

Prefatory Note

The attached document represents the most complete and accurate version available based on original files from the FOMC Secretariat at the Board of Governors of the Federal Reserve System.

Please note that some material may have been redacted from this document if that material was received on a confidential basis. Redacted material is indicated by occasional gaps in the text or by gray boxes around non-text content. All redacted passages are exempt from disclosure under applicable provisions of the Freedom of Information Act.

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

June 5, 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

(This page is intentionally blank.)

Domestic Economic Developments and Outlook

The spending and labor market indicators that we have received since the April Tealbook show resource utilization as having continued to tighten thus far this year. The unemployment rate fell to 4.3 percent in May, down 0.4 percentage point from the end of last year. In addition, the payroll employment gain through May exceeded the pace that we think is consistent with no change in labor utilization. Meanwhile, the incoming data on spending and production suggest that real GDP growth will rebound from an annual rate of 1¼ percent in the first quarter to 2½ percent this quarter. On average, the pace of growth over the first half of the year is about ½ percentage point faster than our estimate of potential GDP growth.

Although the case seems strong that utilization has been tightening, it is a closer call as to whether that tightening has proceeded more quickly than we expected in the April Tealbook. On the one hand, the unemployment rate in May was 0.2 percentage point lower than in our previous forecast, while the projected level of real GDP in the second quarter is a touch higher. On the other hand, the recent pace of payroll employment growth has been weaker than we had anticipated. Moreover, recent monthly readings on PCE price inflation have been soft.

In particular, the April reading on PCE price inflation surprised us slightly to the downside, as we had expected a larger bounceback following the very low March value. Total PCE prices rose 1.7 percent in the 12 months through April, while core prices rose 1.5 percent, 0.1 percentage point softer than expected in the previous Tealbook. We continue to view the recent soft readings as importantly reflecting idiosyncratic and transitory factors and, therefore, as telling us relatively little about the degree of tightness in the real economy. On balance, in light of the lower unemployment rate and slightly higher level of real GDP, we judge that resource utilization in the second quarter is a little tighter than we had thought in April.

We now project that real GDP growth over 2017 as a whole will average almost 2½ percent, ¼ percentage point above the April Tealbook forecast. GDP growth is forecast to slow to 2¼ percent in 2018 and to 1¾ percent in 2019, as the stimulus from the fiscal expansion that we continue to assume will occur is offset by the ongoing

Comparing the Staff Projection with Other Forecasts

The staff's projection for real GDP growth is above the projections from both the Survey of Professional Forecasters (SPF) and the Blue Chip consensus forecast in 2017 and below the Blue Chip consensus in 2018. The staff's unemployment rate forecast is lower than both outside forecasts. The staff's projection for CPI inflation 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 noticeably below the SPF forecasts in 2017 but are in line with the SPF forecasts in 2018.

Comparison of Tealbook and Outside Forecasts

	2017	2018
GDP (Q4/Q4 percent change)		
June Tealbook	2.4	2.2
Blue Chip (5/10/17)	2.1	2.4
SPF median (5/12/17)	2.2	n.a.
Unemployment rate (Q4 level)		
June Tealbook	4.2	3.9
Blue Chip (5/10/17)	4.4	4.2
SPF median (5/12/17)	4.4	n.a.
CPI inflation (Q4/Q4 percent change)		
June Tealbook	1.9	2.3
Blue Chip (5/10/17)	2.2	2.3
SPF median (5/12/17)	2.3	2.3
PCE price inflation (Q4/Q4 percent change)		
June Tealbook	1.6	1.9
SPF median (5/12/17)	2.0	2.0
Core PCE price inflation (Q4/Q4 percent change)		
June Tealbook	1.6	1.9
SPF median (5/12/17)	2.0	2.0

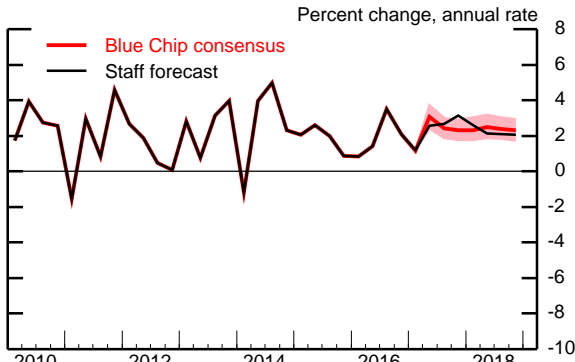
Note: SPF is the Survey of Professional Forecasters, CPI is the consumer price index, and PCE is personal consumption expenditures. Blue Chip does not provide results for PCE price inflation. The Blue Chip consensus forecast includes input from about 50 panelists, and the SPF about 40. Roughly 20 panelists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

n.a. Not available.

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

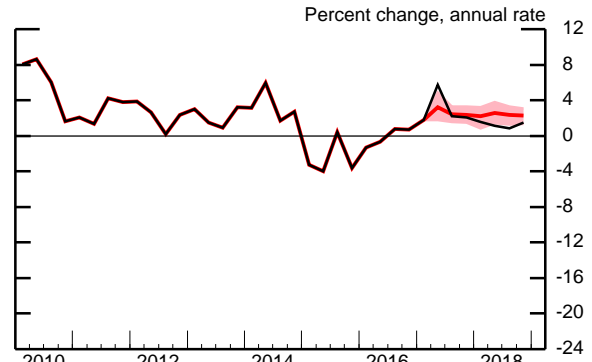
Tealbook Forecast Compared with Blue Chip (Blue Chip survey released May 10, 2017)

Real GDP

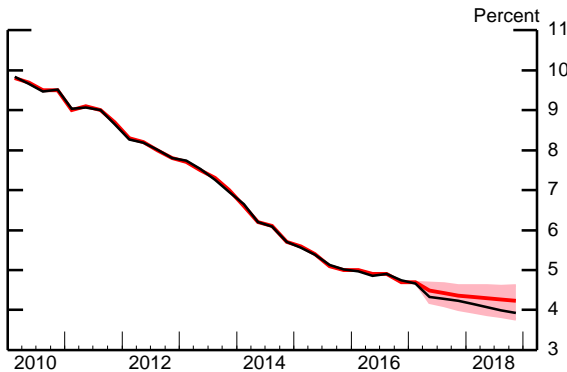


Note: The shaded area represents the area between the Blue Chip top 10 and bottom 10 averages.

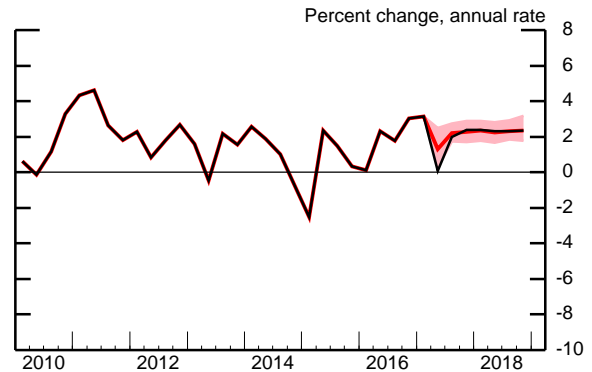
Industrial Production



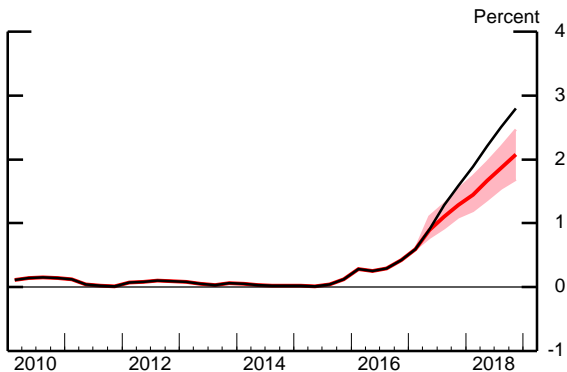
Unemployment Rate



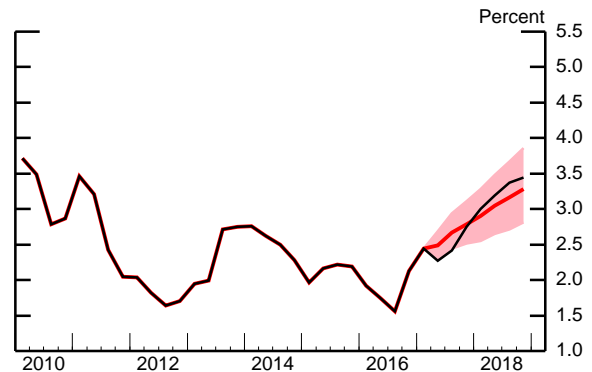
Consumer Price Index



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.

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

Revisions to the Staff Projection since the Previous SEP

The FOMC most recently published its Summary of Economic Projections, or SEP, following the March FOMC meeting. The table below compares the staff's current economic projection with the one we presented in the March Tealbook.

Since March, we have revised up our projection for the increase in real GDP in 2017 by about ½ percentage point. Our forecast for real GDP growth in 2018 and 2019 is unrevised. With faster GDP growth, on net, over the projection period, the unemployment rate falls by more than in the March forecast and reaches 3.8 percent at the end of 2019, which is 1.1 percentage points below the staff's downwardly revised estimate of the longer-run natural rate.

The available data on consumer price inflation for March and April were weak, but we view these readings as importantly reflecting idiosyncratic and transitory factors. As a result, the forecast for core PCE price inflation is marked down this year but is unrevised thereafter. Total PCE inflation is expected to move up modestly over the next couple of years and to reach 2 percent in 2019, 0.1 percentage point higher than in the March forecast.

With the outlook for the GDP gap somewhat tighter, the federal funds rate path from the intercept-adjusted inertial Taylor (1999) rule that we use in our baseline forecast is above that in the March Tealbook through most of the projection period.

Staff Economic Projections Compared with the March Tealbook

Variable	2016	2017		2017	2018	2019	Longer run
		H1	H2				
Real GDP ¹	2.0	1.9	2.9	2.4	2.2	1.8	1.7
March Tealbook	1.9	1.7	2.2	2.0	2.2	1.9	1.7
Unemployment rate ²	4.7	4.3	4.2	4.2	3.9	3.8	4.9
March Tealbook	4.7	4.7	4.6	4.6	4.2	4.1	5.0
PCE inflation ¹	1.4	1.4	1.7	1.6	1.9	2.0	2.0
March Tealbook	1.4	2.0	1.5	1.7	1.8	1.9	2.0
Core PCE inflation ¹	1.7	1.6	1.7	1.6	1.9	2.0	n.a.
March Tealbook	1.7	2.0	1.5	1.8	1.9	2.0	n.a.
Federal funds rate ²	.45	.92	1.48	1.48	2.70	3.67	3.00
March Tealbook	.45	.94	1.45	1.45	2.46	3.36	3.00
Memo:							
Federal funds rate, end of period	.63	.94	1.51	1.51	2.73	3.68	3.00
March Tealbook	.63	1.02	1.53	1.53	2.54	3.42	3.00
GDP gap ^{2,3}	.5	.7	1.3	1.3	1.9	2.0	n.a.
March Tealbook	.4	.5	.9	.9	1.5	1.7	n.a.

1. Percent change from final quarter of preceding period to final quarter of period indicated.

2. Percent, final quarter of period indicated.

3. Percent difference between actual and potential. A negative number indicates that the economy is operating below potential.

n.a. Not available.

gradual normalization of monetary policy.¹ With real GDP growth expected to outpace our estimate of potential output growth throughout the medium term, real economic activity further overshoots its sustainable level. As a result, the unemployment rate is projected to be 3.8 percent at the end of 2019, 1.1 percentage points below our estimate of its natural rate, and 0.2 percentage point lower than in the April Tealbook. We now project that the 12-month change in both total and core PCE price inflation will run a little lower through the end of this year than in our previous projection. Beyond this year, though, our inflation forecast is not materially different from the April Tealbook and reaches 2 percent in 2019.

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. But there continues to be considerable uncertainty about the potential size, timing, and composition of any fiscal policy changes—indeed, probably more so than earlier this year.
 - In preparing the current forecast we contemplated delaying the onset or reducing the magnitude of the assumed fiscal expansion. Although we see lower odds of something equivalent to our assumed policy change being enacted, we still view it to be the modal outcome.
- We continue to 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.

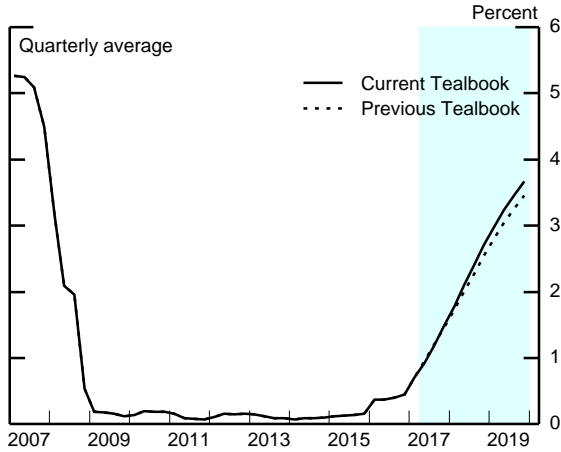
Monetary Policy

- The intercept-adjusted inertial Taylor (1999) rule that we use in our projection calls for the federal funds rate to increase a little more than 1 percentage point per year, on average, over the projection period and to average 3.7 percent in

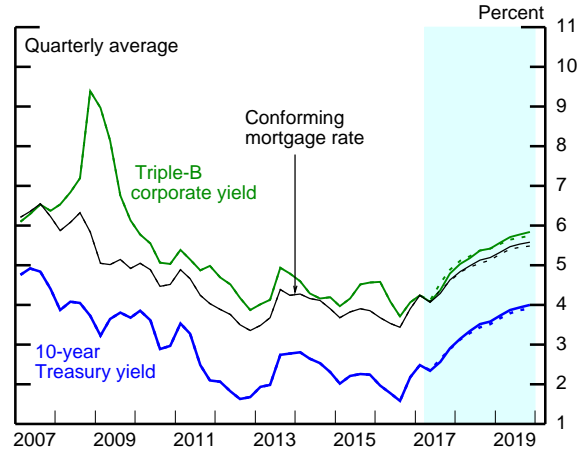
¹ The assumed placeholder for fiscal expansion adds about $\frac{1}{4}$ percentage point to the growth rate of real GDP in both 2018 and 2019.

Key Background Factors underlying the Baseline Staff Projection

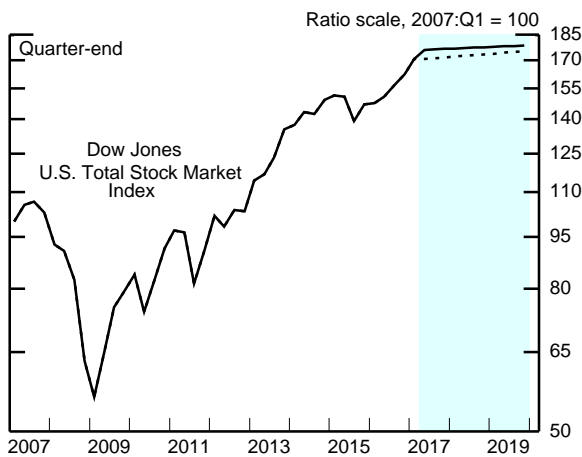
Federal Funds Rate



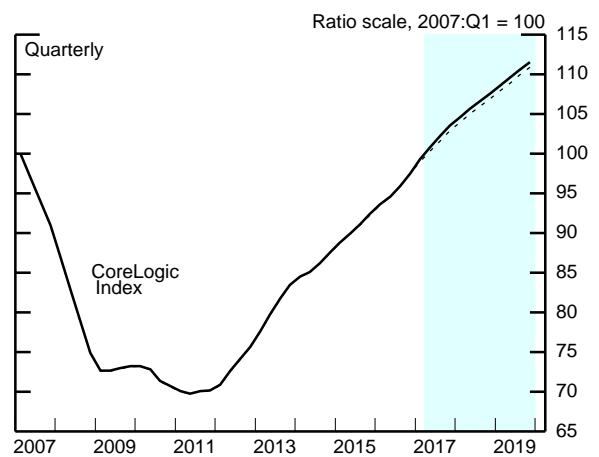
Long-Term Interest Rates



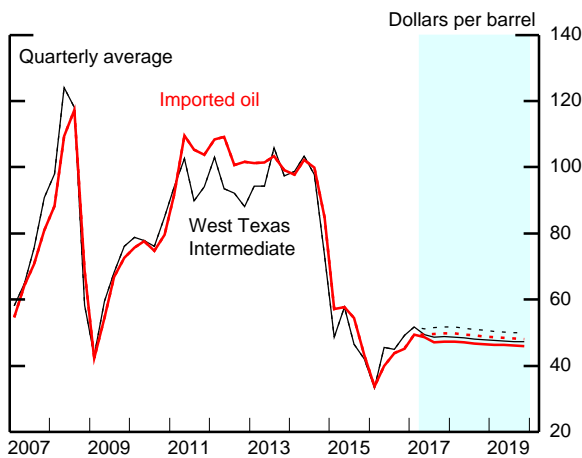
Equity Prices



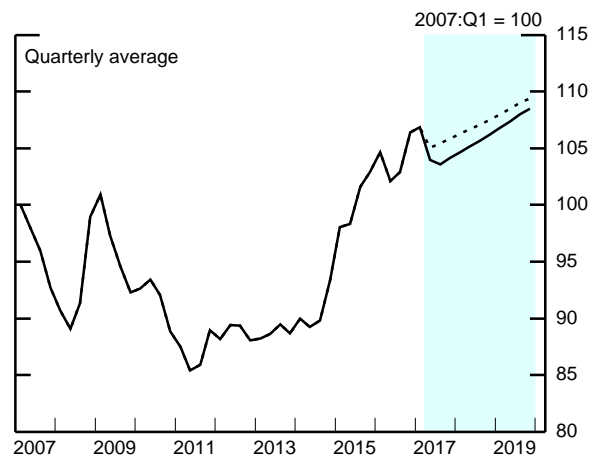
House Prices



Crude Oil Prices



Broad Real Dollar



the fourth quarter of 2019. This path is a bit steeper than in the April Tealbook, reflecting the slightly tighter economy we are projecting.

- The SOMA portfolio remains at its current level until the third quarter of 2017 and then begins a gradual and predictable decline as reinvestments from principal repayments on securities held in the portfolio are phased out.

Other Interest Rates

- The 10-year Treasury yield is projected to rise significantly over the medium term from an average of 2.3 percent in the current quarter to 4.0 percent by the end of 2019. In line with the slightly steeper trajectory for the federal funds rate, the yield at the end of 2019 is a bit higher than in our April forecast and modestly above its assumed longer-run value of 3.5 percent.
- The path of 30-year fixed mortgage rates was revised mostly in line with the path for the 10-year Treasury yield. However, we lowered our projection for the triple-B corporate bond spread by 5 to 10 basis points in both 2017 and 2018 in response to the persistently lower-than-projected spread over the past few quarters.

Equity Prices and Home Prices

- Equity prices have risen about 3¾ percent since the April Tealbook, whereas we had projected stock prices to be about flat. Nevertheless, in our view, notable valuation pressures will limit the scope for further stock price appreciation over the medium term. Accordingly, equity prices are projected to rise at an average annual rate of only ½ percent from here forward, a tad less than in the April Tealbook. (For a discussion of the rationale behind the staff’s forecast of equity prices, see the box “Stock Market Trajectory in the Baseline Forecast.”)
- Incoming data on house prices have been slightly stronger than expected, and we have nudged up our forecast for house price appreciation this year to around 6 percent. We judge that the ratio of house prices to rents is marginally above its long-run trend. To reflect this consideration, we project the growth in home values to slow to around 4 percent in 2018 and 2019, a pace that would stabilize house prices relative to rents.

Stock Market Trajectory in the Baseline Forecast

The most recent QS report highlighted valuation pressures across a range of assets, including U.S. equities, where price-to-earnings ratios have reached extraordinarily high levels not seen since the bursting of the tech stock bubble in the early 2000s. Valuation of equities relative to government bonds, as gauged by the staff's estimate of the expected equity premium, is also higher than average (that is, the equity premium is low), although not near historical extremes. Moreover, in recent Tealbooks we have been projecting that the equity premium (the shaded area in figure 1) will further narrow toward historically low levels on the expectation that equity prices will remain resilient even as interest rates increase. In light of these valuation concerns, we contemplated adopting a new baseline stock market path in which stock prices would *decline* 5 to 10 percent by the end of 2018 relative to their current level. Notwithstanding the valuation pressures noted previously, we decided against such a change for the following reasons.

Importantly, the recent forecasts already had stock prices rising at a historically very slow pace, about 1 percent per year in nominal terms. Including dividends, this pace would imply annual returns on stocks of about 3 percent. This return is well below average historical equity returns and reflects the staff's view that currently elevated valuation pressures are likely to weigh heavily on equity returns in the medium term.

Standard asset pricing models imply that investors must be expecting to earn some, even if small, premium on stocks over a two-year period relative to the risk-free (nominal) return on a two-year Treasury bond. To rationalize a decline in stock prices over the next two years, we would have to adopt one of two arguments, neither of which we currently find very compelling.

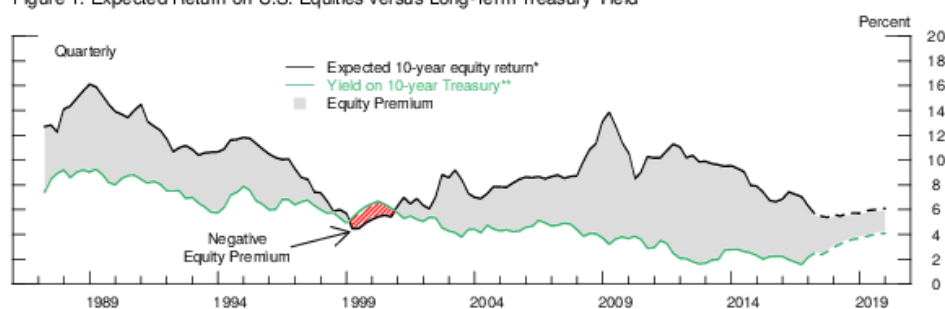
The first possible argument would be that the Tealbook forecast and narrative embed a substantial negative surprise to markets and investors, such as disappointing (after-tax) corporate earnings, increased downside risk to economic conditions, or higher-than-expected interest rates. But the baseline forecast anticipates steady, gradual strengthening of the economy over the next two years without a serious inflation threat. Moreover, the rise in long-term Treasury yields embedded in the baseline is not far out of line with market expectations. All of this suggests the staff forecast is broadly consistent with key dimensions of the market's outlook; accordingly, if the staff forecast were to be realized, we do not think that equity investors would be disappointed.

The second possible argument for a stock market decline is an assumption that investors will reassess their exposure to equities in light of continued prevailing high valuations—in effect, an increase in risk aversion triggered by something outside of the staff forecast. With regard to this rationalization, the vast

literature on forecasting stock returns does offer evidence that there is some predictive content of stock valuation measures for subsequent returns, though such tests have less predictive power out of sample.¹ Most predictive regressions, however, would suggest low positive, rather than *negative*, expected returns. An alternative approach involves estimating the probability of a stock market crash or substandard returns. Here, again, recent research and preliminary staff analysis tend to suggest that current stock market valuations would, at best, predicate a fairly modest increase in the odds of substandard future returns, with wide confidence bands.²

Finally, although valuation ratios and equity premium measures do not enable us to predict the timing and extent of stock market corrections with much confidence, these variables are useful in assessing the financial system’s vulnerability to negative shocks. Thus, for now at least, we think it is preferable to signal our concerns regarding valuation pressures through the use of alternative scenarios rather than adjustments to the baseline forecast.

Figure 1: Expected Return on U.S. Equities versus Long-Term Treasury Yield



*Staff estimate using a dividend discount model incorporating staff forecast of corporate profits.

**Off-the-run 10-year Treasury yield.

Note: Dotted lines represent staff forecast. The shaded area represents the equity premium, shown in red when negative.

Source: Staff projection as of May 31, 2017.

¹ See Ivo Welch and Amit Goyal (2008), “A Comprehensive Look at the Empirical Performance of Equity Premium Prediction,” *Review of Financial Studies*, vol. 21 (July), pp. 1455–1508; and Jessica A. Wachter and Missaka Warusawitharana (2015), “What Is the Chance That the Equity Premium Varies over Time? Evidence from Regressions on the Dividend-Price Ratio,” *Journal of Econometrics*, vol. 186 (May), pp. 74–93.

² See William N. Goetzmann (2015), “Bubble Investing: Learning from History,” NBER Working Paper Series 21693 (Cambridge, Mass.: National Bureau of Economic Research, October), <http://www.nber.org/papers/w21693>. Another recent study (Greenwood, Shleifer, and You, 2017) finds that sharp stock price increases help predict heightened probability of a crash in a particular industry but agrees that it is difficult to forecast negative average returns (Robin Greenwood, Andrei Shleifer, and Yang You (2017), “Bubbles for Fama,” NBER Working Paper Series 23191 (Cambridge, Mass.: National Bureau of Economic Research, February), <http://www.nber.org/papers/w23191>).

Foreign Economic Activity and the Dollar

- Foreign real GDP growth picked up to 3¼ percent in the first quarter, a bit more than we anticipated in the April Tealbook. We expect growth abroad to moderate to a 2½ percent pace by early next year, in part as Canada’s growth settles to a more sustainable rate and policy stimulus in China diminishes. As in the April Tealbook, we expect foreign growth to remain at this near-potential pace through the medium term.
- The broad nominal dollar has depreciated about 1¼ percent since the time of the April Tealbook. We expect the broad real dollar to appreciate at about a 2 percent annual rate through the forecast period, as market expectations for the federal funds rate move up toward the staff forecast, leaving the level of the dollar at the end of 2019 about ¾ percent lower than in the April Tealbook. The slightly greater pace of dollar appreciation in this projection reflects the marginally more restrictive stance of U.S. monetary policy in response to the slightly tighter economy.

Oil and Commodity Prices

- Against a backdrop of continued increases in U.S. oil production, oil prices fluctuated over the intermeeting period on changing market convictions about OPEC’s agreement to cut production. Ultimately, OPEC renewed the agreement for an additional nine months, but the agreement did not include additional production cuts that some market participants had expected. The spot price of Brent crude oil closed most recently at \$51 per barrel, \$2 per barrel lower than at the time of the April Tealbook. As in the April Tealbook, we project that oil prices will decline gradually over the projection period.
- Agricultural prices have risen 2 percent since the April Tealbook, mainly on increased wheat and corn prices. Cool weather and heavy rains in the Midwest have delayed planting schedules and pose some risk for the winter harvest.

THE OUTLOOK FOR REAL GDP AND AGGREGATE SUPPLY

On balance, the incoming spending data have surprised us to the upside relative to our expectations in the April Tealbook. We currently estimate that real GDP increased at an annual rate of 1¼ percent in the first quarter, and we project GDP growth to step up to

about a 2½ percent pace in the second and third quarters, largely reflecting a pickup in consumption spending from its transitorily low first-quarter pace. On net, our projection for GDP growth in the first half is revised up a couple tenths of a percentage point from the previous Tealbook, mainly due to upward revisions in E&I spending and net exports.

- We estimate that real PCE posted a meager increase of ½ percent at an annual rate during the first quarter. We continue to attribute the weakness to a variety of special factors, including depressed outlays for energy services due to unseasonably warm weather, a step-down in motor vehicle sales from an above-trend pace last year, and some payback from strong gains in non-energy services in the fourth quarter. The incoming spending data have corroborated our view that PCE growth will pick up during the second quarter, although we tempered our near-term forecast in light of the sharp downward revision to real disposable personal income in the fourth quarter of last year.² Even so, with ongoing gains in employment and still-upbeat levels of sentiment, we expect real PCE growth to average about 3 percent this quarter and next.
- Investment in E&I is estimated to have increased at an annual rate of 7 percent in the first quarter, well above our April Tealbook forecast of 2½ percent growth. In addition, indicators of business spending in the second quarter remain upbeat. Investment in E&I is now projected to rise at nearly a 5 percent pace during the first half of this year, twice as fast as in the April Tealbook, and we expect a similar increase in the third quarter.
- We estimate that residential investment rose at a robust 14 percent annual rate in the first quarter, noticeably stronger than in the April Tealbook. Some of that strength was likely pulled forward in response to unseasonably warm weather, the anticipation of higher interest rates, or both. We expect that the

² Incorporating information from unemployment insurance tax records led the BEA to revise down their estimate of labor compensation in the fourth quarter of 2016 by \$114 billion. Anecdotal reports suggest that the weak fourth-quarter reading could partly reflect a shifting of income from late last year into early this year in anticipation of a potential cut in personal tax rates; such a shift would imply a sharp increase in compensation in the first quarter. Indeed, the opposite pattern occurred in late 2012 and early 2013, when compensation was pulled forward noticeably in advance of the 2013 expiration of the Bush tax cuts. For now, we have tentatively taken on board the lower level of income: The BEA has not assumed a first-quarter rebound in compensation, and we have not overridden their assumption in our projection. (This question could be resolved in the summer when the unemployment insurance tax records for the first quarter are incorporated in the national accounts.)

Federal Reserve System Nowcasts of 2017:Q2 Real GDP Growth
(Percent change at annual rate from previous quarter)

Federal Reserve entity	Type of model	Nowcast as of May 31, 2017
Federal Reserve Bank		
Boston	<ul style="list-style-type: none"> Mixed-frequency BVAR 	3.7
New York	<ul style="list-style-type: none"> Factor-augmented autoregressive model combination Factor-augmented autoregressive model combination, financial factors only Dynamic factor model 	2.4 2.3 2.3
Cleveland	<ul style="list-style-type: none"> Bayesian regressions with stochastic volatility Tracking model 	2.7 2.6
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) 	3.8
Chicago	<ul style="list-style-type: none"> Dynamic factor models Bayesian VARs 	2.6 3.6
St. Louis	<ul style="list-style-type: none"> Dynamic factor models News index model Let-the-data-decide regressions 	2.7 2.6 2.8
Kansas City	<ul style="list-style-type: none"> Accounting-based tracking estimate 	2.9
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) 	3.1 2.9 3.8
Memo: Median of Federal Reserve System nowcasts		2.8

strong growth of residential investment in the first quarter will give way to a fairly flat trajectory in the second and third quarters, as higher mortgage rates start to weigh more heavily on housing demand.

- Investment in drilling and mining structures shot up more than 450 percent at an annual rate in the first quarter, substantially more than we had projected. Looking ahead, indicators of oil drilling activity have risen further, pointing to solid gains in drilling and mining structures investment in the second and third quarters. However, the incoming data on investment in other nonresidential structures have been weaker than we expected. All told, our forecast for nonresidential structures investment in the first half of this year is unrevised from the April Tealbook, while the third quarter is somewhat stronger.
- The contribution of net exports to real GDP growth is $\frac{1}{2}$ percentage point stronger in the first quarter, reflecting both lower-than-expected imports and higher-than-expected exports. We have also revised up the net export contribution in the second and third quarters by about 0.1 percentage point in response to the recent dollar depreciation. Net exports are now projected to be neutral for first-half GDP growth and a modest drag in the third quarter.
- On balance, the incoming data on industrial production have been somewhat stronger than we had anticipated in the April Tealbook. We expect increases in industrial production to moderate in the coming months, as utilities production is held down by a return to seasonally normal temperatures and manufacturing production is restrained by a slowdown in motor vehicle assemblies. Mining output has risen at a rapid clip in recent months, largely as a result of gains in oil and gas drilling and crude oil production. (For a discussion of U.S. crude oil production, see the box “Why Is U.S. Oil Output So Strong?”)

All told, real GDP is projected to rise nearly $2\frac{1}{2}$ percent this year, $\frac{1}{4}$ percentage point faster than in the April Tealbook. Beyond 2017, our GDP growth forecast is unrevised at $2\frac{1}{4}$ percent in 2018 and $1\frac{3}{4}$ percent in 2019; toward the end of the medium term, growth slows because of the ongoing gradual normalization of monetary policy.

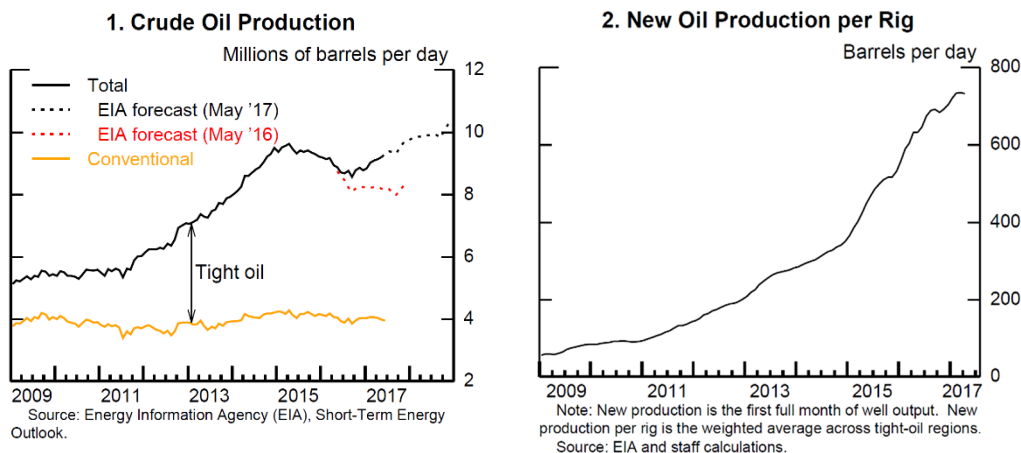
- The key conditioning factors underpinning our forecast are more accommodative, on balance, than in the April Tealbook—in particular, the

Why Is U.S. Oil Output So Strong?

Total U.S. crude oil production nearly doubled from around 5 million barrels per day (b/d) in the mid-2000s to just under 9½ million b/d in 2015 (figure 1, black line). This increase was almost exclusively due to production from unconventional “tight oil” geographies, where methods such as horizontal drilling and hydraulic fracturing have been exploited to extract oil and gas trapped in low-permeability rock formations. However, between 2014 and 2016, oil prices fell about 70 percent, and the count of drilling rigs in operation—a widely used predictor of near-term crude oil production—plummeted by a similar magnitude. To the surprise of many industry analysts, total U.S. production fell only 6 percent and has turned up in recent quarters.

Why did oil production not fall by more? The answer lies in the large and widespread productivity gains in drilling and extraction technologies not reflected in some existing indicators of production. These gains in productivity imply that (1) a simple count of drilling rigs is, by itself, no longer a good predictor of near-term production, and (2) U.S. producers are able to remain profitable at far lower prices than in previous years. Thus, even with the expected path of oil prices below \$60 per barrel and the number of active drilling rigs far lower than a few years ago, the Energy Information Administration (EIA) projects U.S. oil production to average 9.3 million b/d in 2017 and to reach an all-time annual record of 10.0 million b/d in 2018 (figure 1, black dotted line). Understanding the factors behind the EIA’s projected growth in oil production is important, as these estimates are incorporated into the Board staff’s forecasts for real GDP and industrial production.¹

Mapping Rig Counts to Output. Traditionally, the rig count has been seen as a good indicator of near-term production because a large fraction of a well’s output occurs in its first few months. However, the linkage between drilling rigs and oil extraction relies on the assumption that the productivity of successive cohorts of new wells is relatively stable. Since the onset of the tight-oil boom in 2010, the first-month output of new wells advanced rapidly, with a new well in the tight-oil areas producing roughly 700 b/d in early 2017, more than four times the 2010 level (figure 2).

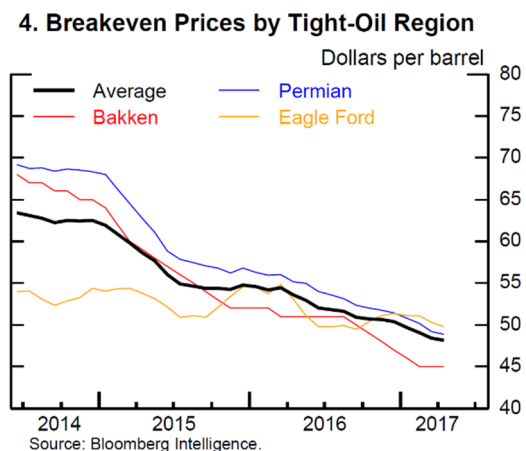
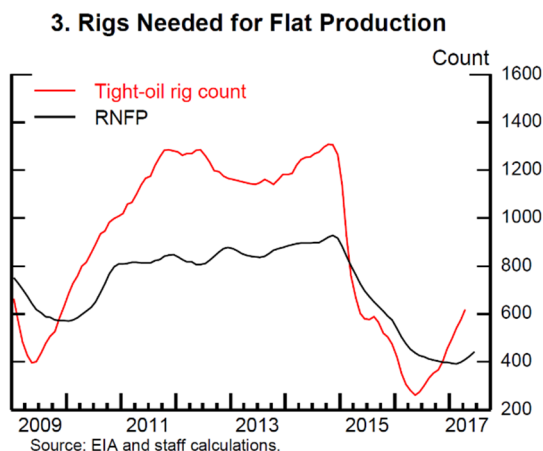


¹ Oil output is not a direct input into the spending-side calculation of GDP, but as domestic oil production rises, oil imports—which are subtracted from aggregate expenditures to measure GDP—decline. Thus, a shift toward domestically sourced oil boosts the level of real GDP.

Drawing on new EIA data for the main tight-oil regions, the staff have constructed a new measure—the number of rigs needed for flat production (RNFP)—that helps gauge the direction and magnitude of expected changes in domestic oil production. The RNFP uses estimates of the productivity of new wells to calculate the number of rigs required to keep total production constant in the tight-oil regions—that is, to exactly offset the natural decline in output from existing wells.² With conventional oil production roughly flat over the past decade—see figure 1, orange line—the RNFP and the tight-oil rig count can be used to predict changes in aggregate production. Figure 3 shows the RNFP (black line) and the tight-oil rig count (red line). With the number of rigs now trending above the RNFP, total oil production should continue to expand in the coming months, consistent with the EIA projection embedded in the staff forecast.

Breakeven Prices. The oil price required for a new drilling project to be economically viable has declined notably. The downward trend in those prices, known as breakeven prices, also supports the strong production forecast. Breakeven prices in the tight-oil areas have been falling over the past two years while also converging across regions toward more similar levels (figure 4).³ While part of the decline likely reflects input costs for drilling that fell during the industry downturn (for example, rig rental rates, sand, and labor), structural changes—such as innovations in drilling and new well completion techniques—account for a substantial portion of the reduction. In April 2017, average breakevens were a little below spot oil prices, as shown by the black line in figure 4; however, average numbers hide a large degree of heterogeneity, even within regions.⁴

Looking Forward. Large productivity gains in recent years have altered historical relationships, making new indicators helpful in understanding current and future trends. Further production gains may face some headwinds in future months, as input costs are likely to increase with more drilling rigs returning to use, but new technologies also have considerable scope to spread across existing producers. Hence, current projections for near-record production levels of U.S. crude oil in 2017 and 2018 appear consistent with a path of moderate oil prices and modest levels of rigs in operation.



² Rising production puts upward pressure on future values of the RNFP, but productivity gains counteract this effect, reducing the number of rigs needed to maintain a given level of output.

³ Definitions of breakeven prices vary widely. We report wellhead half-cycle breakevens, a measure of well profitability that excludes transportation expenses, the cost of exploration, and other field developments.

⁴ Within-region breakevens range from about \$30 per barrel in some areas of the Permian Basin to \$70 per barrel in some counties within the Bakken region.

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

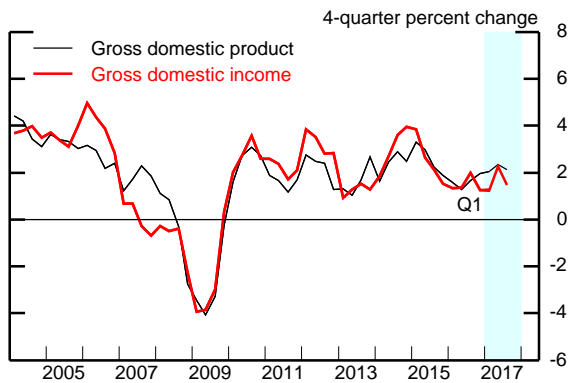
Domestic Econ Devel & Outlook

Measure	2017:Q1		2017:Q2		2017:Q3	
	Previous Tealbook	Current Tealbook	Previous Tealbook	Current Tealbook	Previous Tealbook	Current Tealbook
Real GDP	.9	1.2	2.6	2.6	2.2	2.7
Private domestic final purchases	1.8	2.6	3.0	2.9	2.8	3.0
Personal consumption expenditures	.6	.6	3.1	3.0	3.0	2.8
Residential investment	11.4	13.9	-1.3	-1.1	-1.5	-2.6
Nonres. private fixed investment	5.4	10.2	4.4	3.3	3.0	5.9
Government purchases	-1.8	-.9	2.4	.3	2.2	1.8
<i>Contributions to change in real GDP</i>						
Inventory investment ¹	.0	-1.0	-.1	.4	-.1	.1
Net exports ¹	-.3	.2	-.3	-.3	-.5	-.3
Unemployment rate	4.7	4.7	4.5	4.3	4.5	4.3
PCE chain price index	2.4	2.4	1.2	.4	1.6	1.6
Ex. food and energy	2.0	2.1	1.6	1.1	1.7	1.8

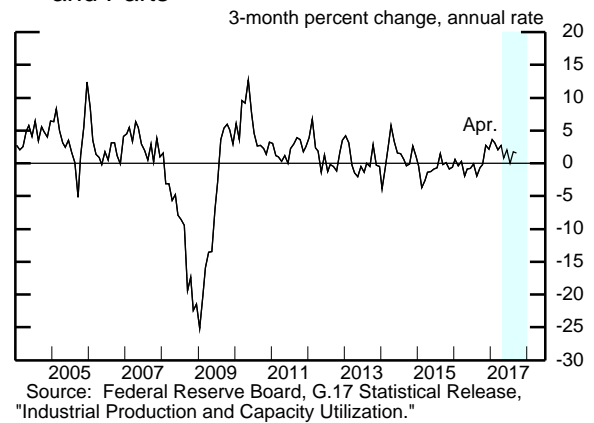
1. Percentage points.

