal and real federal funds rates reported in the Monetary Policy Strategies section are expressed on the same 360-day basis as the published federal funds rate. Consistent with the methodology in the FRB/US model, the simple rules are first implemented on a fully compounded, 365-day basis and then converted to a 360-day basis.

of the U.S. economy.³ This measure depends on a broad array of economic factors, some of which take the form of projected values of the model’s exogenous variables.

The “Average projected real federal funds rate” reported in the panel is the average of the real federal funds rate under the Tealbook baseline projection calculated over the same 12-quarter period as the Tealbook-consistent FRB/US r^* . The average projected real federal funds rate and the Tealbook-consistent FRB/US r^* may produce somewhat different macroeconomic outcomes even when their values are identical. The reason is that, in the Tealbook-consistent FRB/US r^* simulations, the real federal funds rate is held constant over the entire 12-quarter period to close the output gap at the end of this time frame, whereas in the Tealbook baseline, the real federal funds rate can vary over time.

FRB/US MODEL SIMULATIONS

The results presented in the exhibits “Simple Policy Rule Simulations” and “Optimal Control Simulations under Commitment” are derived from dynamic simulations of the FRB/US model. Each simulated policy strategy is assumed to be in force over the whole period covered by the simulation; this period extends several decades beyond the time horizon shown in the exhibits. The simulations are conducted under the assumption that market participants as well as price and wage setters have perfect foresight and are predicated on the staff’s extended Tealbook projection, which includes the macroeconomic effects of the Committee’s large-scale asset purchase programs. When the Tealbook is published early in a quarter, all of the simulations begin in that quarter; when the Tealbook is published late in a quarter, all of the simulations begin in the subsequent quarter.

COMPUTATION OF OPTIMAL CONTROL POLICIES UNDER COMMITMENT

The optimal control simulations posit that policymakers minimize a discounted weighted sum of squared inflation gaps (measured as the difference between four-quarter headline PCE price inflation, π_t^{PCE} , and the Committee’s 2 percent objective), squared unemployment gaps ($ugap_t$, measured as the difference between the unemployment rate and the staff’s estimate of the natural rate), and squared changes in the federal funds rate. In the following equation, the resulting loss function embeds the assumption that policymakers discount the future using a quarterly discount factor $\beta = 0.9963$:

$$L_t = \sum_{\tau=0}^T \beta^\tau \{ \lambda_\pi (\pi_{t+\tau}^{PCE} - \pi^{LR})^2 + \lambda_{u,t+\tau} (ugap_{t+\tau})^2 + \lambda_R (R_{t+\tau} - R_{t+\tau-1})^2 \}.$$

The exhibit “Optimal Control Simulations under Commitment” considers four specifications of the weights on the inflation gap, the unemployment gap, and the rate change components of the loss function. The box “Optimal Control and the Loss Function” in the

³ For a discussion of this and other concepts of equilibrium interest rates, see Gust and others (2016).

Monetary Policy Strategies section of the June 2016 Tealbook B provides motivations for the four specifications of the loss function.

The first specification, “Equal weights,” assigns equal weights to all three components at all times. The second specification, “Asymmetric weight on *ugap*,” uses the same weights as the equal-weights specification whenever the unemployment rate is above the staff’s estimate of the natural rate, but it assigns no penalty to the unemployment rate falling below the natural rate. The third specification, “Large weight on inflation gap,” attaches a relatively large weight to inflation gaps. The fourth specification, “Minimal weight on rate adjustments,” places almost no weight on changes in the federal funds rate.⁴ The table “Loss Functions” shows the weights used in the four specifications. The optimal control policy and associated outcomes depend on the relative (rather than the absolute) values of the weights.

	λ_π	$\lambda_{u,t+\tau}$		λ_R
		$ugap_{t+\tau} < 0$	$ugap_{t+\tau} \geq 0$	
Equal weights	1	1	1	1
Asymmetric weight on <i>ugap</i>	1	0	1	1
Large weight on inflation gap	5	1	1	1
Minimal weight on rate adjustment	1	1	1	0.01

For each of these four specifications of the loss function, the optimal control policy is the path for the federal funds rate that minimizes the loss function in the FRB/US model, subject to the effective lower bound constraint on nominal interest rates, under the assumption of perfect foresight and conditional on the staff’s extended Tealbook projection. Policy tools other than the federal funds rate are taken as given and subsumed within the Tealbook baseline. The path chosen by policymakers today is assumed to be credible, meaning that the public see this path as a binding commitment on policymakers’ future decisions; the optimal control policy takes as given the initial lagged value of the federal funds rate but is otherwise unconstrained by policy decisions made prior to the simulation period. The discounted losses are calculated over a horizon that ends sufficiently far in the future so that extending the horizon further would not affect the policy prescriptions shown in the exhibits.

⁴ The inclusion of a minimal but strictly positive weight on changes in the federal funds rate helps ensure a well-behaved numerical solution.

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Changes in GDP, Prices, and Unemployment
(Percent, annual rate except as noted)

Interval	Nominal GDP		Real GDP		PCE price index		Core PCE price index		Unemployment rate ¹	
	03/03/17	04/20/17	03/03/17	04/20/17	03/03/17	04/20/17	03/03/17	04/20/17	03/03/17	04/20/17
<i>Quarterly</i>										
2016:Q1	1.3	1.3	.8	.8	.3	.3	2.1	2.1	5.0	5.0
Q2	3.7	3.7	1.4	1.4	2.0	2.0	1.8	1.8	4.9	4.9
Q3	5.0	5.0	3.5	3.5	1.5	1.5	1.7	1.7	4.9	4.9
Q4	4.0	4.2	1.9	2.1	2.0	2.0	1.2	1.3	4.7	4.7
2017:Q1	4.3	3.3	1.4	.9	2.6	2.4	2.3	2.0	4.7	4.7
Q2	3.7	3.9	2.1	2.6	1.4	1.2	1.7	1.6	4.7	4.5
Q3	3.8	4.1	2.1	2.2	1.5	1.6	1.6	1.7	4.7	4.5
Q4	4.0	4.4	2.3	2.6	1.5	1.6	1.5	1.6	4.6	4.4
2018:Q1	4.5	4.8	2.4	2.6	1.8	1.9	1.9	1.9	4.5	4.3
Q2	4.1	4.1	2.1	2.0	1.8	1.8	1.9	1.9	4.4	4.2
Q3	4.1	4.0	2.1	2.0	1.8	1.8	1.8	1.9	4.3	4.2
Q4	4.1	4.1	2.1	2.1	1.8	1.8	1.8	1.9	4.2	4.1
<i>Two-quarter²</i>										
2016:Q2	2.5	2.5	1.1	1.1	1.1	1.1	1.9	1.9	-1	-1
Q4	4.5	4.6	2.7	2.8	1.7	1.7	1.5	1.5	-2	-2
2017:Q2	4.0	3.6	1.7	1.7	2.0	1.8	2.0	1.8	.0	-2
Q4	3.9	4.2	2.2	2.4	1.5	1.6	1.5	1.6	-1	-1
2018:Q2	4.3	4.4	2.3	2.3	1.8	1.8	1.9	1.9	-2	-2
Q4	4.1	4.0	2.1	2.0	1.8	1.8	1.8	1.9	-2	-1
<i>Four-quarter³</i>										
2015:Q4	3.0	3.0	1.9	1.9	.4	.4	1.4	1.4	-7	-7
2016:Q4	3.5	3.5	1.9	2.0	1.4	1.4	1.7	1.7	-3	-3
2017:Q4	3.9	3.9	2.0	2.1	1.7	1.7	1.8	1.7	-1	-3
2018:Q4	4.2	4.2	2.2	2.2	1.8	1.8	1.9	1.9	-4	-3
2019:Q4	4.0	3.9	1.9	1.8	1.9	1.9	2.0	2.0	-1	-1
<i>Annual</i>										
2015	3.7	3.7	2.6	2.6	.3	.3	1.4	1.4	5.3	5.3
2016	2.9	3.0	1.6	1.6	1.1	1.1	1.7	1.7	4.9	4.9
2017	4.1	4.0	2.0	2.0	1.9	1.8	1.7	1.7	4.7	4.5
2018	4.1	4.3	2.2	2.3	1.7	1.7	1.8	1.8	4.4	4.2
2019	4.0	4.0	2.0	1.9	1.9	1.9	1.9	1.9	4.2	4.0

1. Level, except for two-quarter and four-quarter intervals.
 2. Percent change from two quarters earlier; for unemployment rate, change is in percentage points.
 3. Percent change from four quarters earlier; for unemployment rate, change is in percentage points.

