

Prefatory Note

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Class II FOMC – Restricted (FR)

Report to the FOMC on Economic Conditions and Monetary Policy



Book A

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

April 20, 2018

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

Authorized for Public Release

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Domestic Economic Developments and Outlook

The information received since the March Tealbook remains consistent with our view that the economy continues to expand at an above-trend pace. Although the March employment report was not as strong as we had expected, our broad assessment is that labor market conditions continued to tighten through the first quarter: The unemployment rate remained flat, but the labor force participation rate (LFPR) moved up and payroll employment gains averaged well above the pace estimated to be consistent with no change in resource utilization. On the spending side, GDP growth appears to have slowed in the first quarter, but we judge that the slowdown is temporary and expect that GDP growth will bounce back in the current quarter. Over the first half of the year, real GDP is projected to increase at an annual rate of $2\frac{1}{4}$ percent, about $\frac{1}{4}$ percentage point less than we had forecast in the March Tealbook but sufficient to further widen the gap between actual and potential output.

Over the medium term, we continue to project an economy with above-trend growth and very high resource utilization, buoyed by expansionary fiscal policy and solid foreign growth. We forecast that real GDP will increase about $2\frac{1}{2}$ percent this year and next before slowing to a 2 percent pace in 2020 as monetary policy continues to tighten. By the end of the medium term, the level of real GDP is projected to be $3\frac{1}{4}$ percent above our estimate of its potential—nearly $\frac{1}{2}$ percentage point less than in our previous forecast but still indicative of a very tight economy. Correspondingly, the unemployment rate is expected to be 3.3 percent at the end of 2020—a little higher than in the March Tealbook but still $1\frac{1}{2}$ percentage points below our estimate of its natural rate.

The latest monthly readings on prices have come in a touch above our expectations and provide additional support for our view that the factors that held down inflation last year were transitory. With the March CPI and PPI now in hand, we estimate that the 12-month change in core PCE prices stepped up to 1.9 percent last month, 0.1 percentage point above our March Tealbook projection, as the extraordinarily low reading from March of last year dropped out of the calculation. For the year as a whole, we expect core inflation to be 2.0 percent—also 0.1 percentage point higher than in our previous forecast. Core inflation is then projected to edge up to 2.1 percent in 2019 and 2020 as resource utilization tightens further and underlying inflation inches up. Total PCE prices are expected to increase 2.1 percent this year, a little more than core prices,

Comparing the Staff Projection with Other Forecasts

The staff's projection for real GDP growth is $\frac{1}{4}$ percentage point lower than the projections from both the Survey of Professional Forecasters (SPF) and the Blue Chip consensus in 2018 and $\frac{1}{4}$ percentage point higher than the Blue Chip in 2019. The staff's unemployment rate forecast is below the outside forecasts in both 2018 and 2019. The staff's projections for total CPI and PCE inflation are a little higher than the outside forecasts in 2018 but are about the same in 2019, while the staff forecast for core PCE inflation is a touch higher than the SPF in both years. (Note that the SPF projections are more than two months old.)

Comparison of Tealbook and Outside Forecasts

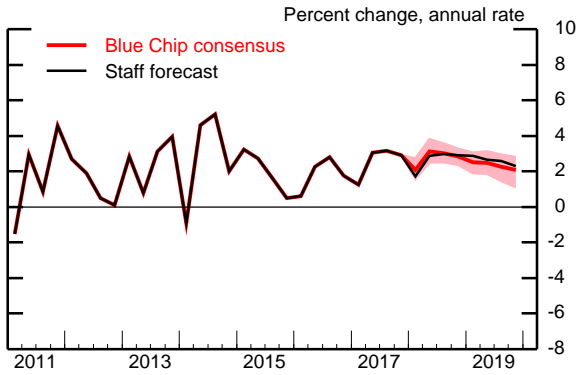
	2017	2018	2019
GDP (Q4/Q4 percent change)			
April Tealbook	2.6	2.6	2.6
Blue Chip (04/10/18)	2.6	2.8	2.3
SPF median (02/09/18)	2.5	2.8	n.a.
Unemployment rate (Q4 level)			
April Tealbook	4.1	3.6	3.3
Blue Chip (04/10/18)	4.1	3.7	3.6
SPF median (02/09/18)	4.1	3.8	n.a.
CPI inflation (Q4/Q4 percent change)			
April Tealbook	2.1	2.4	2.2
Blue Chip (04/10/18)	2.1	2.3	2.2
SPF median (02/09/18)	2.1	2.1	2.2
PCE price inflation (Q4/Q4 percent change)			
April Tealbook	1.7	2.1	1.9
SPF median (02/09/18)	1.7	1.9	2.0
Core PCE price inflation (Q4/Q4 percent change)			
April Tealbook	1.5	2.0	2.1
SPF median (02/09/18)	1.5	1.9	2.0