Recent Nonfinancial Developments (1)

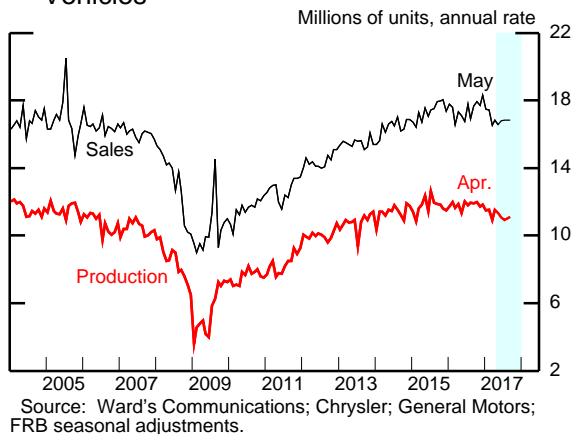
Real GDP and GDI



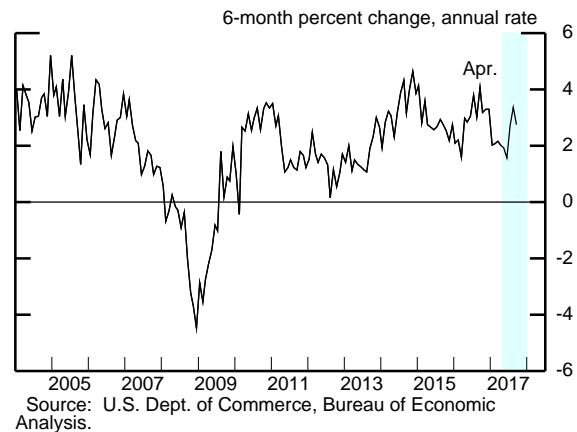
Manufacturing IP ex. Motor Vehicles and Parts



Sales and Production of Light Motor Vehicles

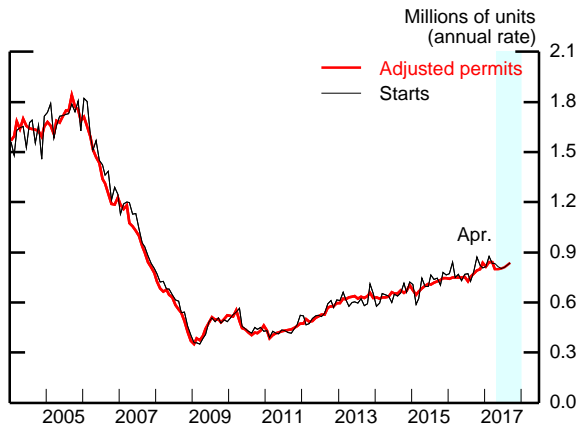


Real PCE Growth



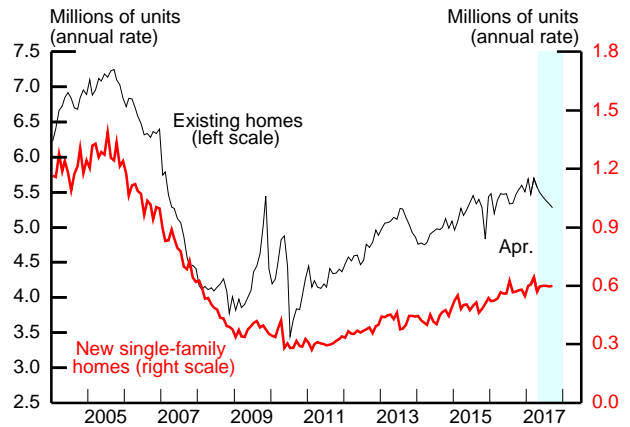
Recent Nonfinancial Developments (2)

Single-Family Housing Starts and Permits



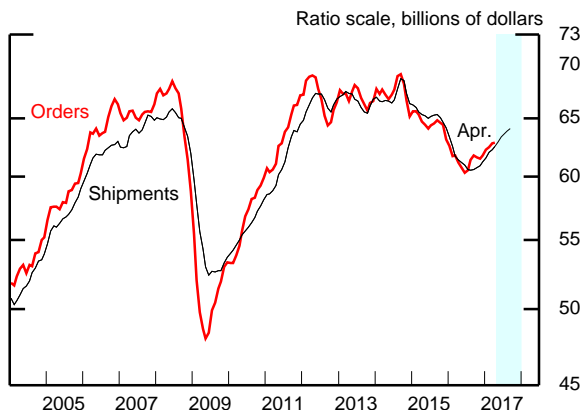
Note: Adjusted permits equal permit issuance plus total starts outside of permit-issuing areas.
Source: U.S. Census Bureau.

Home Sales



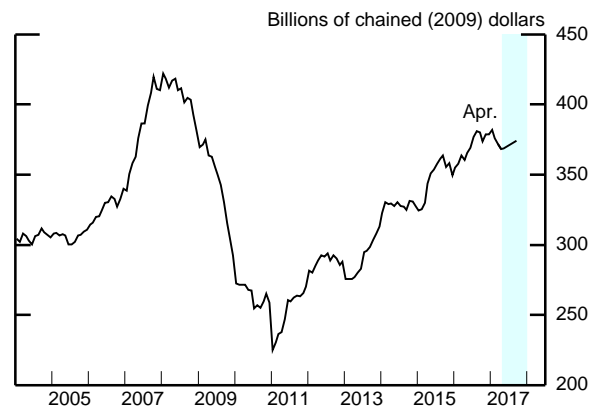
Source: For existing, National Association of Realtors; for new, U.S. Census Bureau.

Nondefense Capital Goods ex. Aircraft



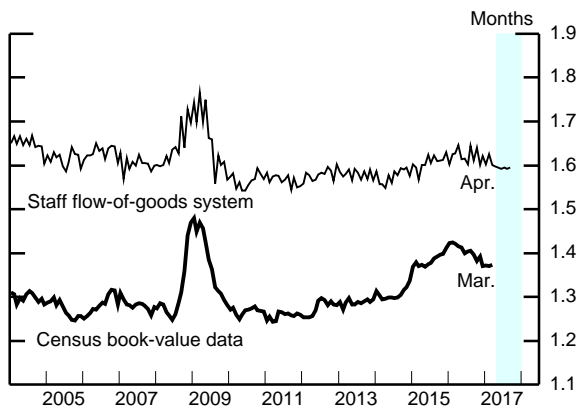
Note: Data are 3-month moving averages.
Source: U.S. Census Bureau.

Nonresidential Construction Put in Place



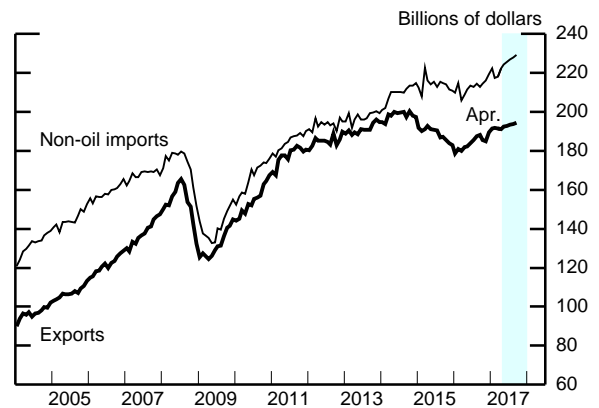
Note: Nominal CPIP deflated by BEA prices through 2016:Q4 and by the staff's estimated deflator thereafter.
Source: U.S. Census Bureau.

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.

dollar is modestly weaker, equity and home prices are slightly higher, and oil prices are a bit lower.

- However, the projected level of household income is lower throughout the forecast, which restrains the growth rate of PCE over the medium term, all else being equal.
- We assume that potential GDP growth will move up from 1½ percent this year to 1¾ percent in 2019; the level of potential at the end of 2019 is 0.1 percent higher than in our April forecast because of stronger projected capital spending. With real GDP growth projected to outpace potential growth over the medium term, resource utilization tightens further: Real GDP is expected to exceed its potential level by 2 percent at the end of 2019, ¼ percentage point more than in the April Tealbook.

THE OUTLOOK FOR THE LABOR MARKET

Taken together, the April and May employment reports indicate that the labor market has tightened further.

- The unemployment rate declined from 4.5 percent in March to 4.3 percent in May, 0.2 percentage point lower than we projected in the April Tealbook, while the labor force participation rate (LFPR) declined from 63.0 percent in March to 62.7 percent in May, 0.1 percentage point below our expectation. We now project the unemployment rate to remain at 4.3 percent through September, 0.2 percentage point lower than in our previous forecast.
- Payroll employment rose 174,000 in April and 138,000 in May, somewhat slower than we expected in the April Tealbook. Employers have added an average of 160,000 payroll jobs per month so far this year, about 20,000 per month slower than in the April Tealbook but still faster than the pace we estimate to be consistent with unchanged labor market slack (90,000 to 120,000 per month). Balancing the weaker-than-expected employment readings against the upward revisions to our near-term forecast for GDP growth, we project payroll gains to average about 170,000 per month through September, little changed from our April forecast.

- Other labor market indicators continue to point to strong labor demand. Notably, initial claims for unemployment insurance remain near historic lows, the quits rate is essentially back to its pre-recession level, and consumers' expectations of job availability have surpassed the high-water mark reached in the previous expansion.

In our judgment, the labor market is tight: Our projection of the unemployment rate in the current quarter is 0.6 percentage point below our estimate of its natural rate, and the LFPR is 0.1 percentage point above its estimated trend.³

Looking ahead, the labor market is projected to tighten further over the medium term and to be very tight by the end of 2019.

- After decreasing about 1 percentage point since early 2015, the unemployment rate is projected to decline another 0.5 percentage point over the medium term and to end 2019 at 3.8 percent, 0.2 percentage point lower than in the April Tealbook.
- Average monthly total payroll gains are expected to slow from 166,000 in 2017 to 122,000 in 2019. Both the LFPR and the employment-to-population ratio are projected to continue to improve relative to their declining trends.
- We project that productivity will increase slightly less than 1 percent per year, on average, 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.⁴

THE OUTLOOK FOR INFLATION

Core PCE price inflation picked up in April from the exceptionally low March reading, but the pickup was smaller than we had projected. Our best judgment is that the

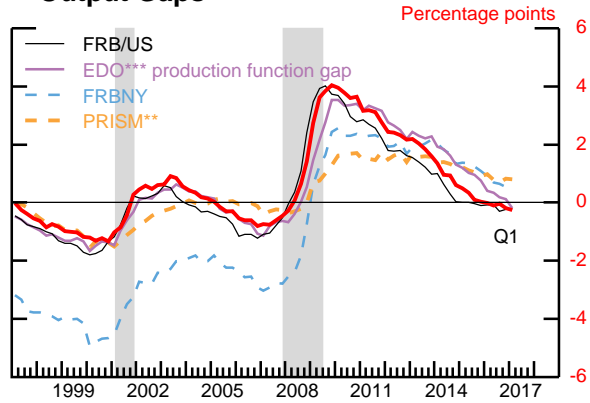
³ We considered revising down our estimate of the natural rate of unemployment in this projection in light of the further decline in unemployment and the weak recent readings on inflation. For the moment, however, we have chosen not to make any adjustment, in large part because we view those weak inflation readings to be transitory.

⁴ Productivity typically falls below its structural level when the labor market becomes tight, possibly because a larger share of workers hired in a tight labor market have below-average productivity than is the case during a slack labor market.

Alternative Measures of Slack

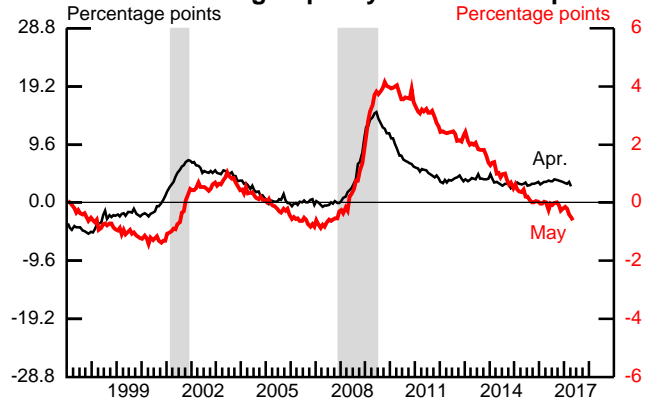
The red line in each panel is the staff's measure of the unemployment rate gap (right axis).

Output Gaps



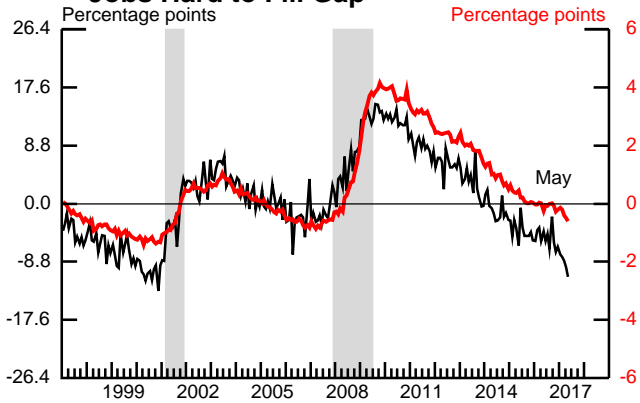
** PRISM uses a flex-price output gap.
 *** EDO is Estimated, Dynamic, Optimization-based model.
 Source: Federal Reserve Board; PRISM: Federal Reserve Board Bank of Philadelphia, PRISM Model Documentation (June 2011); FRBNY: Federal Reserve Bank of New York Staff Report 618 (May 2013, revised April 2014).

Manufacturing Capacity Utilization Gap*



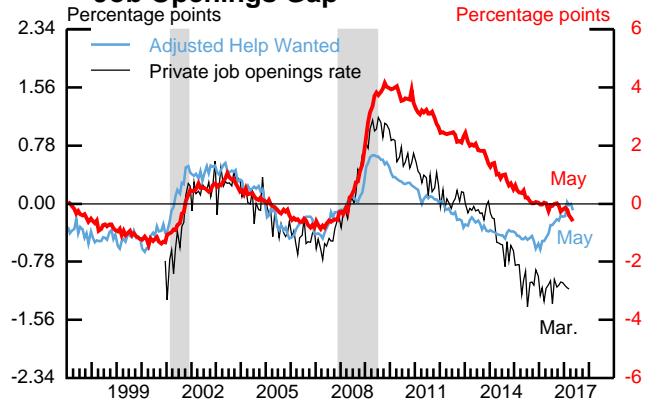
Source: Federal Reserve Board.

Jobs Hard to Fill Gap*



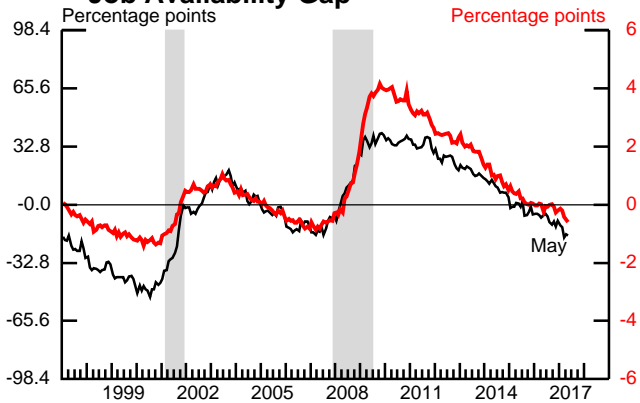
Note: Percent of small businesses surveyed with at least one "hard to fill" job opening. Seasonally adjusted by Federal Reserve Board Staff.
 Source: National Federation of Independent Business, Small Business Economic Trends Survey.

Job Openings Gap*



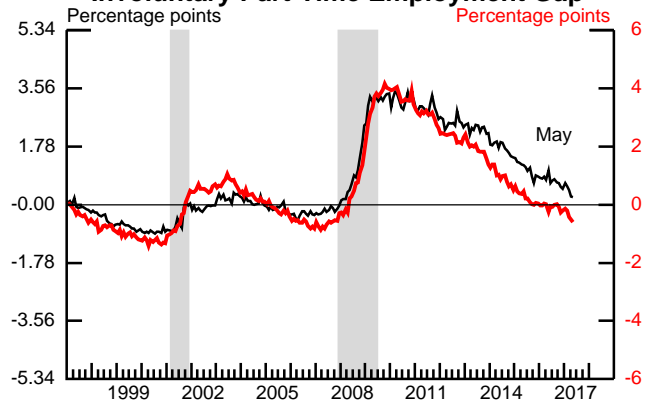
Note: Job openings rate is the number of job openings divided by employment plus job openings. Help Wanted adjusted following Cajner and Ratner (2016).
 Source: Job Openings and Labor Turnover Survey; U.S. Department of Labor, Bureau of Labor Statistics, Current Employment Statistics; Conference Board, Help Wanted OnLine.

Job Availability Gap*



Note: Percent of households believing jobs are plentiful minus the percent believing jobs are hard to get.
 Source: Conference Board.

Involuntary Part-Time Employment Gap



Note: Percent of employment.
 Source: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey.

* Plots the negative of the gap to have the same sign as the unemployment rate gap.

Note: The shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research. Output gaps are multiplied by negative 0.54 to facilitate comparison with the unemployment rate gap. Manufacturing capacity utilization gap is constructed by subtracting its average rate from 1972 to 2013. Other gaps were constructed by subtracting each series' average in 2004:Q4 and 2005:Q1.

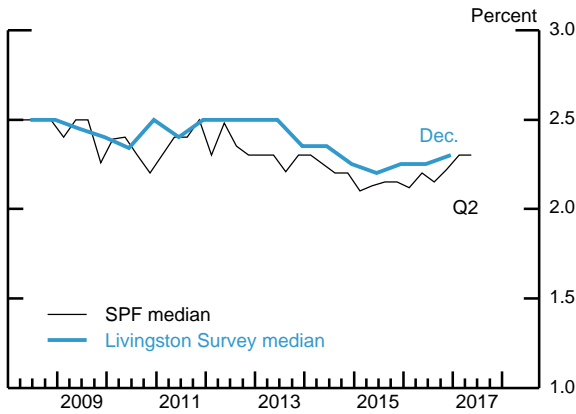
recent inflation data do not point to a significantly slower pace of monthly price increases going forward; indeed, the fundamentals underlying the core inflation forecast are a little stronger in this projection.

- At the time of the April Tealbook, we had the very weak March CPI report in hand; we subsequently received the March and April readings on PCE prices.⁵ Core PCE prices declined 0.1 percent in March and rose 0.2 percent in April. Both readings were slightly lower than we projected in the previous Tealbook.
 - Much of the softness in core PCE prices in March and April can be explained by sharp declines in prices for wireless telephone services and prescription drugs; we think that these declines have limited signal value for monthly inflation readings going forward.
 - That said, a number of categories of consumer prices registered weak readings in March; indeed, the trimmed mean PCE price index also slowed that month, though not by as much as the core index.
 - In addition, first-quarter core import prices were weaker than expected, a factor that we think is modestly restraining core PCE inflation in the current quarter. We have revised up our projected path for core import price inflation over the rest of the year in response to the dollar's recent depreciation.
- For the second quarter, these various factors led us to mark down our forecast for core PCE inflation to 1.1 percent, 0.5 percentage point below our April Tealbook projection. Core inflation is projected to step up to 1.8 percent in the third quarter, 0.1 percentage point faster than in the April Tealbook, reflecting the higher projected path for core goods import price inflation.
- Measured on a 12-month change basis, core PCE prices moved down to 1.5 percent in April, rounding 0.1 percentage point lower than in our previous forecast. We expect the 12-month change in both total and core PCE inflation to remain at around 1½ percent until this year's low March reading drops out of the calculation.

⁵ The May CPI report will be released on the second day of the June FOMC meeting.

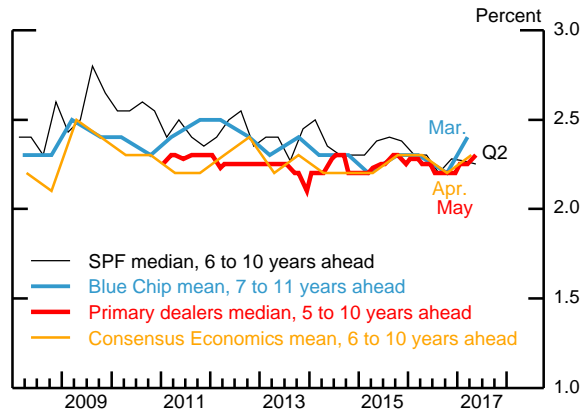
Survey Measures of Longer-Term Inflation Expectations

CPI Next 10 Years



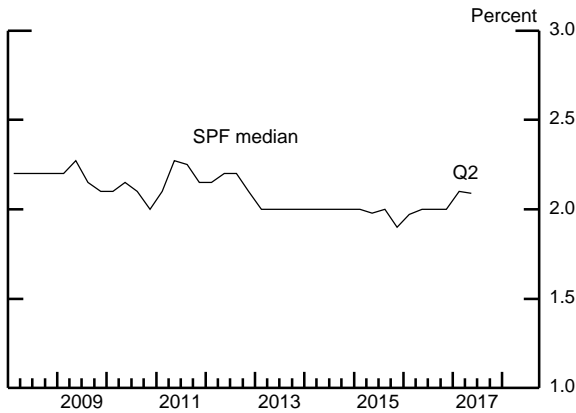
Note: SPF is Survey of Professional Forecasters.
Source: Federal Reserve Bank of Philadelphia.

CPI Forward Expectations



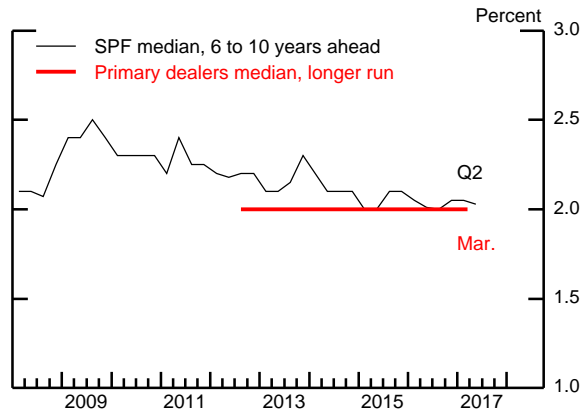
Source: Federal Reserve Bank of Philadelphia; Blue Chip Economic Indicators; Federal Reserve Bank of New York; Consensus Economics.

PCE Next 10 Years



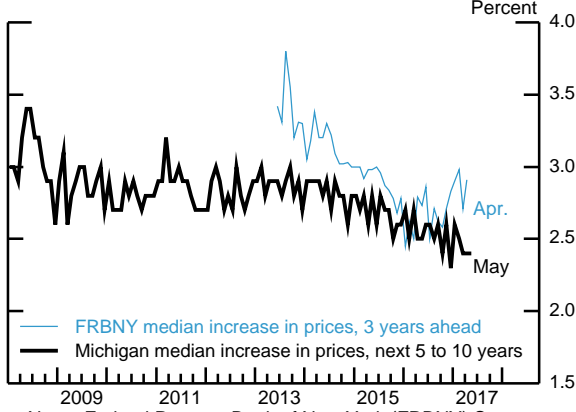
Source: Federal Reserve Bank of Philadelphia.

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.

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.

- Core import price inflation is expected to step up from a ½ percent pace in the first quarter to 2¼ percent in the second and third quarters, as the drag from earlier dollar appreciation is replaced by a boost from recent dollar depreciation. Thereafter, import price inflation is expected to slow to a ½ percent pace, consistent with moderate foreign inflation, a gradually appreciating dollar, and slowly declining commodity prices.
- The incoming data on longer-run inflation expectations are little changed, on balance, since the April Tealbook. Median expectations over the next 5 to 10 years from the University of Michigan Surveys of Consumers held at 2.4 percent in May, and the Survey of Professional Forecasters' median 10-year inflation expectations for PCE prices remained stable at 2.1 percent in the second quarter. Longer-term TIPS-based measures of inflation compensation edged lower in May. The median of inflation expectations 3 years ahead reported in the Federal Reserve Bank of New York's Survey of Consumer Expectations increasing from 2.7 percent in March to 2.9 percent in April.

We continue to see PCE price inflation converging to 2 percent by the end of the medium term.

- We now project core PCE prices to rise 1.6 percent in 2017, 0.1 percentage point lower than in the April Tealbook, and then to move up to 2.0 percent by 2019. Total PCE price inflation is also expected to move up from 1.6 percent this year to 2.0 percent in 2019. Our forecasts for core inflation in 2018 and 2019 are unrevised to rounding relative to April, while our forecast for total inflation is up 0.1 percentage point in both years.
- The ¼ percentage point increase in core inflation between 2016 and 2019 is driven by the diminishing pass-through from earlier declines in energy prices and core import prices, along with the further tightening of resource utilization. We also continue to assume a small pickup (5 basis points in both 2018 and 2019) in the prevailing level of inflation expectations relevant for price and wage setting.

Incoming data on labor compensation have been mixed. We continue to expect compensation growth to pick up over the medium term as the labor market tightens further.

- After increasing at a pace of about 2 percent in the second half of last year, the ECI for private workers rose at an annual rate of 3.2 percent in the three months ending in March, somewhat more than we expected. The pickup was particularly pronounced in occupation groups and industries that tend to be more affected by minimum wages, which had increased in several states in January; we expect ECI growth to step down to about a 2¼ percent pace over the rest of the year. Over the 12 months ending in March, the ECI increased 2.3 percent, up from 1.8 percent over the preceding 12 months.
- Average hourly earnings (AHE) increased 2.5 percent over the 12 months ending in May, unchanged from the preceding 12 months. With AHE now having come in below our expectations in four of the first five months of this year, we marked down our near-term forecast modestly. We now anticipate this 12-month change will move roughly sideways at around 2½ percent through September, nearly ½ percentage point lower than our previous forecast.
- The Federal Reserve Bank of Atlanta’s Wage Growth Tracker was 3.5 percent in April, below its recent highs but noticeably above the pace seen a few years ago.
- Incorporating the BEA’s large downward revision to compensation in the fourth quarter of last year, we now estimate that compensation per hour in the business sector fell 2.1 percent at an annual rate in that quarter and rose only 1.6 percent in 2016. Although the BEA’s estimates for the first quarter, which are still based on incomplete source data, imply that hourly compensation rose at a 1.7 percent annual rate, we see upside risk to this estimate. The very weak fourth-quarter growth in compensation per hour may be partly due to the shifting of compensation that we discussed in footnote 2; if so, when the more complete source data are available, this series could eventually show a sharper rebound in the first quarter than currently estimated. In any event, we continue to project that this measure of compensation growth will pick up

over the medium term to about 3½ percent by 2019 as the labor market tightens further.

THE LONG-TERM OUTLOOK

- We continue to assume that the natural rate of unemployment will be 4.9 percent in the longer run, and that the growth rate of potential GDP will be 1.7 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 first half of 2022.
- Real GDP growth slows to about 1½ percent in 2020 and 1¼ percent in 2021 as the federal funds rate is above its neutral level. The unemployment rate is 4.0 percent in 2020 and continues to rise gradually toward its assumed natural rate in subsequent years.
- PCE price inflation moves up from 2.0 percent in 2019 and hovers slightly above the Committee’s long-run objective for several years before moving back to 2 percent.
- With output above its potential level and inflation a bit over the Committee’s 2 percent objective, the nominal federal funds rate is about 1¼ percentage points above its long-run value of 3 percent in 2021 and then moves back toward its long-run value thereafter.

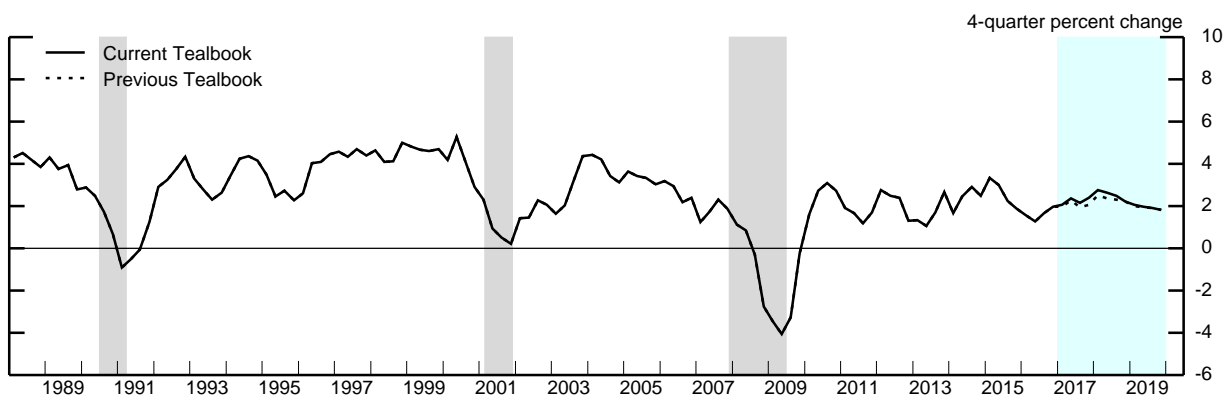
(This page is intentionally blank.)

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	1.9	2.9	2.4	2.2	1.8
Previous Tealbook	2.0	1.7	2.4	2.1	2.2	1.8
Final sales	2.0	2.2	2.8	2.5	2.3	1.9
Previous Tealbook	2.0	1.8	2.5	2.1	2.2	1.9
Personal consumption expenditures	3.1	1.8	2.9	2.4	2.9	2.5
Previous Tealbook	3.1	1.8	2.9	2.4	2.9	2.5
Residential investment	1.1	6.2	2.4	4.3	3.1	4.2
Previous Tealbook	1.1	4.8	3.3	4.1	2.7	4.4
Nonresidential structures	1.9	13.8	6.3	10.0	.7	-.7
Previous Tealbook	1.9	14.2	3.3	8.6	.2	-.6
Equipment and intangibles	-.6	4.7	5.2	5.0	3.6	1.7
Previous Tealbook	-.6	2.4	3.6	3.0	3.9	1.8
Federal purchases	-.2	-.8	2.1	.6	-.2	.2
Previous Tealbook	-.2	.2	2.0	1.1	.0	-.1
State and local purchases	.4	.0	1.5	.8	.8	.8
Previous Tealbook	.4	.3	1.6	.9	.8	.9
Exports	1.5	4.2	2.4	3.3	3.0	2.9
Previous Tealbook	1.5	3.3	1.8	2.6	2.6	2.9
Imports	2.6	3.7	4.1	3.9	4.5	4.2
Previous Tealbook	2.6	4.8	4.0	4.4	4.7	4.2
Contributions to change in real GDP (percentage points)						
Inventory change	.0	-.3	.1	-.1	-.1	-.1
Previous Tealbook	.0	-.1	-.1	-.1	.0	-.1
Net exports	-.2	.0	-.3	-.2	-.3	-.3
Previous Tealbook	-.2	-.3	-.4	-.3	-.4	-.3

Domestic Econ Devel & Outlook

Real GDP

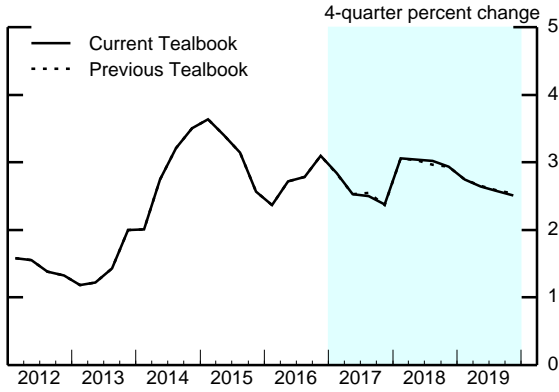


Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

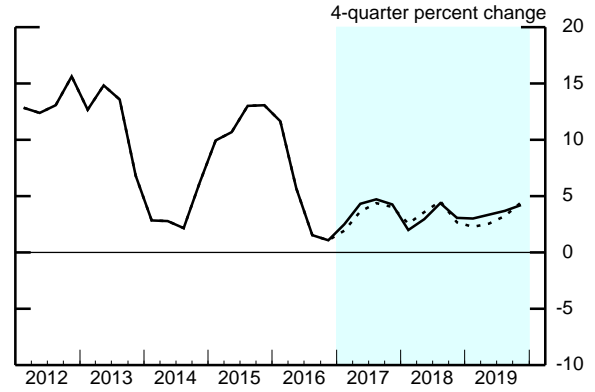
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Components of Final Demand

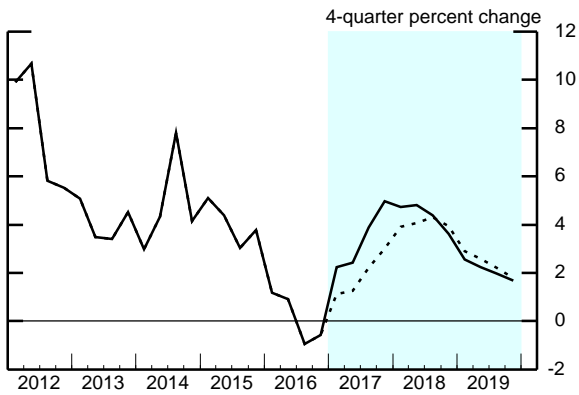
Personal Consumption Expenditures



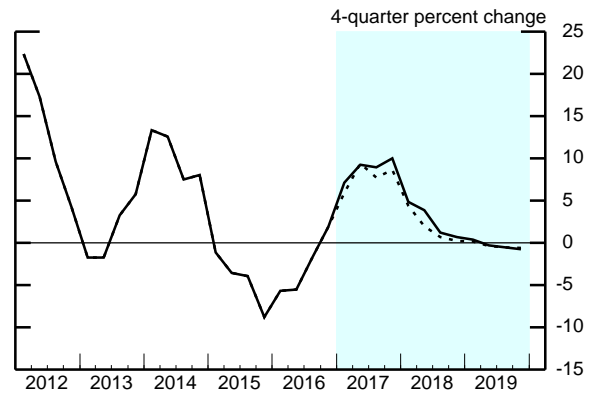
Residential Investment



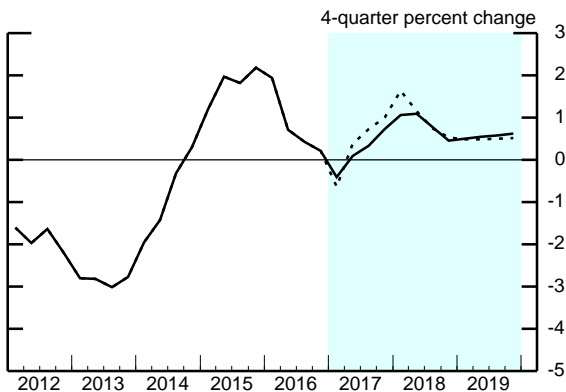
Equipment and Intangibles



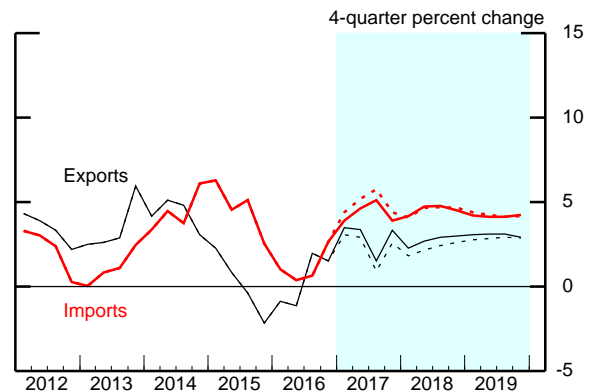
Nonresidential Structures



Government Consumption and Investment



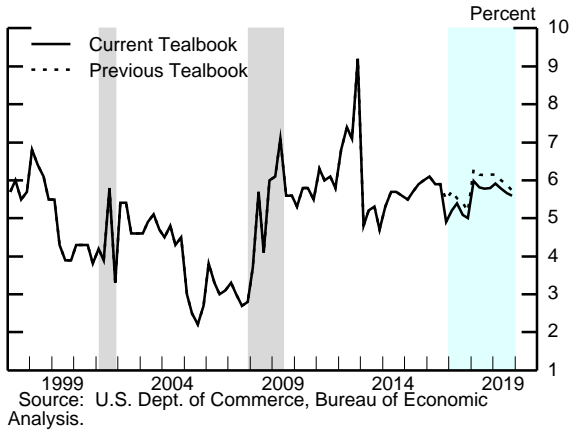
Exports and Imports



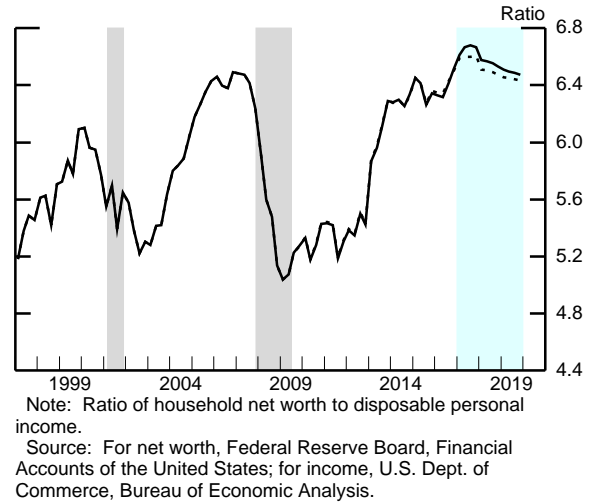
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Aspects of the Medium-Term Projection

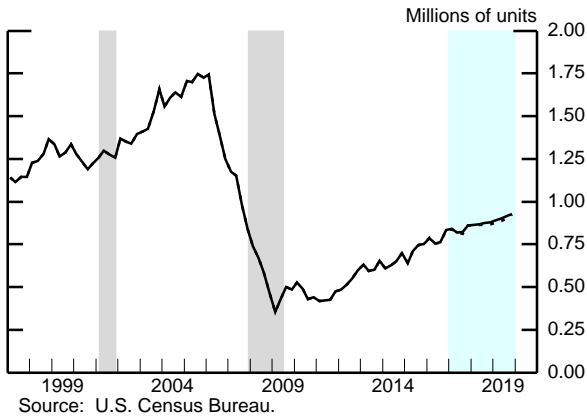
Personal Saving Rate



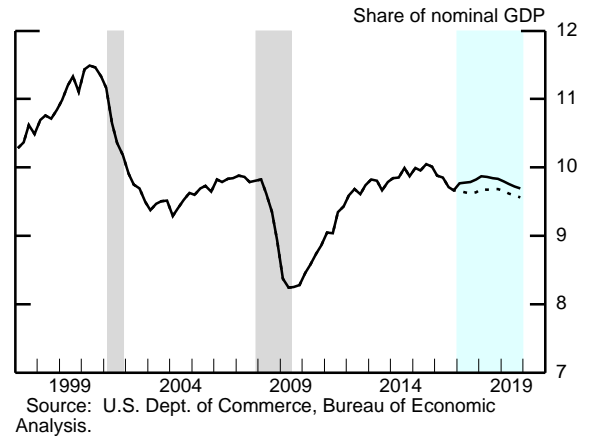
Wealth-to-Income Ratio



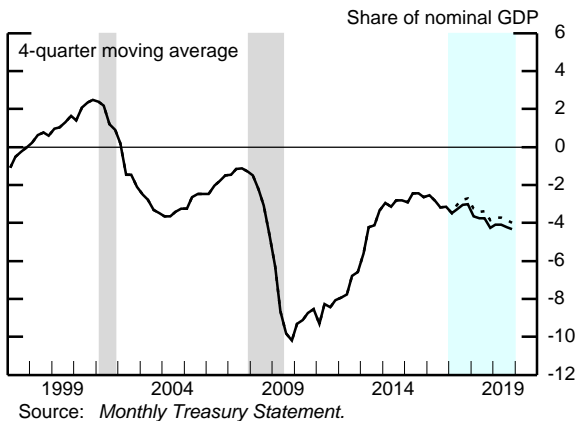
Single-Family Housing Starts



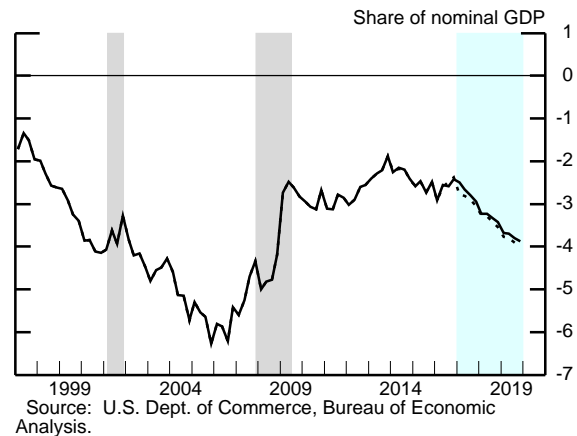
Equipment and Intangibles Spending



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.

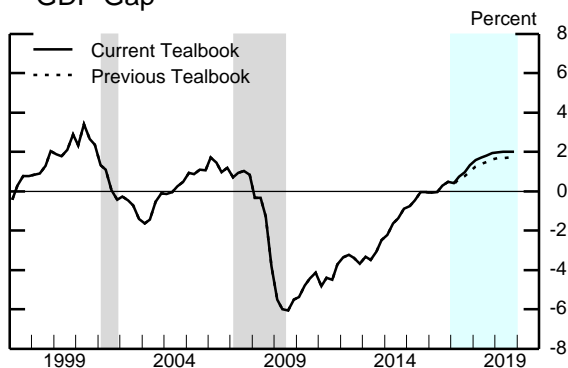
Decomposition of Potential GDP
(Percent change, Q4 to Q4, except as noted)

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	1.2	1.3
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	.5	.5	.5
Multifactor productivity	.6	1.0	1.5	.9	.0	.2	.4	.5	.6
Structural hours	1.6	1.2	.8	.0	.6	.7	.1	.4	.4
Previous Tealbook	1.6	1.2	.8	.0	.6	.7	.1	.4	.4
Labor force participation	.4	-.1	-.2	-.5	-.6	-.4	-.4	-.4	-.4
Previous Tealbook	.4	-.1	-.2	-.5	-.6	-.4	-.4	-.4	-.4
Memo:									
GDP gap ³	-1.9	2.4	.8	-4.2	.0	.5	1.3	1.9	2.0
Previous Tealbook	-1.9	2.4	.8	-4.2	.0	.5	1.0	1.6	1.8

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.

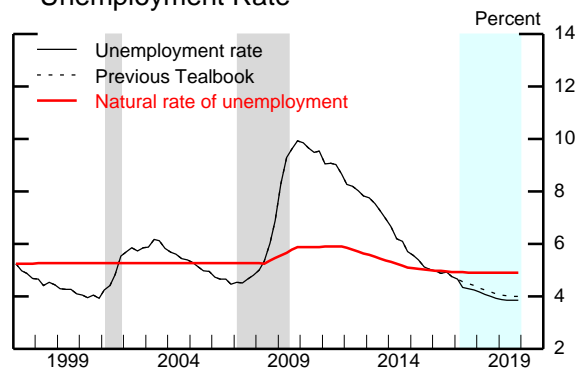
1. Percentage points.
2. Total business sector.
3. Percent difference between actual and potential GDP in the final quarter of the period indicated. A negative number indicates that the economy is operating below potential.

GDP Gap



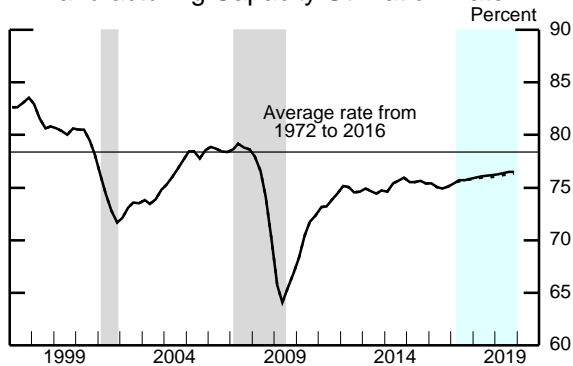
Note: The GDP gap is the percent difference between actual and potential GDP; a negative number indicates that the economy is operating below potential.
Source: U.S. Department of Commerce, Bureau of Economic Analysis; staff assumptions.

Unemployment Rate



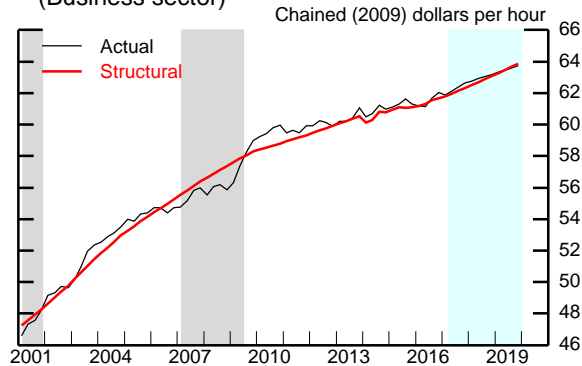
Source: U.S. Department of Labor, Bureau of Labor Statistics; staff assumptions.