Greensheets

Changes in Real Gross Domestic Product and Related Items

(Percent, annual rate except as noted)

Item	2016				2017				2018				2016 ¹	2017 ¹	2018 ¹	2019 ¹
	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Real GDP	1.4	3.5	2.1		.9	2.6	2.2	2.6	2.6	2.0	2.0	2.1	2.0	2.1	2.2	1.8
<i>Previous Tealbook</i>	1.4	3.5	1.9		1.4	2.1	2.1	2.3		2.4	2.1	2.1		2.0	2.2	1.9
Final sales	2.6	3.0	1.1		.9	2.7	2.3	2.7	2.7	2.7	2.0	2.1	2.0	2.1	2.2	1.9
<i>Previous Tealbook</i>	2.6	3.0	.9		1.4	2.1	2.1	2.4	2.4	2.5	2.1	2.1	1.9	2.0	2.2	2.0
Priv. dom. final purch.	3.2	2.4	3.4		1.8	3.0	2.8	3.2	3.2	3.6	2.9	2.7	2.5	2.7	2.9	2.4
<i>Previous Tealbook</i>	3.2	2.4	3.1		2.4	2.8	2.8	3.0	3.0	3.5	3.0	2.9	2.5	2.7	3.0	2.6
Personal cons. expend.	4.3	3.0	3.5		.6	3.1	3.0	2.8	2.8	3.4	3.0	2.8	3.1	2.4	2.9	2.5
<i>Previous Tealbook</i>	4.3	3.0	3.0		1.5	3.0	2.9	2.7	2.7	3.4	3.0	2.7	3.0	2.5	3.0	2.5
Durables	9.8	11.6	11.4		-1.0	5.4	4.7	5.5	5.5	5.6	5.0	4.5	7.9	3.6	4.8	2.0
Nondurables	5.7	-5	3.3		1.5	3.6	3.3	2.7	2.7	3.6	3.1	3.0	2.6	2.8	3.1	2.6
Services	3.0	2.7	2.4		.6	2.5	2.7	2.4	2.4	2.9	2.6	2.4	2.5	2.0	2.6	2.6
Residential investment	-7.7	-4.1	9.6		11.4	-1.3	-1.5	8.3	8.3	5.2	2.6	2.1	1.1	4.1	2.7	4.4
<i>Previous Tealbook</i>	-7.7	-4.1	9.4		8.0	-2.5	-1.6	3.9	3.9	3.8	4.5	5.2	1.1	1.9	4.6	5.5
Nonres. priv. fixed invest.	1.0	1.4	.9		5.4	4.4	3.0	4.1	4.1	4.6	2.6	2.5	-1	4.2	3.1	1.2
<i>Previous Tealbook</i>	1.0	1.4	1.9		5.7	3.7	3.4	4.2	4.2	3.5	3.0	3.2	.2	4.2	2.9	1.8
Equipment & intangibles	1.8	-1.3	1.7		2.4	2.4	2.4	4.9	4.9	6.0	3.0	3.3	-6	3.0	3.9	1.8
<i>Previous Tealbook</i>	1.8	-1.3	3.0		5.7	3.4	3.5	5.1	5.1	4.6	3.6	3.9	-3	4.4	3.7	2.3
Nonres. structures	-2.1	12.0	-1.9		17.1	11.4	5.3	1.4	1.4	-2	1.5	-1	1.9	8.6	.2	-6
<i>Previous Tealbook</i>	-2.1	12.0	-2.1		5.8	4.6	3.1	.9	.9	-3	.7	.6	1.8	3.6	.3	.0
Net exports ²	-558	-522	-605		-619	-635	-657	-670	-670	-693	-718	-737	-563	-645	-724	-785
<i>Previous Tealbook</i> ²	-558	-522	-600		-626	-655	-677	-696	-696	-725	-752	-773	-562	-663	-759	-828
Exports	1.8	10.0	-4.5		5.5	1.3	1.6	2.1	2.1	2.4	2.5	2.7	1.5	2.6	2.6	2.9
Imports	.2	2.2	9.0		6.4	3.3	4.4	3.5	3.5	5.1	5.4	4.7	2.6	4.4	4.7	4.2
Gov't. cons. & invest.	-1.7	.8	.2		-1.8	2.4	2.2	1.3	1.3	.7	.5	.5	.2	1.0	.5	.5
<i>Previous Tealbook</i>	-1.7	.8	.0		-4	1.8	1.6	1.4	1.4	.8	.7	.7	.2	1.1	.7	.7
Federal	-4	2.4	-1.2		-2.7	3.1	3.2	.8	.8	.4	-1	-1	-2	1.1	.0	-1
Defense	-3.2	2.0	-3.6		-5.6	4.5	4.5	1.0	1.0	.5	.5	.5	-2.0	1.0	.5	.5
Nondefense	3.8	3.0	2.3		1.6	1.2	1.3	.5	.5	.3	-9	-9	2.5	1.2	-7	-8
State & local	-2.5	-2	1.0		-1.3	2.0	1.6	1.6	1.6	.8	.8	.8	.4	.9	.8	.9
Change in priv. inventories ²	-9	7	50		46	42	39	34	34	30	29	28	22	40	29	22
<i>Previous Tealbook</i> ²	-9	7	46		48	46	43	37	37	36	35	33	21	44	34	15

1. Change from fourth quarter of previous year to fourth quarter of year indicated.

2. Billions of chained (2009) dollars.

Changes in Real Gross Domestic Product and Related Items
(Change from fourth quarter of previous year to fourth quarter of year indicated, unless otherwise noted)

Item	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Real GDP	2.7	1.7	1.3	2.7	2.5	1.9	2.0	2.1	2.2	1.8
<i>Previous Tealbook</i>	2.7	1.7	1.3	2.7	2.5	1.9	1.9	2.0	2.2	1.9
Final sales	2.0	1.5	1.7	2.0	2.7	2.0	2.0	2.1	2.2	1.9
<i>Previous Tealbook</i>	2.0	1.5	1.7	2.0	2.7	2.0	1.9	2.0	2.2	2.0
Priv. dom. final purch.	3.5	2.6	2.3	2.6	3.8	2.7	2.5	2.7	2.9	2.4
<i>Previous Tealbook</i>	3.5	2.6	2.3	2.6	3.8	2.7	2.5	2.7	3.0	2.6
Personal cons. expend.	3.1	1.5	1.3	2.0	3.5	2.6	3.1	2.4	2.9	2.5
<i>Previous Tealbook</i>	3.1	1.5	1.3	2.0	3.5	2.6	3.0	2.5	3.0	2.5
Durables	9.3	4.8	7.2	5.2	8.6	5.5	7.9	3.6	4.8	2.0
Nondurables	3.3	.4	.8	2.6	2.8	2.3	2.6	2.8	3.1	2.6
Services	2.0	1.4	.6	1.3	2.9	2.2	2.5	2.0	2.6	2.6
Residential investment	-5.2	6.0	15.7	6.8	6.2	13.1	1.1	4.1	2.7	4.4
<i>Previous Tealbook</i>	-5.2	6.0	15.7	6.8	6.2	13.1	1.1	1.9	4.6	5.5
Nonres. priv. fixed invest.	8.1	9.0	5.2	4.8	5.0	.8	-1	4.2	3.1	1.2
<i>Previous Tealbook</i>	8.1	9.0	5.2	4.8	5.0	.8	.2	4.2	2.9	1.8
Equipment & intangibles	12.0	9.2	5.5	4.5	4.1	3.8	-6	3.0	3.9	1.8
<i>Previous Tealbook</i>	12.0	9.2	5.5	4.5	4.1	3.8	-3	4.4	3.7	2.3
Nonres. structures	-4.0	8.0	4.1	5.8	8.0	-8.8	1.9	8.6	.2	-6
<i>Previous Tealbook</i>	-4.0	8.0	4.1	5.8	8.0	-8.8	1.8	3.6	.3	.0
Net exports ¹	-459	-459	-447	-405	-426	-540	-563	-645	-724	-785
<i>Previous Tealbook</i> ¹	-459	-459	-447	-405	-426	-540	-562	-663	-759	-828
Exports	10.1	4.2	2.2	5.9	3.1	-2.2	1.5	2.6	2.6	2.9
Imports	12.0	3.5	.3	2.5	6.1	2.5	2.6	4.4	4.7	4.2
Gov't. cons. & invest.	-1.1	-3.0	-2.2	-2.8	.3	2.2	.2	1.0	.5	.5
<i>Previous Tealbook</i>	-1.1	-3.0	-2.2	-2.8	.3	2.2	.2	1.1	.7	.7
Federal	3.2	-4.0	-2.1	-6.7	-1.3	1.7	-2	1.1	.0	-1
Defense	2.0	-4.1	-3.9	-7.1	-4.1	.6	-2.0	1.0	.5	.5
Nondefense	5.5	-3.9	1.0	-6.0	3.4	3.4	2.5	1.2	-7	-8
State & local	-4.0	-2.3	-2.3	-1	1.3	2.5	.4	.9	.8	.9
Change in priv. inventories ¹	58	38	55	79	58	84	22	40	29	22
<i>Previous Tealbook</i> ¹	58	38	55	79	58	84	21	44	34	15