Note: SPF is the Survey of Professional Forecasters, CPI is the consumer price index, and PCE is personal consumption expenditures. Blue Chip does not provide results for overall and core 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.

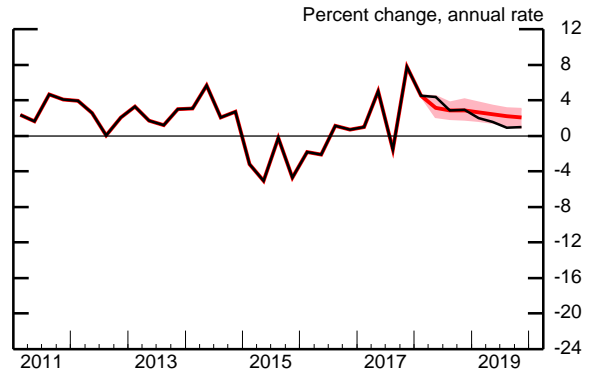
Source: Blue Chip Economic Indicators; Federal Reserve Bank of Philadelphia.

Tealbook Forecast Compared with Blue Chip

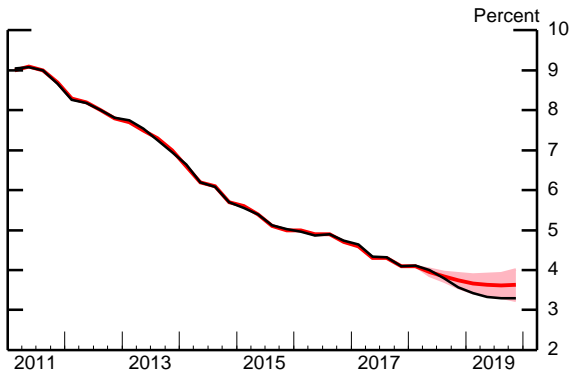
Real GDP



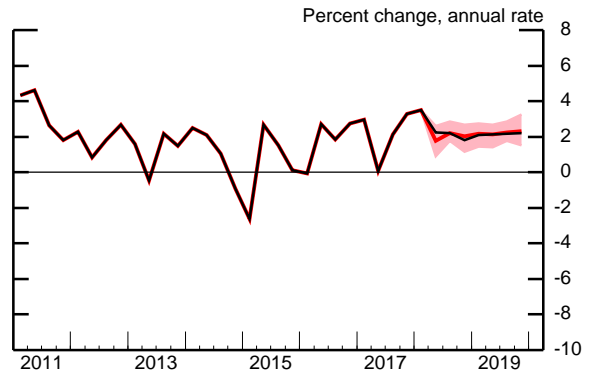
Industrial Production