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	1.2	.2	1.8	1.0	.9	.9
Previous Tealbook	1.3	.1	1.5	.8	.9	.9
Nonfarm payroll employment ²	187	163	169	166	167	122
Previous Tealbook	187	179	174	176	169	122
Private employment ²	170	161	160	160	158	113
Previous Tealbook	170	172	165	168	160	113
Labor force participation rate ³	62.7	62.8	62.7	62.7	62.5	62.3
Previous Tealbook	62.7	62.8	62.7	62.7	62.5	62.3
Civilian unemployment rate ³	4.7	4.3	4.2	4.2	3.9	3.8
Previous Tealbook	4.7	4.5	4.4	4.4	4.1	4.0

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	1.4	1.7	1.6	1.9	2.0
Previous Tealbook	1.4	1.8	1.6	1.7	1.8	1.9
Food and beverages	-1.7	1.4	1.8	1.6	2.1	2.2
Previous Tealbook	-1.7	1.3	2.0	1.7	2.1	2.2
Energy	.8	-1.6	.8	-.4	1.1	.9
Previous Tealbook	.8	2.6	.2	1.4	.3	.7
Excluding food and energy	1.7	1.6	1.7	1.6	1.9	2.0
Previous Tealbook	1.7	1.8	1.6	1.7	1.9	2.0
Prices of core goods imports ¹	.0	1.4	1.6	1.5	.6	.6
Previous Tealbook	.0	1.4	1.3	1.3	.7	.7
	Mar. 2017	Apr. 2017	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	1.5	1.5	1.6	1.6
Previous Tealbook	1.9	1.7	1.8	1.8	1.9	1.8
Excluding food and energy	1.6	1.5	1.5	1.6	1.6	1.5
Previous Tealbook	1.6	1.6	1.6	1.7	1.7	1.6

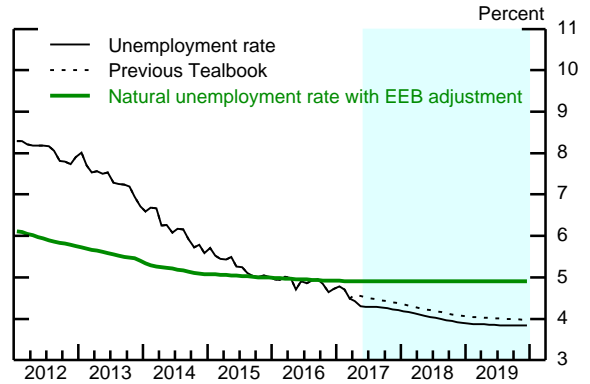
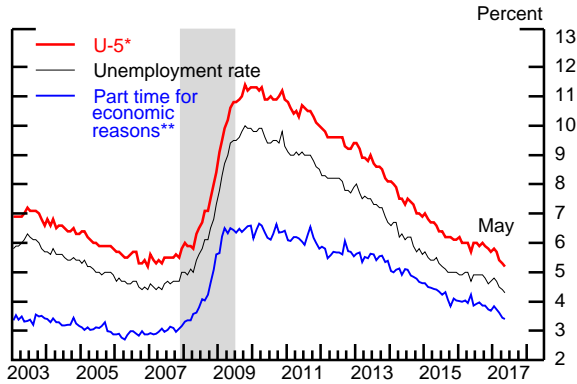
1. Core goods imports exclude computers, semiconductors, oil, and natural gas.

2. Staff forecast.

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

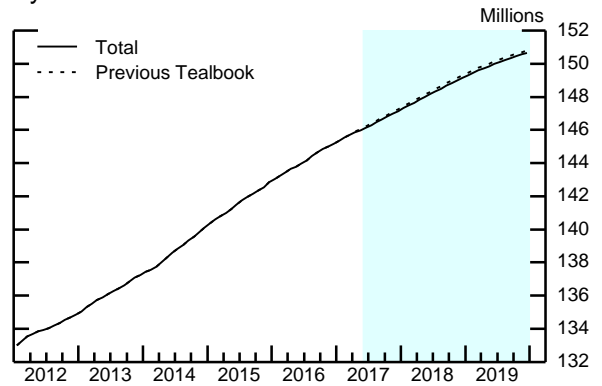
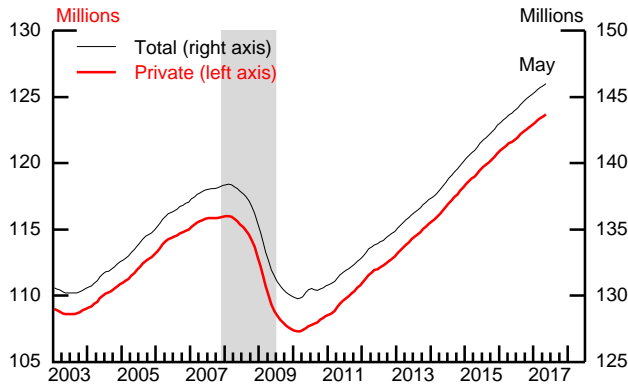
Labor Market Developments and Outlook (1)

Measures of Labor Underutilization



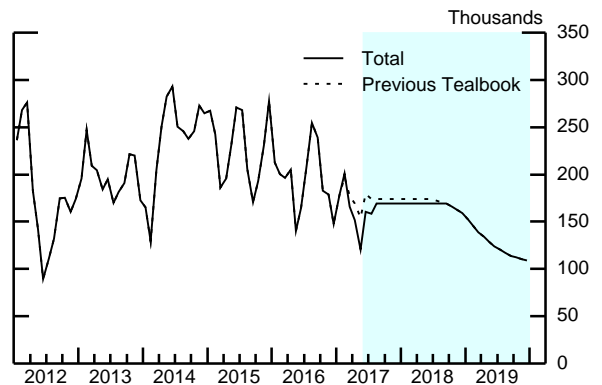
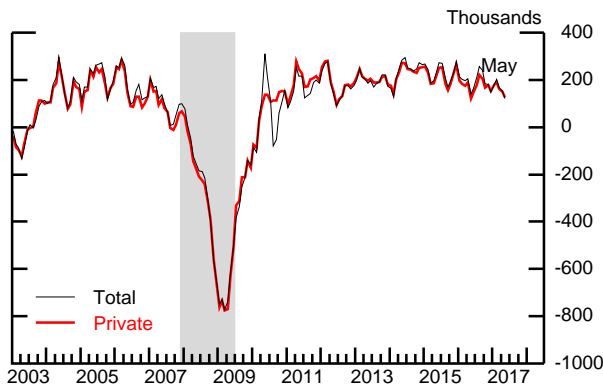
* U-5 measures total unemployed persons plus all marginally attached to the labor force, as a percent of the labor force plus persons marginally attached to the labor force.
 ** Percent of Current Population Survey employment.
 EEB Extended and emergency unemployment benefits.
 Source: U.S. Department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

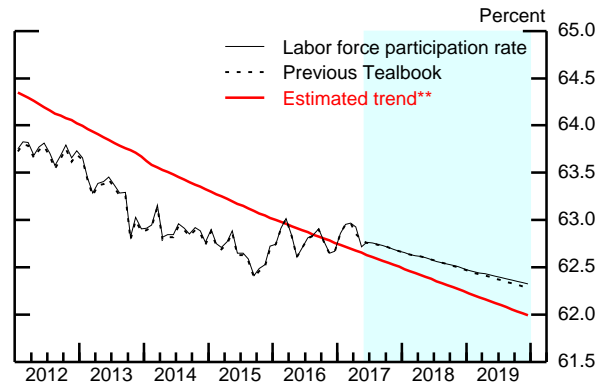
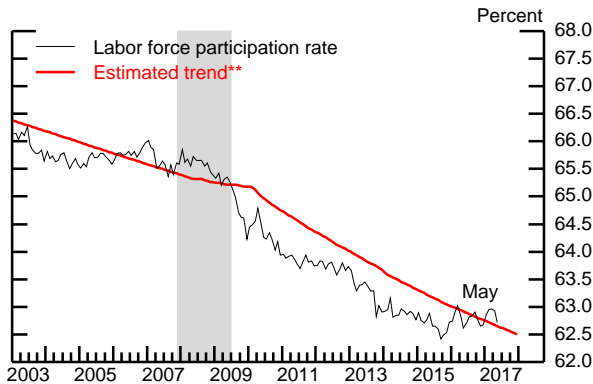


* 3-month moving averages.
 Source: U.S. Department of Labor, Bureau of Labor Statistics.

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*

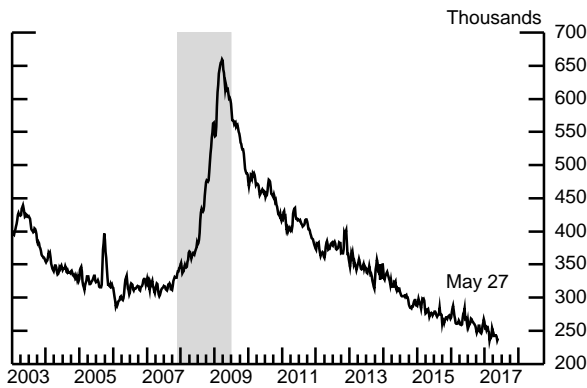


* Published data adjusted by staff to account for changes in population weights.

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

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

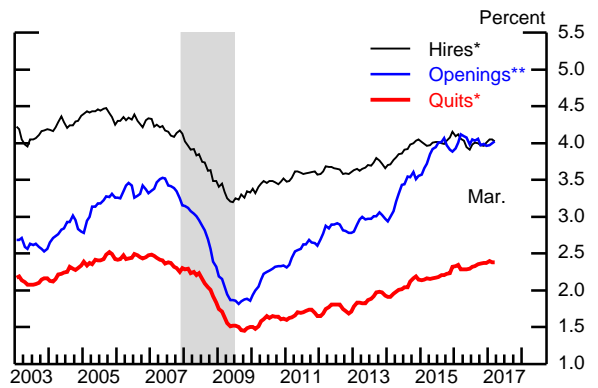
Initial Unemployment Insurance Claims*



* 4-week moving average.

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

Hires, Quits, and Job Openings

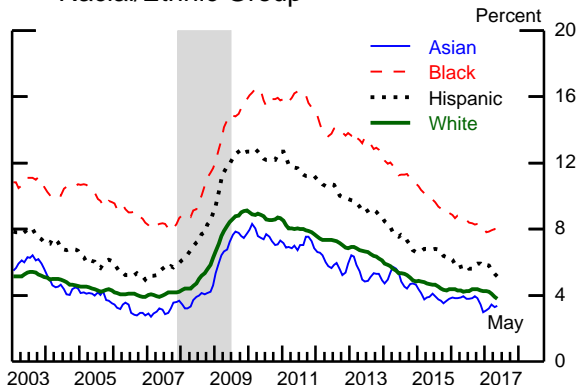


* Percent of private nonfarm payroll employment, 3-month moving average.

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

Source: Job Openings and Labor Turnover Survey.

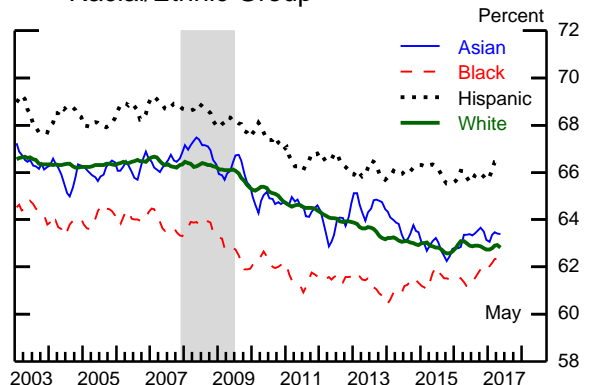
Unemployment Rate by Racial/Ethnic Group



Note: These categories are not mutually exclusive, as the ethnicity Hispanic may include people of any race. The Current Population Survey defines Hispanic ethnicity as those who report their origin is Mexican, Puerto Rican, Cuban, Central American, or South American (and some others). 3-month moving averages.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey.

Labor Force Participation Rate by Racial/Ethnic Group



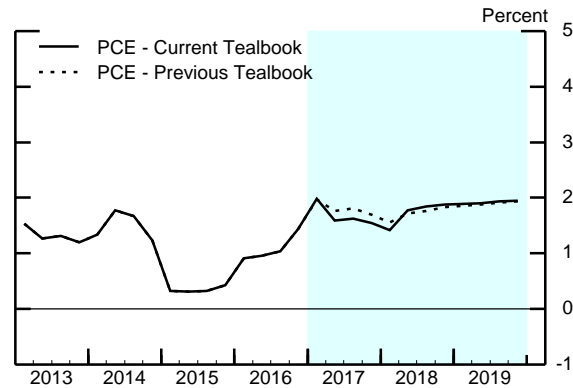
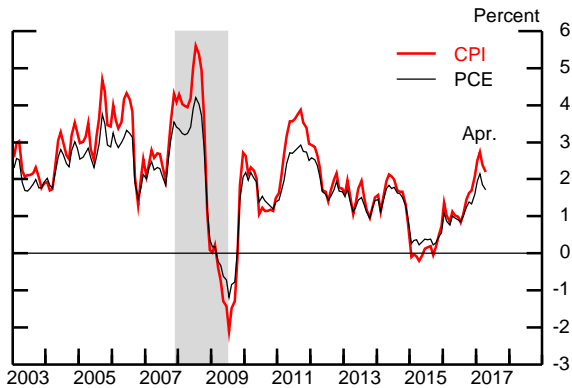
Note: These categories are not mutually exclusive, as the ethnicity Hispanic may include people of any race. The Current Population Survey defines Hispanic ethnicity as those who report their origin is Mexican, Puerto Rican, Cuban, Central American, or South American (and some others). 3-month moving averages.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey.

Inflation Developments and Outlook (1)

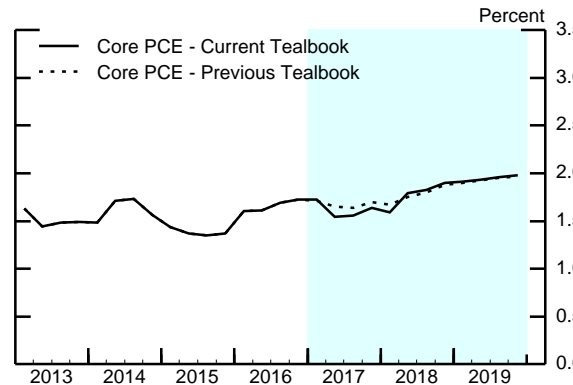
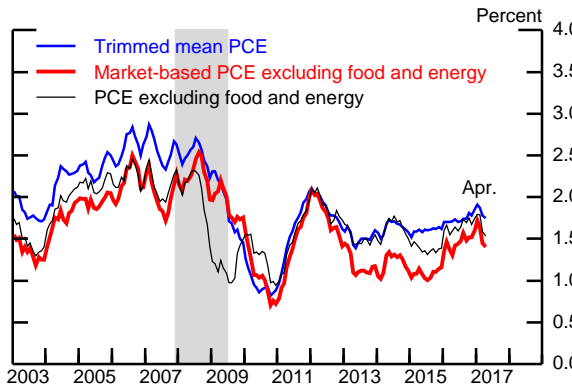
(Percent change from year-earlier period)

Headline Consumer Price Inflation



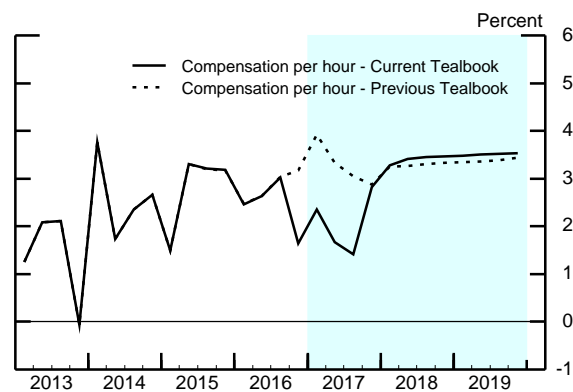
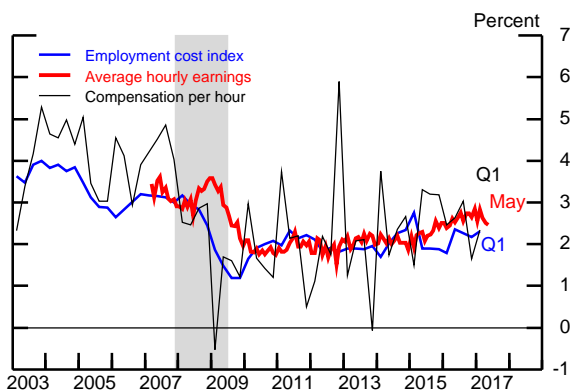
Source: For CPI, U.S. Department of Labor, Bureau of Labor Statistics; for PCE, U.S. Department of Commerce, Bureau of Economic Analysis.

Measures of Underlying PCE Price Inflation



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.

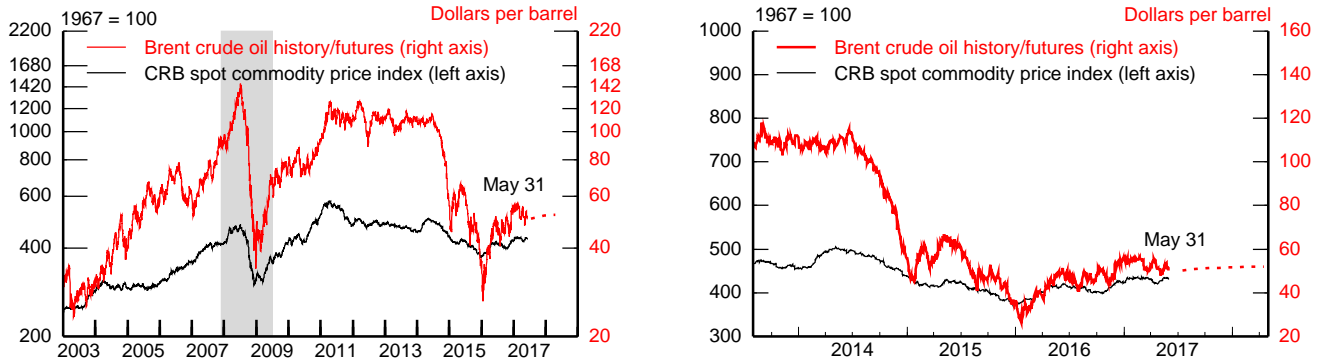
Source: U.S. Department of Labor, Bureau of Labor Statistics.

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)

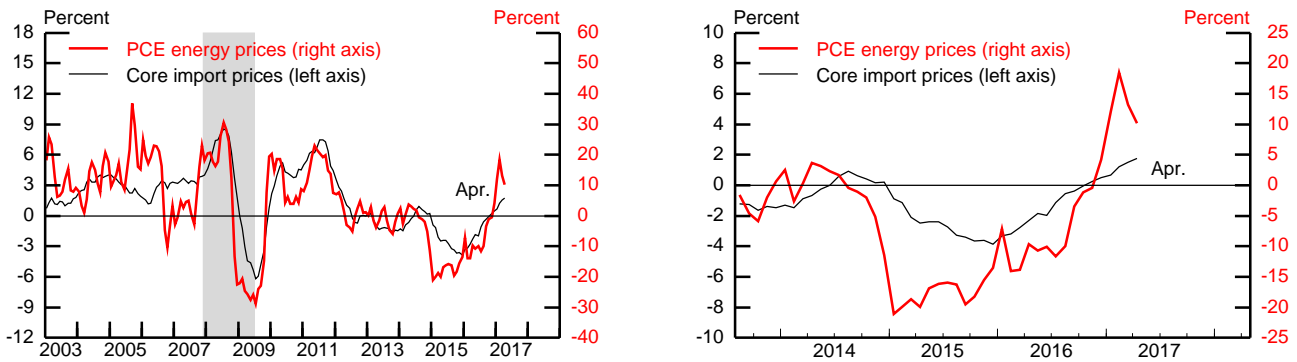
(Percent change from year-earlier period, except as noted)

Commodity and Oil Price Levels



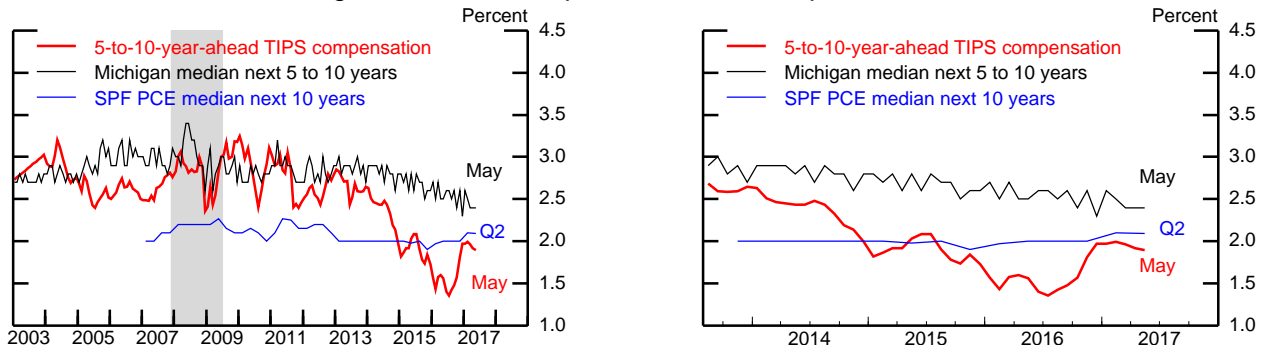
Note: Futures prices (dotted lines) are the latest observations on monthly futures contracts.
 Source: For oil prices, U.S. Department of Energy, Energy Information Agency; for commodity prices, Commodity Research Bureau (CRB).

Energy and Import Price Inflation



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.
 Source: For Michigan, University of Michigan Surveys of Consumers; for SPF, the Federal Reserve Bank of Philadelphia; for TIPS, Federal Reserve Board staff calculations.

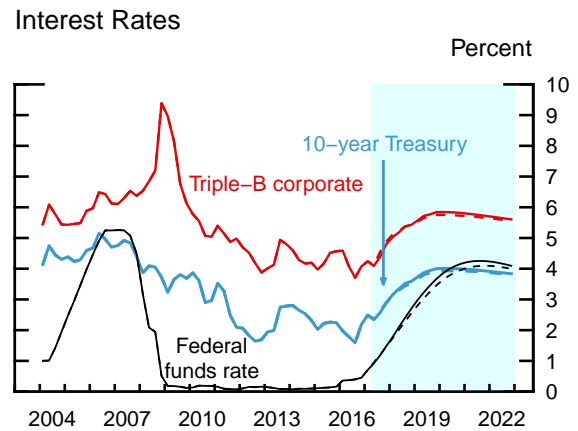
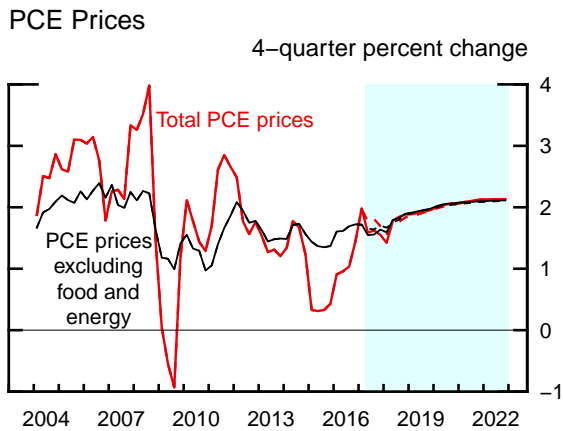
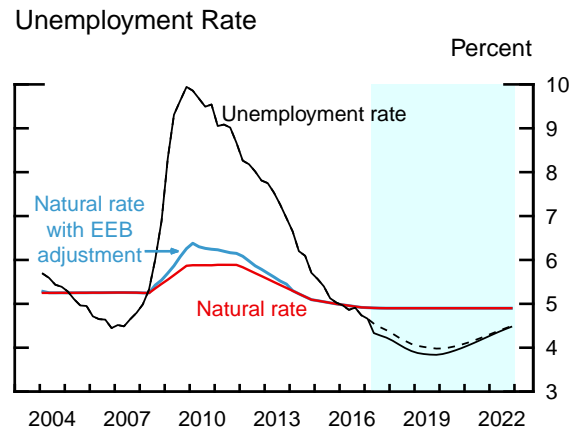
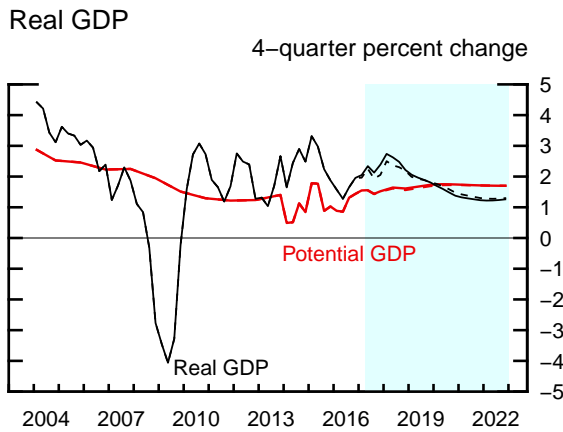
Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

The Long-Term Outlook

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

Measure	2017	2018	2019	2020	2021	2022	Longer run
Real GDP	2.4	2.2	1.8	1.4	1.2	1.3	1.7
Previous Tealbook	2.1	2.2	1.8	1.5	1.3	1.3	1.7
Civilian unemployment rate ¹	4.2	3.9	3.8	4.0	4.2	4.5	4.9
Previous Tealbook	4.4	4.1	4.0	4.1	4.3	4.5	4.9
PCE prices, total	1.6	1.9	2.0	2.1	2.1	2.1	2.0
Previous Tealbook	1.7	1.8	1.9	2.1	2.1	2.1	2.0
Core PCE prices	1.6	1.9	2.0	2.1	2.1	2.1	2.0
Previous Tealbook	1.7	1.9	2.0	2.0	2.1	2.1	2.0
Federal funds rate ¹	1.48	2.70	3.67	4.17	4.25	4.09	3.00
Previous Tealbook	1.47	2.55	3.46	3.97	4.10	3.99	3.00
10-year Treasury yield ¹	2.9	3.6	4.0	4.0	3.9	3.8	3.5
Previous Tealbook	2.9	3.5	3.9	3.9	3.9	3.8	3.5

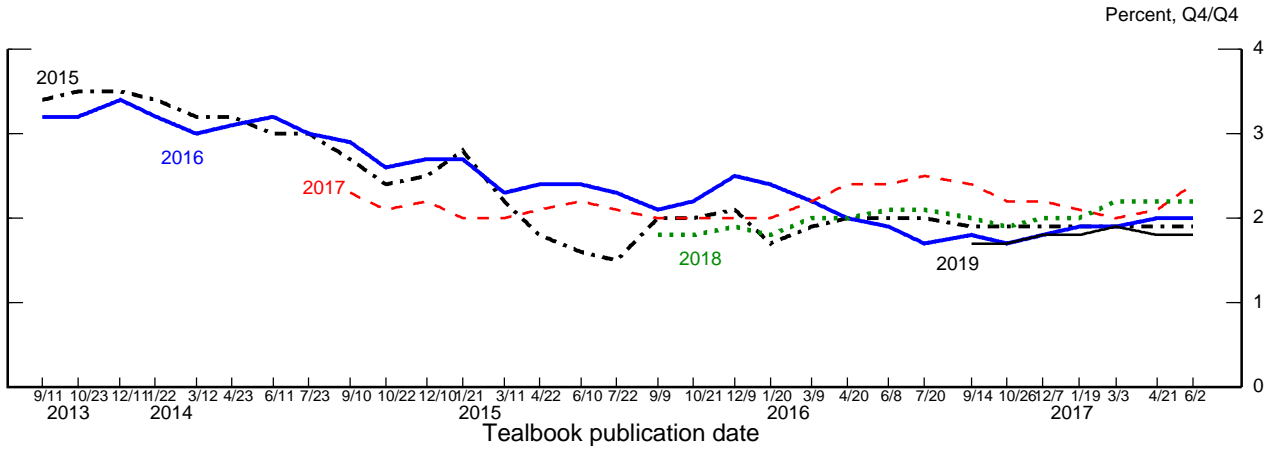
1. Percent, average for the final quarter of the period.



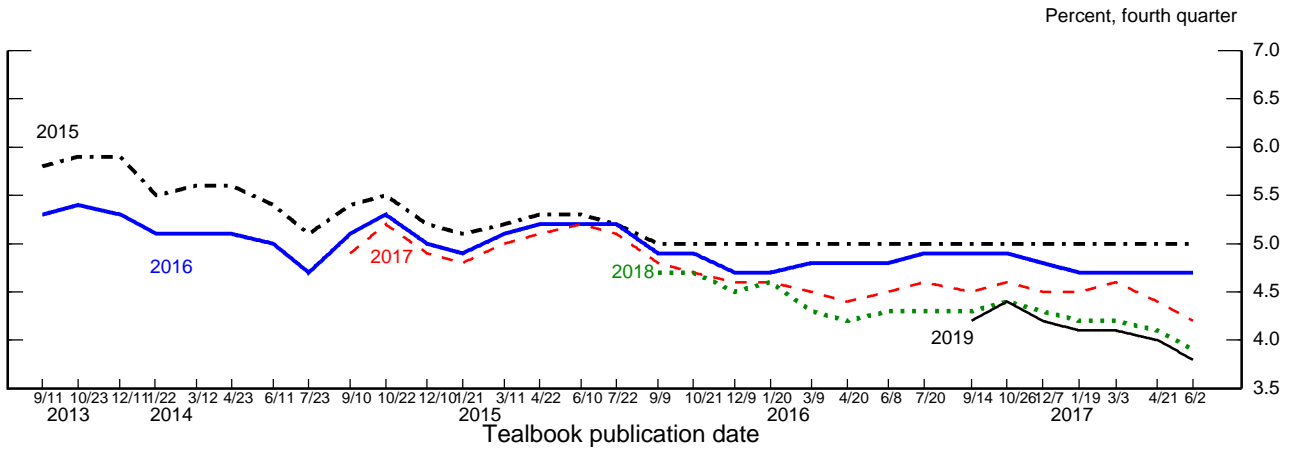
Note: In each panel, shading represents the projection period, and dashed lines are the previous Tealbook.

Evolution of the Staff Forecast

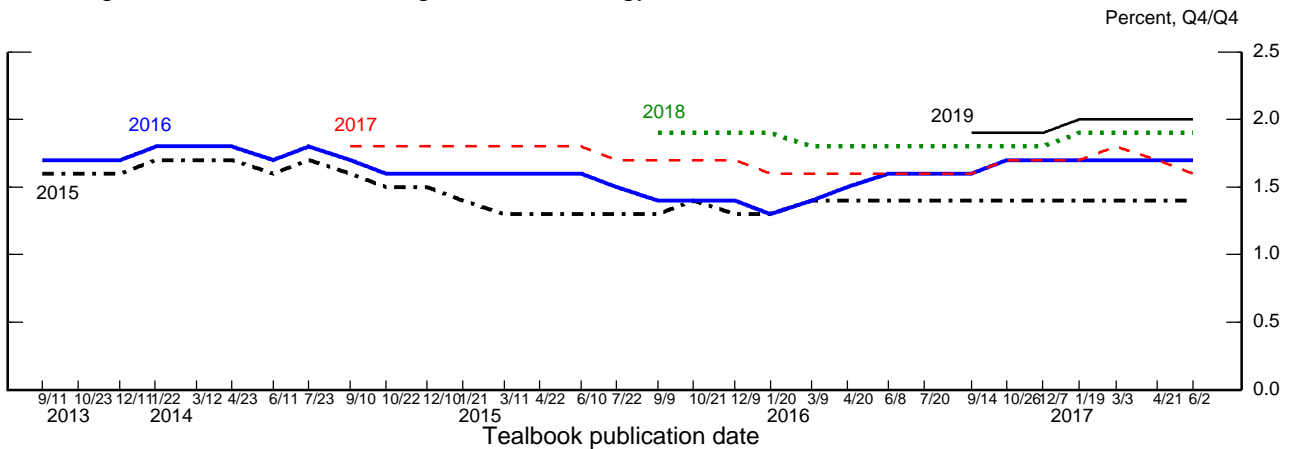
Change in Real GDP



Unemployment Rate



Change in PCE Prices excluding Food and Energy



(This page is intentionally blank.)

International Economic Developments and Outlook

We estimate that total foreign growth picked up to 3¼ percent at an annual rate in the first quarter from 2¾ percent in the fourth. Foreign economies have now registered their third consecutive quarter of above-trend growth following lackluster performance in the first half of last year. Incoming data have continued to surprise us on the upside, and our estimate of first-quarter growth abroad is ¼ percentage point higher than in the April Tealbook. The revisions have been widespread, with sizable markups in Canada, Japan, and Mexico, although the United Kingdom—where growth tumbled to below 1 percent—is a major exception.

We see foreign growth moderating to its potential rate of 2½ percent by early next year and staying at about that pace for the remainder of the forecast period. The projected deceleration in foreign activity reflects the waning of forces that led to the earlier strong growth, with the expansion in Canada and Japan moving down to a more sustainable pace, credit stimulus in China diminishing, commodity prices leveling off from their increases over the past year, and the recent sharp rebound in global trade showing some signs of slowing. That said, in response to strong activity data in the foreign economies, we have revised up foreign growth slightly for the remainder of 2017, with the forecast unchanged thereafter.

Risks surrounding our foreign outlook appear to be more balanced than last year. On the upside, the strength of recent activity indicators from abroad—and the pattern of upward revisions to our foreign outlook over the past few Tealbooks—could foreshadow stronger momentum in the foreign economies than what we currently expect. We explore the consequences of such an outcome in the “Stronger Foreign Growth” alternative scenario in the Risks and Uncertainty section.

On the downside, we remain concerned about economic and financial prospects for the euro area, especially in Italy, despite a decline in near-term risks following the French election. Moreover, in China, stepped-up efforts to rein in credit growth, while positive for longer-term financial stability, raise the risk of a sharp escalation of financial stress in the near term. In addition, we remain mindful of the possibility that monetary policy normalization in the United States could disrupt emerging market economies (EMEs). Such a risk would be heightened were developments in the U.S. economy, such as unexpectedly high inflation, to require faster tightening of monetary policy, a situation

we explore in the “EME Turbulence and Stronger Dollar” alternative scenario in the Risks and Uncertainty section.

Recent data suggest that inflation in the advanced foreign economies (AFEs) will moderate to just above 1 percent at an annual rate in the second quarter from 2.3 percent in the first as the effects of higher energy prices fade. AFE inflation should gradually pick up to 1½ percent over the forecast period, although this pickup masks divergent trends. In the euro area and Japan, inflation moves up in response to tighter resource pressures but remains considerably below central banks’ targets; as such, we assume that monetary policy in these regions will remain highly accommodative. In Canada, inflation stays close to the 2 percent target, while in the United Kingdom it falls toward 2 percent as the pass-through from earlier currency depreciation fades; in both economies, we project that monetary authorities will start removing stimulus next year.

We estimate that inflation in the EMEs will come in at about 3½ percent this quarter, unchanged from the first quarter. Thereafter, we see inflation declining to a little over 3 percent by the end of this year and stabilizing at that pace. The decline in inflation largely reflects a deceleration of prices in Mexico as the effects of earlier currency depreciation and gasoline price hikes wane. We have seen diverse movements in monetary policy among the EMEs, concentrated in Latin America: The central banks of Mexico and Argentina recently hiked their policy rates, while the central banks of Brazil, Chile, and Colombia eased.

ADVANCED FOREIGN ECONOMIES

- **Canada.** Real GDP growth climbed to 3.7 percent in the first quarter from 2.7 percent in the fourth, ¾ percentage point higher than our April Tealbook estimate. This step-up in growth was driven by unusually strong consumption, reflecting the recent introduction of the Canada Child Benefit program, and by the resumption of investment in the energy sector. Recent indicators, such as the April manufacturing PMI, suggest that growth will moderate to about 2½ percent in the current quarter. We expect that growth, supported by accommodative monetary and fiscal policies, will average around 2 percent through mid-2018 and settle at its potential pace of 1¾ percent thereafter.
- **Japan.** Real GDP growth picked up from 1.4 percent in the fourth quarter to 2.2 percent in the first, almost 1 percentage point faster than estimated in the April

Tealbook. This acceleration was driven by a pickup in household spending and a large swing in inventory investment. Recent indicators, including April industrial production and the May manufacturing PMI, suggest that economic activity has continued to expand at a solid pace. Accordingly, we now project GDP growth to average almost 1½ percent over the remainder of this year, up a bit from our April forecast and well above our estimate of potential growth of ½ percent. Thereafter, growth should move down further to ¾ percent in 2018 before stalling in 2019 as a result of a legislated consumption tax hike. Given continued monetary stimulus throughout the forecast period and the projected opening of a significant positive output gap, we forecast that inflation will rise from about zero in early 2017 to 1¼ percent in 2019 (excluding the effects of the tax hike), still well below the 2 percent target.

- ***Euro Area.*** Real GDP growth held steady at 2 percent in the first quarter. Recent indicators—such as PMIs and confidence readings through May—have been relatively strong, consistent with growth rising to 2¼ percent in the current quarter. We project that growth will edge down to 1¾ percent in 2018 and 2019. Compared with the April Tealbook, this forecast is ¼ percentage point stronger for 2017, reflecting the strength of recent data, but is unchanged thereafter.

Data through May suggest that inflation will step down from 2.9 percent in the first quarter to ½ percent in the current quarter entirely as a result of a decline in food and energy prices. Headline inflation should rise to 1¼ percent in late 2017 as food and energy prices recover, and edge up further to 1½ percent by 2019 as resource slack is slowly absorbed. We continue to assume that the European Central Bank will purchase assets at its current monthly pace of €60 billion through the end of 2017 before tapering in the first half of 2018. In addition, we anticipate that the deposit rate will remain at negative 0.4 percent until early 2019 before rising to 0 percent by the end of the forecast period.

- ***United Kingdom.*** In contrast to most foreign economies, U.K. GDP growth plunged from 2.7 percent in the fourth quarter to 0.7 percent in the first quarter, 1¼ percentage points below our April Tealbook projection. This slowdown is due to a decline in exports after a fourth-quarter surge and to weak private consumption reflecting the moderation in real incomes caused by higher inflation. Recent indicators, such as April retail sales and PMIs through May, suggest GDP will rise 1½ percent in the

current quarter. Thereafter, growth should stay at about that pace through 2019, as uncertainty surrounding Brexit weighs on household and business spending.

Inflation rose to 3.9 percent in the first quarter, and we expect it to moderate to slightly above 3 percent this quarter as past sterling depreciation continues to pass through to consumer prices. As this boost wanes, inflation should decline to near the 2 percent target by early 2018. With wage growth more subdued than previously expected, we now anticipate that the Bank of England will raise its policy rate in the fourth quarter of 2018, one quarter later than assumed in the April Tealbook.

EMERGING MARKET ECONOMIES

- **Mexico.** Worries that uncertainty about U.S. trade policy will weigh on the Mexican economy are abating somewhat. GDP growth edged down to 2.7 percent in the first quarter from 2.9 percent in the fourth but was still $\frac{3}{4}$ percentage point above what we had in the April Tealbook. Growth was supported by stronger-than-expected exports and household demand against the backdrop of the lowest unemployment rate since 2007. Recent indicators—including weak manufacturing exports as well as the sales, production, and exports of vehicles—suggest that growth will drop further to about 2 percent in the current quarter. But this projection is nonetheless $\frac{1}{4}$ percentage point higher than in the April forecast, as U.S. manufacturing production looks stronger. We expect Mexican growth to gradually move up to $2\frac{1}{2}$ percent by the end of 2018. Reduced drag from fiscal consolidation, a weaker peso, and past reforms in the energy sector should support growth, but be offset by tightened monetary policy.

We see inflation declining to 6 percent in the current quarter from nearly double-digit inflation in the first as the effects of past peso depreciation and a January hike in fuel prices start to wane. Inflation should decline further to near the 3 percent inflation target by 2018. Responding to inflationary pressures, the Bank of Mexico raised the policy rate 25 basis points in mid-May to 6.75 percent, 375 basis points above its level at the start of its tightening phase in late 2015. We expect more rate hikes later this year.

- **Brazil.** GDP growth experienced a stunning turnaround from negative 2.2 percent in the fourth quarter to 4.3 percent in the first. We had anticipated a substantial pickup, but a surge in agricultural exports boosted growth $1\frac{3}{4}$ percentage points above our April Tealbook estimate. As exports normalize, we see Brazilian growth moderating

to $\frac{3}{4}$ percent in the current quarter before gradually picking up to about $2\frac{1}{4}$ percent by 2019. Lately, financial conditions in Brazil have tightened in the wake of a political crisis that erupted in mid-May and threatens to topple the interim government of President Michel Temer. These developments and the weaker incoming indicators for the second quarter prompted us to mark down our near-term Brazilian outlook. Over the longer term, our baseline forecast is unchanged and continues to assume that the government will implement critical fiscal and structural reforms, but the recent political turmoil has increased uncertainty about future progress toward these reforms and about the economic outlook more generally.

Amid double-digit unemployment and tight monetary policy, inflation declined to 4.1 percent in April on a 12-month basis, below the $4\frac{1}{2}$ percent target. This decline, coupled with still-weak domestic demand, led the Brazilian central bank to slash its policy rate 100 basis points in mid-April and another 100 basis points in late May, to 10.25 percent. We expect further cuts in the next few months.

- **China.** After a strong first quarter, we estimate that real GDP growth will slow to $6\frac{1}{2}$ percent this quarter, slightly below our April Tealbook projection. Infrastructure and property-sector investment have held up, but PMIs, exports, commodity imports, industrial production, and manufacturing investment all weakened in April. Some of the moderation in domestic demand likely reflects diminishing credit stimulus, and we expect growth to fall further over the coming quarters amid ongoing efforts by Chinese authorities to tighten domestic financial conditions. All told, we see growth stepping down to about $6\frac{1}{4}$ percent in the second half of this year and then slowing further, in line with potential growth, to $5\frac{3}{4}$ percent by 2019. Downside risks to the outlook remain, including the possibility of a sharp adjustment in the property market, a run on the financial system, or renewed capital outflows leading to sharp moves in the exchange rate.

Headline consumer price inflation fell to negative 0.6 percent in the first quarter on falling food prices. We see inflation increasing to $2\frac{1}{2}$ percent in the current quarter as food price inflation stabilizes and staying about there over the forecast period.

- **Other Emerging Asia.** Strong export growth throughout much of the region, together with a rebound in India as the negative effects of its demonetization policy abated, boosted growth in other emerging Asia to 4.4 percent in the first quarter, from 3.5 percent in the fourth. We see the robust export growth that has supported the

region's strong performance moderating some of late. Two important drivers of Asian exports have been Chinese demand for the region's products and strong performance in the high-tech sector. Most recent indicators for regional exports, Chinese imports, and high tech appear to have cooled somewhat. As such, we see growth in other emerging Asia edging down over the next few quarters and settling at around 3½ percent by early next year.

(This page is intentionally blank.)