1. Billions of chained (2009) dollars.

Contributions to Changes in Real Gross Domestic Product
(Percentage points, annual rate except as noted)

Item	2016				2017				2018				2016 ¹	2017 ¹	2018 ¹	2019 ¹
	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Real GDP <i>Previous Tealbook</i>	1.4	3.5	2.1		.9	2.6	2.2	2.6	2.6	2.0	2.0	2.1	2.0	2.1	2.2	1.8
	1.4	3.5	1.9		1.4	2.1	2.1	2.3	2.3	2.4	2.1	2.1	1.9	2.0	2.2	1.9
Final sales <i>Previous Tealbook</i>	2.6	3.0	1.1		.9	2.7	2.3	2.7	2.7	2.7	2.0	2.1	2.0	2.1	2.2	1.9
	2.6	3.0	.9		1.4	2.1	2.1	2.4	2.4	2.5	2.1	2.1	1.9	2.0	2.2	2.0
Priv. dom. final purch. <i>Previous Tealbook</i>	2.7	2.1	2.9		1.5	2.6	2.4	2.7	2.7	3.1	2.3	2.2	2.1	2.3	2.5	2.1
	2.7	2.1	2.6		2.0	2.4	2.3	2.6	2.6	2.9	2.5	2.3	2.1	2.3	2.6	2.2
Personal cons. expend. <i>Previous Tealbook</i>	2.9	2.0	2.4		.4	2.1	2.1	1.9	1.9	2.3	2.0	1.9	2.1	1.6	2.0	1.8
	2.9	2.0	2.1		1.0	2.0	2.0	1.9	1.9	2.4	2.0	1.9	2.0	1.7	2.0	1.8
Durables	.7	.8	.8		-1	.4	.4	.4	.4	.4	.4	.3	.6	.3	.4	.1
Nondurables	.8	-1	.5		.2	.5	.5	.4	.4	.5	.4	.4	.4	.4	.5	.4
Services	1.4	1.3	1.1		.3	1.2	1.2	1.1	1.1	1.4	1.2	1.1	1.2	1.0	1.2	1.2
Residential investment <i>Previous Tealbook</i>	-3	-2	.4		.4	-1	-1	.3	.3	.2	.1	.1	.0	.2	.1	.2
	-3	-2	.3		.3	-1	-1	.2	.2	.1	.2	.2	.0	.1	.2	.2
Nonres. priv. fixed invest. <i>Previous Tealbook</i>	.1	.2	.1		.7	.5	.4	.5	.5	.6	.3	.3	.0	.5	.4	.2
	.1	.2	.2		.7	.5	.4	.5	.5	.4	.4	.4	.0	.5	.4	.2
Equipment & intangibles <i>Previous Tealbook</i>	.2	-1	.2		.2	.2	.2	.5	.5	.6	.3	.3	-1	.3	.4	.2
	.2	-1	.3		.5	.3	.3	.5	.5	.4	.4	.4	.0	.4	.4	.2
Nonres. structures <i>Previous Tealbook</i>	-1	.3	-1		.4	.3	.1	.0	.0	.0	.0	.0	.0	.2	.0	.0
	-1	.3	-1		.2	.1	.1	.0	.0	.0	.0	.0	.0	.1	.0	.0
Net exports <i>Previous Tealbook</i>	.2	.9	-1.8		-3	-3	-5	-3	-3	-5	-5	-4	-2	-3	-4	-3
	.2	.9	-1.7		-6	-6	-5	-4	-4	-6	-6	-4	-2	-5	-5	-3
Exports	.2	1.2	-6		.6	.2	.2	.3	.3	.3	.3	.3	.2	.3	.3	.3
Imports	.0	-3	-1.3		-9	-5	-7	-5	-5	-8	-8	-7	-4	-7	-7	-6
Gov't. cons. & invest. <i>Previous Tealbook</i>	-3	.1	.0		-3	.4	.4	.2	.2	.1	.1	.1	.0	.2	.1	.1
	-3	.1	.0		-1	.3	.3	.2	.2	.1	.1	.1	.0	.2	.1	.1
Federal	.0	.2	-1		-2	.2	.2	.1	.1	.0	.0	.0	.0	.1	.0	.0
Defense	-1	.1	-1		-2	.2	.2	.0	.0	.0	.0	.0	-1	.0	.0	.0
Nondefense	.1	.1	.1		.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	.0	.0
State & local	-3	.0	.1		-1	.2	.2	.2	.2	.1	.1	.1	.0	.1	.1	.1
Change in priv. inventories <i>Previous Tealbook</i>	-1.2	.5	1.0		.0	-1	-1	-1	-1	-1	.0	.0	.0	-1	.0	-1
	-1.2	.5	.9		.0	.0	.0	-1	-1	.0	.0	-1	.0	-1	.0	-1

1. Change from fourth quarter of previous year to fourth quarter of year indicated.

Changes in Prices and Costs
(Percent, annual rate except as noted)