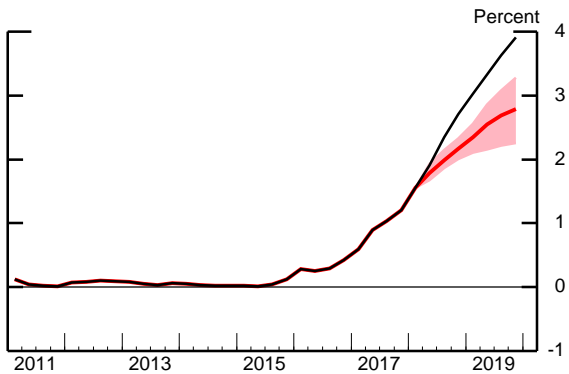
Unemployment Rate



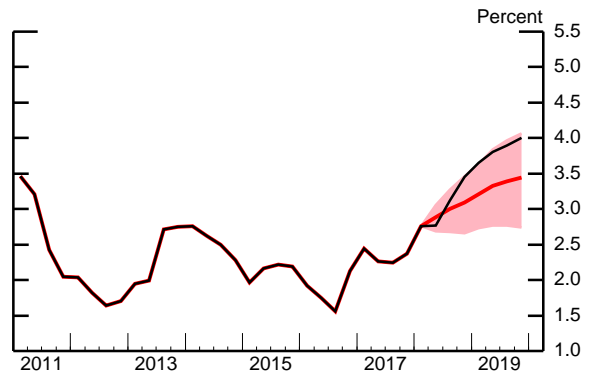
Consumer Price Index



Treasury Bill Rate



10-Year Treasury Yield

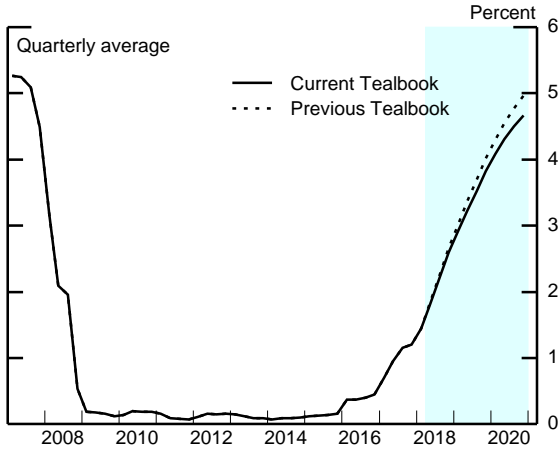


Note: The yield is for on-the-run Treasury securities. Over the forecast period, the staff's projected yield is assumed to be 15 basis points below the off-the-run yield.

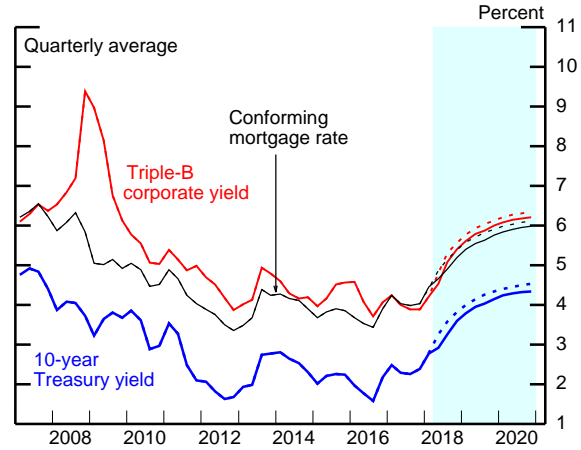
Note: The shaded area represents the area between the Blue Chip top 10 and bottom 10 averages.