The Foreign GDP Outlook

Real GDP*

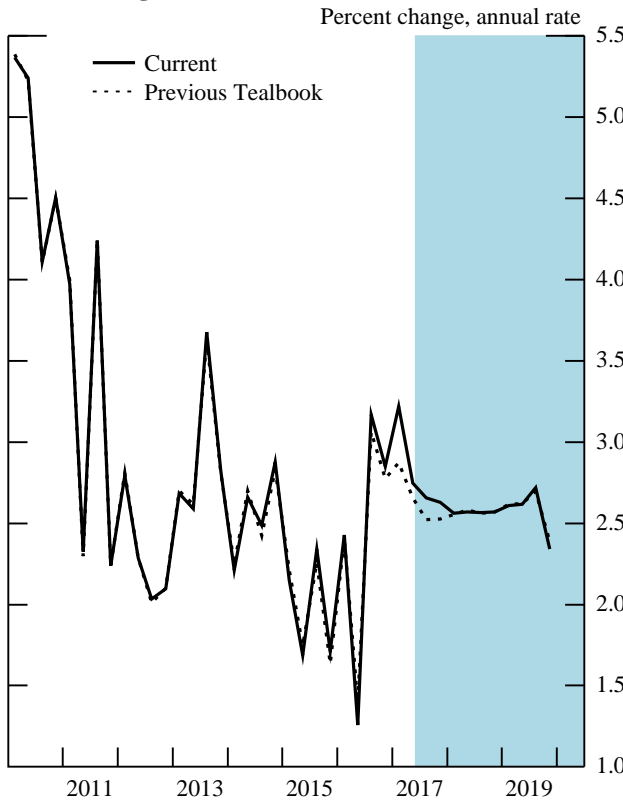
Percent change, annual rate

	2016			2017			2018	2019
	H1	Q3	Q4	Q1	Q2	H2		
1. Total Foreign	1.8	3.2	2.8	3.2	2.7	2.6	2.6	2.6
Previous Tealbook	1.9	3.1	2.8	2.9	2.7	2.5	2.6	2.6
2. Advanced Foreign Economies	1.4	2.6	2.3	2.7	2.2	1.9	1.7	1.7
Previous Tealbook	1.4	2.4	2.3	2.4	2.0	1.8	1.8	1.7
3. Canada	.7	4.2	2.7	3.7	2.4	2.1	1.8	1.8
4. Euro Area	1.8	1.7	1.9	2.0	2.2	1.9	1.8	1.8
5. Japan	2.1	1.0	1.4	2.2	1.7	1.2	.8	.0
6. United Kingdom	1.5	2.0	2.7	.7	1.6	1.7	1.6	1.6
7. Emerging Market Economies	2.3	3.8	3.4	3.7	3.3	3.3	3.4	3.5
Previous Tealbook	2.4	3.7	3.3	3.4	3.3	3.2	3.4	3.5
8. China	6.8	6.8	6.6	7.3	6.5	6.2	5.8	5.7
9. Emerging Asia ex. China	3.7	3.3	3.5	4.4	4.0	3.8	3.6	3.5
10. Mexico	1.0	4.4	2.9	2.7	2.1	2.3	2.4	2.6
11. Brazil	-2.6	-2.3	-2.2	4.3	.7	1.9	2.1	2.2

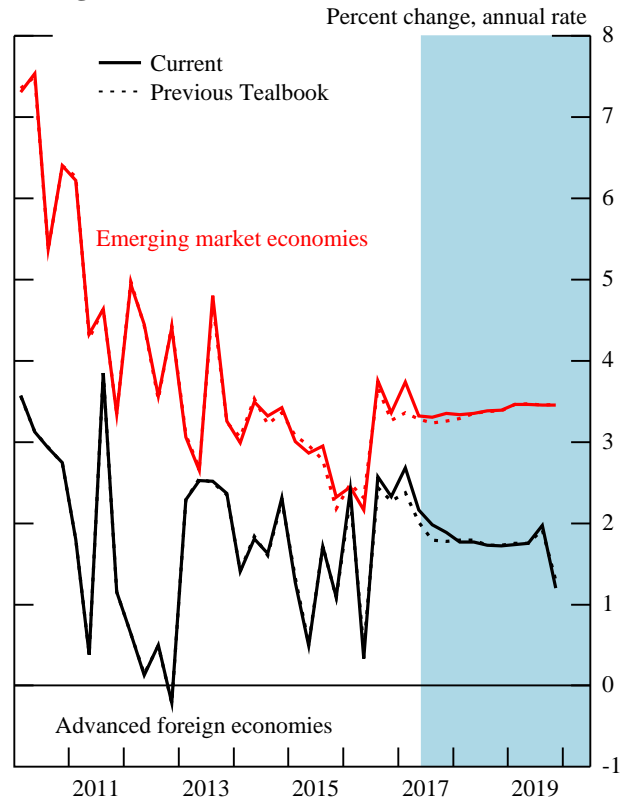
* GDP aggregates weighted by shares of U.S. merchandise exports.

Int'l Econ Devel & Outlook

Total Foreign GDP



Foreign GDP



The Foreign Inflation Outlook

Consumer Prices*

Percent change, annual rate

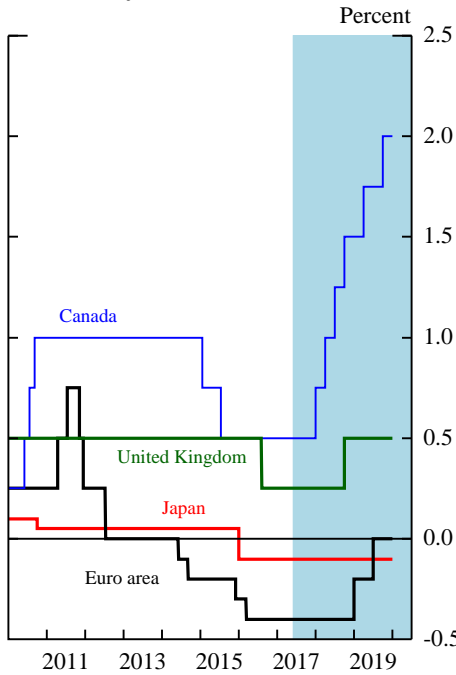
	2016			2017			2018	2019
	H1	Q3	Q4	Q1	Q2	H2		
1. Total Foreign	1.7	1.7	2.6	3.0	2.4	2.4	2.4	2.6
Previous Tealbook	1.7	1.6	2.6	3.0	2.4	2.4	2.4	2.6
2. Advanced Foreign Economies	.4	.9	1.8	2.3	1.1	1.3	1.5	1.9
Previous Tealbook	.4	.9	1.8	2.5	1.4	1.4	1.6	1.9
3. Canada	1.4	1.0	1.7	2.6	1.8	1.7	1.9	2.0
4. Euro Area	-0	1.2	1.9	2.9	.6	1.0	1.4	1.6
5. Japan	-3	-5	2.4	-1	.3	.5	.8	2.5
6. United Kingdom	.4	2.1	1.9	3.9	3.1	2.3	2.1	2.1
7. Emerging Market Economies	2.7	2.2	3.1	3.4	3.4	3.2	3.1	3.1
Previous Tealbook	2.7	2.2	3.1	3.4	3.0	3.2	3.1	3.1
8. China	2.4	1.3	2.6	-6	2.6	2.6	2.5	2.5
9. Emerging Asia ex. China	1.7	1.1	2.7	3.6	1.6	2.9	3.2	3.4
10. Mexico	2.6	3.6	4.1	9.9	6.0	3.5	3.2	3.2
11. Brazil	9.6	6.5	2.6	3.2	3.1	4.9	4.4	4.5

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

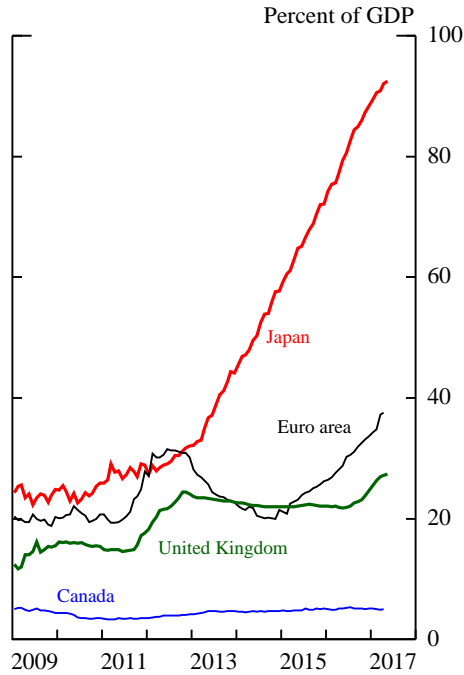
Int'l Econ Devel & Outlook

Foreign Monetary Policy

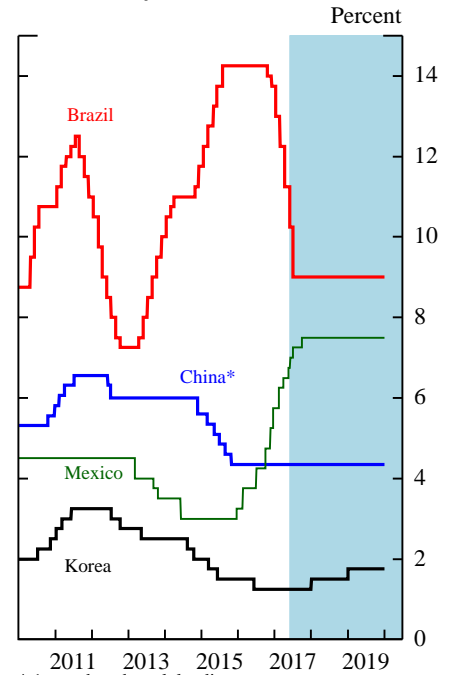
AFE Policy Rates



AFE Central Bank Balance Sheets



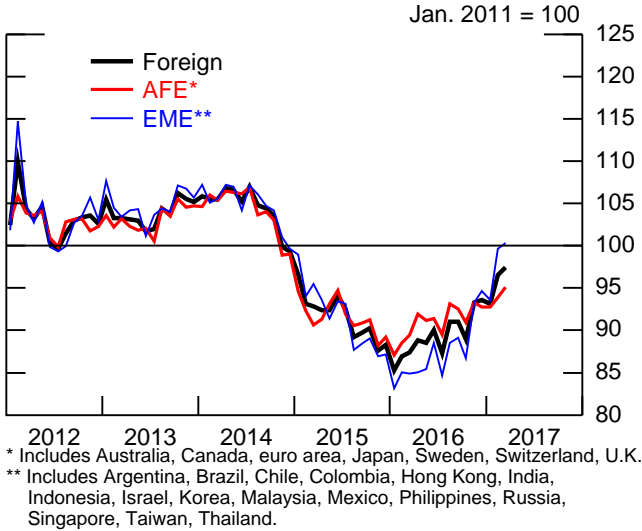
EME Policy Rates



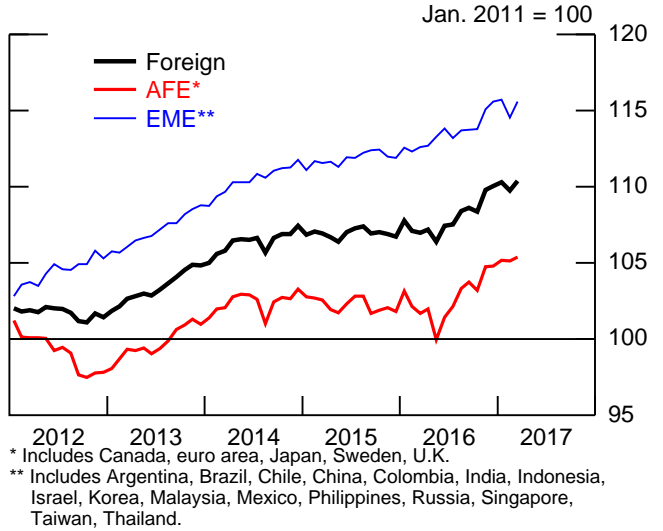
* 1-year benchmark lending rate.

Recent Foreign Indicators

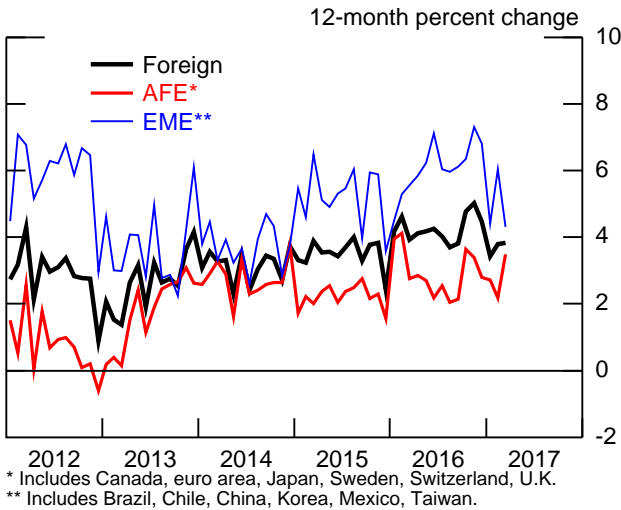
Nominal Exports



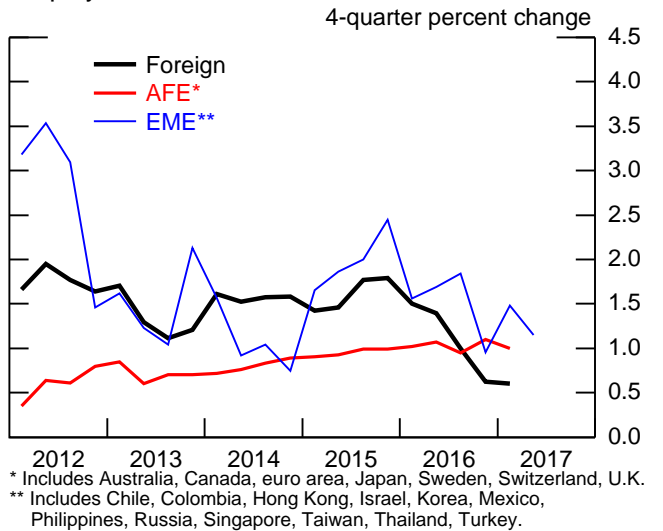
Industrial Production



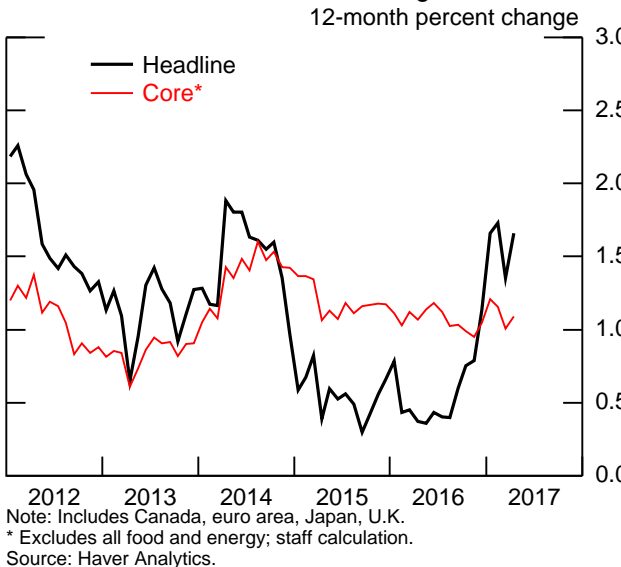
Retail Sales



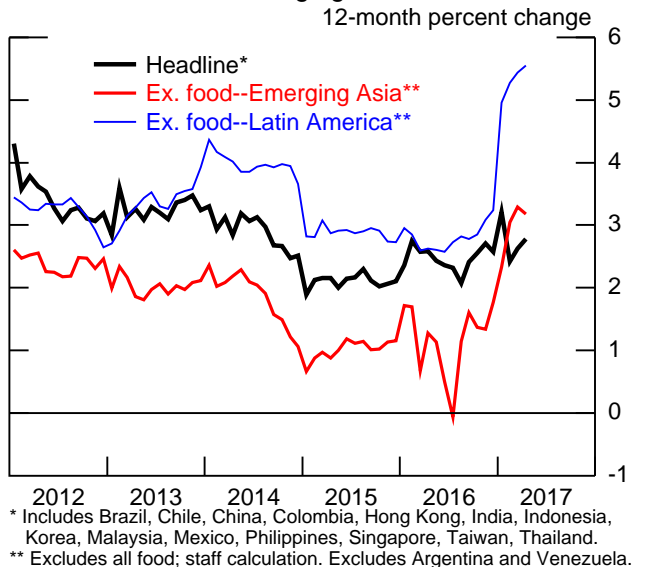
Employment



Consumer Prices: Advanced Foreign Economies

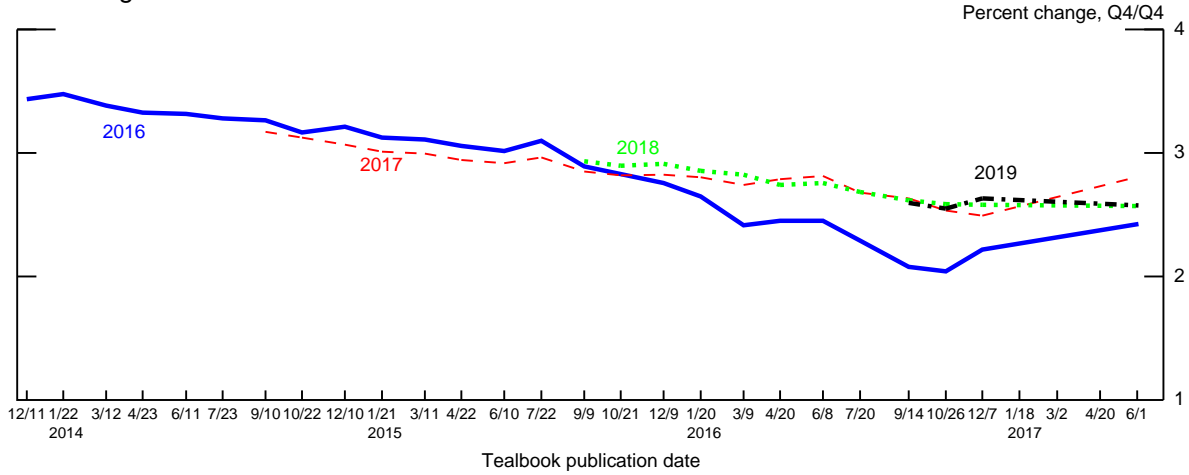


Consumer Prices: Emerging Market Economies

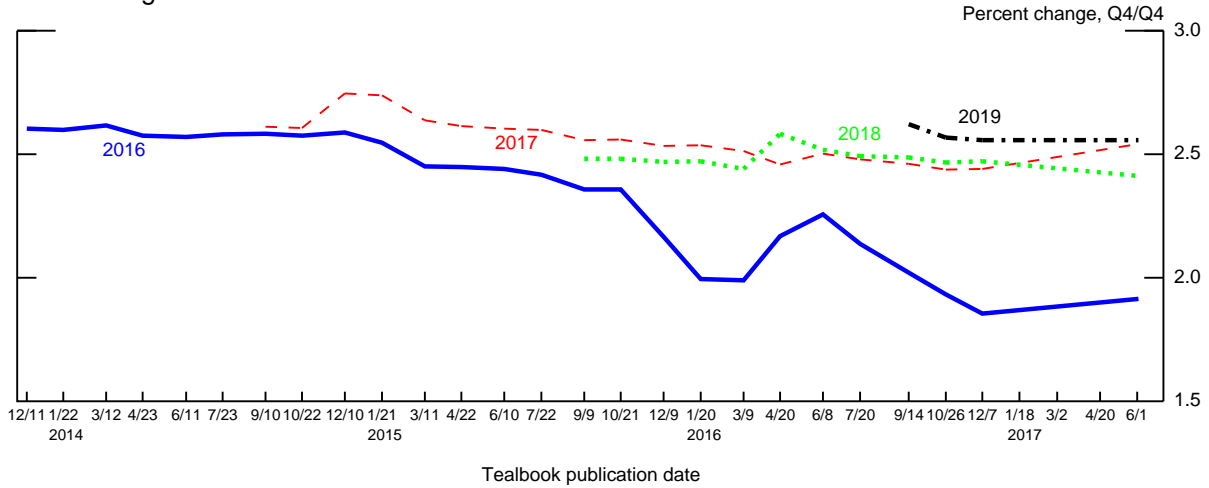


Evolution of Staff's International Forecast

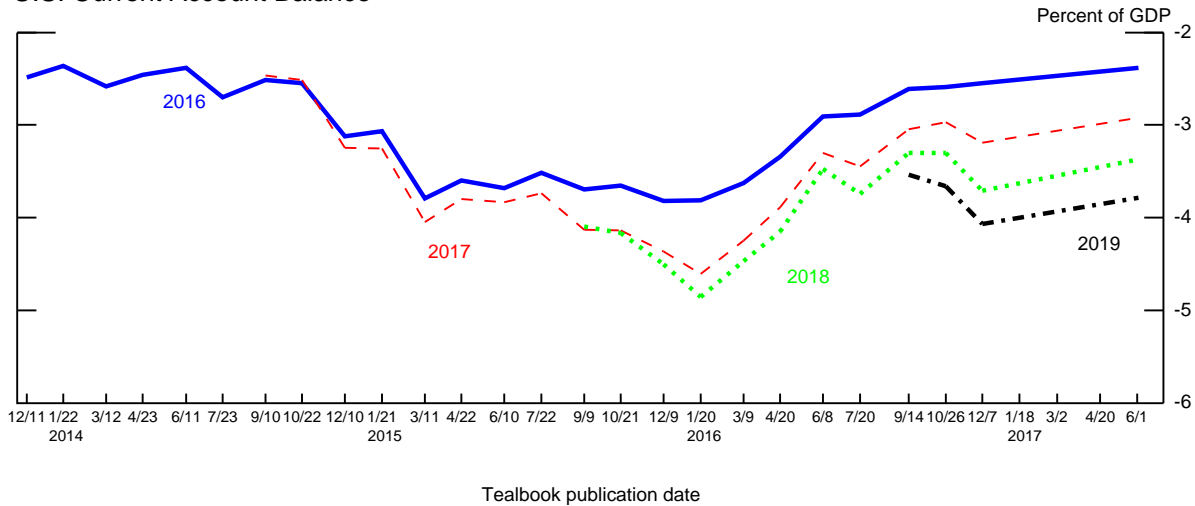
Total Foreign GDP



Total Foreign CPI



U.S. Current Account Balance



Int'l Econ Devel & Outlook

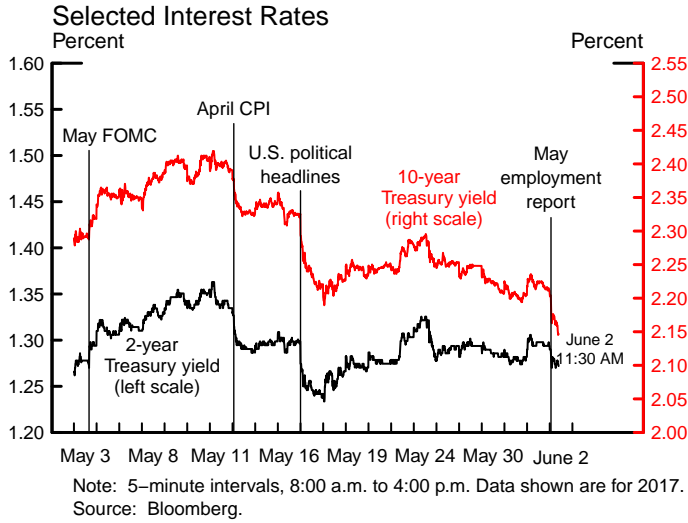
(This page is intentionally blank.)

Financial Market Developments

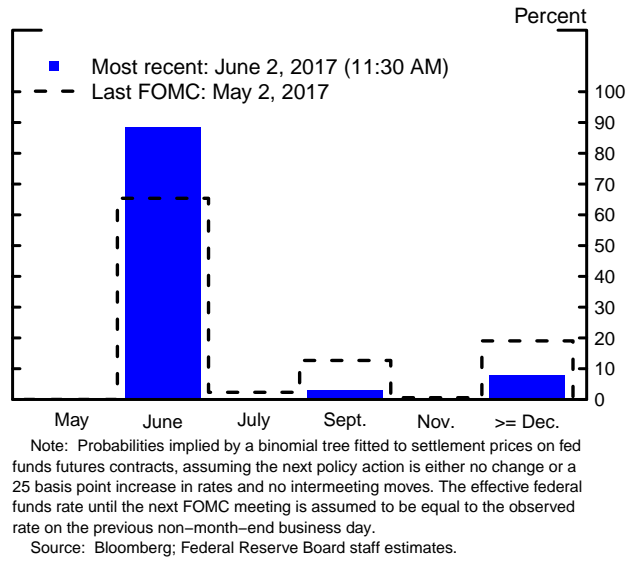
Over the intermeeting period, prices of risky assets were little changed, on net, while Treasury yields declined and the dollar depreciated modestly. Investors perceived FOMC communications as broadly in line with expectations and incoming economic data as slightly weaker than expected on balance. Confidence in the Administration's ability to advance its economic agenda appeared to wane somewhat further, while market participants' perceptions of an improved global economic outlook reportedly provided some support to investor risk sentiment.

- FOMC communications were characterized as about in line with expectations, with investors noting that the Committee did not seem to have materially changed its view of the economic outlook. However, the May FOMC minutes were generally seen as having provided a bit more clarity on the Committee's plan to reduce reinvestments this year.
- Based on a straight read of market quotes, the probability of a rate hike at the June meeting increased, on net, from 65 percent to 90 percent, while the implied risk-neutral probability of at least one more rate hike this year, conditional on a rate hike in June, declined from 58 percent to 44 percent. Market-based expectations of the level of the federal funds rate from early 2018 through the end of 2020 edged down a bit.
- Yields on intermediate- and longer-dated nominal Treasury securities declined, on net, posting modest reactions to domestic economic data releases and U.S. political headlines. TIPS-based inflation compensation declined somewhat in the context of weak inflation data, while implied volatility on Treasury yields remained subdued.
- Broad U.S. equity price indexes edged up, on balance, as perceptions of an improved global outlook and positive news on corporate earnings appeared to roughly offset reduced confidence in the Administration's ability to push forward its economic and regulatory reforms. Near-term option-implied stock price volatility remained near multidecade low levels. Corporate bond spreads were little changed on net.

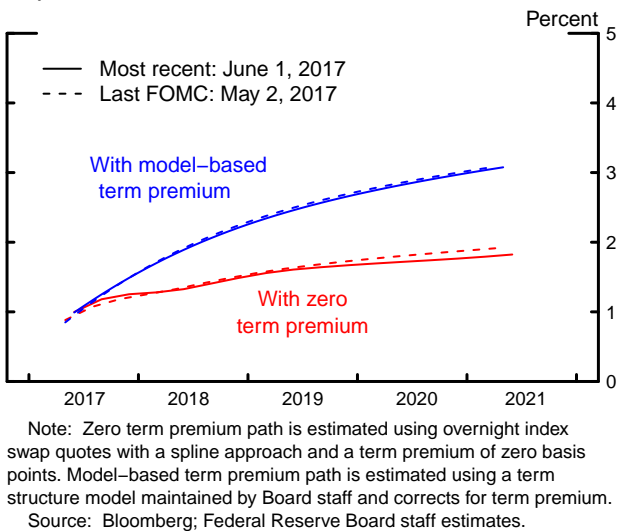
Policy Expectations and Treasury Yields



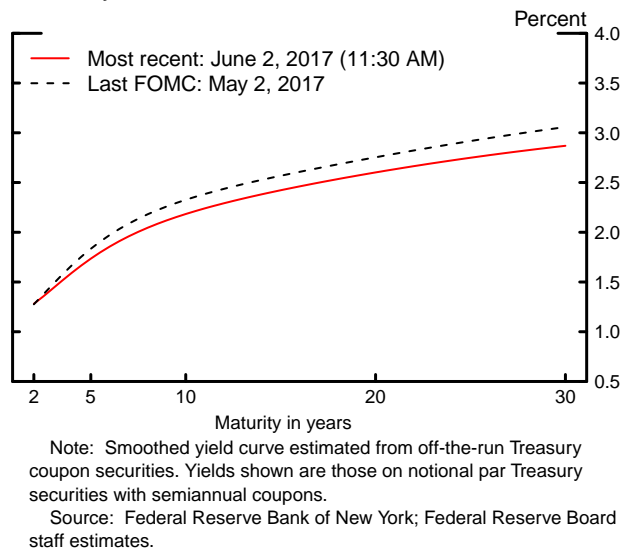
Market-Implied Probability Distribution of the Timing of Next Rate Increase



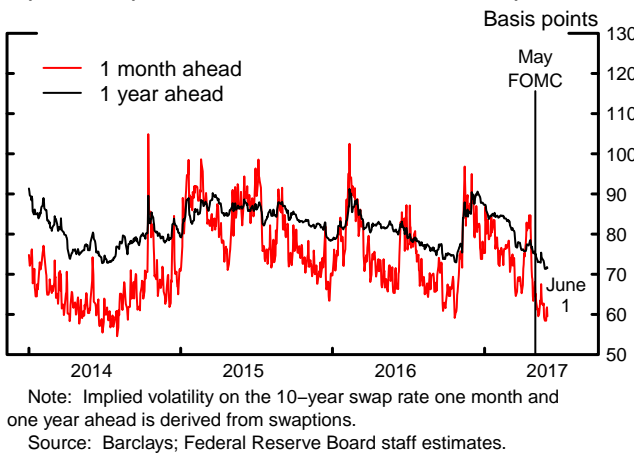
Implied Federal Funds Rate



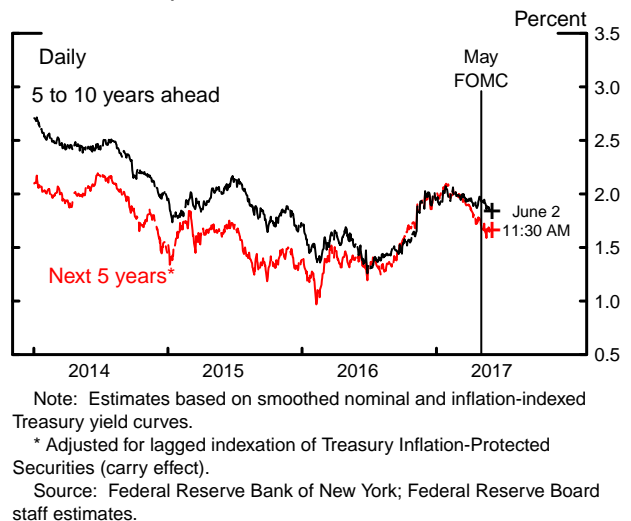
Treasury Yield Curve



Option-Implied Volatilities on 10-Year Swap Rate



Inflation Compensation



Financial Markets

- Foreign market developments were generally positive, boosted by mildly improved sentiment following the French election and foreign data that mostly surprised on the upside. Globally, equity prices generally rose, most euro-area sovereign bond spreads declined modestly, and capital flows to emerging market economies (EMEs) continued. The notable exception was Brazil, where local political developments weighed on domestic financial markets. The broad dollar index declined about 1¼ percent, mainly driven by its depreciation against AFE currencies.

POLICY EXPECTATIONS AND ASSET MARKET DEVELOPMENTS

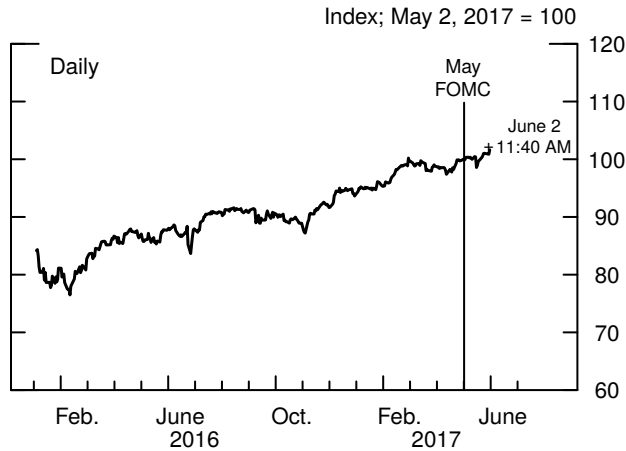
Domestic Developments

FOMC communications over the intermeeting period were viewed as broadly in line with investors' expectations that the Committee would continue to remove policy accommodation at a gradual pace. Market participants interpreted both the Committee's assessment in the May FOMC statement that the slowdown of growth in the first quarter was "likely to be transitory" and the phrase in the May FOMC minutes that "most participants viewed the recent softer inflation data as primarily reflecting transitory factors" as indicating that the Committee had not materially changed its economic outlook. In addition, market participants generally viewed the discussion in the minutes on reducing reinvestments as mitigating the risk that the process of reducing the size of the balance sheet would lead to outsized movements in interest rates or adverse effects on market functioning. Market reports also highlighted the minutes discussion noting that nearly all meeting participants were in favor of a proposed operational plan to gradually increase the caps on the dollar amounts of Treasury and agency securities that would run off each month, with such a plan commencing sometime this year as long as the economy and the path of the federal funds rate evolved as currently expected. Partly in reaction to the minutes, a number of market participants reportedly pulled forward their expectations for the most likely timing of a change to the Committee's reinvestment policy.

The probability of a rate hike occurring at the June meeting—as implied by a straight read of quotes on federal funds futures contracts and without adjusting for term premiums—rose to 90 percent from 65 percent prior to the May meeting, while the implied probability of at least one more rate hike later this year, conditional on a rate hike in June, declined from 58 percent to 44 percent. The expected path of the federal funds rate from 2018 to the end of 2020, as implied by both a straight read from OIS quotes and

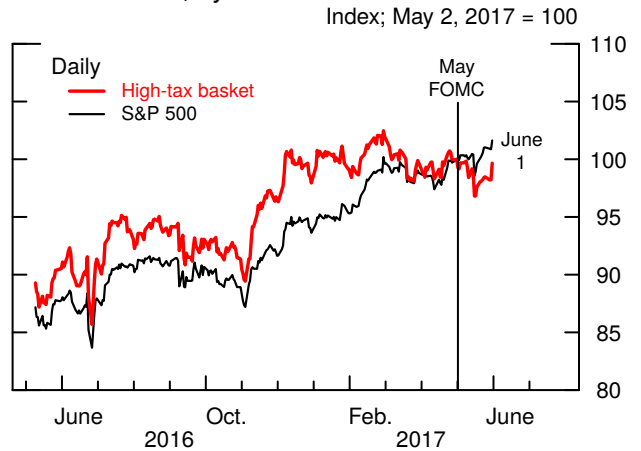
Corporate Asset Market Developments

S&P 500



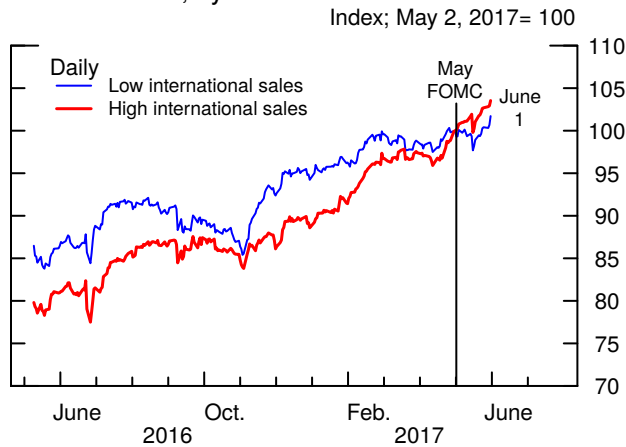
Source: Bloomberg.

Stock Returns, by Domestic Tax Rate



Source: Bloomberg; Goldman Sachs.

Stock Returns, by International Sales



Note: Groups with high and low international sales exposure include all Compustat firms except those in the energy, financial, and utility industries. International sales exposure is defined as the ratio of foreign sales to total sales, with high (low) exposure defined as being above (below) the 67th (33rd) percentile.
Source: Compustat; Yahoo Finance.

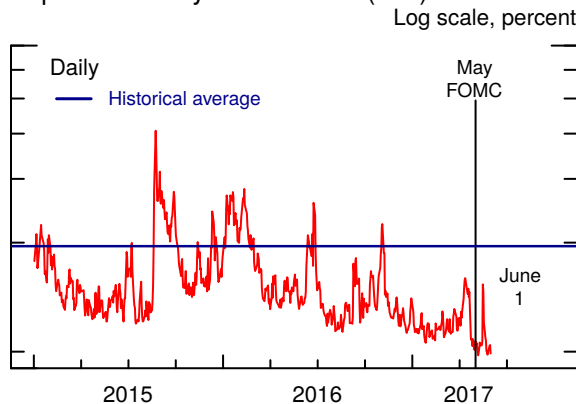
Equity Risk Premium



* Off-the-run 10-year Treasury yield less Philadelphia Fed 10-year expected inflation.

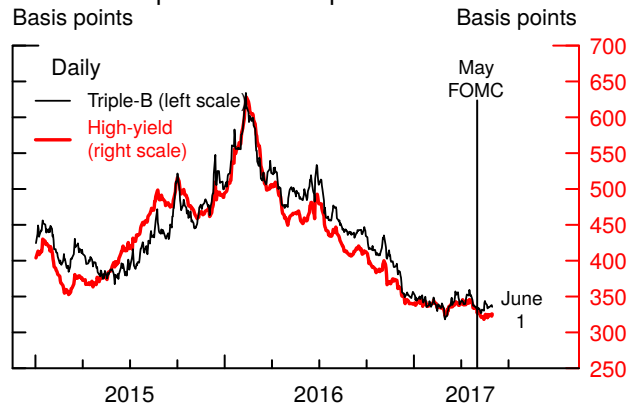
+ Denotes latest observation using daily interest rates and stock prices as well as staff forecast of corporate profits.
Source: Staff projections.

Implied Volatility on S&P 500 (VIX)



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

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.

Financial Markets

a staff model that adjusts for term premiums, declined a bit over the intermeeting period, in part because of the release of the May employment situation report.

The nominal Treasury yield curve flattened somewhat, on net, over the intermeeting period, with the 2-year Treasury yield being little changed and the 10-year yield declining 14 basis points. Following the May FOMC meeting, intermediate- and longer-dated nominal Treasury yields moved up as market participants highlighted the passage in the statement that the slowdown in growth during the first quarter was likely to be transitory. Subsequently, those increases more than reversed in the remainder of the intermeeting period, as yields declined in reaction to the weaker-than-expected April CPI, U.S. political headlines in mid-May that were interpreted as likely impeding the Administration's ability to advance its economic policy agenda, and the somewhat weaker-than-expected May employment situation report. Option-implied volatility on 10-year swap rates briefly jumped up following the political headlines in mid-May but subsequently fell back to near the low end of its multiyear range.

The 5-year measure of TIPS-based inflation compensation edged down 5 basis points, with the decline mostly attributable to the lower-than-expected April CPI print, while the 5-to-10-year forward measure decreased 11 basis points. Spreads of agency MBS over comparable-maturity Treasury securities tightened a touch in reaction to the reinvestments discussion in the May FOMC minutes.

Broad U.S. equity price indexes edged up, on net, since the May FOMC meeting, reflecting two offsetting forces. On the one hand, the improved global outlook may have increased optimism that corporate earnings would continue to strengthen. Indeed, stock prices of firms with high international sales exposure outperformed those of firms with low exposure. On the other hand, investor confidence in the Administration's ability to advance its economic and regulatory reforms appeared to decline further, as stock prices of firms with high effective tax rates—which would benefit the most from corporate tax cuts—underperformed broader equity indexes.

One-month option-implied volatility on the S&P 500 index—the VIX—was about unchanged, on net, and stands near the bottom of its historical distribution. Political headlines on May 17 led to a decline of 1¾ percent in the S&P 500 index on that day and a brief spike in the VIX that quickly retraced. The box “Drivers of Recent Movements of Implied Volatility” investigates the role of policy uncertainty and other factors in the low level of option-implied equity market volatility in recent months.

Drivers of Recent Movements of Implied Volatility

Recent market commentary has been attentive to the historically low levels of option-implied equity market volatility as measured by the VIX. To some, the low VIX has been puzzling in light of the heightened uncertainty about U.S. economic policy; indeed, it has been conjectured that the low levels of the VIX may be driven in part by a recent proliferation of investment strategies involving the selling of options. We show that low implied volatility largely reflects low *actual* market price volatility, which historically is more closely connected to perceived downside risks to near-term economic growth than to popular measures of economic policy uncertainty. Nonetheless, we cannot entirely account for the recent extraordinarily low readings on actual market volatility.

Volatility over the next 30 days implied by S&P 500 index options is close to the 5th percentile of its historical distribution (red line, figure 1).¹ However, the same can be said for actual volatility, the blue line, measured as an exponentially weighted average of past intraday returns. To understand the recent low level of the VIX, it is helpful to dissect it into the sum of expected near-term volatility, the black line, and an insurance premium against market moves in either direction, known as the variance risk premium, shown in figure 2.² Although the variance risk premium is in the bottom quartile of its historical distribution, it has been fairly stable since 2012 and does not appear to be a major driver of recent very low VIX levels. This observation suggests that the current low level of the VIX is significantly driven by expected volatility, while potential drivers such as changes in investment strategies among certain participants in the equity options market—which would work through the variance risk premium—are likely less important.

As shown in figure 1, expected volatility and actual volatility are tightly linked, so to better understand movements in the VIX, the remainder of the analysis focuses on two potential drivers of recent actual volatility: a measure that reflects economic policy uncertainty (the Baker-Bloom-Davis index) and a measure that reflects perceived downside risks to economic fundamentals (the one-quarter-ahead recession probability derived from the Survey of Professional Forecasters). Figure 3 shows both measures. While the policy uncertainty index is well above its long-run median, the recession probability is closer to the lower end of its range. Policy uncertainty and recession risks tend to be highly correlated around recessions but are less correlated when the economy is expanding.

To evaluate the relative importance of these measures for explaining volatility, we estimate quarterly regressions of actual volatility on the two measures, both jointly and individually. Jointly, both measures explain 33 percent of the variation in actual volatility. Individually, recession probability explains 29 percent of the variation, whereas economic policy uncertainty by itself explains only 16 percent. This finding suggests that, over the full sample, economic policy uncertainty adds little explanatory power once we account for recession risk.

Thus, while economic policy uncertainty has increased of late, we should not be too surprised that it has not led to a marked increase in actual volatility or the VIX. However, the question of why actual volatility is at its lowest level since the early 1990s cannot be fully explained by the level of recession risk.

¹ Although this analysis focuses on the VIX, conclusions hold for longer-dated implied volatility estimates, which are also hovering at or near post-crisis lows.

² The decomposition of the VIX into the expectations and premium components was provided by FRBNY staff.