Item	2016				2017				2018				2016 ¹	2017 ¹	2018 ¹	2019 ¹
	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
GDP chain-wt. price index <i>Previous Tealbook</i>	2.3	1.4	2.1		2.4	1.3	1.8	1.8	2.1	2.0	2.0	2.0	1.6	1.8	2.0	2.1
PCE chain-wt. price index <i>Previous Tealbook</i>	2.3	1.4	2.0		2.8	1.6	1.7	1.7	2.0	2.0	1.9	1.9	1.6	1.9	2.0	2.1
Energy <i>Previous Tealbook</i>	2.0	1.5	2.0		2.4	1.2	1.6	1.6	1.9	1.8	1.8	1.8	1.4	1.7	1.8	1.9
Food <i>Previous Tealbook</i>	2.0	1.5	1.9		2.6	1.4	1.5	1.5	1.8	1.8	1.8	1.8	1.4	1.7	1.8	1.9
Ex. food & energy <i>Previous Tealbook</i>	15.5	2.1	26.3		15.2	-8.5	-4	.8	.6	.4	.0	.3	.8	1.4	.3	.7
Ex. food & energy, market based <i>Previous Tealbook</i>	15.5	2.1	26.1		16.0	-7.1	-8	-6	.0	.4	.1	.4	.8	1.5	.2	.6
CPI <i>Previous Tealbook</i>	-1.8	-2.1	-1.2		.4	2.3	1.9	2.0	2.2	2.1	2.1	2.2	-1.7	1.7	2.1	2.2
Ex. food & energy <i>Previous Tealbook</i>	-1.8	-2.1	-1.2		.0	2.0	2.3	2.0	2.2	2.1	2.1	2.2	-1.7	1.6	2.1	2.2
Ex. food & energy <i>Previous Tealbook</i>	1.8	1.7	1.3		2.0	1.6	1.7	1.6	1.9	1.9	1.9	1.9	1.7	1.7	1.9	2.0
Ex. food & energy, market based <i>Previous Tealbook</i>	1.8	1.7	1.2		2.3	1.7	1.6	1.5	1.9	1.9	1.8	1.8	1.7	1.8	1.9	2.0
CPI <i>Previous Tealbook</i>	1.6	1.6	1.3		2.0	1.4	1.5	1.5	1.8	1.8	1.8	1.8	1.5	1.6	1.8	1.9
Ex. food & energy <i>Previous Tealbook</i>	1.6	1.6	1.2		2.3	1.6	1.5	1.4	1.8	1.8	1.8	1.8	1.5	1.7	1.8	1.9
ECI, hourly compensation ² <i>Previous Tealbook</i>	2.3	1.8	3.0		3.1	1.3	2.1	2.2	2.3	2.3	2.2	2.3	1.8	2.2	2.3	2.4
Business sector Output per hour <i>Previous Tealbook</i>	2.3	1.8	3.0		3.6	1.7	2.1	2.0	2.2	2.3	2.2	2.3	1.8	2.4	2.3	2.4
Compensation per hour <i>Previous Tealbook</i>	2.1	2.1	2.0		2.5	1.9	2.3	2.2	2.4	2.4	2.4	2.5	2.2	2.2	2.4	2.5
Unit labor costs <i>Previous Tealbook</i>	2.1	2.1	2.0		2.9	2.3	2.3	2.2	2.4	2.4	2.4	2.4	2.2	2.4	2.4	2.5
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i>	2.3	1.9	1.9		2.5	2.2	2.2	2.2	2.3	2.4	2.4	2.4	2.2	2.3	2.4	2.5
Business sector Output per hour <i>Previous Tealbook</i>	-3	3.7	2.4		-8	1.0	1.4	1.5	.9	.8	.9	.9	1.3	.8	.9	.9
Compensation per hour <i>Previous Tealbook</i>	-4	3.9	2.3		.4	.8	1.0	1.2	.9	.7	.9	1.0	1.3	.9	.9	.9
Unit labor costs <i>Previous Tealbook</i>	5.7	4.3	3.9		1.8	3.3	3.2	3.2	3.3	3.4	3.4	3.4	3.2	2.9	3.3	3.4
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i>	5.6	4.6	4.3		2.9	3.2	3.0	3.0	3.1	3.2	3.3	3.3	3.3	3.0	3.2	3.4
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i>	6.0	.6	1.5		2.6	2.3	1.8	1.6	2.4	2.5	2.4	2.4	1.9	2.1	2.4	2.5
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i>	6.0	.7	2.0		2.4	2.4	2.0	1.7	2.2	2.4	2.4	2.3	2.0	2.1	2.4	2.5
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i>	.5	2.0	-4		1.1	1.7	1.9	.7	.6	.8	.7	.7	.0	1.3	.7	.7
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i>	.5	2.0	-4		-1	2.0	1.7	1.0	.8	.8	.7	.7	.0	1.2	.8	.7

1. Change from fourth quarter of previous year to fourth quarter of year indicated.

2. Private-industry workers.

3. Core goods imports exclude computers, semiconductors, oil, and natural gas.

Greensheets

Changes in Prices and Costs

(Change from fourth quarter of previous year to fourth quarter of year indicated, unless otherwise noted)

Item	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
GDP chain-wt. price index <i>Previous Tealbook</i>	1.8 1.8	1.9 1.9	1.9 1.9	1.6 1.6	1.5 1.5	1.1 1.1	1.6 1.6	1.8 1.9	2.0 2.0	2.1 2.1
PCE chain-wt. price index <i>Previous Tealbook</i>	1.3 1.3	2.7 2.7	1.8 1.8	1.2 1.2	1.2 1.2	.4 .4	1.4 1.4	1.7 1.7	1.8 1.8	1.9 1.9
Energy <i>Previous Tealbook</i>	6.4 6.4	12.0 12.0	2.3 2.3	-2.5 -2.5	-6.2 -6.2	-15.8 -15.8	.8 .8	1.4 1.5	.3 .2	.7 .6
Food <i>Previous Tealbook</i>	1.3 1.3	5.1 5.1	1.2 1.2	.7 .7	2.7 2.7	.3 .3	-1.7 -1.7	1.7 1.6	2.1 2.1	2.2 2.2
Ex. food & energy <i>Previous Tealbook</i>	1.0 1.0	1.9 1.9	1.8 1.8	1.5 1.5	1.6 1.6	1.4 1.4	1.7 1.7	1.7 1.8	1.9 1.9	2.0 2.0
Ex. food & energy, market based <i>Previous Tealbook</i>	.7 .7	1.9 1.9	1.5 1.5	1.1 1.1	1.2 1.2	1.1 1.1	1.5 1.5	1.6 1.7	1.8 1.8	1.9 1.9
CPI <i>Previous Tealbook</i>	1.2 1.2	3.3 3.3	1.9 1.9	1.2 1.2	1.2 1.2	.4 .4	1.8 1.8	2.2 2.4	2.3 2.3	2.4 2.4
Ex. food & energy <i>Previous Tealbook</i>	.6 .6	2.2 2.2	1.9 1.9	1.7 1.7	1.7 1.7	2.0 2.0	2.2 2.2	2.2 2.4	2.4 2.4	2.5 2.5
ECI, hourly compensation ¹ <i>Previous Tealbook</i> ¹	2.1 2.1	2.2 2.2	1.8 1.8	2.0 2.0	2.3 2.3	1.9 1.9	2.2 2.2	2.3 2.3	2.4 2.4	2.5 2.5
Business sector Output per hour <i>Previous Tealbook</i>	1.6 1.6	-1 .0	-1 -2	1.9 2.0	-1 -1	.5 .5	1.3 1.3	.8 .9	.9 .9	.9 .9
Compensation per hour <i>Previous Tealbook</i>	1.2 1.2	.5 .5	5.9 5.8	-1 .0	2.7 2.7	3.2 3.1	3.2 3.3	2.9 3.0	3.3 3.2	3.4 3.4
Unit labor costs <i>Previous Tealbook</i>	-4 -4	.6 .6	6.0 6.0	-2.0 -2.0	2.8 2.8	2.6 2.6	1.9 2.0	2.1 2.1	2.4 2.4	2.5 2.5
Core goods imports chain-wt. price index ² <i>Previous Tealbook</i> ²	2.3 2.3	4.3 4.3	.1 .1	-1.5 -1.5	.5 .5	-3.3 -3.3	.0 .0	1.3 1.2	.7 .8	.7 .7