Figure 1: VIX, Expected Volatility, and Actual Volatility

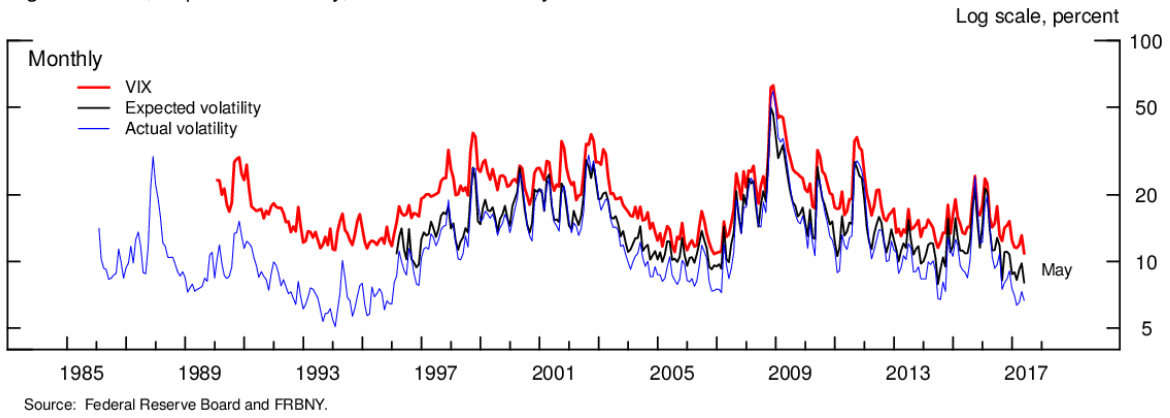


Figure 2: Variance Risk Premium

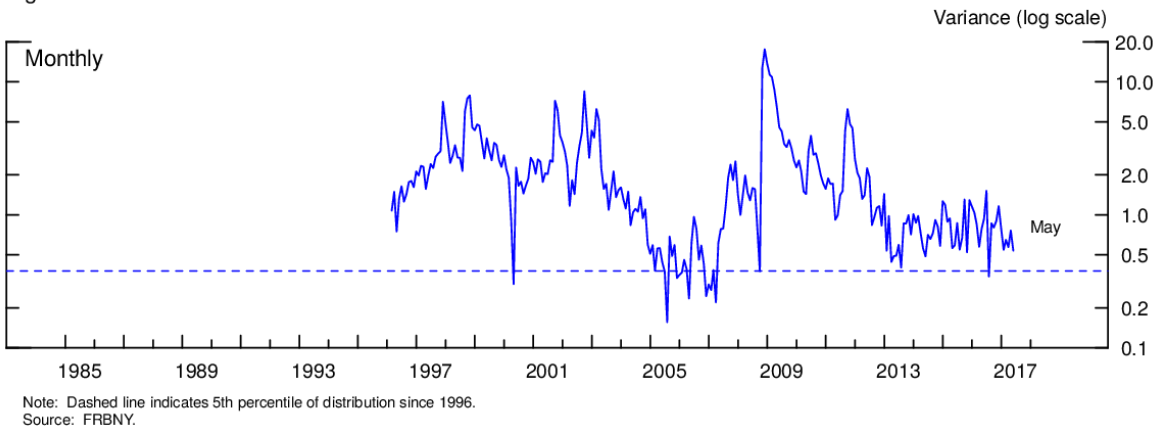
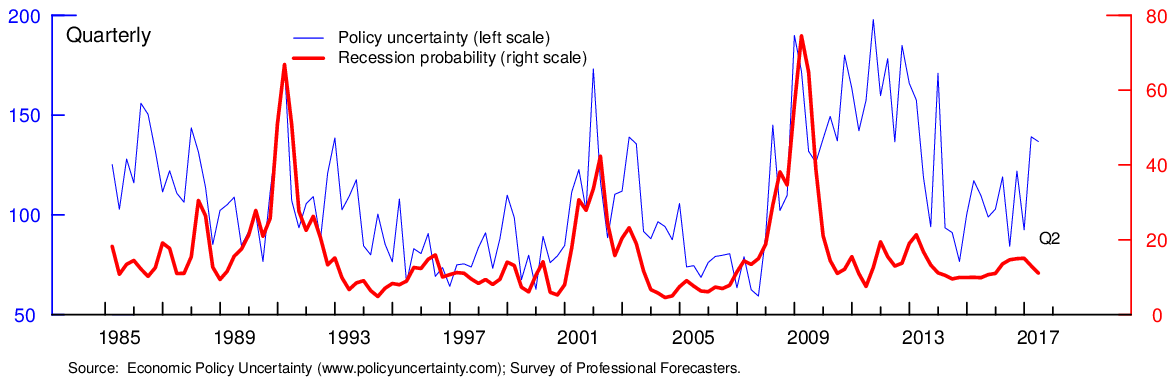
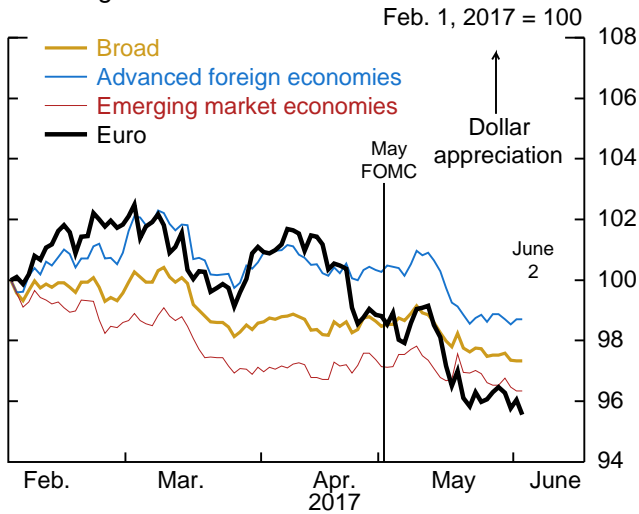


Figure 3: Recession Probability and Policy Uncertainty

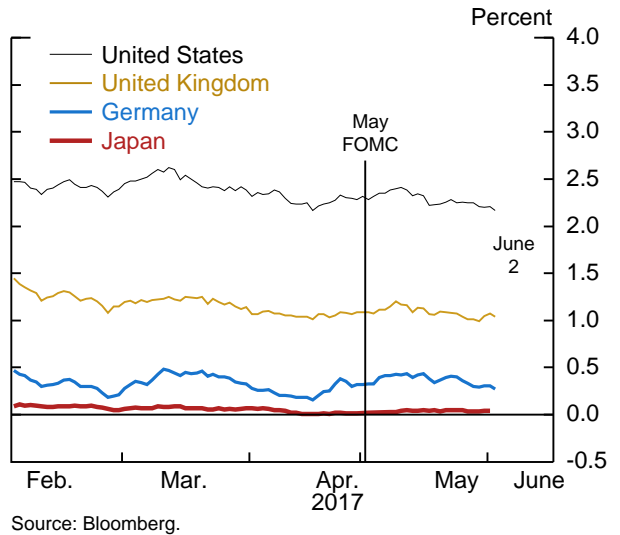


Foreign Developments (All daily series updated on June 2 at 11:15 a.m.)

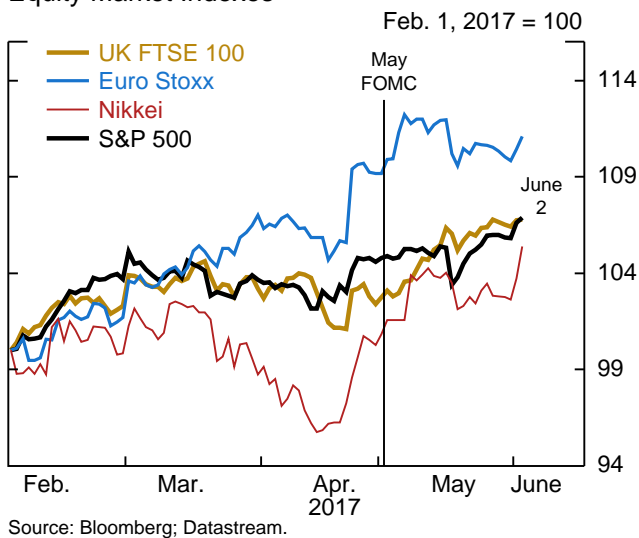
Exchange Rates



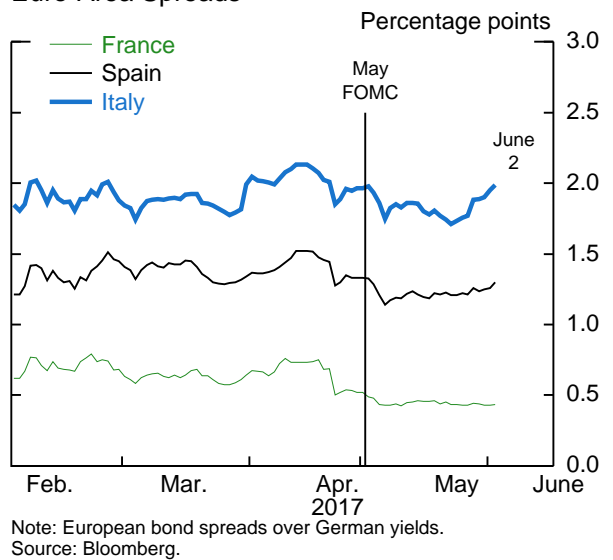
10-Year Nominal Yields



Equity Market Indexes

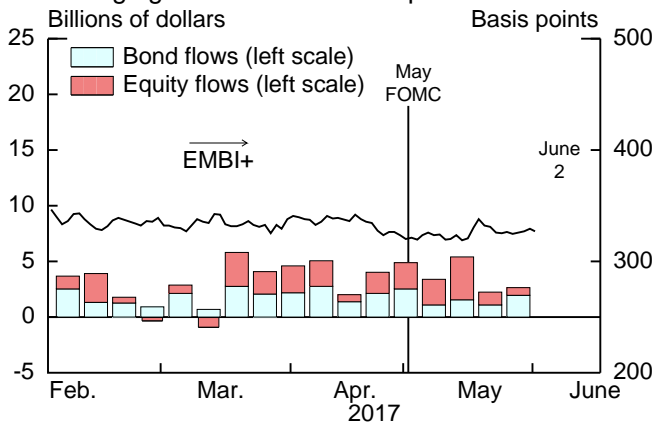


Euro-Area Spreads



Financial Markets

Emerging Market Flows and Spreads



Note: Emerging market bond spreads over zero-coupon Treasury securities. Excludes intra-China flows. EMBI+ is the J.P. Morgan Emerging Markets Bond Index Plus.

Source: Bloomberg; Emerging Portfolio Fund Research.

In the corporate bond market, spreads of yields on investment- and speculative-grade nonfinancial corporate bonds over those on comparable-maturity Treasury securities were little changed, on net, and remained below the medians of their respective historical distributions.

Foreign Developments

Over the intermeeting period, foreign financial markets were supported by generally positive economic data releases abroad, the reduction of political risk in Europe, and robust first-quarter earnings reports in a number of countries. By contrast, political developments in the United States appeared at times to weigh on global market sentiment.

The broad U.S. dollar depreciated about 1¼ percent, mostly reflecting weakness against AFE currencies. In particular, the euro was buoyed by the outcome of the second round of the French presidential election on May 7 and stronger-than-expected euro-area macroeconomic data releases. U.S. developments, including political uncertainty and mixed data reports, also weighed on the dollar. The Brazilian *real* fell about 3 percent against the dollar amid adverse local political developments.

Most AFE 10-year sovereign yields were slightly down over the intermeeting period. Spreads of most euro-area sovereign bonds over those of comparable-maturity German bunds narrowed slightly, largely on diminished perceptions of downside political and economic risks. Late in the period, Italian spreads edged up on the possibility of an early general election, leaving them little changed since the time of the May FOMC meeting.

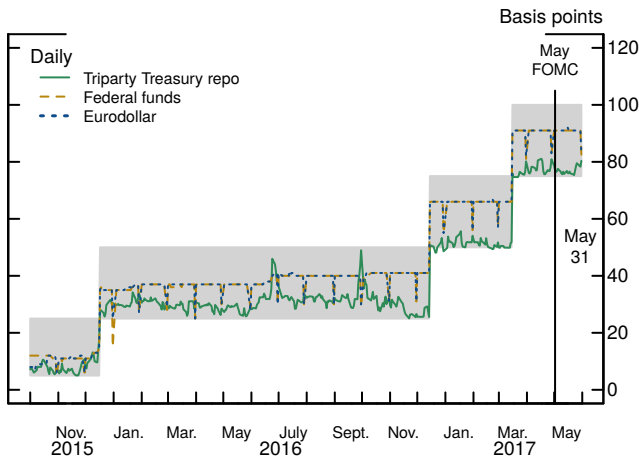
Equity prices rose in most advanced economies. EME equity indexes increased slightly, on balance, although Brazilian stocks took a sizable hit after the emergence of new corruption allegations against President Temer. EME sovereign bond spreads were little changed, while flows into EME mutual funds remained robust.

SHORT-TERM FUNDING MARKETS AND FEDERAL RESERVE OPERATIONS

Conditions in domestic short-term funding markets remained stable over the intermeeting period. The effective federal funds rate held steady at 91 basis points, closely tracked by the overnight Eurodollar rate. Term unsecured funding rates, such as yields on three-month commercial paper and Eurodollar deposits, also remained roughly

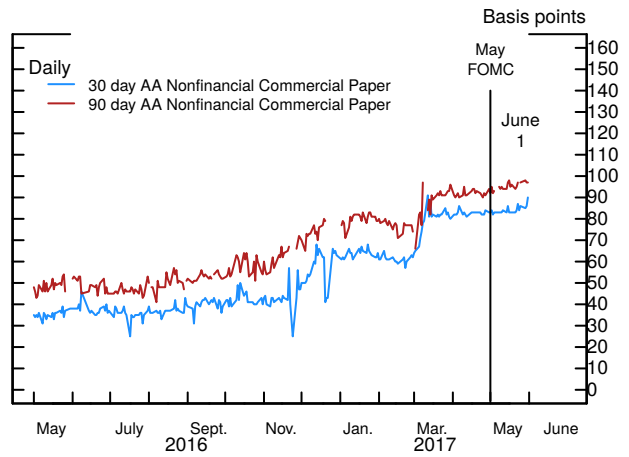
Short-Term Funding Markets and Federal Reserve Operations

Selected Money Market Rates



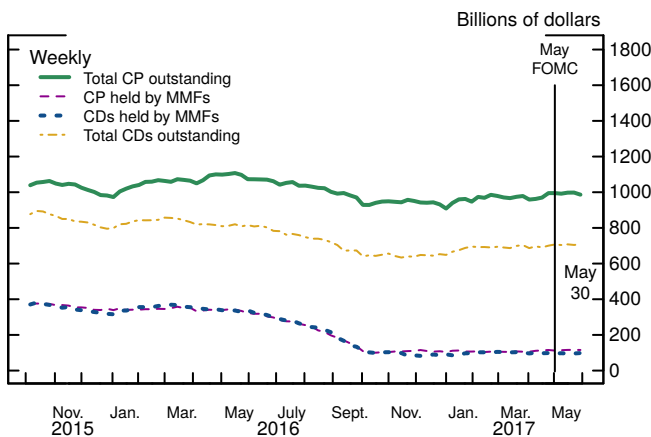
Note: Federal funds rate is a weighted median, and shaded area is the target range for the federal funds rate. Repo is repurchase agreement.
 Source: Federal Reserve Bank of New York; Federal Reserve Board, Form FR 2420, Report of Selected Money Market Rates.

Commercial Paper Rates



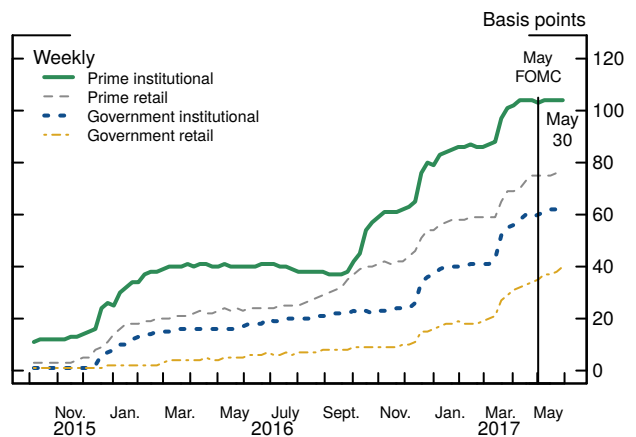
Note: These rates only include domestic issuers.
 Source: The Depository Trust & Clearing Corporation.

CP and CDs: Totals and Amounts Held by MMFs



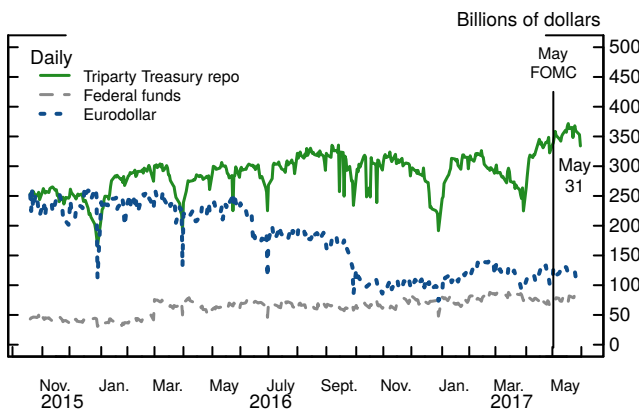
Note: Commercial paper (CP) includes asset-backed commercial paper. MMF is money market fund; CD is negotiable certificate of deposit.
 Source: The Depository Trust & Clearing Corporation; iMoneyNet.

Money Market Fund Net Yields



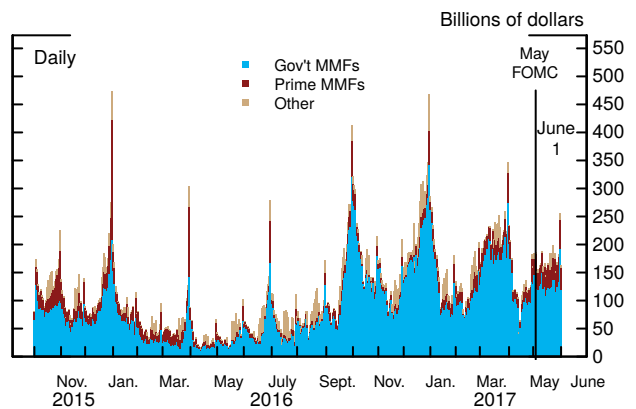
Note: Net yields are the annualized average yield, net of expense ratio, earned over the past 7 days without reinvesting dividends.
 Source: iMoneyNet.

Selected Money Market Volumes



Note: Repo is repurchase agreement.
 Source: For federal funds and Eurodollar, Federal Reserve Board, Form FR 2420, Report of Selected Money Market Rates; for Triparty Treasury repo, Federal Reserve Bank of New York.

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.

Financial Markets

flat, and their spreads relative to comparable term OIS rates narrowed further. The box “The Recent Decline in the LIBOR–OIS Spread” reviews developments in the spread as the effects of money market fund (MMF) reform on this spread have abated.

Treasury repo volumes were higher, on average, by about \$50 billion compared with the previous intermeeting period, in part reflecting somewhat higher net holdings by primary dealers of Treasury securities, which are typically funded by repos, as well as increased matched-book repo activity. Even with heightened volumes, overnight Treasury repo rates remained near the low end of recent ranges as MMFs increased their lending in overnight repo markets to shorten the average maturity of their portfolios ahead of the June FOMC meeting.

ON RRP take-up averaged \$175 billion, in line with the prior intermeeting period.¹ The Federal Reserve System conducted several tests of its operational toolkit to ensure operational readiness, all of which proceeded smoothly.²

¹ The Desk reinvested \$32 billion of maturing Treasury securities, purchased \$23 billion of MBS under the reinvestment program, and rolled \$0.2 billion of expected MBS settlements over the intermeeting period.

² On May 18, the Board conducted a test TDF operation that offered seven-day term deposits at a rate of 1 basis point over the IOER rate with a maximum award per counterparty of \$1 billion. Take-up totaled \$16.3 billion, which was in line with expectations, with 33 banks participating and 13 max bids. Throughout May, the Desk conducted a series of small-value operations, including a Treasury sale, four repo and reverse repo operations, and four agency MBS coupon swaps.

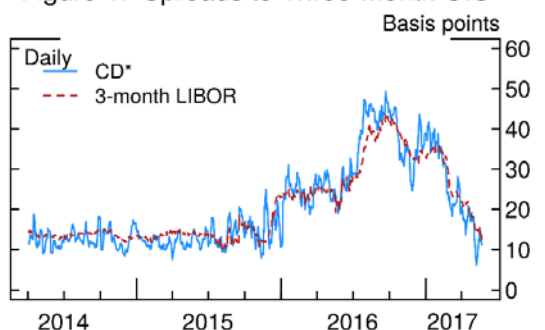
The Recent Decline in the LIBOR–OIS Spread

Since February, the spread between the three-month LIBOR (London interbank offered rate) and the OIS (the overnight index swap) has narrowed notably and now stands at 11 basis points, near its average from 2013 to 2015, as shown in figure 1. Short-term funding pressures, which intensified in the summer of 2016 as money market fund (MMF) reforms were causing prime MMFs to shrink, appear to have abated as banks acquired new funding sources for their commercial paper (CP) and negotiable certificates of deposit (CDs) as well as additional funding via other types of instruments.¹

In the year leading up to the October 2016 implementation deadline for these reforms, prime MMFs greatly reduced their unsecured lending to banks through CP, CDs, and Eurodollar deposits. This reduction in the supply of funds was widely cited as driving up bank unsecured term funding costs. The spread between three-month LIBOR—which closely tracks CD and CP rates—and OIS increased from about 15 basis points to a bit above 40 basis points over this period, as banks offered higher rates to attract funding.²

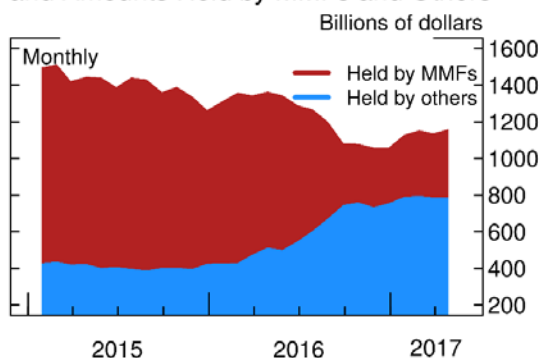
Temporarily higher yields attracted additional demand from money market investors and allowed banks to replace part of the funding lost from MMFs. To be sure, total CP and CDs outstanding have declined about \$300 billion since early 2015, but the decline has not been as steep as the \$700 billion drop in MMF holdings, as shown in figure 2.

Figure 1: Spreads to Three-Month OIS



* 5 day moving average of certificates of deposit with original maturities between 80 and 120 days.
Source: For CDs, Federal Reserve Board, Form FR 2420. For LIBOR and OIS, Bloomberg.

Figure 2: CP and CDs--Total Outstanding and Amounts Held by MMFs and Others



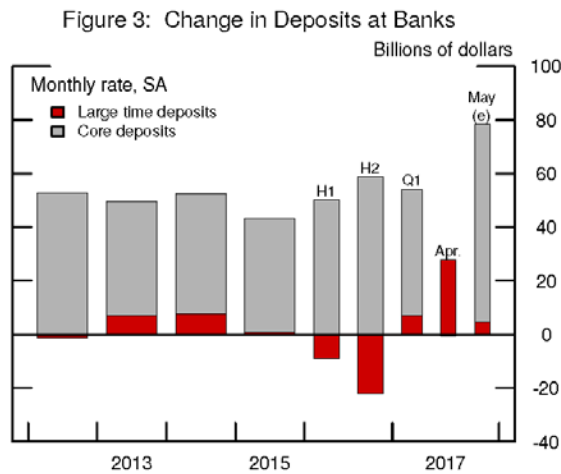
Source: For CP and CDs outstanding, DTCC. For holdings by MMFs, SEC form N-MFP.

¹ The reform imposed floating net asset values, or NAVs, for institutional prime funds and municipal funds and permits liquidity fees and redemption gates for all nongovernment funds.

² The significant movements in the LIBOR–OIS spread over the past year do not appear to have been driven by perceptions of changing bank credit quality. Moreover, despite concerns over LIBOR’s calculation methodology, its co-movement with CP and CD rates suggests that LIBOR remains a useful measure of banks’ unsecured borrowing costs. LIBOR also serves as a reference rate for trillions of dollars in adjustable-rate loans and interest rate derivatives.

Available data on investors in CP and CDs outside of MMFs are very limited. Market participants suggest that the sources of new demand for money market instruments have included bond funds and nonfinancial corporations. MMF substitutes, such as private liquidity funds and offshore money market funds, do not appear to have substantially increased their holdings of CP and CDs.

Short-term funding pressures have also been alleviated as banks that had previously relied on prime MMFs for funding replaced some CP and CD issuance with other instruments. In particular, banks have raised funds through repos, advances from Federal Home Loan Banks, issuance of dollar-denominated bonds and shorter-term debt, and growth in deposits other than CDs, as shown in figure 3.



e Estimate
 Note: Yearly rates are Q4 to Q4; half years are based on Q4 and Q2 average levels; 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.

(This page is intentionally blank.)

Financing Conditions for Businesses and Households

On the whole, financing conditions for nonfinancial businesses and households continued to be supportive of economic activity over the intermeeting period. However, the growth of core loans at banks has stepped down this year, reflecting both weaker demand for business loans and tighter credit standards for consumer loans. In addition, the expansion of total consumer credit has continued to moderate, and the growth of residential mortgage lending slowed a bit in the first quarter, though it remained near the high end of its recent range. Corporate bond issuance has generally been strong.

- Financing conditions for large nonfinancial firms remained solid. Banks' commercial and industrial (C&I) loans bounced back in April and May after declining in the first quarter, though the pace seen in May remained below that of a year ago. Gross bond issuance strengthened significantly in May after a typical seasonal slowdown in April.
- Credit continued to be generally available for small businesses, though demand has remained subdued. Lenders to small businesses noted that delinquency rates have continued to edge up from historically low levels, but credit standards for small business loans have reportedly remained unchanged.
- The expansion of banks' consumer loans continued to ebb in April and May, and growth of overall consumer credit has continued to moderate in recent months. Delinquency rates on subprime credit card and auto loans have drifted up from low levels, and we have seen some signs of tightening credit standards in these markets.

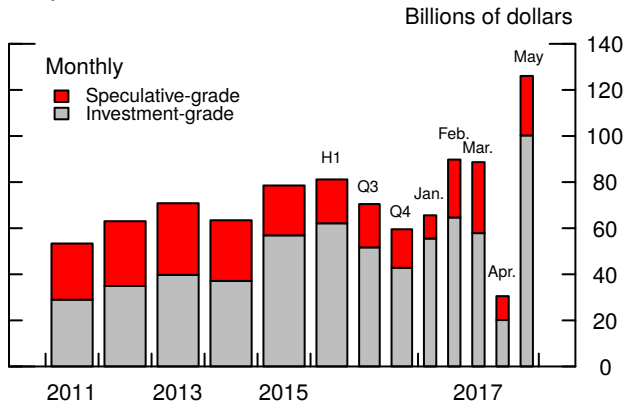
BUSINESS FINANCING CONDITIONS

Nonfinancial Corporations

Financing conditions for large nonfinancial firms remained accommodative over the intermeeting period. Corporate bond issuance rebounded considerably in May after a slowdown in April that was typical for a month in the middle of a corporate earnings-reporting season. Gross issuance of institutional leveraged loans remained strong in April and May, although it receded from the near-record levels seen over the prior two months.

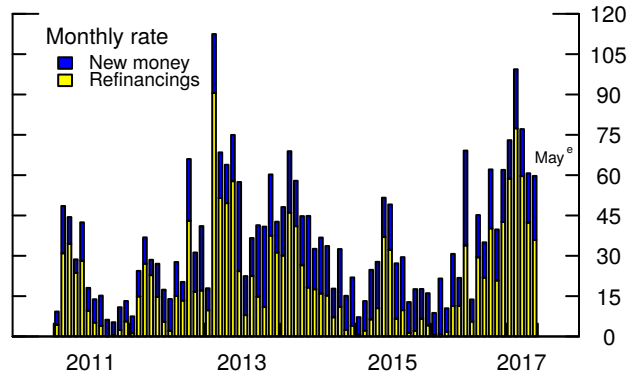
Business Finance

Gross Issuance of Nonfinancial Corporate Bonds



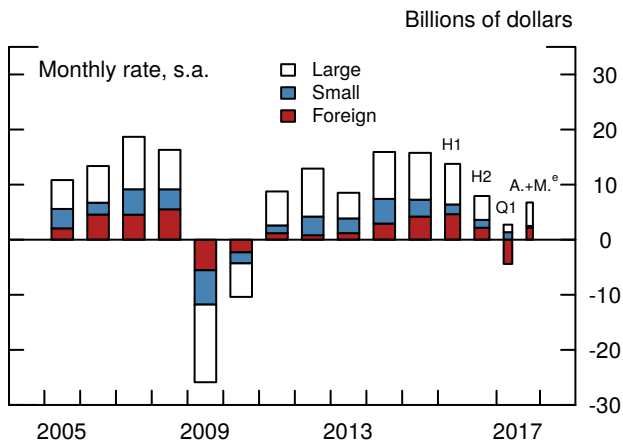
Note: Bonds are categorized by Moody's, Standard & Poor's, and Fitch. Source: Mergent Fixed Income Securities Database.

Institutional Leveraged Loan Issuance, by Purpose



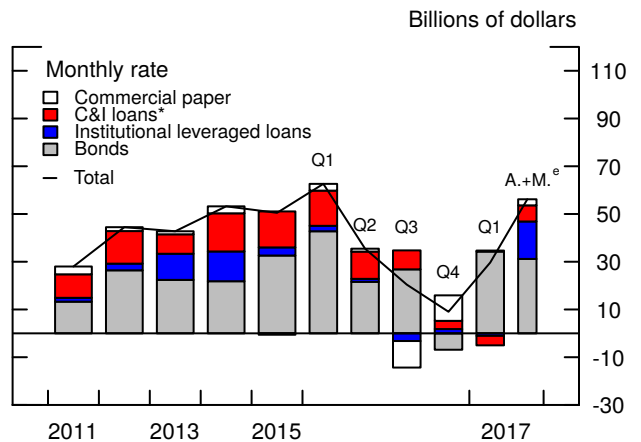
^e Estimate. Source: Thomson Reuters LPC LoanConnector.

Commercial and Industrial Loans



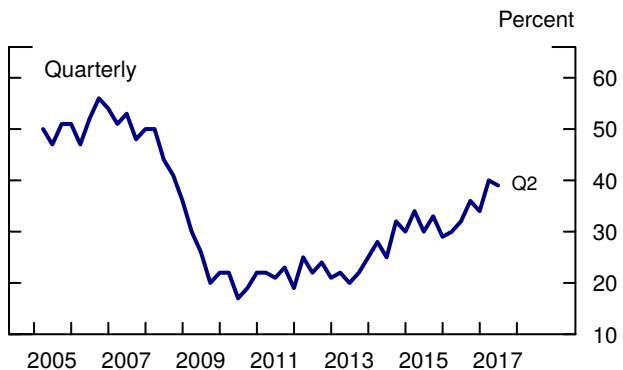
Note: Yearly rates are Q4 to Q4. Half-years are based on Q4 and Q2 average levels, and quarterly and monthly annual rates use corresponding average levels. Large banks are defined as the largest 25 banks by assets. ^e Estimate. Source: Federal Reserve Board, Form FR 2644, Weekly Report of Selected Assets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

Selected Components of Net Debt Financing, Nonfinancial Firms



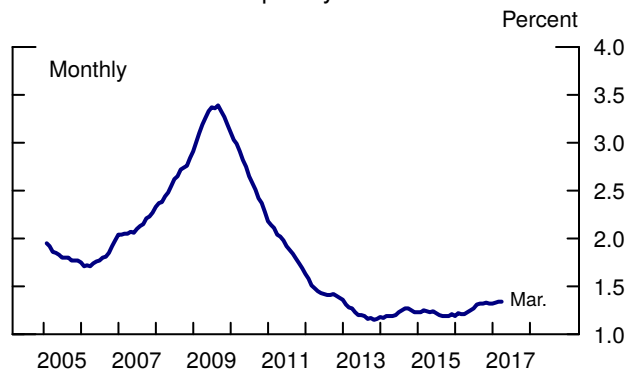
Note: C&I is commercial and industrial. * Period-end basis, seasonally adjusted. ^e May estimate for C&I loans and institutional leveraged loans. Source: Depository Trust & Clearing Corporation; Mergent Fixed Income Securities Database; Federal Reserve Board; Thomson Reuters LPC.

Percent of Firms Reporting That It Was Somewhat or Very Easy to Obtain Small Business Credit over the Previous 12 Months



Note: Data not seasonally adjusted. Source: Wells Fargo/Gallup Small Business Index.

Small Business Delinquency Index



Note: Percent of loans between 30 and 90 days past due. Source: Paynet.

C&I loans picked up in April and May after a weak first quarter, though their growth rate has remained well below the strong pace seen a year ago. As we described in the April Tealbook, in the Senior Loan Officer Opinion Survey banks reported a broad-based decline in demand for C&I loans in the first quarter.

Gross equity issuance by nonfinancial firms remained solid on average. Share repurchases in the fourth quarter of 2016 and mergers and acquisitions (M&A) in the first quarter of this year remained robust overall, albeit somewhat below the very strong average pace seen in recent years. Announcements of new share repurchase programs and M&A activity continued their downward trend, possibly signaling lower future debt issuance.

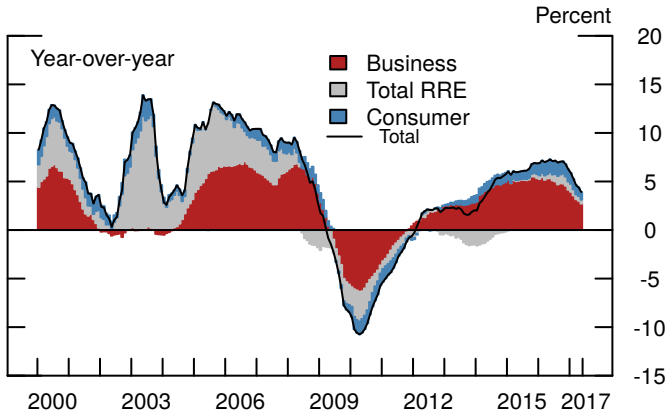
The credit performance of nonfinancial corporations remained stable. Balance sheet leverage indicators ticked down a bit in the fourth quarter but remained close to the historically high levels seen over the past 20 years. While default rates were little changed in April, bond rating downgrades outpaced upgrades in both number and volume in May, indicating a slight deterioration in credit quality.

With reports in hand for almost all S&P 500 firms, aggregate corporate earnings in the first quarter are estimated to have remained near the level seen in the fourth quarter on a seasonally adjusted basis, significantly above their year-ago level. Wall Street analysts again revised up their projections for year-ahead earnings for S&P 500 firms through mid-May.

Small Businesses

Overall, the demand for credit from small businesses remained tepid, while the supply of credit generally continued to appear accommodative. Small business loan originations held steady in March and were close to the volume of a year ago. Survey data suggest that credit supply remained stable, with nearly 40 percent of respondents from the April release of the quarterly Wells Fargo/Gallup Small Business Index survey reporting that it was “somewhat or very easy” to obtain credit over the past 12 months, one of the highest such readings since 2008. While lenders noted that loan delinquency rates have continued to edge up from historically low levels, credit standards for small business loans have reportedly remained unchanged. The April survey also indicated that optimism among small business owners edged down but remained in an elevated range.

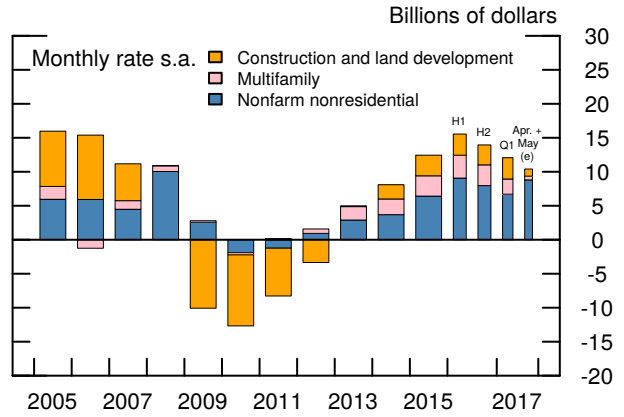
Core Loan Growth at Banks



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 FR 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

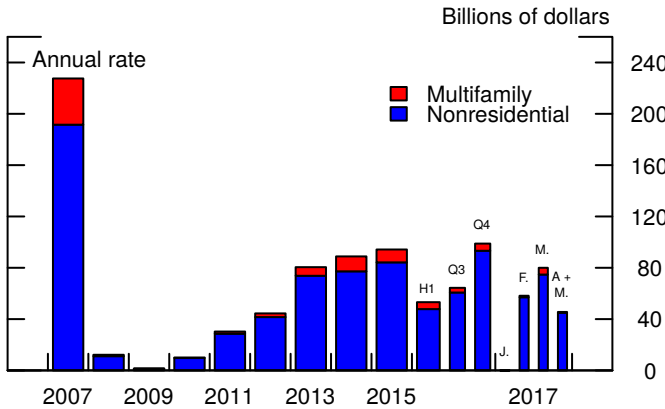
Commercial Real Estate Loans at Banks



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.

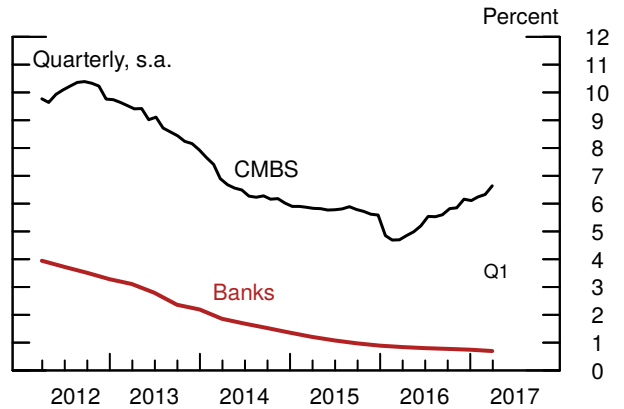
Source: Federal Reserve Board, Form FR 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

CMBS Issuance



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

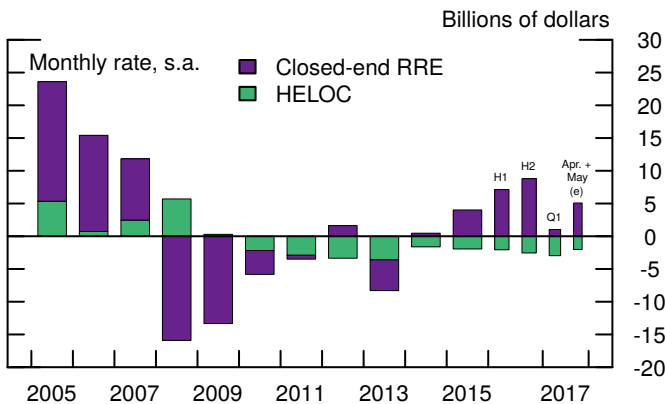
Commercial Real Estate Delinquency Rates



Note: Commercial mortgage-backed securities (CMBS) rate includes lending that is more than 30 days delinquent, foreclosures, and properties that are real estate owned. Commercial real estate delinquency rate at banks is the percentage of nonfarm nonresidential and multifamily lending that is more than 30 days delinquent or nonaccrual.

Source: For CMBS, Citigroup; for banks, FR Y9-C, Consolidated Financial Statements for Holding Companies.

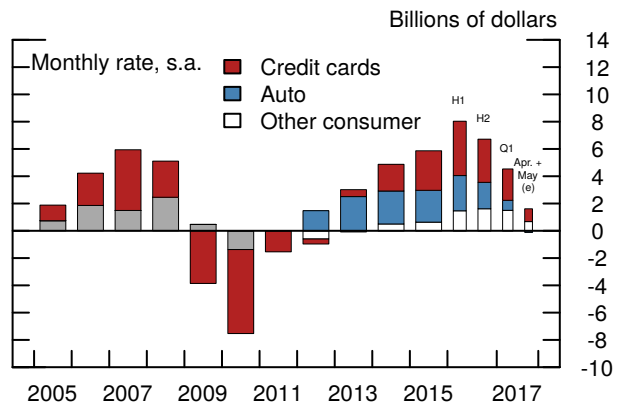
Residential Real Estate at Banks



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. RRE is residential real estate; HELOC is home equity line of credit.

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.

Consumer Loans at Banks



Note: Prior to 2012, data on auto and other consumer loans were not separately available. The combined series is depicted here by the gray bars. Yearly rates are Q4 to Q4. Half-years are based on Q4 and Q2 average levels. Quarterly and monthly annual rates use corresponding average levels.

Source: Federal Reserve Board, Form FR 2644.

Commercial Real Estate

Financing conditions in commercial real estate (CRE) markets remained accommodative. CRE loans on banks' books continued to grow robustly in April, with nonfarm nonresidential loans leading the expansion this year. However, the average growth rate over April and May is a bit lower than that during the first quarter, reflecting in part a slowdown in both construction and multifamily lending. Commercial mortgage-backed securities (CMBS) issuance through the first five months of the year has been similar to the issuance over the first five months of 2016. While delinquency rates on CRE loans at banks continued to tick down in the first quarter, the delinquency rate on loans in CMBS pools continued to increase. The rise in the CMBS delinquency rate is mostly confined to loans that were originated during the period of weak underwriting prior to the crisis. These delinquencies have generally been expected by market participants and are not anticipated to have a material effect on credit availability or market conditions.

MUNICIPAL GOVERNMENT FINANCING CONDITIONS

Credit conditions in municipal bond markets remained accommodative, on balance, and were mostly unaffected by the initiation of Puerto Rico's bankruptcy process.¹ Gross issuance of municipal bonds remained solid in May. On net, the number and dollar volume of credit rating downgrades outpaced the number of upgrades, possibly signaling a slight deterioration in the credit quality of state and local governments.

HOUSEHOLD FINANCING CONDITIONS

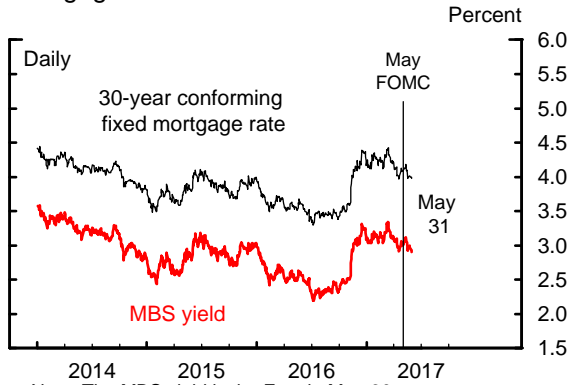
Residential Real Estate

Financing conditions in the residential mortgage market remained generally accommodative over the intermeeting period. Mortgage rates declined slightly, in line with longer-term Treasury and mortgage-backed securities (MBS) yields, but remained elevated relative to the third quarter of 2016. Despite the higher level of mortgage rates, first-quarter growth in total residential mortgage lending remained near the high end of its recent range. Delinquency rates on mortgage loans continued to edge down, amid

¹ On May 3, Puerto Rico entered a court-supervised bankruptcy process after it failed to reach an agreement to restructure its debt by the May 1 deadline. This event had a limited effect on Puerto Rico's bond prices and no noticeable effect on broader municipal markets.

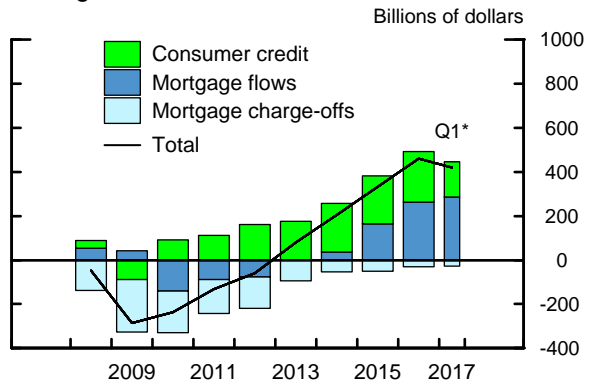
Household Finance

Mortgage Rate and MBS Yield



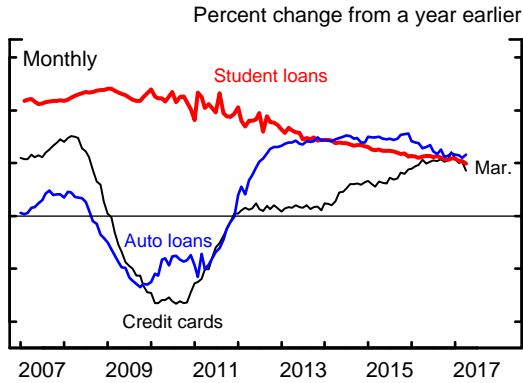
Note: The MBS yield is the Fannie Mae 30-year current-coupon rate.
Source: For MBS yield, Barclays; for mortgage rate, Loansifter.

Changes in Household Debt



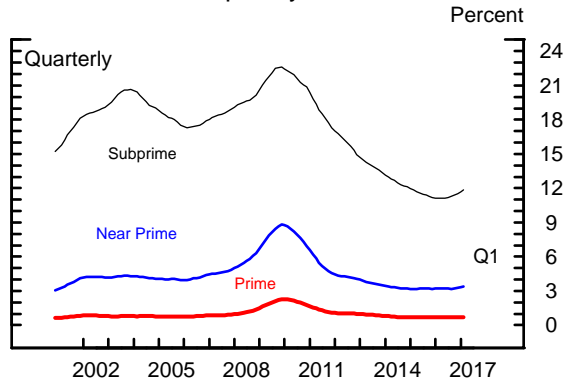
Note: Includes only home mortgage debt and consumer credit.
* Q1 flows are annualized. Q1 value is preliminary.
Source: Federal Reserve Board, Financial Accounts of the United States.

Consumer Credit



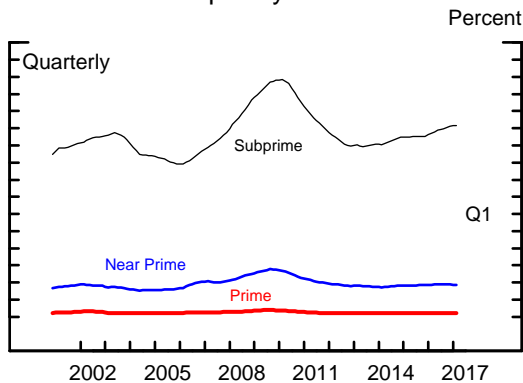
Note: The data are not seasonally adjusted.
Source: Federal Reserve Board.

Credit Card Delinquency Rates



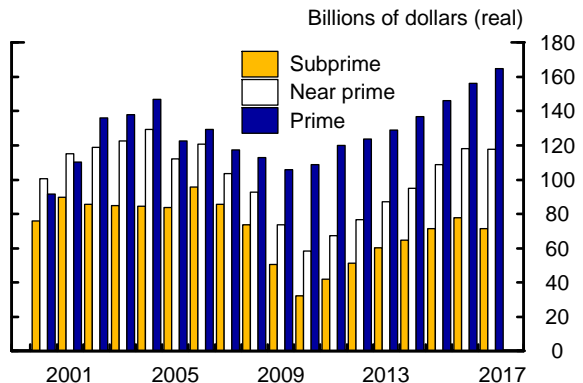
Note: Four-quarter moving average. Credit scores lagged 4 quarters. Delinquency is at least 30 days past due, excluding severe derogatory loans. Near prime between 620 and 719, prime greater than 719.
Source: FRBNY CCP/Equifax.

Auto Loan Delinquency Rates



Note: Four-quarter moving average. Credit scores lagged 4 quarters. Delinquency is at least 30 days past due, excluding severe derogatory loans. Near prime between 620 and 719, prime greater than 719.
Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

New Extensions: Auto



Note: New credit extensions in the past year; data for the first quarter of each year. Near prime between 620 and 719, prime greater than 719; scores measured a year ago.
Source: Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

robust house price growth and still-tight lending standards for households with lower credit scores and harder-to-document incomes.

Consumer Credit

Financing conditions in consumer credit markets remained generally accommodative; however, some indicators point to reductions in credit availability in recent months. The tighter conditions are especially apparent within the subprime segment, where there has been some further deterioration of credit performance.

Credit card balances continued to grow in March at a robust year-over-year rate, though the pace moderated a bit from 2016. Outstanding credit card balances among prime borrowers continued to grow apace with prior years, despite an upward drift in interest rates, and delinquencies remained low by historical standards. However, the growth of credit card balances among subprime borrowers slowed somewhat, and delinquency rates for this group have continued to increase.

Year-over-year growth in auto loans remained solid through the first quarter. Overall delinquency rates on auto loans continued to be relatively low, but the delinquency rate among subprime borrowers remained elevated, reflecting easier lending standards in 2015 and 2016. Recent evidence suggests that these standards have tightened; for example, the credit rating of the average car borrower has trended up, and new extensions of subprime auto loans have declined. We expect that tighter auto lending conditions will lead to improved loan performance among subprime borrowers.

(This page is intentionally blank.)

Risks and Uncertainty

ASSESSMENT OF RISKS

We continue to view the uncertainty around our forecast of economic activity as being about in line, on balance, with the average over the past 20 years (the benchmark used by the FOMC). Several factors point to less-than-average uncertainty. Many empirical indicators of uncertainty are subdued, including options-based indexes of expected stock market volatility (such as the VIX) and corporate bond spreads. In addition, we see the uncertainty associated with the foreign outlook as having subsided further since late last year, particularly with the outcome of the French elections. However, other considerations point to greater-than-average uncertainty. For example, we think that somewhat greater uncertainty continues to prevail about the future direction of federal government policies than before the recent U.S. elections. That uncertainty is reflected in the Baker, Bloom, and Davis index of economic policy uncertainty, which remains at a higher level, on average, than in the two years before the elections.

We now judge the risks to our medium-term GDP projection as balanced. In previous Tealbooks, we considered the risk of monetary policy having to return to the effective lower bound (ELB) as tilting the risks to our economic outlook somewhat to the downside. However, based on stochastic simulations in the FRB/US model around the current baseline forecast, we estimate that the probability of returning to the ELB sometime over the next three years has declined to 23 percent, which is below the threshold level of 25 percent that we proposed in the April Tealbook for removing the downside skew associated with ELB risk.¹ We see the risks around our projection for the unemployment rate as aligned with those for GDP and, therefore, as also balanced.

With regard to inflation, we continue to see the current level of uncertainty as in line with the average over the past 20 years and the risks to the downside and upside as roughly balanced. To the downside, the Michigan survey measure of longer-run inflation expectations remains very low, although other survey-based indicators of longer-run inflation expectations have not moved down. In addition, U.S. monetary policy normalization could generate a greater appreciation of the dollar than we have anticipated

¹ The methodology for calculating this probability was described in the box “A Guidepost for Dropping Effective Lower Bound Risk from the Assessment of Risks” in the April Tealbook. See the exhibit “Effective Lower Bound Risk Estimate” for our current and projected estimates of this probability.

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	1.9	2.9	2.2	1.8	1.4	1.2
Broad policy disappointment	1.9	2.9	1.1	1.6	1.5	1.6
Stronger demand, higher inflation	1.9	4.1	2.5	1.7	1.3	1.1
Lower natural rate, misperception	1.9	2.9	2.2	1.8	1.4	1.3
Greenspan conundrum	1.9	2.9	2.8	2.9	2.0	.9
EME turbulence and stronger dollar	1.9	2.9	1.5	1.2	1.5	1.5
Stronger foreign growth	1.9	3.1	2.6	2.1	1.3	1.1
<i>Unemployment rate¹</i>						
Extended Tealbook baseline	4.3	4.2	3.9	3.8	4.0	4.5
Broad policy disappointment	4.3	4.2	4.4	4.5	4.6	4.7
Stronger demand, higher inflation	4.3	3.9	3.5	3.5	3.7	4.3
Lower natural rate, misperception	4.3	4.1	3.6	3.4	3.5	3.8
Greenspan conundrum	4.3	4.2	3.7	3.1	3.0	3.9
EME turbulence and stronger dollar	4.3	4.2	4.2	4.4	4.6	4.9
Stronger foreign growth	4.3	4.2	3.7	3.5	3.6	4.2
<i>Total PCE prices</i>						
Extended Tealbook baseline	1.4	1.7	1.9	2.0	2.1	2.1
Broad policy disappointment	1.4	1.7	1.8	1.8	1.9	2.0
Stronger demand, higher inflation	1.4	2.1	2.3	2.3	2.4	2.3
Lower natural rate, misperception	1.4	1.7	1.9	1.9	2.0	2.1
Greenspan conundrum	1.4	1.7	1.9	2.0	2.2	2.2
EME turbulence and stronger dollar	1.4	2.2	1.2	1.5	1.9	2.1
Stronger foreign growth	1.4	2.0	2.4	2.3	2.2	2.2
<i>Core PCE prices</i>						
Extended Tealbook baseline	1.6	1.7	1.9	2.0	2.1	2.1
Broad policy disappointment	1.6	1.7	1.8	1.9	1.9	1.9
Stronger demand, higher inflation	1.6	2.1	2.3	2.3	2.4	2.3
Lower natural rate, misperception	1.6	1.7	1.9	1.9	2.0	2.0
Greenspan conundrum	1.6	1.7	1.9	2.1	2.2	2.2
EME turbulence and stronger dollar	1.6	2.2	1.5	1.6	1.9	2.0
Stronger foreign growth	1.6	1.9	2.3	2.3	2.2	2.2
<i>Federal funds rate¹</i>						
Extended Tealbook baseline	.9	1.5	2.7	3.7	4.2	4.1
Broad policy disappointment	.9	1.5	2.3	2.8	3.0	3.1
Stronger demand, higher inflation	.9	1.7	3.4	4.6	5.1	4.8
Lower natural rate, misperception	.9	1.5	2.9	3.8	4.2	3.9
Greenspan conundrum	.9	1.5	2.9	4.3	5.3	5.3
EME turbulence and stronger dollar	.9	2.0	2.5	2.9	3.2	3.5
Stronger foreign growth	.9	1.6	3.2	4.3	4.8	4.6

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

in the baseline forecast. To the upside, with the economy projected to be operating above its long-run potential, inflation may increase more than in the staff forecast, consistent with the predictions of models that emphasize nonlinear effects of economic slack on inflation.

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 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. The second scenario assumes that economic activity is stronger than in the baseline; in addition, inflation is assumed to be more sensitive to tighter resource utilization. In the third scenario, we explore the implications of a lower natural rate of unemployment than in the baseline, with only gradual recognition by policymakers and the staff about the true level of the natural rate. The fourth scenario presents outcomes associated with a situation in which long-term interest rates do not respond to the increases in the federal funds rate that are assumed in the baseline—a phenomenon reminiscent of the “Greenspan conundrum” seen in the mid-2000s. In the fifth scenario, we consider the possibility that faster U.S. policy normalization, prompted by a pickup in inflation, leads to financial turbulence in vulnerable emerging market economies and a stronger appreciation of the dollar. The sixth and last scenario analyzes the effect on U.S. macroeconomic performance of stronger foreign growth.

We simulate these scenarios using three staff models.² In all but two scenarios, the federal funds rate is governed by the same rule as in the baseline. One exception is the Broad Policy Disappointment scenario, in which we assume an alternative adjustment to the intercept in the baseline rule. The other exception is the EME Turbulence and Stronger Dollar scenario, where we assume that the unexpected increase in U.S. inflation in the second half of this year triggers a temporarily larger response of the federal funds rate than implied by the baseline rule, although such a response is later unwound as

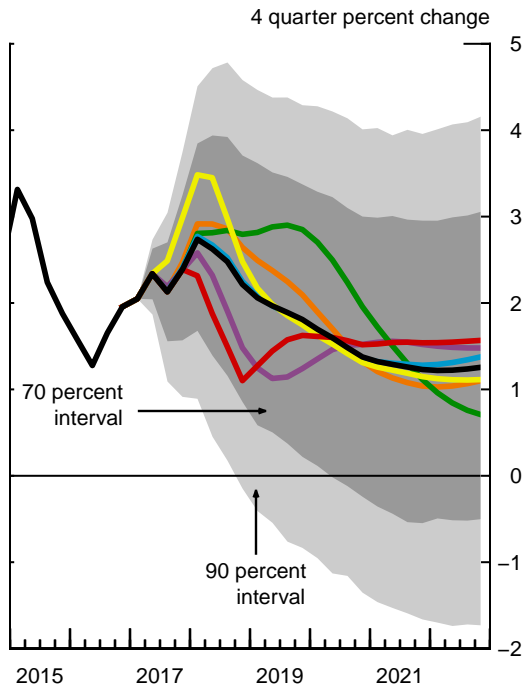
² The models used are FRB/US, which is a large-scale macroeconomic model of the U.S. economy; EDO, which is an estimated medium-scale New Keynesian DSGE model of the U.S. economy; and SIGMA, which is a calibrated multicountry DSGE model.

Forecast Confidence Intervals and Alternative Scenarios

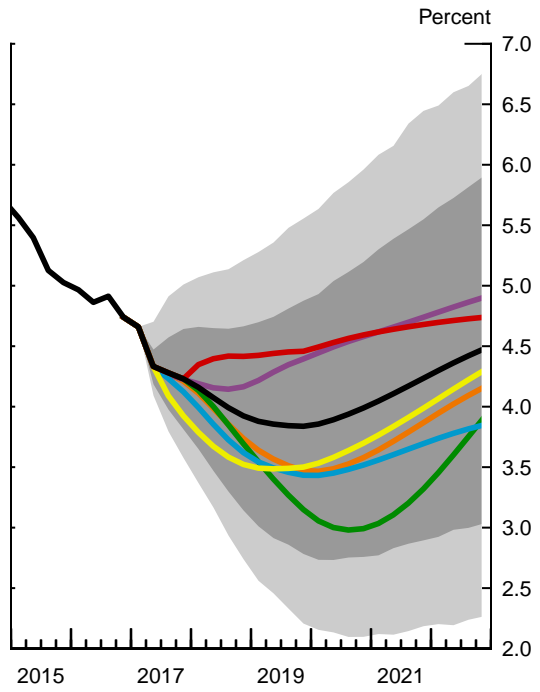
Confidence Intervals Based on FRB/US Stochastic Simulations

- Extended Tealbook baseline
- Lower natural rate, misperception
- EME turbulence and stronger dollar
- Broad policy disappointment
- Greenspan conundrum
- Stronger foreign growth
- Stronger demand, higher inflation

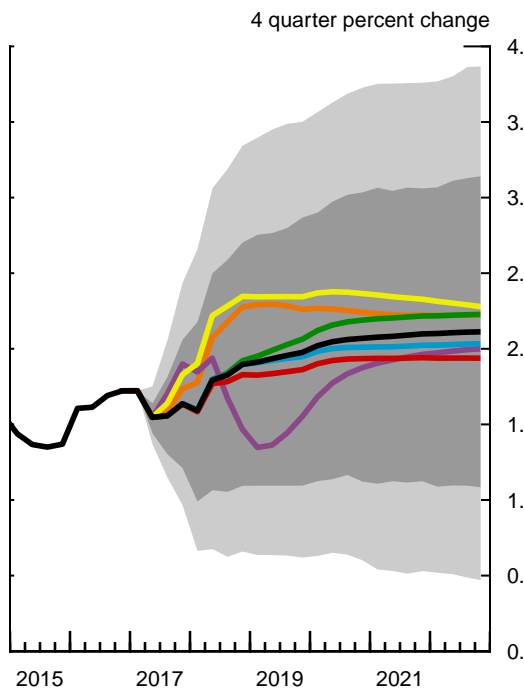
Real GDP



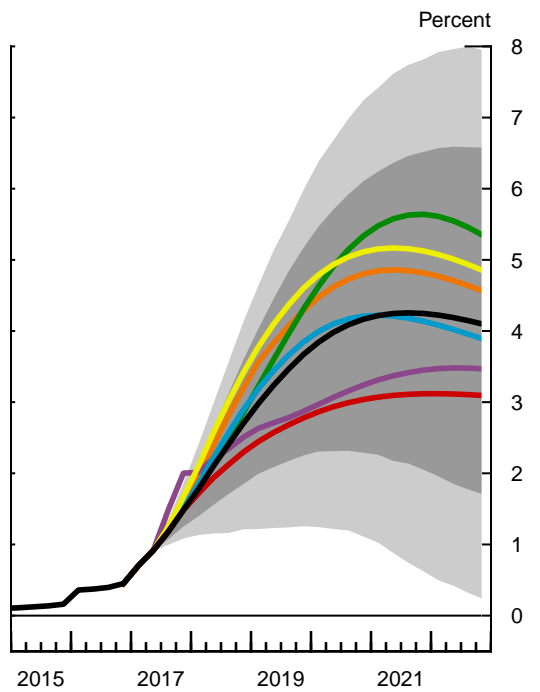
Unemployment Rate



PCE Prices excluding Food and Energy



Federal Funds Rate



financial conditions in EMEs tighten. The size and composition of the SOMA portfolio are assumed to follow the baseline paths in all of the scenarios.

Broad Policy Disappointment (FRB/US)

In this scenario, we assume that the federal government fails to implement the fiscal expansion that is incorporated in the baseline.³ In addition, other policy changes that financial market participants may have priced into current asset values, such as an easing of regulatory burdens, fail to materialize.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. Consequently, in addition to the direct, conventional restraint on aggregate demand stemming from the fact that 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 equity prices fall almost 10 percent from peak to trough.⁵

As a result, real GDP growth slows to about 1 percent in 2018, roughly 1 percentage point less than in the baseline. By the end of 2022, the unemployment rate has risen about ½ percentage point from its level at the end of 2017 to 4.7 percent—just below the staff’s assumption for the natural rate and ¼ percentage point higher than in the baseline. With labor market resources less tight and inflation modestly lower than in the baseline, the federal funds rate rises more gradually and is just over 3 percent at the end of 2022, about 1 percentage point below the baseline rate.⁶

³ 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.

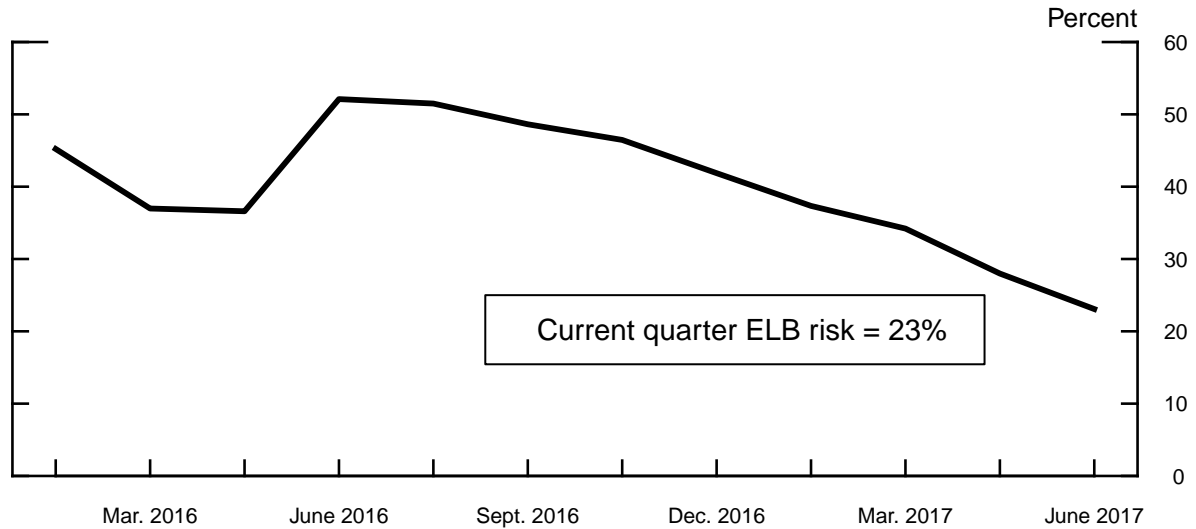
⁴ To be clear, in both the baseline and the alternative simulation, regulatory relief is assumed to not affect the economy directly but rather indirectly through its effects on sentiment and asset values.

⁵ In this scenario, equity values decline gradually over the course of several quarters next year. The results shown here are little changed if, instead, the decline in stock prices occurs immediately in the first quarter of 2018.

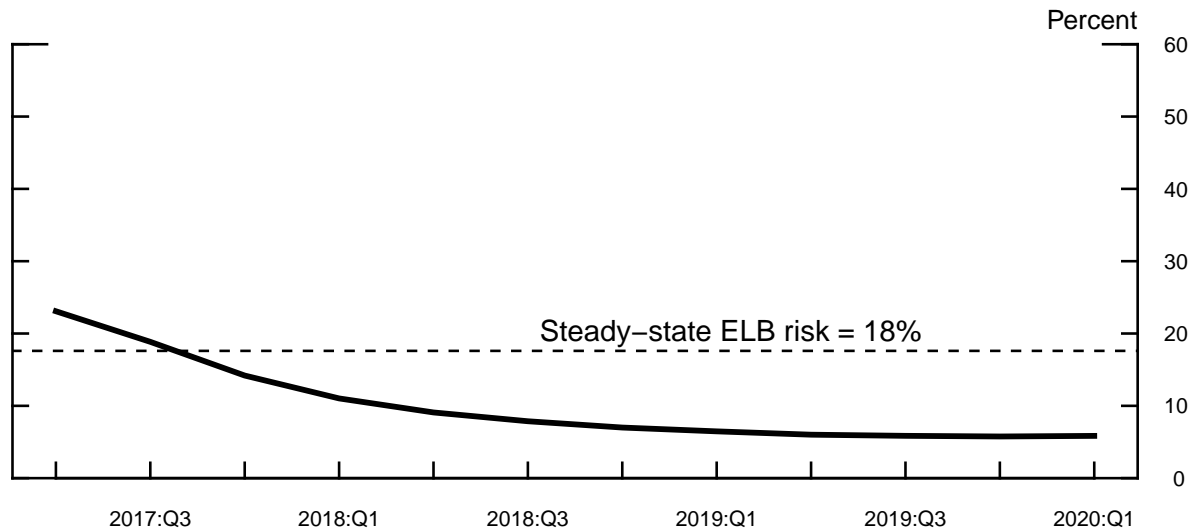
⁶ Without the change in sentiment and equity prices, the failure to implement the fiscal expansion alone would imply that real GDP growth is 0.3 percentage point lower than in the baseline in 2018 and is almost the same as in the baseline in 2019, while the unemployment rate is about 0.2 percentage point higher at the end of 2019. In addition, inflation would be a touch lower than in the baseline. These developments, together with the adjustment to the rule for setting the federal funds rate, would result in a federal funds rate that is ½ percentage point below the baseline at the end of 2020.

Effective Lower Bound Risk Estimate

ELB Risk since Liftoff



Forecast of ELB Risk



Note: Figures show the probability that the federal funds rate reaches the effective lower bound (ELB) over the next 3 years starting in the given quarter. Details behind the computation of the ELB risk measure are provided in the box "A Guidepost for Dropping the Effective Lower Bound Risk from the Assessment of Risks" in the Risks and Uncertainty section of the April 2017 Tealbook A.

Source: Calculation based on FRB/US stochastic simulations around the staff baseline projection.

Stronger Aggregate Demand and Higher Inflation (EDO)

Incoming readings on labor market conditions show continued improvement, and several surveys of consumer sentiment and business activity have remained upbeat in recent months. Furthermore, while business investment was weak over the previous two years, data for this year so far show investment to have picked up considerably. Motivated by these positive developments, this scenario assumes faster consumer and business spending than in the baseline, with growth in residential investment also well above the moderate pace shown in the staff forecast.⁷ Moreover, consistent with the view that the Phillips curve could be steeper at higher rates of resource utilization than when economic activity is relatively weak, we postulate that inflation and wages become more sensitive to tighter resource utilization than in the standard version of the EDO model.⁸

Real GDP rises at an annual rate of 4 percent in the second half of 2017, compared with a 3 percent pace in the baseline. The unemployment rate falls more rapidly, bottoming out at 3½ percent in 2018 and 2019 and remaining lower than in the baseline for some time thereafter. With resource utilization running tighter and the Phillips curve assumed to be steeper than in the standard version of the model, inflation moves above 2 percent in the second half of 2017 and rises to about 2½ percent by 2020.⁹ The federal funds rate reaches 4½ percent at the end of 2019 and peaks slightly above 5 percent in 2021. Given enough time, this path for the federal funds rate would eventually drive the unemployment rate up to its assumed natural rate and bring inflation back down to 2 percent. The unemployment rate does not need to exceed the natural rate in order to bring inflation back down—simply returning to the natural rate is enough—because longer-run inflation expectations remain well anchored throughout this scenario.

⁷ In the staff forecast, residential investment averages 4 percent per year between 2017 and 2019. In this scenario, we calibrate the composition of aggregate demand so that residential investment instead grows around 6½ percent per year.

⁸ For evidence of a nonlinear relationship between wage growth and slack, see, for example, Richard W. Fisher and Evan F. Koenig (2014), “Are We There Yet? Assessing Progress toward Full Employment and Price Stability,” *Economic Letter*, vol. 9 (13) (Dallas: Federal Reserve Bank of Dallas, October), www.dallasfed.org/assets/documents/research/eclett/2014/el1413.pdf. The greater sensitivity of price inflation assumed here is consistent with the estimates of some other DSGE models, such as Frank Smets and Rafael Wouters (2007), “Shocks and Frictions in U.S. Business Cycles: A Bayesian DSGE Approach,” *American Economic Review*, vol. 97 (June), pp. 586–606.

⁹ The larger rise in inflation depends importantly on the substantially smaller adjustment costs for wages and prices in this scenario; the smaller costs lead to a steeper Phillips curve. Had we used our standard coefficients in the wage and price equations, inflation would have been only about 2 percent in 2022, as in the baseline.

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

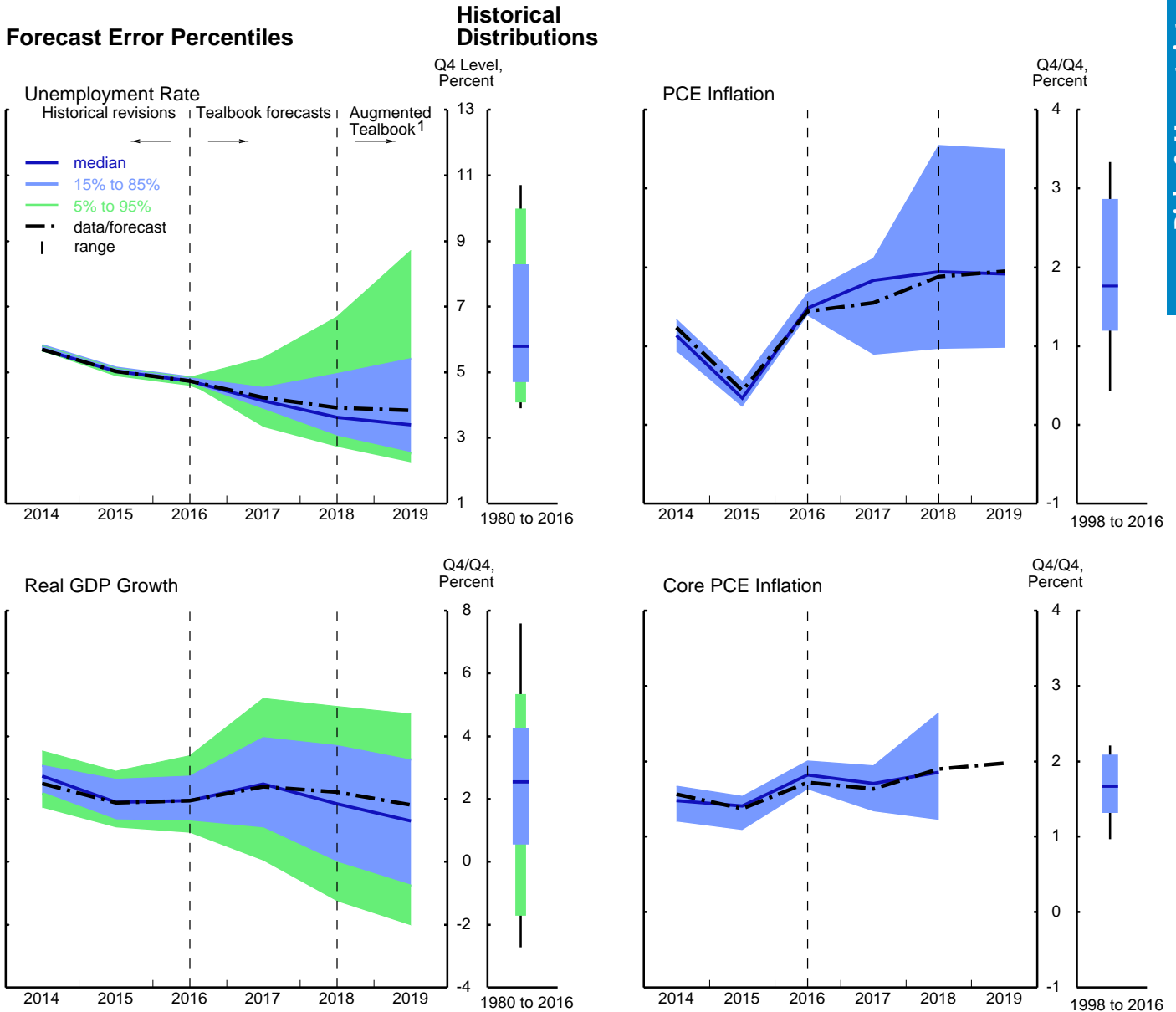
Measure	2017	2018	2019	2020	2021	2022
<i>Real GDP</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	2.4	2.2	1.8	1.4	1.2	1.3
Confidence interval						
Tealbook forecast errors	1.0–4.0	-.1–3.7	-.8–3.2	...	...	...
FRB/US stochastic simulations	1.6–3.2	.9–3.7	.2–3.4	-.2–3.0	-.5–3.0	-.5–3.1
<i>Civilian unemployment rate</i>						
<i>(percent, Q4)</i>						
Projection	4.2	3.9	3.8	4.0	4.2	4.5
Confidence interval						
Tealbook forecast errors	3.8–4.5	3.0–5.0	2.5–5.4	...	...	...
FRB/US stochastic simulations	3.8–4.6	3.1–4.7	2.8–4.9	2.8–5.2	2.9–5.5	3.0–5.9
<i>PCE prices, total</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	1.6	1.9	2.0	2.1	2.1	2.1
Confidence interval						
Tealbook forecast errors	.9–2.1	1.0–3.5	1.0–3.5	...	...	...
FRB/US stochastic simulations	1.0–2.0	1.0–2.8	1.0–2.9	1.0–3.1	1.1–3.2	1.0–3.2
<i>PCE prices excluding food and energy</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	1.6	1.9	2.0	2.1	2.1	2.1
Confidence interval						
Tealbook forecast errors	1.3–1.9	1.2–2.6	...	...	...	...
FRB/US stochastic simulations	1.2–2.1	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	2.7	3.7	4.2	4.2	4.1
Confidence interval						
FRB/US stochastic simulations	1.3–1.7	1.8–3.6	2.3–5.2	2.3–6.1	2.0–6.5	1.7–6.6

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.

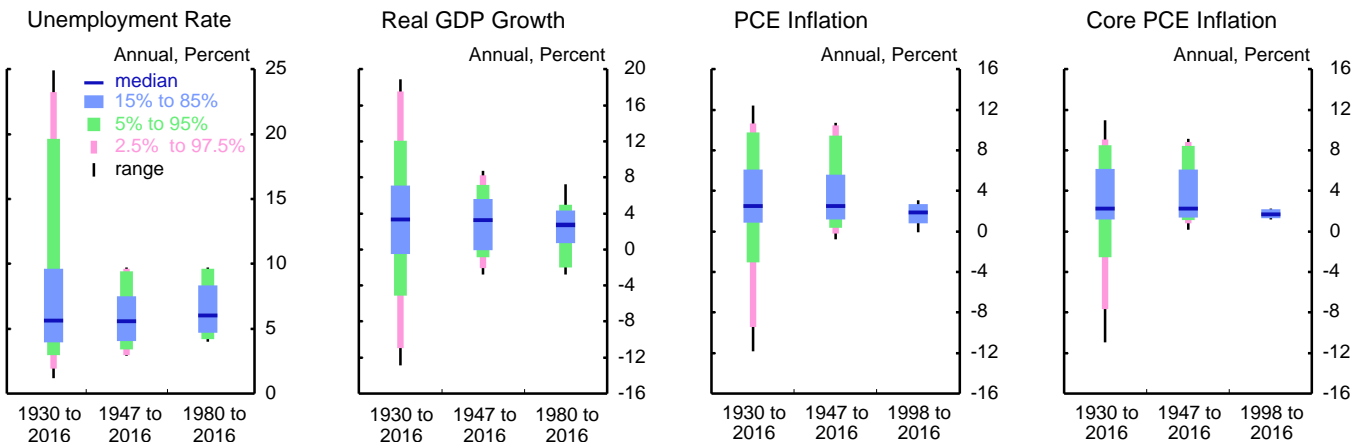
... Not applicable.

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.

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

The baseline forecast anticipates that the unemployment rate will fall to about 3¾ percent by the end of 2019, around 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. Given the difficulties associated with ascertaining the level of the natural rate, we also assume that policymakers' and the staff's perceptions of the natural rate converge to the true natural rate only gradually over time. Hence, the gap between the actual and perceived natural rate is not fully eliminated until the end of 2022.

Because policymakers do not fully recognize the lower natural rate—and the correspondingly higher level of potential—until several years into the simulation, they perceive a lower path of the unemployment rate as implying a more positive output gap than in the baseline, providing an incentive to raise the federal funds rate, all else being equal. As events unfold in this scenario, the initially slightly tighter stance of policy holds real GDP growth close to the baseline for some time. As policymakers' and the staff's estimates of the natural rate of unemployment converge to the truth, GDP growth rises a touch above the staff forecast by the end of 2022, while the unemployment rate is ¾ percentage point below. Inflation falls a shade below the Tealbook projection by the end of 2022. As the higher level of potential becomes apparent to policymakers and the staff, they recognize that resource utilization is less tight than they had previously perceived; as a result, and with the lower path for inflation, the federal funds rate drops below the baseline by the end of 2021.

A Return to the Greenspan Conundrum (FRB/US)

The Committee has raised the federal funds rate three times following the period of near-zero rates. However, according to several measures of term premiums on longer-term Treasury yields, the rate increases occurred in conjunction with ongoing declines in those premiums; indeed, following the initial rise from the ELB, 10-year Treasury yields dropped for three quarters. The absence of a clear imprint from monetary tightening on

long-term yields is reminiscent of what is often referred to as the “Greenspan conundrum” seen in the early 2000s.¹⁰

This scenario simulates the macroeconomic consequences of such a disconnect between the policy rate and longer-term interest rates. Consistent with the original Greenspan conundrum period, we keep long-term rates fixed over the next six quarters at their levels as of the third quarter of this year, reflecting a movement in term premiums that is not attributable to heightened pessimism about the economic outlook on the part of market participants. The short-term federal funds rate continues to evolve according to the prescriptions of the baseline policy rule. Starting in the first quarter of 2019, the conundrum slowly unwinds, and the link between short- and long-term rates is fully restored by the end of the simulation period.

In this scenario, lower long-term rates boost asset prices and spur consumption and investment spending. As a result, real GDP growth reaches 2¾ percent in 2018, about ½ percentage point above the baseline. With a more buoyant economy, the trajectory for the unemployment rate is substantially below the staff forecast, reaching a low of 3 percent in 2020; given the flatness of the model’s wage and price Phillips curves, inflation moves only marginally above the baseline. By the end of 2019, consistent with output being well above potential, the federal funds rate increases to almost 4¼ percent, more than ½ percentage point higher than in the Tealbook projection. As the conundrum unwinds and long rates start to rise along with the short rate, GDP growth slows and the unemployment rate moves back toward the baseline, though it remains about ½ percentage point lower in 2022.

EME Turbulence and Stronger Dollar (SIGMA)

In our baseline, we see the effects of U.S. policy normalization as likely to be manageable for most foreign economies, even while assuming that the federal funds rate rises somewhat faster than markets appear to envision. However, a significant risk remains that U.S. policy normalization could generate substantial adverse spillovers abroad, especially if it proceeds much more quickly than in the baseline and is driven mainly by concerns about U.S. inflation rather than by faster U.S. economic growth.

¹⁰ This risk was previously discussed in a box and an alternative scenario in the September 2016 Tealbook, both titled “A Return to the Greenspan Conundrum.”

This scenario considers the possibility that modestly higher-than-expected U.S. inflation in the second half of this year induces the FOMC to remove policy accommodation noticeably faster than in the baseline, with the federal funds rate rising to 2 percent by the end of this year. These developments lead to rising interest rates in the EMEs. Tighter financial conditions weigh on activity in the EMEs and progressively turn investor attention to underlying EME vulnerabilities, including high corporate leverage. By early next year, EMEs experience large capital outflows and sizable depreciations of their currencies amidst an ongoing flight from EME assets. The turbulence in the EMEs has adverse financial spillovers to both the United States and the rest of the global economy. All told, foreign GDP growth runs, on average, 1 percentage point below the baseline in 2018 and 2019, while flight-to-safety flows cause the broad real dollar to appreciate 10 percent.

The stronger dollar and weaker foreign growth depress U.S. real net exports. Consequently, U.S. real GDP growth moderates to about 1½ percent in 2018 and 1¼ percent in 2019, ½ percentage point less than in the baseline. Lower import prices and weaker economic activity cause core PCE inflation to run, on average, at 1½ percent in 2018 and 2019. After EME financial conditions begin deteriorating sharply in early 2018, the federal funds rate follows a considerably shallower path than in the baseline, reaching only 3 percent by the end of 2019.

Stronger Foreign Growth (SIGMA)

In our baseline forecast, we expect foreign output to expand at a moderate pace and inflation to slowly edge closer to central bank targets, as headwinds facing the foreign economies gradually diminish. However, survey and activity indicators have come in somewhat stronger than expected in recent months, and the expansion abroad may prove faster, especially if accommodative policies become more effective in the context of ongoing balance sheet repair and improvements in consumer and business confidence. In this scenario we assume that foreign GDP growth rises to about 3¼ percent in 2017 and 2018, ½ percentage point higher per year than in our baseline projection. Increased optimism about the foreign outlook, including the perception of diminished tail risks, causes the broad real dollar to depreciate 8 percent by the end of 2019.

U.S. real GDP expands, on average, $2\frac{1}{4}$ percent in 2018 and 2019, $\frac{1}{4}$ percentage point more than in the baseline, as the weaker dollar and stronger foreign growth boost U.S. real net exports. The unemployment rate falls to $3\frac{1}{2}$ percent by the end of 2019. Higher import prices and stronger economic activity cause core PCE inflation to move persistently above 2 percent in 2018 and 2019. The federal funds rate rises more quickly than in the baseline, reaching $4\frac{1}{4}$ percent by the end of 2019.

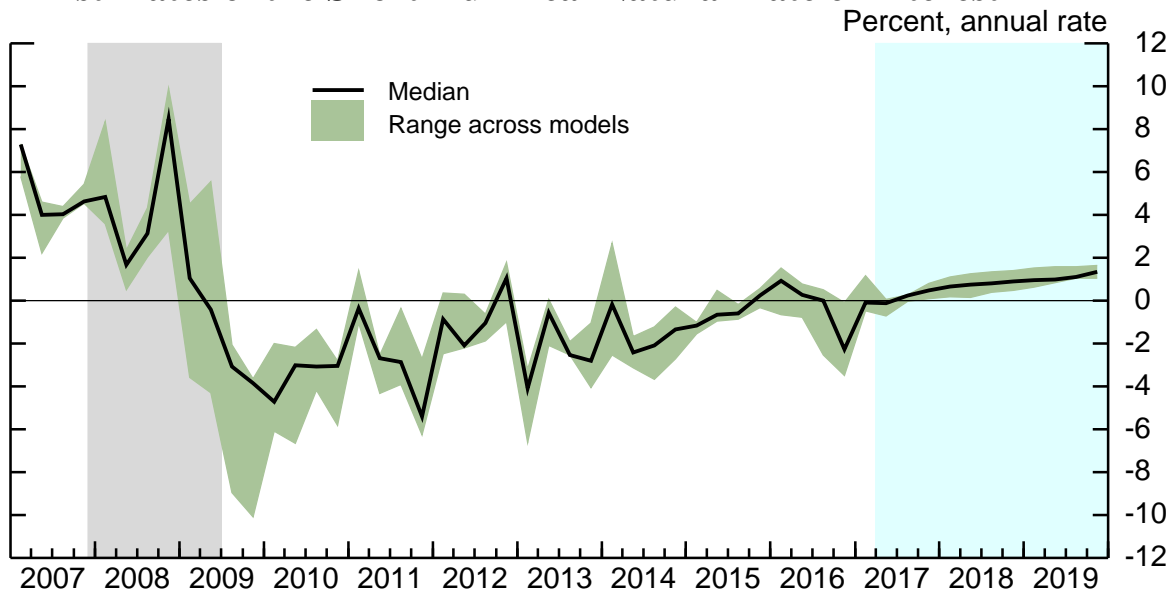
(This page is intentionally blank.)

Alternative Model Forecasts
(Percent change, Q4 to Q4, except as noted)

Measure and projection	2017		2018		2019	
	March Tealbook	Current Tealbook	March Tealbook	Current Tealbook	March Tealbook	Current Tealbook
<i>Real GDP</i>						
Staff	2.0	2.4	2.2	2.2	1.9	1.8
FRB/US	2.0	2.3	2.5	2.3	1.8	1.6
EDO	2.3	2.5	2.2	2.3	2.4	2.3
<i>Unemployment rate¹</i>						
Staff	4.6	4.2	4.2	3.9	4.1	3.8
FRB/US	4.7	4.2	4.5	4.1	4.6	4.2
EDO	4.7	4.3	4.9	4.5	5.0	4.8
<i>Total PCE prices</i>						
Staff	1.7	1.6	1.8	1.9	1.9	2.0
FRB/US	2.1	1.5	1.8	2.0	1.7	2.0
EDO	2.4	1.6	2.4	2.2	2.3	2.3
<i>Core PCE prices</i>						
Staff	1.8	1.6	1.9	1.9	2.0	2.0
FRB/US	2.1	1.6	1.9	2.0	1.8	2.0
EDO	2.3	1.7	2.4	2.2	2.3	2.3
<i>Federal funds rate¹</i>						
Staff	1.4	1.5	2.5	2.7	3.4	3.7
FRB/US	1.5	1.5	2.5	2.6	3.0	3.4
EDO	2.1	1.8	3.0	3.0	3.5	3.6

1. Percent, average for Q4.

Estimates of the Short-Run Real Natural Rate of Interest



Note: Estimates are based on the three models from the System DSGE project; for more information, see the box "Estimates of the Short-Run Real Natural Rate of Interest" in the March 2016 Tealbook. The gray shaded bar indicates a period of recession as defined by the National Bureau of Economic Research.

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	.07	.07	.04	.03
Previous Tealbook	.05	.07	.12	.06
<i>Less than 1 percent</i>				
Current Tealbook	.15	.14	.07	.25
Previous Tealbook	.24	.14	.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	.03	.03	.12	.01
Previous Tealbook	.02	.02	.14	.05
<i>Decrease by 1 percentage point</i>				
Current Tealbook	.08	.08	.10	.26
Previous Tealbook	.11	.09	.11	.03

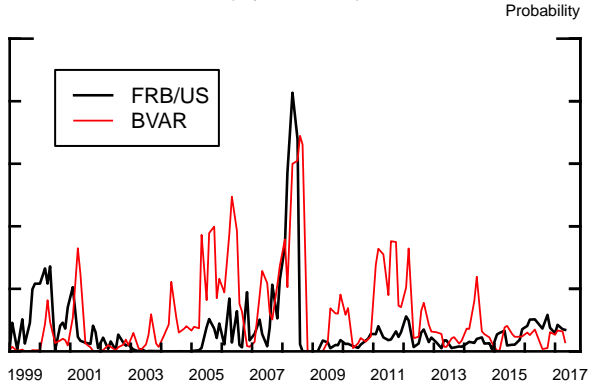
Probability of Near-Term Recession

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

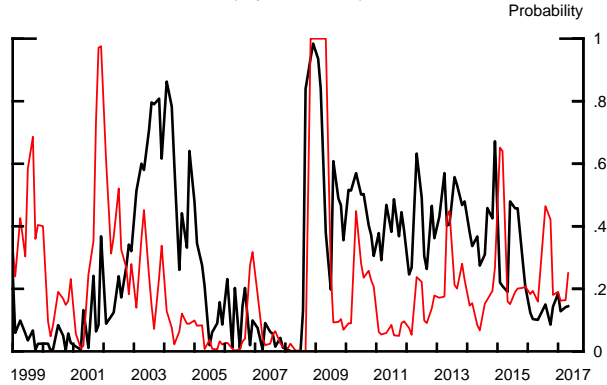
Note: “Staff” represents stochastic simulations in FRB/US around the staff baseline; baselines for FRB/US, BVAR, EDO, and the factor model are generated by those models themselves, up to the current-quarter estimate. Data for the current quarter are taken from the staff estimate for the second Tealbook 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)

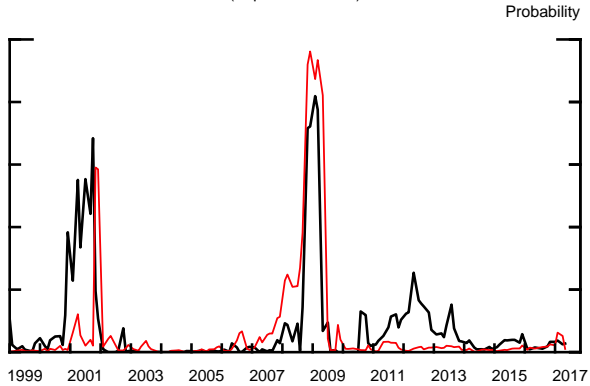
Probability that Total PCE Inflation Is above 3 Percent
(4 quarters ahead)



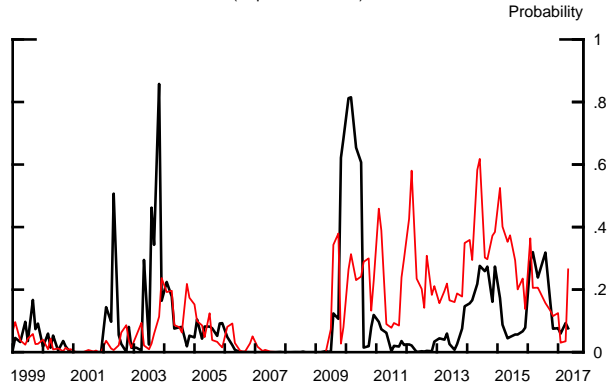
Probability that Total PCE Inflation Is below 1 Percent
(4 quarters ahead)



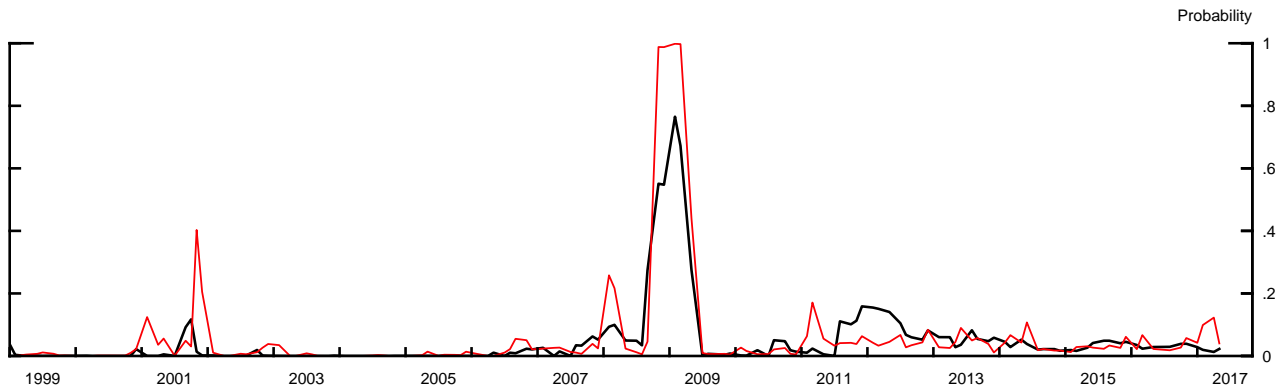
Probability that the Unemployment Rate Increases 1 ppt
(4 quarters ahead)



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.