1. Private-industry workers.

2. Core goods imports exclude computers, semiconductors, oil, and natural gas.

Other Macroeconomic Indicators

Item	2016				2017				2018				2016 ¹	2017 ¹	2018 ¹	2019 ¹
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4					
	<i>Employment and production</i>	164	239	148	178	180	174	174	174	174	174	169					159	187	176	169	122
Nonfarm payroll employment ²	4.9	4.9	4.7	4.7	4.5	4.5	4.4	4.3	4.2	4.2	4.2	4.1	4.7	4.4	4.1	4.0
Unemployment rate ³	4.9	4.9	4.7	4.7	4.7	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.7	4.6	4.2	4.1
<i>Previous Tealbook³</i>	5.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Natural rate of unemployment ³	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
<i>Previous Tealbook³</i>	59.7	59.8	59.7	60.0	59.9	59.9	59.9	59.9	60.0	59.9	59.9	59.9	59.7	59.9	59.9	59.8
Employment-to-Population Ratio ³	59.8	59.7	59.7	59.6	59.6	59.5	59.5	59.4	59.3	59.3	59.3	59.2	59.7	59.5	59.2	59.0
Employment-to-Population Trend ³	-1	.3	.5	.3	.6	.8	1.0	1.3	1.4	1.5	1.5	1.6	.5	1.0	1.6	1.8
GDP gap ⁴	-1	.3	.4	.4	.5	.7	.9	1.1	1.2	1.4	1.4	1.5	.4	.9	1.5	1.7
<i>Previous Tealbook⁴</i>	-7	.8	.7	1.5	4.6	2.7	1.7	1.7	1.2	.6	.6	1.3	-1	2.6	1.2	.8
Industrial production ⁵	-8	1.7	.4	1.4	2.6	.4	1.0	1.5	1.1	.7	.7	1.3	-1	1.4	1.2	1.0
<i>Previous Tealbook⁵</i>	-1.1	-1	1.7	2.7	1.3	1.3	.8	.7	1.0	.7	.6	.6	.3	1.5	.7	.7
Manufacturing industr. prod. ⁵	-1.1	.4	1.4	2.4	1.2	.2	.6	.8	.9	.8	.8	.8	.2	1.1	.8	.9
<i>Previous Tealbook⁵</i>	75.1	74.9	75.1	75.4	75.6	75.7	75.8	75.8	75.9	76.0	76.0	76.0	75.1	75.8	76.0	76.3
Capacity utilization rate - mfg. ³	74.9	74.9	75.0	75.2	75.2	75.1	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
<i>Previous Tealbook³</i>	1.2	1.1	1.2	1.3	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	1.3	1.4
Housing starts ⁶	17.1	17.5	18.0	17.2	17.1	17.0	16.9	17.0	16.9	16.8	16.8	16.8	17.5	17.0	16.8	16.6
Light motor vehicle sales ⁶	3.7	5.0	4.2	3.3	3.9	4.1	4.4	4.8	4.1	4.0	4.1	4.1	3.5	3.9	4.2	3.9
<i>Income and saving</i>	2.9	2.9	2.0	1.7	2.3	2.4	1.8	8.3	2.4	2.7	2.8	2.8	2.5	2.1	4.0	2.1
Nominal GDP ⁵	2.9	2.9	2.0	.9	2.2	2.3	2.0	8.4	2.4	2.8	2.9	2.9	2.5	1.9	4.1	2.3
Real disposable pers. income ⁵	5.9	5.9	5.5	5.7	5.5	5.4	5.2	6.3	6.2	6.1	6.1	6.1	5.5	5.2	6.1	5.7
<i>Previous Tealbook⁵</i>	5.9	5.9	5.6	5.5	5.3	5.1	5.0	6.1	5.9	6.0	6.0	6.0	5.6	5.0	6.0	5.7
Personal saving rate ³	-2.4	25.4	2.1	-7.5	.8	.5	.4	2.7	2.3	2.4	2.5	2.5	9.3	-1.5	2.5	2.3
<i>Corporate profits⁷</i>	10.8	11.3	11.2	11.0	10.9	10.8	10.7	10.7	10.6	10.6	10.6	10.6	11.2	10.7	10.6	10.4
Profit share of GNP ³	18.2	18.6	18.3	18.4	18.5	18.3	18.1	17.9	17.9	17.8	17.7	17.7	18.3	18.1	17.7	17.2
Gross national saving rate ³	3.1	3.7	3.5	3.6	3.8	3.5	3.4	3.2	3.1	3.0	2.9	2.9	3.5	3.4	2.9	2.2
Net national saving rate ³																

1. Change from fourth quarter of previous year to fourth quarter of year indicated, unless otherwise indicated.

2. Average monthly change, thousands.

3. Percent; annual values are for the fourth quarter of the year indicated.

4. Percent difference between actual and potential GDP; a negative number indicates that the economy is operating below potential.

5. Annual values are for the fourth quarter of the year indicated.

6. Level, millions; annual values are annual averages.

7. Percent change, annual rate, with inventory valuation and capital consumption adjustments.

Greensheets

Other Macroeconomic Indicators

(Change from fourth quarter of previous year to fourth quarter of year indicated, unless otherwise noted)

Item	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<i>Employment and production</i>										
Nonfarm payroll employment ¹	88	174	179	192	250	226	187	176	169	122
Unemployment rate ²	9.5	8.7	7.8	7.0	5.7	5.0	4.7	4.4	4.1	4.0
<i>Previous Tealbook²</i>	9.5	8.7	7.8	7.0	5.7	5.0	4.7	4.6	4.2	4.1
Natural rate of unemployment ²	5.9	5.9	5.6	5.4	5.1	5.0	4.9	4.9	4.9	4.9
<i>Previous Tealbook²</i>	5.9	5.9	5.6	5.4	5.1	5.0	5.0	5.0	5.0	5.0
Employment-to-Population Ratio ²	58.3	58.5	58.7	58.5	59.2	59.4	59.7	59.9	59.9	59.8
Employment-to-Population Trend ²	61.1	60.7	60.3	60.2	60.1	59.9	59.7	59.5	59.2	59.0
GDP gap ³	-4.2	-3.7	-3.7	-2.5	-9	0	5	1.0	1.6	1.8
<i>Previous Tealbook³</i>	-4.2	-3.7	-3.7	-2.5	-9	0	4	9	1.5	1.7
Industrial production ⁴	6.0	2.8	2.3	2.2	3.4	-2.7	-1	2.6	1.2	.8
<i>Previous Tealbook⁴</i>	5.9	2.6	2.3	2.0	3.5	-1.6	-1	1.4	1.2	1.0
Manufacturing industr. prod. ⁴	5.9	2.5	1.7	.9	1.5	-6	.3	1.5	.7	.7
<i>Previous Tealbook⁴</i>	5.9	2.5	1.7	.8	2.0	0	.2	1.1	.8	.9
Capacity utilization rate - mfg. ²	72.3	74.4	74.6	74.7	75.9	75.4	75.1	75.8	76.0	76.3
<i>Previous Tealbook²</i>	72.4	74.4	74.3	74.6	76.0	75.4	75.0	75.0	75.0	75.0
Housing starts ⁵	.6	.6	.8	.9	1.0	1.1	1.2	1.3	1.3	1.4
Light motor vehicle sales ⁵	11.6	12.7	14.4	15.5	16.5	17.4	17.5	17.0	16.8	16.6
<i>Income and saving</i>										
Nominal GDP ⁴	4.6	3.6	3.2	4.3	4.1	3.0	3.5	3.9	4.2	3.9
Real disposable pers. income ⁴	2.6	1.7	5.1	-2.8	4.5	3.0	2.5	2.1	4.0	2.1
<i>Previous Tealbook⁴</i>	2.6	1.7	5.1	-2.8	4.5	3.0	2.5	1.9	4.1	2.3
Personal saving rate ²	5.5	5.8	9.2	4.7	5.6	6.0	5.5	5.2	6.1	5.7
<i>Previous Tealbook²</i>	5.5	5.8	9.2	4.7	5.6	6.0	5.6	5.0	6.0	5.7
Corporate profits ⁶	18.0	6.8	.6	4.7	6.6	-11.2	9.3	-1.5	2.5	2.3
Profit share of GNP ²	12.0	12.3	12.0	12.0	12.4	10.7	11.2	10.7	10.6	10.4
Gross national saving rate ²	15.2	16.1	18.0	18.2	19.2	18.8	18.3	18.1	17.7	17.2
Net national saving rate ²	-3	.8	2.9	3.1	4.3	3.9	3.5	3.4	2.9	2.2

1. Average monthly change, thousands.

2. Percent; values are for the fourth quarter of the year indicated.

3. Percent difference between actual and potential GDP; a negative number indicates that the economy is operating below potential. Values are for the fourth quarter of the year indicated.

4. Percent change.

5. Level, millions; values are annual averages.

6. Percent change, with inventory valuation and capital consumption adjustments.

Staff Projections of Federal Sector Accounts and Related Items
(Billions of dollars except as noted)

Item	Fiscal year				2016				2017				2018			
	2016	2017	2018	2019	Q1 ^a	Q2 ^a	Q3 ^a	Q4 ^a	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
					Not seasonally adjusted											
Unified budget					Not seasonally adjusted											
Receipts	3,267	3,410	3,427	3,585	711	993	798	741	732	1,103	834	793	691	1,122	822	802
Outlays	3,852	3,940	4,104	4,383	956	932	984	951	1,049	967	973	997	1,115	1,026	967	1,106
Surplus/deficit	-586	-530	-677	-798	-245	61	-186	-210	-317	136	-138	-204	-424	96	-145	-304
<i>Previous Tealbook</i>	-587	-554	-673	-817	-245	61	-186	-208	-329	112	-129	-202	-393	61	-138	-309
Means of financing:					Not seasonally adjusted											
Borrowing	1,052	240	924	926	251	8	241	259	-68	-13	62	302	488	-49	183	339
Cash decrease	-155	289	-127	-8	20	-50	10	-46	419	-104	20	-68	-34	-17	-8	-4
Other ¹	-311	1	-120	-120	-25	-18	-65	-5	-33	-18	56	-30	-30	-30	-30	-30
Cash operating balance, end of period	353	64	192	199	314	364	353	399	-19	84	64	132	166	183	192	196
NIPA federal sector					Seasonally adjusted annual rates											
Receipts	3,495	3,585	3,614	3,737	3,442	3,485	3,537	3,561	3,564	3,594	3,620	3,668	3,553	3,602	3,634	3,674
Expenditures	4,124	4,269	4,495	4,775	4,111	4,137	4,189	4,215	4,270	4,262	4,329	4,373	4,478	4,529	4,600	4,668
Consumption expenditures	974	995	1,020	1,033	969	975	985	984	990	999	1,008	1,013	1,020	1,023	1,025	1,027
Defense	589	590	604	613	587	586	591	586	586	592	597	599	604	605	607	608
Nondefense	386	405	417	420	382	389	394	397	404	408	411	414	416	417	419	419
Other spending	3,150	3,274	3,475	3,742	3,142	3,163	3,204	3,232	3,280	3,263	3,321	3,360	3,458	3,507	3,574	3,640
Current account surplus	-629	-684	-881	-1,038	-668	-652	-652	-655	-706	-668	-709	-705	-924	-928	-965	-994
Gross investment	266	271	281	287	265	265	267	269	267	272	277	278	280	282	283	284
Gross saving less gross investment ²	-623	-683	-887	-1,049	-662	-646	-647	-652	-700	-667	-713	-709	-931	-935	-973	-1,003
Fiscal indicators																
High-employment (HEB) surplus/deficit ³	-636.7	-728.1	-981.1	-1,180.6	-670.2	-657.4	-671.5	-689.3	-731.4	-716.7	-775.0	-784.7	-1,018.4	-1,035.7	-1,085.8	-1,128.3
Change in HEB, percent of potential GDP	.4	.4	1.2	.8	.7	-1	.0	.1	.2	-1	.3	.0	1.2	.0	.2	.2
Fiscal impetus (FI), percent of GDP ⁴	.2	.3	.4	.3	.5	-1	.3	.2	-2	.5	.5	.3	.7	.3	.3	.3
<i>Previous Tealbook</i>	.2	.3	.4	.3	.5	-1	.3	.2	.0	.4	.4	.3	.8	.3	.3	.3
Federal purchases	.0	.1	.0	.0	-1	.0	.2	-1	-2	.2	.2	.1	.0	.0	.0	.0
State and local purchases	.0	.1	.1	.1	.4	-3	.0	.1	-1	.2	.2	.2	.1	.1	.1	.1
Taxes and transfers	.2	.1	.3	.2	.2	.2	.2	.2	.1	.1	.1	.1	.6	.2	.2	.2

1. Other means of financing include checks issued less checks paid, accrued items, and changes in other financial assets and liabilities.
 2. Gross saving is the current account surplus plus consumption of fixed capital of the general government as well as government enterprises.
 3. HEB is gross saving less gross investment (NIPA) of the federal government in current dollars, with cyclically sensitive receipts and outlays adjusted to the staff's measure of potential output and the natural rate of unemployment. The sign on Change in HEB, as a percent of nominal potential GDP, is reversed. Quarterly figures for change in HEB are not at annual rates.
 4. Fiscal impetus measures the contribution to growth of real GDP from fiscal policy actions at the general government level (excluding multiplier effects). It equals the sum of the direct contributions to real GDP growth from changes in federal purchases and state and local purchases, plus the estimated contribution from real consumption and investment that is induced by discretionary policy changes in transfers and taxes.
 a. Actual.

Foreign Real GDP and Consumer Prices: Selected Countries
(Quarterly percent changes at an annual rate)

Measure and country	2016				2017				Projected			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Real GDP¹												
Total foreign	2.4	1.4	3.1	2.8	2.9	2.7	2.5	2.5	2.6	2.6	2.6	2.6
<i>Previous Tealbook</i>	2.4	1.4	3.1	2.7	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6
Advanced foreign economies	2.3	.5	2.4	2.3	2.4	2.0	1.8	1.8	1.8	1.8	1.7	1.7
Canada	2.7	-1.2	3.8	2.6	3.0	2.3	1.9	1.9	1.9	1.9	1.8	1.8
Japan	1.9	2.2	1.2	1.2	1.3	1.3	1.1	1.0	1.0	.9	.8	.9
United Kingdom	.6	2.4	2.0	2.7	2.0	1.9	1.9	1.7	1.6	1.6	1.6	1.6
Euro area	2.2	1.3	1.7	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Germany	2.9	1.9	.5	1.7	2.2	2.0	1.8	1.8	1.7	1.6	1.6	1.6
Emerging market economies	2.5	2.3	3.7	3.3	3.4	3.3	3.2	3.3	3.3	3.3	3.4	3.4
Asia	4.4	5.2	4.9	4.7	5.2	5.0	4.6	4.5	4.5	4.5	4.5	4.5
Korea	2.0	3.7	1.9	2.0	2.9	3.2	3.1	3.0	3.0	3.0	3.0	3.0
China	6.6	7.1	6.8	6.6	7.1	6.6	6.1	6.0	5.9	5.9	5.8	5.8
Latin America	.8	-5	3.0	1.8	1.9	1.9	2.1	2.2	2.3	2.4	2.4	2.4
Mexico	1.9	.3	4.4	2.9	1.9	1.8	2.2	2.3	2.3	2.3	2.4	2.5
Brazil	-2.4	-1.3	-2.9	-3.4	2.5	2.3	2.0	2.0	2.1	2.1	2.1	2.1
Consumer prices²												
Total foreign	1.4	2.0	1.6	2.6	3.0	2.4	2.4	2.4	2.4	2.4	2.4	2.5
<i>Previous Tealbook</i>	1.4	2.1	1.6	2.6	3.6	2.6	2.5	2.4	2.4	2.5	2.5	2.5
Advanced foreign economies	-3	1.1	.9	1.8	2.5	1.4	1.4	1.4	1.5	1.5	1.6	1.6
Canada	.5	2.2	1.0	1.7	2.9	2.0	1.8	1.7	1.8	1.9	1.9	1.9
Japan	-3	-4	-5	2.4	.0	.4	.6	.8	1.0	1.1	1.2	1.3
United Kingdom	.2	.7	2.0	2.0	4.0	2.8	2.5	2.3	2.2	2.2	2.1	2.1
Euro area	-1.1	1.1	1.2	1.9	3.0	1.3	1.3	1.4	1.4	1.4	1.5	1.5
Germany	-1.2	1.1	1.3	3.0	2.2	1.5	1.6	1.7	1.7	1.8	1.9	2.0
Emerging market economies	2.7	2.7	2.2	3.1	3.4	3.0	3.2	3.1	3.1	3.1	3.1	3.1
Asia	2.0	2.3	1.2	2.6	.9	2.0	2.7	2.7	2.8	2.8	2.8	2.8
Korea	.5	1.0	.4	4.0	2.9	2.6	2.4	2.4	2.8	3.0	3.0	3.0
China	2.5	2.3	1.3	2.6	-6	1.5	2.5	2.5	2.5	2.5	2.5	2.5
Latin America	4.3	3.9	4.5	4.5	9.8	5.5	4.4	4.1	3.9	3.8	3.7	3.7
Mexico	2.8	2.4	3.6	4.1	9.9	5.0	3.8	3.4	3.2	3.2	3.2	3.2
Brazil	11.8	7.5	6.5	2.6	3.2	4.3	4.9	4.9	4.6	4.4	4.4	4.4

¹ Foreign GDP aggregates calculated using shares of U.S. exports.