(This page is intentionally blank.)

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 a little higher than those in the April Tealbook because the staff raised the baseline path for the output gap. The optimal control policy rate paths are also somewhat higher than those in the April Tealbook, reflecting the staff’s projection of a somewhat larger undershooting of the natural rate of unemployment in coming years alongside no material change in the staff’s projection for inflation. All of the simple rules and all but one optimal control exercise prescribe a more rapid increase in the federal funds rate over the next few years than assumed in the staff forecast. In a special exhibit, we conduct optimal control experiments with a version of the FRB/US model that incorporates an alternative to the assumption of model-consistent expectations typically used in our simulations.

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.¹ 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.

- All but one of the prescriptions of the Taylor-type policy rules in the third and fourth quarters of 2017 are a little higher than in the April Tealbook, with the influence of a more positive output gap more than offsetting that of lower inflation.
- 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 We provide details on each of these four simple rules in the appendix to this section.

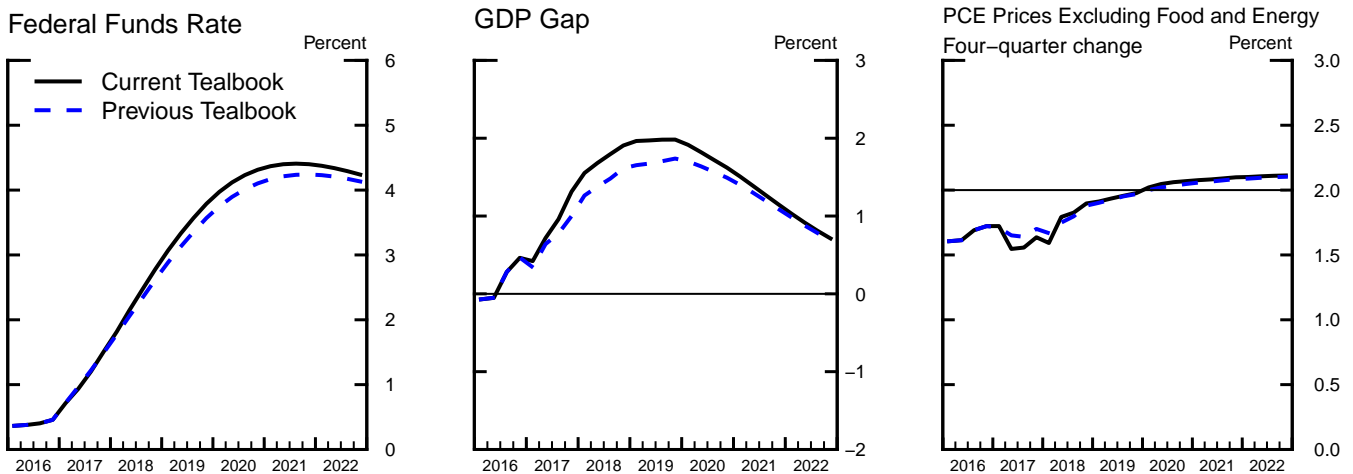
Policy Rules and the Staff Projection

Near-Term Prescriptions of Selected Simple Policy Rules¹

	2017:Q3	2017:Q4
Taylor (1993) rule	2.82	3.11
<i>Previous Tealbook</i>	2.85	3.05
Taylor (1999) rule	3.28	3.74
<i>Previous Tealbook</i>	3.22	3.53
Inertial Taylor (1999) rule	1.28	1.65
<i>Previous Tealbook projection</i>	1.27	1.61
First-difference rule	1.29	1.62
<i>Previous Tealbook projection</i>	1.16	1.41
<i>Addendum:</i>		
Tealbook baseline	1.18	1.48

Monetary Policy Strategies

Key Elements of the Staff Projection



A Medium-Term Equilibrium Real Federal Funds Rate²

	Current Tealbook	Previous Tealbook
Tealbook-consistent FRB/US r^*	2.05	1.76
Average projected real federal funds rate	0.69	0.56

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 April, reflecting the staff's projection of a somewhat faster rise later this year in output.

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.

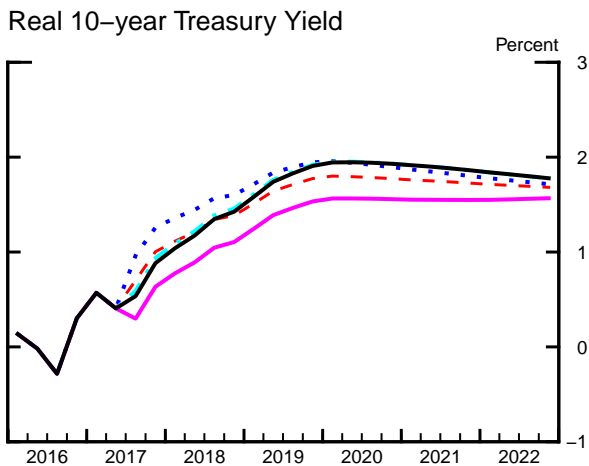
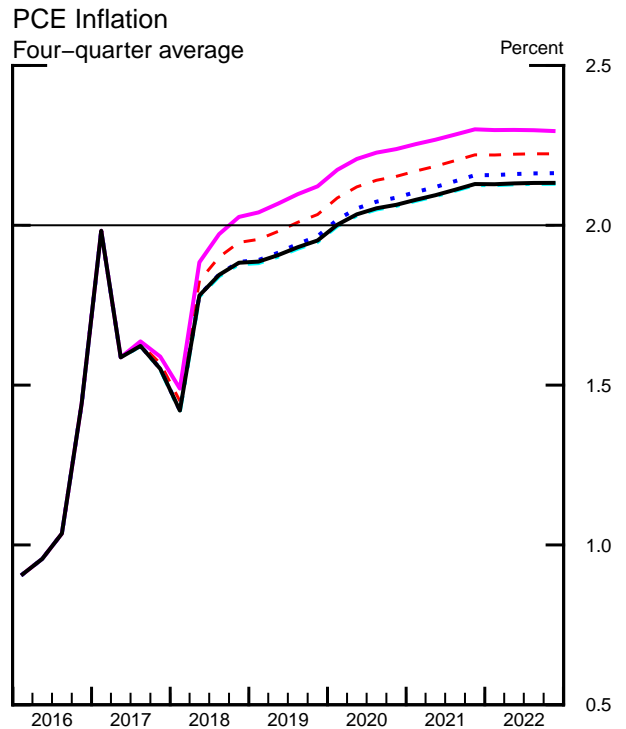
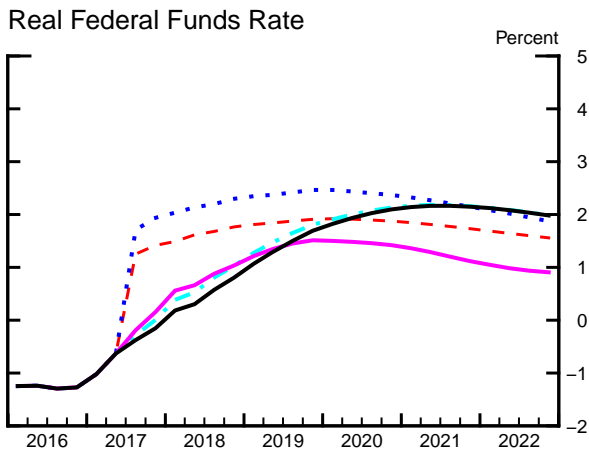
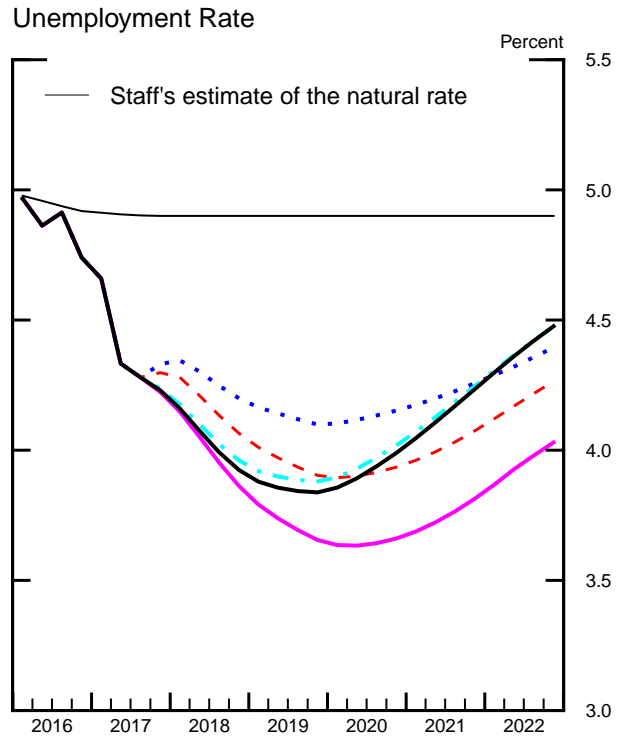
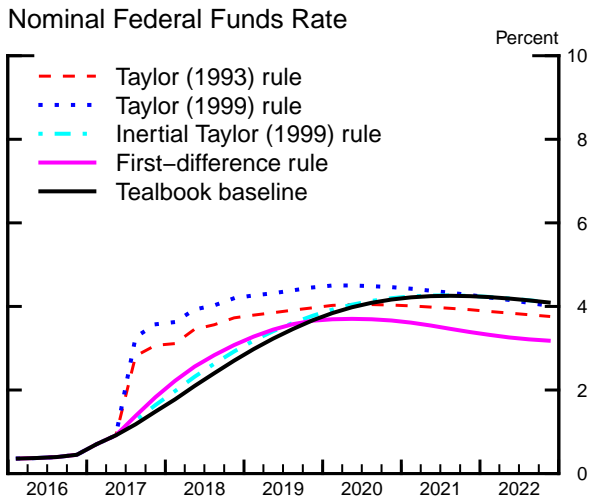
- The current-quarter estimate of Tealbook-consistent FRB/US r^* is 29 basis points higher than projected in the April Tealbook, reflecting the upward revision to the output gap.
- At 2.05 percent, Tealbook-consistent FRB/US r^* is more than 1¼ percentage points above the average projected real federal funds rate in the staff forecast for the same 12-quarter period, up from an average difference of a little less than 1 percentage point over the past year. Also, Tealbook-consistent FRB/US r^* is about 1 percentage point 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 used by the staff in constructing the baseline forecast includes an interest rate smoothing term, reacts to both the output gap and inflation deviations from 2 percent, and is therefore not designed to close the output gap over only three years.

SIMPLE POLICY RULE SIMULATIONS

The second exhibit reports results from dynamic simulations of the FRB/US model under the Taylor (1993) rule, the Taylor (1999) rule, the inertial version of the

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.

Taylor (1999) rule, and the first-difference rule.² These simulations reflect the endogenous responses of the output gap and inflation in response to the different federal funds rate paths implied by each of the specified policy rules.³ The policy rate paths prescribed by each rule are modestly higher than in the April Tealbook, reflecting the 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, a bit more than 1 percentage point per year in 2017 and 2018 and reaches 3¾ percent in late 2019. The pace of tightening subsequently slows, and the federal funds rate peaks at 4¼ percent in 2021 before moving toward its long-run level of 3 percent.
- The inertial Taylor (1999) rule, which has a constant intercept, prescribes 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 implications for 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, beginning early in the next decade and lasting several years, during which the federal funds rate is lower than in the Tealbook projection. Because market participants understand that higher short-term real interest rates during the

² Unless otherwise noted, the simulated path for each policy rule is obtained under the assumptions that policymakers are committed to following the prescriptions of that rule in the future and that financial market participants, price setters, and wage setters not only believe that policymakers will follow through on this commitment but also understand the macroeconomic implications of policymakers doing so.

³ 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.

next several years will be offset by lower real interest rates later on, 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 tends to be closely linked to the real 10-year Treasury yield, and thus the paths for unemployment and inflation under the two rules are similar to the paths in the Tealbook baseline despite the initially large differences in the paths of the federal funds rate.⁴

- 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 latter 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 2018, in conjunction with expectations of higher inflation in the future, implies lower longer-term real rates over the entire projection period than in the Tealbook baseline and therefore higher levels of resource utilization and inflation. Thus, the first-difference rule generates outcomes for the unemployment rate that are markedly below those associated with the baseline policy rule. Consequently, the first-difference rule produces inflation outcomes that are somewhat above those in the Tealbook baseline projection.
- Compared with the corresponding simulations in the April Tealbook, the federal funds rate paths prescribed by the simple rules are 0.1 to 0.3 percentage point higher, on average, over the next three years, reflecting higher projected resource utilization.

⁴ 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.

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.⁵ 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 economic outcomes.⁶

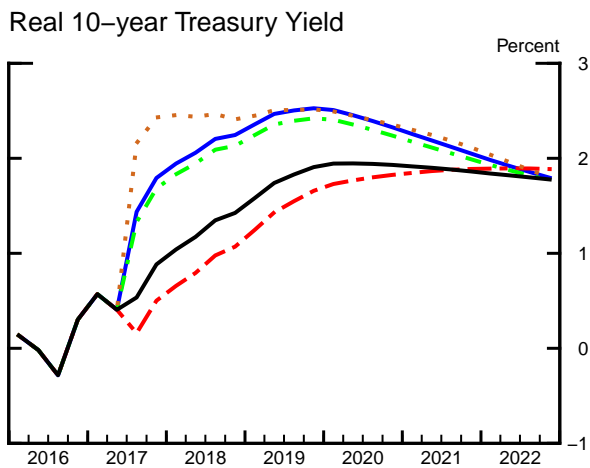
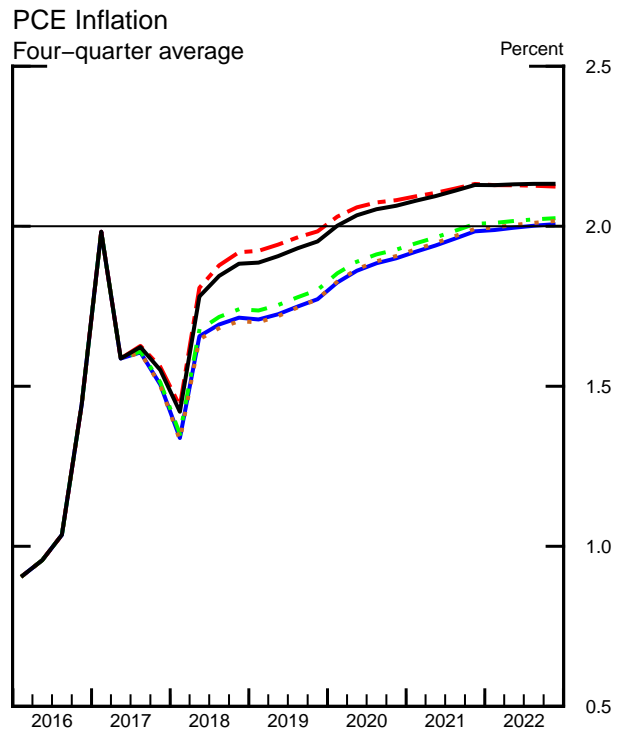
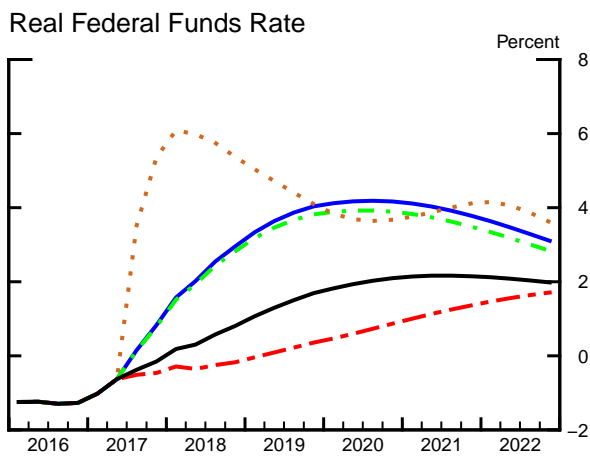
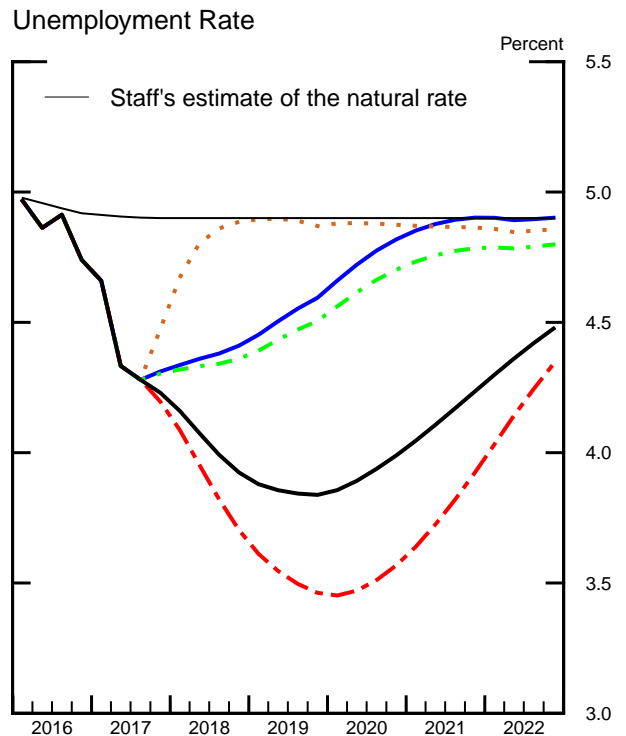
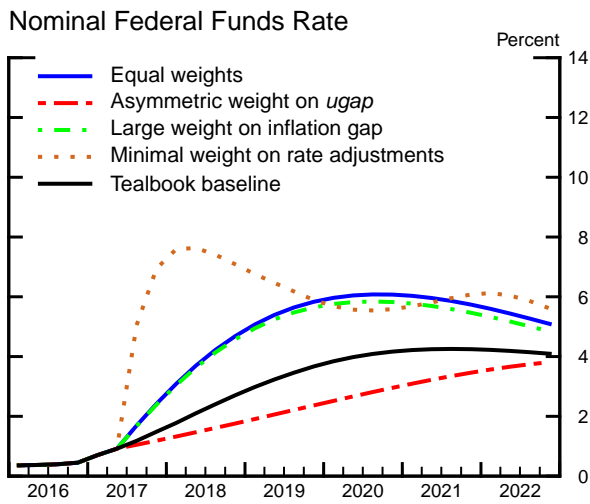
- The first simulation, “Equal weights,” presents the case in which policymakers are assumed to place the same weights on keeping headline PCE inflation close to the Committee’s 2 percent objective, on keeping the unemployment rate close to the staff’s estimate of the natural rate of unemployment, and on keeping the federal funds rate close to its previous value. 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 baseline projection, the unemployment rate falls well below the staff’s estimate of the natural rate over the next several years, an outcome that these policymakers judge to be costly. The tighter policy results in a path for 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 changes in 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 optimal control simulation with equal weights and the Tealbook baseline path. With the asymmetric loss

⁵ 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 in this Tealbook section provides technical details on the optimal control simulations.

⁶ Under the optimal control policies shown in the exhibit, policymakers improve economic outcomes by making promises that bind future policymakers’ actions and that are taken as credible by wage and price setters and by financial market participants. However, the simulations are not conditioned on policy commitments that might have been made prior to the simulation period.

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.

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 the public believes that policymakers will follow through on this policy rate path even as the economy evolves as projected with the substantial undershooting of the natural rate of unemployment, the tighter labor market brings inflation to 2 percent more quickly than in the case of equal weights. Starting around 2025 (not shown), the unemployment rate runs a little above its natural level for several years as policymakers seek to contain the inflationary pressures stemming from a prolonged period with limited resource slack.⁷

- The third simulation exercise, “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 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 are larger in coming years. The reason is that, in the FRB/US model, policymakers face an unappealing tradeoff because inflation responds only weakly 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 in 2017 than under the specification with equal weights in an effort to undo the projected

⁷ 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 re-optimize 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, which rules out time-inconsistent outcomes, policy rates and macroeconomic outcomes are between those under the Tealbook baseline and optimal control under commitment for this loss function. For the other three specifications of the loss function, the simulation results under commitment and discretion are not much different from one another.

undershooting of the natural rate of unemployment; the federal funds rate remains near 6 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 notably higher for a couple of years than in the case of equal weights. While this policy leaves the trajectory for inflation close to those of all except one of the other loss functions over the period shown, it keeps the unemployment rate close to the staff's estimate of the natural rate.⁸

- With the exception of the simulation with a minimal weight on rate adjustments, the federal funds rate paths prescribed by optimal control under each of the above loss functions are about ¼ percentage point higher, on average, over the next three years than in the April Tealbook, reflecting greater projected tightness in the labor market. For the simulation with a minimal weight on rate adjustments, the upward revision is larger for that period, at 1¼ percentage points, because policymakers in the model move aggressively to contain a larger projected undershooting of the natural rate of unemployment.

OPTIMAL CONTROL: ALTERNATIVE ASSUMPTIONS ABOUT EXPECTATIONS FORMATION

In the optimal control simulations described above, in addition to closing the unemployment gap, policymakers eventually return inflation to 2 percent on a sustained basis despite running a policy over the next several years that, in most simulations, is markedly tighter than under the Tealbook baseline. In those simulations, we assume that agents form “model-consistent expectations”—that is, we assume that the public knows the structure of the economy, understands policymakers’ strategy concerning current and future settings of the federal funds rate, and uses that knowledge when forming expectations of future movements in asset prices, wages, and inflation. These assumptions facilitate achievement of policymakers’ stated objectives, particularly for inflation. In particular, in simulations with model-consistent expectations, long-term inflation expectations move to 2 percent almost immediately from their current value of 1.8 percent assumed in the staff’s baseline, as the public expects that the policymakers will act vigorously to bring inflation to 2 percent over the medium run. An alternative

⁸ After 2022, the nominal and real federal funds rates for this simulation are sometimes above and sometimes below the case of equal weights.

assumption is that inflation expectations are “sticky,” in the sense that they respond slowly to changes in actual inflation and other influences. The staff view underlying the Tealbook baseline forecast is consistent with the latter perspective: Long-term inflation expectations are expected to rise only gradually toward 2 percent even as tight resource utilization lifts actual inflation slightly above 2 percent for an extended period.⁹

In this special exhibit, we explore the implications for optimal control policy and macroeconomic outcomes of departing from the assumption of model-consistent expectations. To do so, we assume instead that the public forms expectations based solely on historical relationships as represented by small-scale statistical models—that is, we assume “VAR-based expectations.”¹⁰ To illustrate the policy implications of this alternative assumption, we show simulations under model-consistent expectations and under VAR-based expectations for two loss functions: “Equal weights” and “Asymmetric weight on *ugap*.”

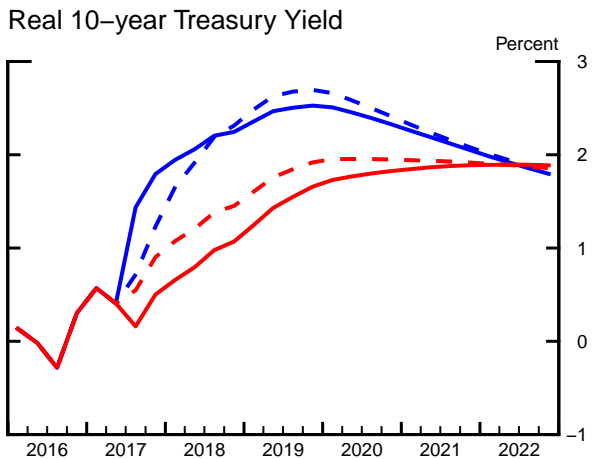
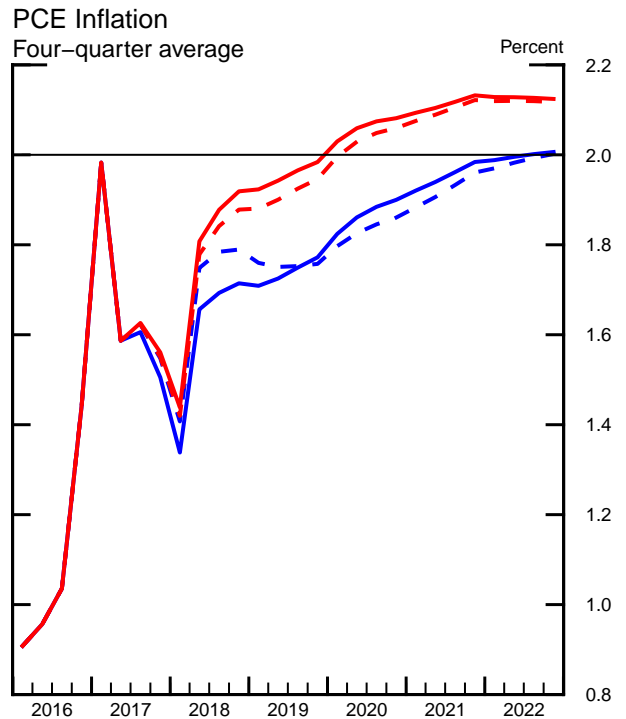
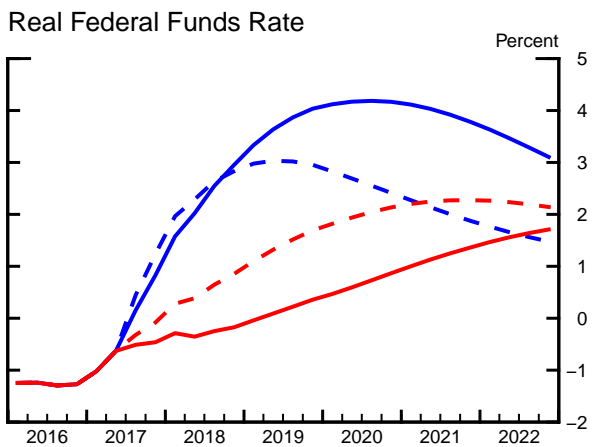
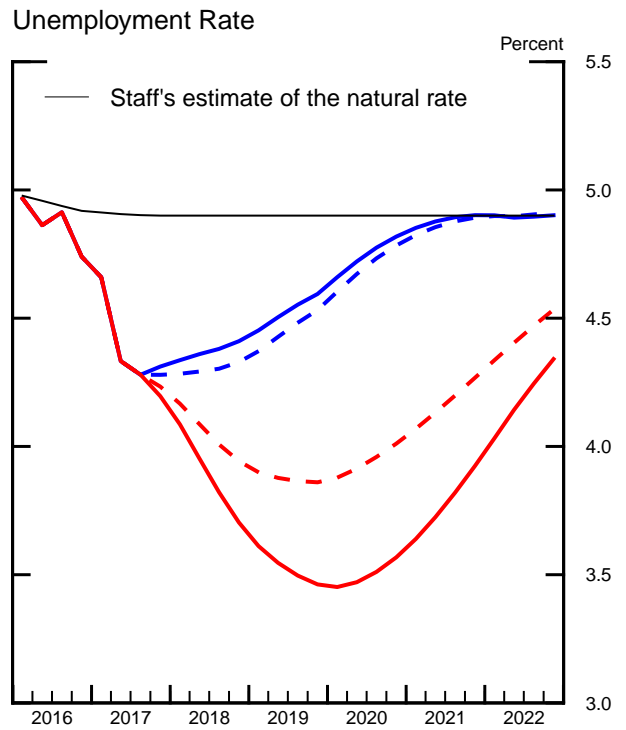
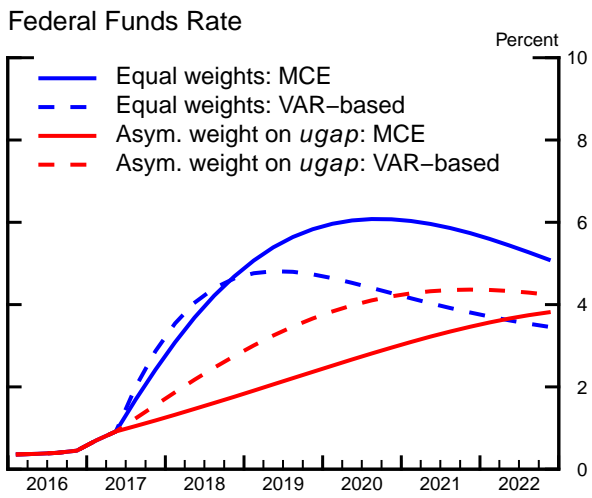
- The first simulation, “Equal weights: MCE,” reproduces the optimal control policy and outcomes from the “Equal weights” simulation of the previous exhibit. The second simulation, “Equal weights: VAR-based,” is obtained under optimal control using the VAR-based expectations version of the FRB/US model. In the early part of the period shown, policymakers choose a fairly similar path for the federal funds rate, but model-consistent and VAR-based expectations produce some differences in economic outcomes. In the model-consistent expectations case, the public foresees the inflationary implications of high future levels of resource utilization, but the public also expects that a tighter stance of policy will follow. These anticipations initially induce a lower path for inflation than under VAR-based expectations and a higher path for the 10-year real Treasury yield, which is a key influence on

⁹ For background information on the recent behavior of longer-term inflation expectations, see Michiel De Pooter and others (2016), “Longer-Term Inflation Expectations: Evidence and Policy Implications,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Division of Research and Statistics, Division of Monetary Affairs, Division of International Finance, March 4. For an exploration of the upside risks to inflation stemming from a period of tight resource utilization, see Cynthia Doniger and others (2016), “Ramifications of Allowing the Unemployment Rate to Undershoot Its Natural Rate,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Division of Monetary Affairs, Division of International Finance, Division of Research and Statistics, December 1.

¹⁰ The assumption of VAR-based expectations is the assumption conventionally used in simulations of the FRB/US model in the Risks and Uncertainty section of Tealbook A.

Optimal Control: Alternative Assumptions About Expectations Formation

Monetary Policy Strategies



Note: The simulations whose labels include "MCE" and "VAR-based" use the version of the FRB/US model with model-consistent expectations and VAR-based expectations, respectively.

aggregate demand in the FRB/US model. By contrast, under VAR-based expectations, given the low initial level of inflation expectations and the fact that the public does not accurately foresee the unusually low levels of unemployment that are forthcoming, policymakers need only to raise the federal funds rate for a relatively brief period to contain inflation expectations and achieve the Committee's 2 percent inflation objective. Moreover, later in the simulation, the paths for the federal funds in the two models diverge, despite the real 10-year Treasury yields converging. This divergence arises because, in the VAR-based expectations version of the model, the 10-year Treasury yield is not tied directly to the future path for the federal funds rate as it is in the model-consistent expectations version of the model. This feature explains why the differences in inflation and unemployment are small relative to the differences in the paths for the nominal rate late in the simulation.

- The third simulation, “Asymmetric weight on *ugap*: MCE,” reproduces the optimal control policy and outcomes from the previous exhibit when there is no penalty in the loss function on unemployment undershooting its natural rate. Also shown are results from a fourth simulation, “Asymmetric weight on *ugap*: VAR-based,” for which the asymmetric loss function is again used, this time with the FRB/US model under VAR-based expectations. Unconcerned by persistently low unemployment, policymakers with these preferences choose policies that are, for some time, notably easier than in the corresponding equal-weights cases. Moreover, policymakers facing model-consistent expectations choose a lower path for the nominal funds rate than they do under VAR-based expectations. Intuitively, the belief under model-consistent expectations that policymakers are committed to achieving 2 percent inflation induces the public to look beyond the lengthy period of very low unemployment when forming inflation expectations. The assumed credibility of this promise helps line up actual inflation with the longer-term objective over the period shown and beyond. Under VAR-based expectations, policymakers do not benefit in the same way from the foresight and conviction of the public. Initially, long-term inflation expectations stand somewhat below the Committee's inflation objective but, absent a sufficiently strong policy response, would eventually be lifted persistently above 2 percent by the lengthy period of low unemployment. To preemptively limit the associated losses, policymakers in the VAR-based expectations case must

tighten policy more in the short run than in the model-consistent expectations case.

- This special exhibit highlights the important role that expectations formation can play in determining optimal policy by presenting results for two stark alternatives. When expectations are model consistent, promises to achieve policy objectives in the future can generate powerful effects on current economic outcomes through expectations. But, these channels assume the public possesses detailed knowledge of the structure of the economy and the policy strategy. By contrast, under VAR-based expectations, the public only uses limited information and expectations are formed only on the basis of past outcomes. These two features of VAR-based expectations imply that the public will be systematically surprised even in the face of large policy changes.

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	2022
<i>Nominal federal funds rate¹</i>						
Taylor (1993)	3.1	3.7	4.0	4.0	3.9	3.8
Taylor (1999)	3.6	4.2	4.5	4.5	4.3	4.0
Inertial Taylor (1999)	1.6	2.9	3.8	4.2	4.3	4.1
First-difference	1.8	3.1	3.7	3.7	3.4	3.2
Extended Tealbook baseline	1.5	2.7	3.7	4.2	4.2	4.1
<i>Real GDP</i>						
Taylor (1993)	2.3	2.1	1.9	1.6	1.4	1.4
Taylor (1999)	2.2	1.9	1.8	1.6	1.5	1.4
Inertial Taylor (1999)	2.4	2.2	1.8	1.4	1.3	1.3
First-difference	2.4	2.4	2.1	1.6	1.4	1.4
Extended Tealbook baseline	2.4	2.2	1.8	1.4	1.2	1.3
<i>Unemployment rate¹</i>						
Taylor (1993)	4.3	4.1	3.9	3.9	4.1	4.3
Taylor (1999)	4.3	4.2	4.1	4.2	4.3	4.4
Inertial Taylor (1999)	4.2	4.0	3.9	4.0	4.2	4.5
First-difference	4.2	3.9	3.7	3.7	3.8	4.0
Extended Tealbook baseline	4.2	3.9	3.8	4.0	4.2	4.5
<i>Total PCE prices</i>						
Taylor (1993)	1.6	1.9	2.0	2.2	2.2	2.2
Taylor (1999)	1.6	1.9	2.0	2.1	2.2	2.2
Inertial Taylor (1999)	1.5	1.9	1.9	2.1	2.1	2.1
First-difference	1.6	2.0	2.1	2.2	2.3	2.3
Extended Tealbook baseline	1.6	1.9	2.0	2.1	2.1	2.1
<i>Core PCE prices</i>						
Taylor (1993)	1.7	2.0	2.1	2.2	2.2	2.2
Taylor (1999)	1.6	1.9	2.0	2.1	2.1	2.1
Inertial Taylor (1999)	1.6	1.9	2.0	2.1	2.1	2.1
First-difference	1.7	2.0	2.1	2.2	2.3	2.3
Extended Tealbook baseline	1.6	1.9	2.0	2.1	2.1	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	0.9	2.8	3.1	3.1	3.5	3.6	3.7
Taylor (1999)	0.7	0.9	3.3	3.6	3.6	3.9	4.0	4.2
Inertial Taylor (1999)	0.7	0.9	1.3	1.6	2.0	2.3	2.6	2.9
First-difference	0.7	0.9	1.4	1.8	2.2	2.6	2.8	3.1
Extended Tealbook baseline	0.7	0.9	1.2	1.5	1.8	2.1	2.4	2.7
<i>Real GDP</i>								
Taylor (1993)	2.0	2.3	2.1	2.3	2.6	2.4	2.3	2.1
Taylor (1999)	2.0	2.3	2.1	2.2	2.5	2.2	2.0	1.9
Inertial Taylor (1999)	2.0	2.3	2.1	2.4	2.7	2.6	2.4	2.2
First-difference	2.0	2.3	2.1	2.4	2.8	2.7	2.6	2.4
Extended Tealbook baseline	2.0	2.3	2.1	2.4	2.7	2.6	2.5	2.2
<i>Unemployment rate¹</i>								
Taylor (1993)	4.7	4.3	4.3	4.3	4.3	4.2	4.1	4.1
Taylor (1999)	4.7	4.3	4.3	4.3	4.3	4.3	4.2	4.2
Inertial Taylor (1999)	4.7	4.3	4.3	4.2	4.2	4.1	4.0	4.0
First-difference	4.7	4.3	4.3	4.2	4.1	4.1	4.0	3.9
Extended Tealbook baseline	4.7	4.3	4.3	4.2	4.2	4.1	4.0	3.9
<i>Total PCE prices</i>								
Taylor (1993)	2.0	1.6	1.6	1.6	1.5	1.8	1.9	1.9
Taylor (1999)	2.0	1.6	1.6	1.6	1.4	1.8	1.8	1.9
Inertial Taylor (1999)	2.0	1.6	1.6	1.5	1.4	1.8	1.8	1.9
First-difference	2.0	1.6	1.6	1.6	1.5	1.9	2.0	2.0
Extended Tealbook baseline	2.0	1.6	1.6	1.6	1.4	1.8	1.8	1.9
<i>Core PCE prices</i>								
Taylor (1993)	1.7	1.5	1.6	1.7	1.6	1.8	1.9	2.0
Taylor (1999)	1.7	1.5	1.6	1.6	1.6	1.8	1.8	1.9
Inertial Taylor (1999)	1.7	1.5	1.6	1.6	1.6	1.8	1.8	1.9
First-difference	1.7	1.5	1.6	1.7	1.7	1.9	2.0	2.0
Extended Tealbook baseline	1.7	1.5	1.6	1.6	1.6	1.8	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	2022
<i>Nominal federal funds rate¹</i>						
Equal weights	2.4	4.7	5.8	6.1	5.7	5.1
Aymmetric weight on <i>ugap</i>	1.2	1.8	2.4	3.0	3.5	3.8
Large weight on inflation gap	2.4	4.6	5.6	5.8	5.5	4.8
Minimal weight on rate adjustments	6.9	7.1	5.9	5.6	6.1	5.6
Extended Tealbook baseline	1.5	2.7	3.7	4.2	4.2	4.1
<i>Real GDP</i>						
Equal weights	2.2	1.4	1.3	1.3	1.5	1.6
Aymmetric weight on <i>ugap</i>	2.5	2.6	2.1	1.4	1.1	1.0
Large weight on inflation gap	2.2	1.5	1.4	1.3	1.5	1.6
Minimal weight on rate adjustments	2.0	0.8	1.6	1.7	1.6	1.6
Extended Tealbook baseline	2.4	2.2	1.8	1.4	1.2	1.3
<i>Unemployment rate¹</i>						
Equal weights	4.3	4.4	4.6	4.8	4.9	4.9
Aymmetric weight on <i>ugap</i>	4.2	3.7	3.5	3.6	3.9	4.3
Large weight on inflation gap	4.3	4.4	4.5	4.7	4.8	4.8
Minimal weight on rate adjustments	4.5	4.9	4.9	4.9	4.9	4.9
Extended Tealbook baseline	4.2	3.9	3.8	4.0	4.2	4.5
<i>Total PCE prices</i>						
Equal weights	1.5	1.7	1.8	1.9	2.0	2.0
Aymmetric weight on <i>ugap</i>	1.6	1.9	2.0	2.1	2.1	2.1
Large weight on inflation gap	1.5	1.7	1.8	1.9	2.0	2.0
Minimal weight on rate adjustments	1.5	1.7	1.8	1.9	2.0	2.0
Extended Tealbook baseline	1.6	1.9	2.0	2.1	2.1	2.1
<i>Core PCE prices</i>						
Equal weights	1.6	1.7	1.8	1.9	2.0	2.0
Aymmetric weight on <i>ugap</i>	1.6	1.9	2.0	2.1	2.1	2.1
Large weight on inflation gap	1.6	1.8	1.8	1.9	2.0	2.0
Minimal weight on rate adjustments	1.6	1.7	1.8	1.9	2.0	2.0
Extended Tealbook baseline	1.6	1.9	2.0	2.1	2.1	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	0.9	1.7	2.4	3.1	3.7	4.2	4.7
Asymmetric weight on <i>ugap</i>	0.7	0.9	1.0	1.2	1.3	1.5	1.6	1.8
Large weight on inflation gap	0.7	0.9	1.7	2.4	3.0	3.6	4.1	4.6
Minimal weight on rate adjustments	0.7	0.9	5.1	6.9	7.6	7.6	7.4	7.1
Extended Tealbook baseline	0.7	0.9	1.2	1.5	1.8	2.1	2.4	2.7
<i>Real GDP</i>								
Equal weights	2.0	2.3	2.1	2.2	2.4	2.0	1.6	1.4
Asymmetric weight on <i>ugap</i>	2.0	2.3	2.1	2.5	2.9	2.9	2.9	2.6
Large weight on inflation gap	2.0	2.3	2.1	2.2	2.4	2.1	1.7	1.5
Minimal weight on rate adjustments	2.0	2.3	2.1	2.0	1.9	1.3	0.9	0.8
Extended Tealbook baseline	2.0	2.3	2.1	2.4	2.7	2.6	2.5	2.2
<i>Unemployment rate¹</i>								
Equal weights	4.7	4.3	4.3	4.3	4.3	4.4	4.4	4.4
Asymmetric weight on <i>ugap</i>	4.7	4.3	4.3	4.2	4.1	4.0	3.8	3.7
Large weight on inflation gap	4.7	4.3	4.3	4.3	4.3	4.3	4.3	4.4
Minimal weight on rate adjustments	4.7	4.3	4.3	4.5	4.7	4.8	4.9	4.9
Extended Tealbook baseline	4.7	4.3	4.3	4.2	4.2	4.1	4.0	3.9
<i>Total PCE prices</i>								
Equal weights	2.0	1.6	1.6	1.5	1.3	1.7	1.7	1.7
Asymmetric weight on <i>ugap</i>	2.0	1.6	1.6	1.6	1.4	1.8	1.9	1.9
Large weight on inflation gap	2.0	1.6	1.6	1.5	1.4	1.7	1.7	1.7
Minimal weight on rate adjustments	2.0	1.6	1.6	1.5	1.3	1.6	1.7	1.7
Extended Tealbook baseline	2.0	1.6	1.6	1.6	1.4	1.8	1.8	1.9
<i>Core PCE prices</i>								
Equal weights	1.7	1.5	1.5	1.6	1.5	1.7	1.7	1.7
Asymmetric weight on <i>ugap</i>	1.7	1.5	1.6	1.6	1.6	1.8	1.9	1.9
Large weight on inflation gap	1.7	1.5	1.5	1.6	1.5	1.7	1.7	1.8
Minimal weight on rate adjustments	1.7	1.5	1.5	1.6	1.5	1.7	1.7	1.7
Extended Tealbook baseline	1.7	1.5	1.6	1.6	1.6	1.8	1.8	1.9

1. Percent, average for the quarter.

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 of the U.S. economy.³ This measure depends on a broad array of economic factors, some of

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.