² Foreign CPI aggregates calculated using shares of U.S. non-oil imports.

Foreign Real GDP and Consumer Prices: Selected Countries
(Percent change, Q4 to Q4)

Measure and country	-----Projected-----									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Real GDP¹										
Total foreign	3.2	2.3	2.9	2.6	2.0	2.4	2.6	2.6	2.6	2.6
<i>Previous Tealbook</i>	3.2	2.3	2.9	2.5	2.0	2.4	2.5	2.6	2.6	2.6
Advanced foreign economies	1.8	.3	2.4	1.8	1.2	1.9	2.0	1.8	1.7	1.7
Canada	3.1	.7	3.6	2.2	.4	1.9	2.3	1.8	1.8	1.8
Japan	.2	.3	2.7	-.3	1.2	1.6	1.2	.9	.1	.1
United Kingdom	1.3	1.3	2.4	3.5	1.7	1.9	1.9	1.6	1.6	1.6
Euro area	.5	-1.1	.7	1.3	2.0	1.8	1.8	1.8	1.8	1.8
Germany	2.4	.2	1.6	1.6	1.3	1.8	1.9	1.6	1.4	1.4
Emerging market economies	4.6	4.3	3.4	3.3	2.7	2.9	3.3	3.4	3.5	3.5
Asia	5.1	5.7	5.4	5.0	4.4	4.8	4.8	4.5	4.4	4.4
Korea	2.9	2.1	3.5	2.8	3.3	2.4	3.0	3.0	2.9	2.9
China	8.7	8.0	7.6	7.1	6.8	6.8	6.5	5.8	5.7	5.7
Latin America	4.1	3.4	1.6	1.9	1.3	1.3	2.0	2.4	2.6	2.6
Mexico	4.2	3.4	1.0	2.6	2.4	2.4	2.1	2.4	2.6	2.6
Brazil	2.7	2.6	2.6	-.3	-5.8	-2.5	2.2	2.1	2.2	2.2
Consumer prices²										
Total foreign	3.4	2.3	2.4	2.0	1.4	1.9	2.6	2.4	2.6	2.6
<i>Previous Tealbook</i>	3.4	2.3	2.4	2.0	1.4	1.9	2.8	2.5	2.6	2.6
Advanced foreign economies	2.2	1.3	1.0	1.2	.5	.9	1.7	1.6	1.9	1.9
Canada	2.7	1.0	1.0	2.0	1.3	1.4	2.1	1.9	2.0	2.0
Japan	-.3	-.2	1.4	2.6	.2	.3	.4	1.1	2.5	2.5
United Kingdom	4.6	2.6	2.1	.9	1.1	1.2	2.9	2.2	2.1	2.1
Euro area	2.9	2.3	.8	1	2	.7	1.7	1.4	1.6	1.6
Germany	2.6	1.9	1.4	.4	.2	1.0	1.7	1.8	2.0	2.0
Emerging market economies	4.3	3.1	3.4	2.7	2.1	2.7	3.2	3.1	3.1	3.1
Asia	4.4	2.6	3.1	1.8	1.5	2.0	2.1	2.8	2.9	2.9
Korea	3.9	1.7	1.1	1.0	.9	1.5	2.6	3.0	3.0	3.0
China	4.6	2.1	2.9	1.5	1.5	2.2	1.5	2.5	2.5	2.5
Latin America	4.1	4.4	4.1	4.8	3.4	4.3	5.9	3.8	3.5	3.5
Mexico	3.5	4.1	3.6	4.2	2.3	3.2	5.5	3.2	3.2	3.2
Brazil	6.7	5.6	5.8	6.5	10.4	7.1	4.3	4.4	4.4	4.4

¹ Foreign GDP aggregates calculated using shares of U.S. exports.

² Foreign CPI aggregates calculated using shares of U.S. non-oil imports.

U.S. Current Account

Quarterly Data

	2016				2017				Projected-----2018			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Billions of dollars, s.a.a.r.</i>												
U.S. current account balance	-532.3	-479.0	-464.0	-449.5	-527.9	-539.1	-562.7	-596.8	-645.2	-658.9	-691.6	-724.2
<i>Previous Tealbook</i>	-531.6	-477.3	-456.0	-528.2	-551.3	-547.0	-583.2	-625.1	-684.5	-699.6	-732.2	-770.0
Current account as percent of GDP	-2.9	-2.6	-2.5	-2.4	-2.8	-2.8	-2.9	-3.0	-3.3	-3.3	-3.4	-3.5
<i>Previous Tealbook</i>	-2.9	-2.6	-2.4	-2.8	-2.9	-2.8	-3.0	-3.2	-3.5	-3.5	-3.6	-3.8
Net goods & services	-504.8	-503.2	-464.9	-529.3	-563.4	-578.3	-600.8	-621.9	-653.4	-661.2	-674.6	-690.9
Investment income, net	146.0	186.5	177.5	257.1	218.5	211.2	216.2	199.2	191.2	174.3	161.1	140.8
Direct, net	218.6	254.5	254.0	343.2	298.5	303.0	324.6	326.5	338.8	343.4	353.0	355.8
Portfolio, net	-72.6	-68.1	-76.5	-86.1	-80.0	-91.7	-108.4	-127.3	-147.6	-169.1	-192.0	-215.0
Other income and transfers, net	-173.4	-162.2	-176.6	-177.3	-183.0	-172.0	-178.1	-174.1	-183.0	-172.0	-178.1	-174.1

Annual Data

	Projected-----2019									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	
<i>Billions of dollars</i>										
U.S. current account balance	-460.4	-446.5	-366.4	-392.1	-463.0	-481.2	-556.6	-680.0	-810.4	
<i>Previous Tealbook</i>	-460.4	-446.5	-366.4	-392.1	-463.0	-498.3	-576.7	-721.6	-850.5	
Current account as percent of GDP	-3.0	-2.8	-2.2	-2.3	-2.6	-2.6	-2.9	-3.4	-3.9	
<i>Previous Tealbook</i>	-3.0	-2.8	-2.2	-2.3	-2.6	-2.7	-3.0	-3.6	-4.1	
Net goods & services	-548.6	-536.8	-461.9	-490.2	-500.4	-500.6	-591.1	-670.0	-725.8	
Investment income, net	229.0	224.4	228.4	234.3	193.4	191.8	211.3	166.8	92.2	
Direct, net	298.6	293.8	296.3	289.0	265.4	267.6	313.1	347.8	364.9	
Portfolio, net	-69.5	-69.4	-67.9	-54.8	-72.0	-75.8	-101.8	-180.9	-272.8	
Other income and transfers, net	-140.8	-134.2	-132.9	-136.1	-156.0	-172.4	-176.8	-176.8	-176.8	

Abbreviations

ABS	asset-backed securities
AFE	advanced foreign economy
AHCA	American Health Care Act
BHC	bank holding company
BOE	Bank of England
BOJ	Bank of Japan
CDS	credit default swaps
C&I	commercial and industrial
CMBS	commercial mortgage-backed securities
CPH	compensation per hour
CPI	consumer price index
CRE	commercial real estate
ECB	European Central Bank
ECI	employment cost index
E&I	equipment and intangibles
EME	emerging market economy
EU	European Union
FOMC	Federal Open Market Committee; also, the Committee
FX	foreign exchange
GDP	gross domestic product
GSE	government-sponsored enterprise
M&A	mergers and acquisitions
MBS	mortgage-backed securities
MMF	money market fund
LFPR	labor force participation rate
NFIB	National Federation of Independent Business
OIS	overnight index swap
ON RRP	overnight reverse repurchase agreement

OPEC	Organization of the Petroleum Exporting Countries
PCE	personal consumption expenditures
PMI	purchasing managers index
PPI	producer price index
QM	qualified mortgage
QS assessment	QS Assessment of Financial Stability
SEP	Summary of Economic Projections
SLOOS	Senior Loan Officer Opinion Survey on Bank Lending Practices
SOMA	System Open Market Account
S&P	Standard & Poor's
TIPS	Treasury Inflation-Protected Securities

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

DIVISION OF RESEARCH AND STATISTICS

Date: May 12, 2017
To: Federal Open Market Committee
From: David Wilcox
Subject: Corrected Probabilities of Returning to the Effective Lower Bound

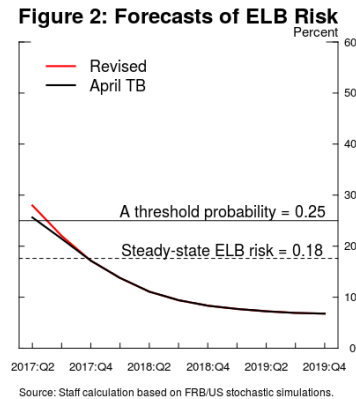
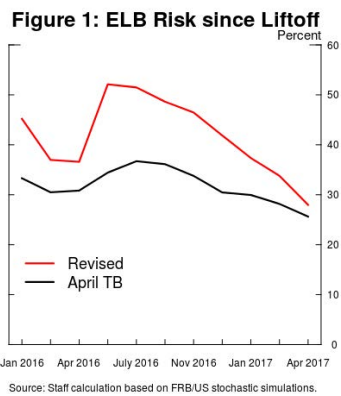
In the Risk and Uncertainty section of the April Tealbook A, the box “A Guidepost for Dropping Effective Lower Bound Risk from the Assessment of Risks” (on pages 68-69) presented calculations of the probability that the federal funds rate would return to the effective lower bound (ELB). The calculations were constructed using stochastic simulations of the FRB/US model around the staff baseline projection and were shown in figures 1 and 2 of the box.

During the process of preparing to show updated versions of these probabilities in subsequent Tealbooks, a small error was found in the code that constructed these calculations. This note provides corrected calculations of the probabilities that had been shown in the box. The red lines in figures 1 and 2 show the correct probabilities, and the black lines show what was in the April Tealbook. In a few places in the text, the correct calculations are shown in red and the incorrect ones are shown in black ~~strikeout~~. Even with these corrections, the main point of the box is unchanged: Given the baseline April forecast, the probability of returning to the ELB will probably be low enough around the third quarter of this year that we will consider dropping it as a factor that contributes importantly to our assessment of a downside skew in the risks for our projection of economic activity.

A Guidepost for Dropping Effective Lower Bound Risk from the Assessment of Risks

The staff has for some time judged that the risks to the projection for real activity are skewed to the downside due to the effective lower bound (ELB) constraint on the federal funds rate. All else being equal, a higher expected path for the federal funds rate lowers the probability that policymakers will be constrained by the ELB in the near future, which reduces downside macroeconomic risks. With the federal funds rate having risen to the range of $\frac{3}{4}$ to 1 percent and expected to rise further going forward, we will face a decision about when to drop the ELB reference from the Tealbook’s assessment of risks. In this discussion, we describe how one specific measure of ELB risk has evolved since liftoff and is expected to evolve in the future. We then lay out one possible way to use this measure to inform our decision on when to drop our reference to the downside economic risk stemming from the ELB.

Figure 1 shows a measure of ELB risk—the probability that the federal funds rate will be at the ELB for at least one quarter during the next three years—computed from 20,000 stochastic simulations of FRB/US around the Tealbook baseline projection using the non-inertial version of the Taylor rule.¹ According to figure 1, the ELB risk measure was above 40 percent throughout most of 2016 but then moved below 40 percent early this year. The ELB risk measure based on the April 2017 Tealbook projection is 28 percent.²



¹ We use the non-inertial Taylor rule to capture the fact that policymakers typically cut interest rates aggressively in the face of a looming recession, even though they often increase interest rates gradually in the aftermath of a recession. In sticky-price models that account for the ELB, this asymmetric behavior is consistent with the prescription of optimal commitment policy and other well-performing rules, such as the price-level targeting rule and the rule proposed in David Reifschneider and John C. Williams (2000), “Three Lessons for Monetary Policy in a Low-Inflation Era,” *Journal of Money, Credit and Banking*, vol. 32 (November), pp. 936–66.

² In the stochastic simulation, many of the ELB episodes are short lived, with the federal funds rate touching the ELB in only one or two quarters. According to the April 2017 Tealbook projection, the probability that the federal funds rate will be at the ELB for at least *four quarters* (not necessarily consecutive) during the next three years is about 10 percent.

Note that ELB risk fluctuated during 2016 even though the actual federal funds rate remained constant in the range of $\frac{1}{4}$ to $\frac{1}{2}$ percent. These movements reflect the fact that the ELB risk measure depends not only on the current federal funds rate, but also on the projected path of the federal funds rate. When the projected path of the federal funds rate becomes flatter (steeper), ELB risk increases (decreases). For example, when the staff reduced its estimate of the long-run equilibrium value of the federal funds rate—the intercept in the Taylor rule—in the June 2016 Tealbook projection, the projected path of the federal funds rate flattened appreciably. As a result, the ELB risk increased, from about ~~37~~ ~~34~~ percent in April 2016 to more than ~~52~~ ~~34~~ percent in June 2016.

Figure 2 shows the projected path of the ELB risk according to the current Tealbook forecast. In this figure, the ELB risk at any given date shows the model-implied probability that the federal funds rate will be at the ELB for at least one quarter during the subsequent three years if the economy has evolved according to the current Tealbook projection up to that time. Because the federal funds rate is expected to rise, ELB risk is expected to decline further from its current level. It declines even below its steady-state value of 18 percent—shown by the dashed line—reflecting the projected overshooting of the federal funds rate above its long-run value of 3 percent.³ Indeed, as a result of the forward-looking nature of the ELB risk measure, the ELB risk is expected to decline below its steady-state value in ~~late 2017~~ ~~early 2018~~, when the federal funds rate is still expected to be substantially below its long-run value of 3 percent.

We plan to consult this ELB risk measure to inform our decision about when to drop the ELB reference in our assessment of risks in the Tealbook. Our provisional plan is to stop highlighting the ELB risk sometime after our measure of ELB risk is below 25 percent. The choice of 25 percent is somewhat arbitrary, and others may see a different threshold level as more appropriate. As can be seen in figure 2, according to the April Tealbook projection, the ELB risk measure is likely to dip below 25 percent for the first time in 2017:Q3, when the federal funds rate is projected to be a little above 1 percent. The date when this measure moves below 25 percent will depend on the actual evolution of the economy as well as the evolution of the staff projection. If the federal funds rate rises more slowly or the staff projection of the funds rate path becomes flatter than anticipated by the current Tealbook projection—possibly because the staff further lowers its estimate of the long-run equilibrium natural rate—the threshold will be breached later than 2017:Q3.

³ The steady-state value of the ELB risk is the model-implied probability that the federal funds rate will be at the ELB for at least one quarter during the next three years, conditional on the economy being at its steady state today. This concept is distinct from the unconditional probability that the federal funds rate is at the ELB. To compute the steady-state ELB risk shown in figure 2, we begin stochastic simulations from a steady state consistent with that shown in the Long-Term Outlook exhibit of the April Tealbook projection.