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

which take the form of projected values of the model’s exogenous variables. The measure is derived under the assumption that agents in the model form VAR-based expectations—that is, agents use small-scale statistical models so that their expectations of future variables are determined solely by historical relationships.

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 form model-consistent expectations 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 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.

Loss Functions

	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 $ugap$	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 that market participants and wage and price setters employ model-consistent expectations 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.

REFERENCES

- Erceg, Christopher, Jon Faust, Michael Kiley, Jean-Philippe Laforte, David López-Salido, Stephen Meyer, Edward Nelson, David Reifschneider, and Robert Tetlow (2012). “An Overview of Simple Policy Rules and Their Use in Policymaking in Normal Times and Under Current Conditions,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Divisions of International Finance, Monetary Affairs, and Research and Statistics, July 18.
- Gust, Christopher, Benjamin K. Johansson, David López-Salido, and Robert Tetlow (2016). “ r^* : Concepts, Measures, and Uses,” memorandum to the Federal Open Market Committee, Board of Governors of the Federal Reserve System, Division of Monetary Affairs, October 13.
- Orphanides, Athanasios (2003). “Historical Monetary Policy Analysis and the Taylor Rule,” *Journal of Monetary Economics*, vol. 50 (July), pp. 983–1022.
- Taylor, John B. (1993). “Discretion versus Policy Rules in Practice,” *Carnegie-Rochester Conference Series on Public Policy*, vol. 39 (December), pp. 195–214.
- Taylor, John B. (1999). “A Historical Analysis of Monetary Policy Rules,” in John B. Taylor, ed., *Monetary Policy Rules*. Chicago: University of Chicago Press, pp. 319–41.

(This page is intentionally blank.)

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	
	04/21/17	06/02/17	04/21/17	06/02/17	04/21/17	06/02/17	04/21/17	06/02/17	04/21/17	06/02/17
<i>Quarterly</i>										
2016:Q1	1.3	1.3	0.8	0.8	0.3	0.3	2.1	2.1	5.0	5.0
2016:Q2	3.7	3.7	1.4	1.4	2.0	2.0	1.8	1.8	4.9	4.9
2016:Q3	5.0	5.0	3.5	3.5	1.5	1.5	1.7	1.7	4.9	4.9
2016:Q4	4.2	4.2	2.1	2.1	2.0	2.0	1.3	1.3	4.7	4.7
2017:Q1	3.3	3.5	0.9	1.2	2.4	2.4	2.0	2.1	4.7	4.7
2017:Q2	3.9	3.4	2.6	2.6	1.2	0.4	1.6	1.1	4.5	4.3
2017:Q3	4.1	4.4	2.2	2.7	1.6	1.6	1.7	1.8	4.5	4.3
2017:Q4	4.4	5.0	2.6	3.1	1.6	1.7	1.6	1.6	4.4	4.2
2018:Q1	4.8	4.7	2.6	2.6	1.9	1.9	1.9	1.9	4.3	4.2
2018:Q2	4.1	4.2	2.0	2.1	1.8	1.9	1.9	1.9	4.2	4.1
2018:Q3	4.0	4.1	2.0	2.1	1.8	1.9	1.9	1.9	4.2	4.0
2018:Q4	4.1	4.1	2.1	2.1	1.8	1.9	1.9	1.9	4.1	3.9
<i>Two-quarter²</i>										
2016:Q2	2.5	2.5	1.1	1.1	1.1	1.1	1.9	1.9	-0.1	-0.1
2016:Q4	4.6	4.6	2.8	2.8	1.7	1.7	1.5	1.5	-0.2	-0.2
2017:Q2	3.6	3.4	1.7	1.9	1.8	1.4	1.8	1.6	-0.2	-0.4
2017:Q4	4.2	4.7	2.4	2.9	1.6	1.7	1.6	1.7	-0.1	-0.1
2018:Q2	4.4	4.5	2.3	2.4	1.8	1.9	1.9	1.9	-0.2	-0.1
2018:Q4	4.0	4.1	2.0	2.1	1.8	1.9	1.9	1.9	-0.1	-0.2
<i>Four-quarter³</i>										
2015:Q4	3.0	3.0	1.9	1.9	0.4	0.4	1.4	1.4	-0.7	-0.7
2016:Q4	3.5	3.5	2.0	2.0	1.4	1.4	1.7	1.7	-0.3	-0.3
2017:Q4	3.9	4.0	2.1	2.4	1.7	1.6	1.7	1.6	-0.3	-0.5
2018:Q4	4.2	4.3	2.2	2.2	1.8	1.9	1.9	1.9	-0.3	-0.3
2019:Q4	3.9	4.0	1.8	1.8	1.9	2.0	2.0	2.0	-0.1	-0.1
<i>Annual</i>										
2015	3.7	3.7	2.6	2.6	0.3	0.3	1.4	1.4	5.3	5.3
2016	3.0	3.0	1.6	1.6	1.1	1.1	1.7	1.7	4.9	4.9
2017	4.0	4.0	2.0	2.2	1.8	1.7	1.7	1.6	4.5	4.4
2018	4.3	4.4	2.3	2.5	1.7	1.7	1.8	1.8	4.2	4.0
2019	4.0	4.0	1.9	1.9	1.9	1.9	1.9	1.9	4.0	3.9

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		1.2	2.6	2.7	3.1	2.6	2.1	2.1	2.1	2.0	2.4	2.2	1.8
<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
Final sales	2.6	3.0	1.1		2.2	2.2	2.5	3.0	2.7	2.1	2.1	2.2	2.0	2.5	2.3	1.9
<i>Previous Tealbook</i>	2.6	3.0	1.1		.9	2.7	2.3	2.7	2.7	2.0	2.0	2.1	2.0	2.1	2.2	1.9
Priv. dom. final purch.	3.2	2.4	3.4		2.6	2.9	3.0	3.5	3.6	2.9	2.7	2.6	2.5	3.0	2.9	2.4
<i>Previous Tealbook</i>	3.2	2.4	3.4		1.8	3.0	2.8	3.2	3.6	2.9	2.7	2.6	2.5	2.7	2.9	2.4
Personal cons. expend.	4.3	3.0	3.5		.6	3.0	2.8	3.0	3.3	3.0	2.8	2.7	3.1	2.4	2.9	2.5
<i>Previous Tealbook</i>	4.3	3.0	3.5		.6	3.1	3.0	2.8	3.4	3.0	2.8	2.7	3.1	2.4	2.9	2.5
Durables	9.8	11.6	11.4		-1.4	5.7	4.7	5.8	5.6	5.0	4.5	4.0	7.9	3.6	4.8	2.0
Nondurables	5.7	-5	3.3		1.2	3.8	3.1	2.9	3.6	3.1	3.0	2.9	2.6	2.7	3.1	2.6
Services	3.0	2.7	2.4		.8	2.4	2.5	2.6	2.9	2.6	2.4	2.4	2.5	2.1	2.6	2.6
Residential investment	-7.7	-4.1	9.6		13.9	-1.1	-2.6	7.8	4.2	2.6	3.1	2.4	1.1	4.3	3.1	4.2
<i>Previous Tealbook</i>	-7.7	-4.1	9.6		11.4	-1.3	-1.5	8.3	5.2	2.6	2.1	.9	1.1	4.1	2.7	4.4
Nonres. priv. fixed invest.	1.0	1.4	.9		10.2	3.3	5.9	5.0	4.9	2.6	2.1	2.2	-1	6.1	2.9	1.1
<i>Previous Tealbook</i>	1.0	1.4	.9		5.4	4.4	3.0	4.1	4.6	2.6	2.5	2.5	-1	4.2	3.1	1.2
Equipment & intangibles	1.8	-1.3	1.7		7.0	2.6	4.5	5.9	6.0	2.9	2.7	2.9	-6	5.0	3.6	1.7
<i>Previous Tealbook</i>	1.8	-1.3	1.7		2.4	2.4	2.4	4.9	6.0	3.0	3.3	3.4	-6	3.0	3.9	1.8
Nonres. structures	-2.1	12.0	-1.9		22.5	5.7	10.9	1.9	.9	1.9	.1	-2	1.9	10.0	.7	-7
<i>Previous Tealbook</i>	-2.1	12.0	-1.9		17.1	11.4	5.3	1.4	-2	1.5	-1	-5	1.9	8.6	.2	-6
Net exports ²	-558	-522	-605		-597	-610	-627	-640	-662	-684	-698	-703	-563	-618	-687	-741
<i>Previous Tealbook</i> ²	-558	-522	-605		-619	-635	-657	-670	-693	-718	-737	-747	-563	-645	-724	-785
Exports	1.8	10.0	-4.5		7.3	1.3	2.2	2.7	2.9	2.9	3.1	3.0	1.5	3.3	3.0	2.9
Imports	.2	2.2	9.0		4.4	3.0	4.1	4.1	5.4	5.3	4.3	3.0	2.6	3.9	4.5	4.2
Gov't. cons. & invest.	-1.7	.8	.2		-9	.3	1.8	1.7	.4	.5	.5	.5	.2	.7	.5	.6
<i>Previous Tealbook</i>	-1.7	.8	.2		-1.8	2.4	2.2	1.3	.7	.5	.5	.4	.2	1.0	.5	.5
Federal	-4	2.4	-1.2		-2.0	.4	2.2	2.0	-2	-2	-2	-2	-2	.6	-2	.2
Defense	-3.2	2.0	-3.6		-3.9	0	3.7	3.7	1.1	1.1	1.1	1.1	-2.0	.8	1.1	1.0
Nondefense	3.8	3.0	2.3		.7	.9	.0	-3	-2.0	-2.0	-2.0	-2.0	2.5	.3	-2.0	-9
State & local	-2.5	-2	1.0		-1	.2	1.5	1.5	.8	.8	.8	.8	.4	.8	.8	.8
Change in priv. inventories ²	-9	7	50		4	20	25	29	25	26	26	18	22	20	24	15
<i>Previous Tealbook</i> ²	-9	7	50		46	42	39	34	30	29	28	28	22	40	29	22

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	2.4	2.2	1.8
<i>Previous Tealbook</i>	2.7	1.7	1.3	2.7	2.5	1.9	2.0	2.1	2.2	1.8
Final sales	2.0	1.5	1.7	2.0	2.7	2.0	2.0	2.5	2.3	1.9
<i>Previous Tealbook</i>	2.0	1.5	1.7	2.0	2.7	2.0	2.0	2.1	2.2	1.9
Priv. dom. final purch.	3.5	2.6	2.3	2.6	3.8	2.7	2.5	3.0	2.9	2.4
<i>Previous Tealbook</i>	3.5	2.6	2.3	2.6	3.8	2.7	2.5	2.7	2.9	2.4
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	3.1	2.4	2.9	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	2.7	3.1	2.6
Services	2.0	1.4	.6	1.3	2.9	2.2	2.5	2.1	2.6	2.6
Residential investment	-5.2	6.0	15.7	6.8	6.2	13.1	1.1	4.3	3.1	4.2
<i>Previous Tealbook</i>	-5.2	6.0	15.7	6.8	6.2	13.1	1.1	4.1	2.7	4.4
Nonres. priv. fixed invest.	8.1	9.0	5.2	4.8	5.0	.8	-1	6.1	2.9	1.1
<i>Previous Tealbook</i>	8.1	9.0	5.2	4.8	5.0	.8	-1	4.2	3.1	1.2
Equipment & intangibles	12.0	9.2	5.5	4.5	4.1	3.8	-6	5.0	3.6	1.7
<i>Previous Tealbook</i>	12.0	9.2	5.5	4.5	4.1	3.8	-6	3.0	3.9	1.8
Nonres. structures	-4.0	8.0	4.1	5.8	8.0	-8.8	1.9	10.0	.7	-7
<i>Previous Tealbook</i>	-4.0	8.0	4.1	5.8	8.0	-8.8	1.9	8.6	.2	-6
Net exports ¹	-459	-459	-447	-405	-426	-540	-563	-618	-687	-741
<i>Previous Tealbook¹</i>	-459	-459	-447	-405	-426	-540	-563	-645	-724	-785
Exports	10.1	4.2	2.2	5.9	3.1	-2.2	1.5	3.3	3.0	2.9
Imports	12.0	3.5	.3	2.5	6.1	2.5	2.6	3.9	4.5	4.2
Gov't. cons. & invest.	-1.1	-3.0	-2.2	-2.8	.3	2.2	.2	.7	.5	.6
<i>Previous Tealbook</i>	-1.1	-3.0	-2.2	-2.8	.3	2.2	.2	1.0	.5	.5
Federal	3.2	-4.0	-2.1	-6.7	-1.3	1.7	-2	.6	-2	.2
Defense	2.0	-4.1	-3.9	-7.1	-4.1	.6	-2.0	.8	1.1	1.0
Nondefense	5.5	-3.9	1.0	-6.0	3.4	3.4	2.5	.3	-2.0	-9
State & local	-4.0	-2.3	-2.3	-1	1.3	2.5	.4	.8	.8	.8
Change in priv. inventories ¹	58	38	55	79	58	84	22	20	24	15
<i>Previous Tealbook¹</i>	58	38	55	79	58	84	22	40	29	22

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	1.2	2.6	2.7	3.1	2.6	2.1	2.1					2.1	2.0	2.4	2.2	1.8
	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
Final sales <i>Previous Tealbook</i>	2.6	3.0	1.1	2.2	2.2	2.5	3.0	2.7	2.1	2.1	2.2	2.0	2.5	2.3	1.9
	2.6	3.0	1.1	.9	2.7	2.3	2.7	2.7	2.0	2.0	2.1	2.0	2.1	2.2	1.9
Priv. dom. final purch. <i>Previous Tealbook</i>	2.7	2.1	2.9	2.2	2.4	2.6	3.0	3.1	2.5	2.3	2.2	2.1	2.5	2.5	2.1
	2.7	2.1	2.9	1.5	2.6	2.4	2.7	3.1	2.5	2.3	2.2	2.1	2.3	2.5	2.1
Personal cons. expend. <i>Previous Tealbook</i>	2.9	2.0	2.4	.4	2.1	2.0	2.1	2.3	2.0	1.9	1.9	2.1	1.6	2.0	1.7
	2.9	2.0	2.4	.4	2.1	2.1	1.9	2.3	2.0	1.9	1.9	2.1	1.6	2.0	1.8
Durables	.7	.8	.8	-1	.4	.4	.4	.4	.4	.3	.3	.6	.3	.4	.1
Nondurables	.8	-1	.5	.2	.5	.4	.4	.5	.4	.4	.4	.4	.4	.5	.4
Services	1.4	1.3	1.1	.4	1.1	1.2	1.2	1.4	1.2	1.1	1.2	1.2	1.0	1.2	1.2
Residential investment <i>Previous Tealbook</i>	-3	-2	.4	.5	.0	-1	.3	.2	.1	.1	.1	.0	.2	.1	.2
	-3	-2	.4	.4	-1	-1	.3	.2	.1	.1	.0	.0	.2	.1	.2
Nonres. priv. fixed invest. <i>Previous Tealbook</i>	.1	.2	.1	1.2	.4	.7	.6	.6	.3	.3	.3	.0	.7	.4	.1
	.1	.2	.1	.7	.5	.4	.5	.6	.3	.3	.3	.0	.5	.4	.2
Equipment & intangibles <i>Previous Tealbook</i>	.2	-1	.2	.7	.2	.4	.6	.6	.3	.3	.3	-1	.5	.4	.2
	.2	-1	.2	.2	.2	.2	.5	.6	.3	.3	.3	-1	.3	.4	.2
Nonres. structures <i>Previous Tealbook</i>	-1	.3	-1	.6	.2	.3	.1	.0	.1	.0	.0	.0	.3	.0	.0
	-1	.3	-1	.4	.3	.1	.0	.0	.0	.0	.0	.0	.2	.0	.0
Net exports <i>Previous Tealbook</i>	.2	.9	-1.8	.2	-3	-3	-3	-5	-4	-3	-1	-2	-2	-3	-3
	.2	.9	-1.8	-3	-3	-5	-3	-5	-5	-4	-2	-2	-3	-4	-3
Exports	.2	1.2	-6	.8	.2	.3	.3	.3	.4	.4	.4	.2	.4	.4	.3
Imports	.0	-3	-1.3	-6	-4	-6	-6	-8	-8	-6	-5	-4	-6	-7	-6
Gov't. cons. & invest. <i>Previous Tealbook</i>	-3	.1	.0	-2	.1	.3	.3	.1	.1	.1	.1	.0	.1	.1	.1
	-3	.1	.0	-3	.4	.4	.2	.1	.1	.1	.1	.0	.2	.1	.1
Federal	.0	.2	-1	-1	.0	.1	.1	.0	.0	.0	.0	.0	.0	.0	.0
Defense	-1	.1	-1	-2	.0	.1	.1	.0	.0	.0	.0	-1	.0	.0	.0
Nondefense	.1	.1	.1	.0	.0	.0	.0	-1	-1	-1	-1	.1	.0	-1	.0
State & local	-3	.0	.1	.0	.0	.2	.2	.1	.1	.1	.1	.0	.1	.1	.1
Change in priv. inventories <i>Previous Tealbook</i>	-1.2	.5	1.0	-1.0	.4	.1	.1	-1	.0	.0	-2	.0	-1	-1	-1
	-1.2	.5	1.0	.0	-1	-1	-1	-1	.0	.0	.0	.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 2.3	1.4 1.4	2.1 2.1		2.2 2.4	.8 1.3	1.7 1.8	1.8 1.8		2.1 2.1	2.0 2.0	2.0 2.0	1.6 1.6	1.6 1.8	2.0 2.0	2.1 2.1	
PCE chain-wt. price index <i>Previous Tealbook</i>	2.0 2.0	1.5 1.5	2.0 2.0		2.4 2.4	.4 1.2	1.6 1.6	1.7 1.6		1.9 1.9	1.9 1.8	1.9 1.8	1.4 1.4	1.6 1.7	1.9 1.8	2.0 1.9	
Energy <i>Previous Tealbook</i>	15.5 15.5	2.1 2.1	26.3 26.3		15.5 15.2	-16.2 -8.5	-1.9 -4	3.5 .8		2.0 .6	1.1 .4	.7 .0	.7 .3	.8 .8	-4 1.4	1.1 1.3	.9 .7
Food <i>Previous Tealbook</i>	-1.8 -1.8	-2.1 -2.1	-1.2 -1.2		.4 .4	2.5 2.3	1.6 1.9	2.0 2.0		2.2 2.2	2.1 2.1	2.1 2.2	-1.7 -1.7	1.6 1.7	2.1 2.1	2.2 2.2	
Ex. food & energy <i>Previous Tealbook</i>	1.8 1.8	1.7 1.7	1.3 1.3		2.1 2.0	1.1 1.6	1.8 1.7	1.6 1.6		1.9 1.9	1.9 1.9	1.9 1.9	1.7 1.7	1.6 1.7	1.9 1.9	2.0 2.0	
Ex. food & energy, market based <i>Previous Tealbook</i>	1.6 1.6	1.6 1.6	1.3 1.3		2.0 2.0	.7 1.4	1.6 1.5	1.6 1.5		1.8 1.8	1.8 1.8	1.9 1.8	1.5 1.5	1.5 1.6	1.8 1.8	1.9 1.9	
CPI <i>Previous Tealbook</i>	2.3 2.3	1.8 1.8	3.0 3.0		3.1 3.1	.1 1.3	2.0 2.1	2.4 2.2		2.4 2.3	2.3 2.3	2.3 2.3	1.8 1.8	1.9 2.2	2.3 2.3	2.4 2.4	
Ex. food & energy <i>Previous Tealbook</i>	2.1 2.1	2.1 2.1	2.0 2.0		2.5 2.5	1.0 1.9	2.3 2.3	2.3 2.2		2.4 2.4	2.4 2.4	2.5 2.4	2.2 2.2	2.0 2.2	2.4 2.4	2.5 2.5	
ECI, hourly compensation ² <i>Previous Tealbook</i> ²	2.3 2.3	1.9 1.9	1.9 1.9		3.2 2.5	2.3 2.2	2.3 2.2	2.4 2.2		2.6 2.3	2.4 2.4	2.4 2.4	2.2 2.2	2.5 2.3	2.5 2.4	2.6 2.5	
Business sector																	
Output per hour <i>Previous Tealbook</i>	-3 -3	3.7 3.7	2.4 2.4		-1.2 -8	1.6 1.0	2.0 1.4	1.6 1.5		.8 .9	.9 .8	.8 .9	1.2 1.3	1.0 .8	.9 .9	.9 .9	
Compensation per hour <i>Previous Tealbook</i>	5.7 5.7	4.3 4.3	-2.1 3.9		1.7 1.8	2.9 3.3	3.3 3.2	3.5 3.2		3.5 3.3	3.5 3.4	3.5 3.4	1.6 3.2	2.8 2.9	3.5 3.3	3.5 3.4	
Unit labor costs <i>Previous Tealbook</i>	6.0 6.0	.6 .6	-4.4 1.5		2.9 2.6	1.3 2.3	1.3 1.8	1.8 1.6		2.7 2.4	2.5 2.5	2.6 2.4	.4 1.9	1.8 2.1	2.6 2.4	2.6 2.5	
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i> ³	.5 .5	2.0 2.0	-4 -4		.6 1.1	2.2 1.7	2.3 1.9	.9 .7		.4 .6	.6 .8	.6 .7	.0 .0	1.5 1.3	.6 .7	.6 .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	1.6 1.8	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	1.6 1.7	1.9 1.8	2.0 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	-4 1.4	1.1 .3	.9 .7
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	1.6 1.7	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	1.6 1.7	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	1.5 1.6	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	1.9 2.2	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	2.0 2.2	2.4 2.4	2.5 2.5
ECL, hourly compensation ¹ <i>Previous Tealbook</i> ¹	2.0 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	2.5 2.3	2.5 2.4	2.6 2.5
Business sector Output per hour <i>Previous Tealbook</i>	1.6 1.6	-1 -1	-1 -1	1.9 1.9	-1 -1	.5 .5	1.2 1.3	1.0 .8	.9 .9	.9 .9
Compensation per hour <i>Previous Tealbook</i>	1.2 1.2	.5 .5	5.9 5.9	-1 -1	2.7 2.7	3.2 3.2	1.6 3.2	2.8 2.9	3.5 3.3	3.5 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	.4 1.9	1.8 2.1	2.6 2.4	2.6 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	1.5 1.3	.6 .7	.6 .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	166	160	169	169	169	169	169	169					169	187	166	167	122
Nonfarm payroll employment ²	4.9	4.9	4.7	4.7	4.3	4.3	4.2	4.2	4.1	4.0	3.9	3.9	4.7	4.2	3.9	3.8
Unemployment rate ³	4.9	4.9	4.7	4.7	4.5	4.5	4.4	4.4	4.3	4.2	4.1	4.1	4.7	4.4	4.1	4.0
<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	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
<i>Previous Tealbook³</i>	59.7	59.8	59.7	60.0	60.1	60.1	60.0	60.0	59.4	59.3	59.2	60.1	59.7	60.0	60.1	59.9
Employment-to-Population Ratio ³	59.8	59.7	59.7	59.6	59.6	59.5	59.5	59.5	59.4	59.3	59.2	59.2	59.7	59.5	59.2	59.0
Employment-to-Population Trend ³	-1	.3	.5	.4	.7	1.0	1.3	1.3	1.6	1.7	1.9	1.9	.5	1.3	1.9	2.0
GDP gap ⁴	-1	.3	.5	.3	.6	.8	1.0	1.0	1.3	1.4	1.6	1.6	.5	1.0	1.6	1.8
<i>Previous Tealbook⁴</i>	-7	.8	.7	1.8	5.7	2.2	2.1	2.1	1.5	1.1	1.5	1.5	-1	2.9	1.2	.9
Industrial production ⁵	-7	.8	.7	1.5	4.6	2.7	1.7	1.7	1.7	1.2	.6	1.3	-1	2.6	1.2	.8
<i>Previous Tealbook⁵</i>	-1.1	-1	1.6	2.3	2.2	.7	1.3	1.3	1.0	1.1	.9	.8	.3	1.6	1.0	.8
Manufacturing industr. prod. ⁵	-1.1	-1	1.7	2.7	1.3	1.3	.8	.8	.7	1.0	.7	.6	.3	1.5	.7	.7
<i>Previous Tealbook⁵</i>	75.1	74.9	75.1	75.4	75.7	75.7	75.8	75.8	75.9	76.1	76.2	76.2	75.1	75.8	76.2	76.5
Capacity utilization rate - mfg. ³	75.1	74.9	75.1	75.4	75.6	75.7	75.8	75.8	75.8	75.9	76.0	76.0	75.1	75.8	76.0	76.3
<i>Previous Tealbook³</i>	17.1	17.5	18.0	17.2	16.7	16.8	16.9	16.9	17.0	17.0	16.8	16.8	17.5	16.9	16.9	16.6
Housing starts ⁶	3.7	5.0	4.2	3.5	3.4	4.4	5.0	5.0	4.7	4.2	4.1	4.1	3.5	4.0	4.3	4.0
Light motor vehicle sales ⁶	2.9	2.9	-3	1.7	3.8	1.6	2.7	2.7	7.7	2.2	2.8	2.8	1.9	2.4	3.8	2.3
<i>Income and saving</i>	2.9	2.9	2.0	1.7	2.3	2.4	1.8	1.8	8.3	2.4	2.7	2.8	2.5	2.1	4.0	2.1
Nominal GDP ⁵	5.9	5.9	4.9	5.2	5.4	5.1	5.0	5.0	6.0	5.8	5.8	5.8	4.9	5.0	5.8	5.6
Real disposable pers. income ⁵	5.9	5.9	5.5	5.7	5.5	5.4	5.2	5.2	6.3	6.2	6.1	6.1	5.5	5.2	6.1	5.7
<i>Previous Tealbook⁵</i>	-2.4	25.4	2.1	-7.3	4.4	3.7	3.2	3.2	3.5	2.0	2.2	2.2	9.3	.9	2.5	1.4
Corporate profits ⁷	10.8	11.3	11.2	10.9	11.0	11.0	11.0	11.0	10.9	10.9	10.8	10.8	11.2	11.0	10.8	10.6
Profit share of GNP ³	18.2	18.6	17.7	17.6	18.1	17.9	17.8	17.8	17.6	17.6	17.5	17.4	17.7	17.8	17.4	17.0
Gross national saving rate ³	3.1	3.7	2.8	2.9	3.3	3.0	3.0	3.0	2.8	2.7	2.6	2.5	2.8	3.0	2.5	1.8
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.

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	166	167	122
Unemployment rate ²	9.5	8.7	7.8	7.0	5.7	5.0	4.7	4.2	3.9	3.8
<i>Previous Tealbook²</i>	9.5	8.7	7.8	7.0	5.7	5.0	4.7	4.4	4.1	4.0
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	4.9	4.9	4.9	4.9
Employment-to-Population Ratio ²	58.3	58.5	58.7	58.5	59.2	59.4	59.7	60.0	60.1	59.9
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	1.3	1.9	2.0
<i>Previous Tealbook³</i>	-4.2	-3.7	-3.7	-2.5	-9	0	5	1.0	1.6	1.8
Industrial production ⁴	6.0	2.8	2.3	2.2	3.4	-2.7	-1	2.9	1.2	.9
<i>Previous Tealbook⁴</i>	6.0	2.8	2.3	2.2	3.4	-2.7	-1	2.6	1.2	.8
Manufacturing industr. prod. ⁴	5.9	2.5	1.7	.9	1.5	-6	.3	1.6	1.0	.8
<i>Previous Tealbook⁴</i>	5.9	2.5	1.7	.9	1.5	-6	.3	1.5	.7	.7
Capacity utilization rate - mfg. ²	72.3	74.4	74.6	74.7	75.9	75.4	75.1	75.8	76.2	76.5
<i>Previous Tealbook²</i>	72.3	74.4	74.6	74.7	75.9	75.4	75.1	75.8	76.0	76.3
Housing starts ⁵	.6	.6	.8	.9	1.0	1.1	1.2	1.2	1.3	1.4
Light motor vehicle sales ⁵	11.6	12.7	14.4	15.5	16.5	17.4	17.5	16.9	16.9	16.6
<i>Income and saving</i>										
Nominal GDP ⁴	4.6	3.6	3.2	4.3	4.1	3.0	3.5	4.0	4.3	4.0
Real disposable pers. income ⁴	2.6	1.7	5.1	-2.8	4.5	3.0	1.9	2.4	3.8	2.3
<i>Previous Tealbook⁴</i>	2.6	1.7	5.1	-2.8	4.5	3.0	2.5	2.1	4.0	2.1
Personal saving rate ²	5.5	5.8	9.2	4.7	5.6	6.0	4.9	5.0	5.8	5.6
<i>Previous Tealbook²</i>	5.5	5.8	9.2	4.7	5.6	6.0	5.5	5.2	6.1	5.7
Corporate profits ⁶	18.0	6.8	.6	4.7	6.6	-11.2	9.3	.9	2.5	1.4
Profit share of GNP ²	12.0	12.3	12.0	12.0	12.4	10.7	11.2	11.0	10.8	10.6
Gross national saving rate ²	15.2	16.1	18.0	18.2	19.2	18.8	17.7	17.8	17.4	17.0
Net national saving rate ²	-3	.8	2.9	3.1	4.3	3.9	2.8	3.0	2.5	1.8

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.

4. Values are for the fourth quarter of the year indicated.

5. Percent change.

6. Level, millions; values are annual averages.

7. 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 ^a	Q2	Q3	Q4	Q1	Q2	Q3	Q4
					Not seasonally adjusted											
Unified budget																
Receipts	3,268	3,345	3,351	3,520	711	993	798	741	732	1,045	827	784	669	1,087	811	792
Outlays	3,853	3,925	4,101	4,394	956	932	984	951	1,049	953	972	997	1,114	1,025	964	1,112
Surplus/deficit	-585	-579	-750	-875	-245	61	-186	-210	-317	92	-145	-213	-445	62	-154	-319
<i>Previous Tealbook</i>	-586	-530	-677	-798	-245	61	-186	-210	-317	136	-138	-204	-424	96	-145	-304
Means of financing:																
Borrowing	1,052	136	1,140	1,012	251	8	241	259	-68	-117	62	388	547	4	202	358
Cash decrease	-155	442	-271	-17	20	-50	10	-46	419	43	26	-144	-72	-36	-18	-9
Other ¹	-313	1	-120	-120	-25	-18	-65	-5	-33	-18	56	-30	-30	-30	-30	-30
Cash operating balance, end of period	353	-89	182	199	314	364	353	399	-19	-63	-89	56	128	164	182	191
NIPA federal sector																
Receipts	3,495	3,558	3,576	3,707	3,442	3,485	3,537	3,528	3,613	3,533	3,560	3,610	3,519	3,570	3,603	3,644
Expenditures	4,124	4,262	4,489	4,782	4,111	4,137	4,189	4,215	4,274	4,255	4,304	4,365	4,472	4,524	4,595	4,665
Consumption expenditures	974	990	1,008	1,019	969	975	985	984	986	991	997	1,003	1,008	1,009	1,011	1,012
Defense	589	586	601	613	587	586	591	586	584	586	590	595	601	603	605	607
Nondefense	386	403	407	405	382	389	394	397	402	405	407	408	407	406	405	404
Other spending	3,150	3,273	3,482	3,763	3,142	3,163	3,204	3,232	3,288	3,265	3,306	3,362	3,464	3,515	3,585	3,654
Current account surplus	-629	-704	-914	-1,075	-668	-652	-652	-688	-661	-723	-744	-756	-756	-953	-954	-1,021
Gross investment	266	274	287	297	265	265	267	269	274	275	279	283	286	288	291	293
Gross saving less gross investment ²	-623	-705	-926	-1,095	-662	-646	-647	-685	-662	-724	-749	-765	-964	-967	-1,007	-1,038
Fiscal indicators																
High-employment (HEB) surplus/deficit ³	-636.6	-755.8	-1,040.3	-1,247.6	-670.2	-657.3	-671.4	-722.1	-697.1	-780.0	-823.8	-860.4	-1,069.8	-1,088.4	-1,142.7	-1,185.7
Change in HEB, percent of potential GDP	.4	.5	1.3	.8	.7	-1	.0	.2	-2	.4	.2	.2	1.0	.0	.2	.2
Fiscal impetus (FI), percent of GDP ⁴	.2	.2	.4	.3	.5	-1	.3	.2	-1	.2	.4	.4	.7	.3	.3	.3
<i>Previous Tealbook</i>	.2	.3	.4	.3	.5	-1	.3	.2	-2	.5	.5	.3	.7	.3	.3	.3
Federal purchases	.0	.0	.0	.0	-1	.0	.2	-1	-1	.0	.1	.1	.0	.0	.0	.0
State and local purchases	.0	.1	.1	.1	.4	-3	.0	.1	.0	.0	.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	1.3	3.2	2.8	3.2	2.7	2.7	2.6	2.6	2.6	2.6	2.6
<i>Previous Tealbook</i>	2.4	1.4	3.1	2.8	2.9	2.7	2.5	2.5	2.6	2.6	2.6	2.6
Advanced foreign economies	2.4	.3	2.6	2.3	2.7	2.2	2.0	1.9	1.8	1.8	1.7	1.7
Canada	2.8	-1.4	4.2	2.7	3.7	2.4	2.1	2.1	1.9	1.9	1.8	1.8
Japan	2.6	1.7	1.0	1.4	2.2	1.7	1.3	1.1	1.0	.9	.8	.7
United Kingdom	.6	2.4	2.0	2.7	.7	1.6	1.7	1.7	1.6	1.6	1.6	1.6
Euro area	2.2	1.3	1.7	1.9	2.0	2.2	2.0	1.9	1.8	1.8	1.8	1.8
Germany	2.9	1.9	.5	1.7	2.4	2.3	2.0	1.9	1.7	1.5	1.5	1.5
Emerging market economies	2.4	2.2	3.8	3.4	3.7	3.3	3.3	3.4	3.3	3.4	3.4	3.4
Asia	4.4	5.3	4.6	4.7	5.5	5.0	4.7	4.7	4.5	4.5	4.5	4.5
Korea	2.0	3.7	1.9	2.0	4.3	3.6	3.4	3.2	3.0	3.0	3.0	3.0
China	6.6	7.1	6.8	6.6	7.3	6.5	6.4	6.1	5.9	5.9	5.8	5.8
Latin America	.6	-.5	3.0	2.0	2.4	2.0	2.1	2.3	2.4	2.4	2.5	2.5
Mexico	1.8	.2	4.4	2.9	2.7	2.1	2.2	2.3	2.3	2.3	2.4	2.5
Brazil	-4.0	-1.3	-2.3	-2.2	4.3	.7	1.9	2.0	2.1	2.1	2.1	2.1
Consumer prices²												
Total foreign	1.4	2.1	1.7	2.6	3.0	2.4	2.4	2.4	2.4	2.4	2.4	2.4
<i>Previous Tealbook</i>	1.4	2.0	1.6	2.6	3.0	2.4	2.4	2.4	2.4	2.4	2.4	2.5
Advanced foreign economies	-.4	1.2	.9	1.8	2.3	1.1	1.2	1.3	1.4	1.5	1.5	1.6
Canada	.5	2.2	1.0	1.7	2.6	1.8	1.8	1.7	1.8	1.9	1.9	1.9
Japan	-.3	-.4	-.5	2.4	-.1	.3	.5	.6	.7	.8	.9	1.0
United Kingdom	.1	.8	2.1	1.9	3.9	3.1	2.4	2.2	2.2	2.1	2.1	2.1
Euro area	-1.2	1.2	1.2	1.9	2.9	.6	.9	1.2	1.2	1.3	1.4	1.5
Germany	-1.3	1.2	1.3	3.0	2.1	.8	1.2	1.5	1.6	1.7	1.8	1.9
Emerging market economies	2.6	2.7	2.2	3.1	3.4	3.4	3.2	3.1	3.1	3.1	3.1	3.1
Asia	2.0	2.3	1.2	2.6	.9	2.2	2.7	2.7	2.8	2.8	2.8	2.8
Korea	.5	1.0	.4	4.0	2.9	.9	2.3	2.6	3.0	3.0	3.0	3.0
China	2.5	2.3	1.3	2.6	-.6	2.6	2.7	2.5	2.5	2.5	2.5	2.5
Latin America	4.3	3.9	4.5	4.5	9.8	6.4	4.3	4.1	3.9	3.8	3.8	3.7
Mexico	2.8	2.4	3.6	4.1	9.9	6.0	3.6	3.4	3.2	3.2	3.2	3.2
Brazil	11.8	7.5	6.5	2.6	3.2	3.1	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	2.8	2.6	2.6	2.6
<i>Previous Tealbook</i>	3.2	2.3	2.9	2.6	2.0	2.4	2.6	2.6	2.6	2.6
Advanced foreign economies	1.8	.3	2.4	1.8	1.1	1.9	2.2	1.7	1.7	1.7
Canada	3.1	.7	3.6	2.2	.4	2.0	2.6	1.8	1.8	1.8
Japan	.2	.3	2.7	-.3	1.0	1.7	1.6	.8	.0	.0
United Kingdom	1.3	1.3	2.4	3.5	1.7	1.9	1.4	1.6	1.6	1.6
Euro area	.5	-1.1	.7	1.3	2.0	1.8	2.0	1.8	1.8	1.8
Germany	2.4	.2	1.6	1.6	1.3	1.8	2.2	1.5	1.4	1.4
Emerging market economies	4.6	4.3	3.4	3.3	2.8	2.9	3.4	3.4	3.4	3.5
Asia	5.1	5.7	5.4	5.0	4.4	4.8	5.0	4.5	4.4	4.4
Korea	2.9	2.1	3.5	2.8	3.3	2.4	3.6	3.0	2.9	2.9
China	8.7	8.0	7.6	7.1	6.8	6.8	6.6	5.8	5.7	5.7
Latin America	4.1	3.4	1.6	1.9	1.3	1.2	2.2	2.4	2.4	2.6
Mexico	4.2	3.4	1.0	2.7	2.5	2.3	2.3	2.4	2.4	2.6
Brazil	2.7	2.5	2.6	-.2	-5.7	-2.4	2.2	2.1	2.1	2.2
Consumer prices²										
Total foreign	3.4	2.3	2.4	2.0	1.4	1.9	2.5	2.4	2.6	2.6
<i>Previous Tealbook</i>	3.4	2.3	2.4	2.0	1.4	1.9	2.6	2.4	2.6	2.6
Advanced foreign economies	2.2	1.3	1.0	1.2	.5	.9	1.5	1.5	1.9	1.9
Canada	2.7	1.0	1.0	2.0	1.3	1.4	2.0	1.9	2.0	2.0
Japan	-.3	-.2	1.4	2.6	.2	.3	.3	.8	.8	.8
United Kingdom	4.6	2.6	2.1	.9	.1	1.2	2.9	2.1	2.1	2.1
Euro area	2.9	2.3	.8	.2	.2	.7	1.4	1.4	1.6	1.6
Germany	2.6	1.9	1.4	.4	.2	1.0	1.4	1.7	2.0	2.0
Emerging market economies	4.3	3.1	3.4	2.7	2.1	2.7	3.3	3.1	3.1	3.1
Asia	4.4	2.6	3.1	1.8	1.5	2.0	3.1	2.8	2.9	2.9
Korea	3.9	1.7	1.1	1.0	.9	1.5	2.2	3.0	3.0	3.0
China	4.6	2.1	2.9	1.5	1.5	2.2	1.8	2.5	2.5	2.5
Latin America	4.1	4.4	4.1	4.8	3.4	4.3	6.1	3.8	3.6	3.6
Mexico	3.5	4.1	3.6	4.2	2.3	3.2	5.7	3.2	3.2	3.2
Brazil	6.7	5.6	5.8	6.5	10.4	7.1	4.0	4.4	4.4	4.5

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	-531.8	-470.9	-482.7	-456.4	-475.2	-509.6	-542.4	-579.5	-640.4	-647.4	-675.8	-702.0
<i>Previous Tealbook</i>	-532.3	-479.0	-464.0	-449.5	-527.9	-539.1	-562.7	-596.8	-645.2	-658.9	-691.6	-724.2
Current account as percent of GDP	-2.9	-2.6	-2.6	-2.4	-2.5	-2.7	-2.8	-3.0	-3.2	-3.2	-3.3	-3.4
<i>Previous Tealbook</i>	-2.9	-2.6	-2.5	-2.4	-2.8	-2.8	-2.9	-3.0	-3.3	-3.3	-3.4	-3.5
Net goods & services	-504.3	-495.1	-483.6	-536.2	-555.9	-567.1	-583.5	-604.7	-641.4	-640.6	-647.5	-656.6
Investment income, net	146.0	186.5	177.5	257.1	257.2	224.8	214.5	194.5	179.2	160.5	145.0	124.0
Direct, net	218.6	254.5	254.0	343.2	356.6	314.7	322.1	321.2	326.9	330.7	339.3	342.2
Portfolio, net	-72.6	-68.1	-76.5	-86.1	-99.3	-89.9	-107.7	-126.7	-147.7	-170.2	-194.3	-218.2
Other income and transfers, net	-173.4	-162.2	-176.6	-177.3	-176.5	-167.3	-173.4	-169.4	-178.3	-167.3	-173.4	-169.4

Annual Data

	Projected-----2017										Projected-----2018		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	-391.4	-463.1	-485.4	-526.7	-666.4	-789.2				
<i>Previous Tealbook</i>	-460.4	-446.5	-366.4	-392.1	-463.0	-481.2	-556.6	-680.0	-810.4				
Current account as percent of GDP	-3.0	-2.8	-2.2	-2.2	-2.6	-2.6	-2.7	-3.3	-3.8				
<i>Previous Tealbook</i>	-3.0	-2.8	-2.2	-2.3	-2.6	-2.6	-2.9	-3.4	-3.9				
Net goods & services	-548.6	-536.8	-461.9	-489.5	-500.4	-504.8	-577.8	-646.5	-692.8				
Investment income, net	229.0	224.4	228.4	234.3	193.4	191.8	222.8	152.2	75.7				
Direct, net	298.6	293.8	296.3	289.0	265.4	267.6	328.7	334.8	353.3				
Portfolio, net	-69.5	-69.4	-67.9	-54.8	-72.0	-75.8	-105.9	-182.6	-277.7				
Other income and transfers, net	-140.8	-134.2	-132.9	-136.1	-156.0	-172.4	-171.6	-172.1	-172.1				

Abbreviations

AFE	advanced foreign economy
AHE	average hourly earnings
BEA	Bureau of Economic Analysis
C&I	commercial and industrial
CMBS	commercial mortgage-backed securities
CPI	consumer price index
CRE	commercial real estate
ECI	employment cost index
E&I	equipment and intangibles
ELB	effective lower bound
EME	emerging market economy
FOMC	Federal Open Market Committee; also, the Committee
GDP	gross domestic product
M&A	mergers and acquisitions
MBS	mortgage-backed securities
MCE	model-consistent expectations
Michigan survey	University of Michigan Surveys of Consumers
MMF	money market fund
LFPR	labor force participation rate
LIBOR	London interbank offered rate
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

repo	repurchase agreement
SOMA	System Open Market Account
S&P	Standard & Poor's
TIPS	Treasury Inflation-Protected Securities
VAR	value at risk