Key Background Factors underlying the Baseline Staff Projection

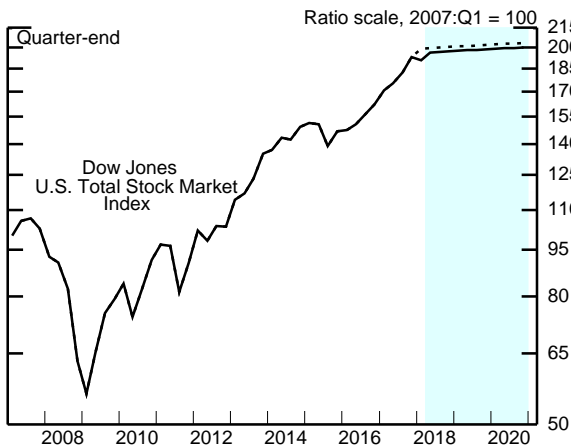
Federal Funds Rate



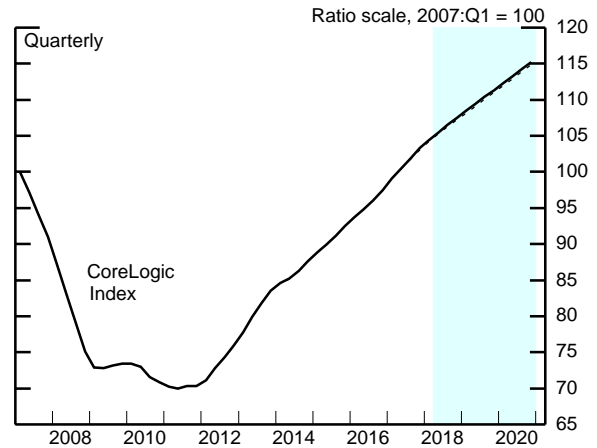
Long-Term Interest Rates



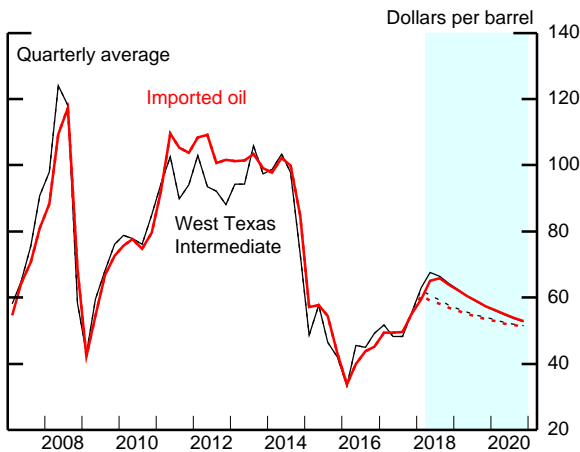
Equity Prices



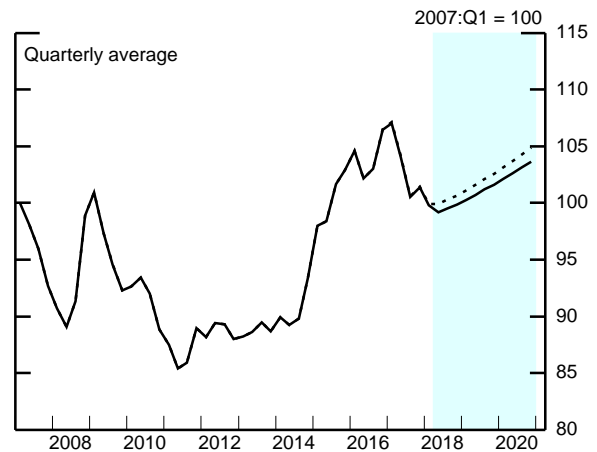
House Prices



Crude Oil Prices



Broad Real Dollar



boosted by an increase in energy prices in the first half of the year. After this year, total inflation—at 1.9 percent in 2019 and 2.0 percent in 2020—is restrained a bit by declining energy prices and runs a little below core inflation. Relative to the March Tealbook, inflation at the end of the projection is a touch lower, reflecting the higher unemployment rate in this forecast. Finally, as in the March Tealbook, we have not incorporated any effects on either real activity or inflation from higher import tariffs.¹

KEY BACKGROUND FACTORS

Fiscal Policy

- We have not changed our fiscal policy assumptions in this projection. We still estimate that discretionary policy actions across all levels of government will boost aggregate demand growth $\frac{1}{2}$ percentage point in 2018, $\frac{3}{4}$ percentage point in 2019, and $\frac{1}{2}$ percentage point in 2020, exclusive of any multiplier effects and offsets from reactions in interest rates and the dollar. Roughly one-half of that medium-term impetus is due to the recent federal tax cuts, while about one-fourth reflects the recent federal spending legislation; most of the remainder is due to projected increases in real state and local government expenditures.
- The federal deficit is projected to rise from $3\frac{1}{2}$ percent of GDP in fiscal year 2017 to $5\frac{1}{4}$ percent in fiscal 2020—a step-up that primarily reflects the effects of the recent tax and spending bills.
 - We continue to assume that, in five years, confronted with an elevated and rising debt-to-GDP ratio, fiscal policymakers will begin to enact deficit reduction measures that gradually bring annual deficits back to sustainable levels.

Monetary Policy

- The inertial version of the Taylor (1999) rule that we use to set the path of monetary policy calls for the federal funds rate to increase nearly $1\frac{1}{2}$ percentage points in total this year and to rise about 1 percentage point per year, on average, in the next two years, reaching 4.7 percent in the fourth

¹ We estimate that the effects of the new steel and aluminum tariffs, in isolation, will be minimal for both net exports and prices. Other potential tariff changes remain highly uncertain at this point and are therefore not included in our projection.

quarter of 2020. This trajectory is a little less steep than in the March Tealbook, primarily reflecting the slightly lower level of resource utilization in this projection.

- The SOMA portfolio continues to shrink as securities are redeemed in a manner consistent with the Committee’s June 2017 Addendum to the Policy Normalization Principles and Plans and with the process initiated in October 2017.

Other Interest Rates

- The 10-year Treasury yield is projected to rise significantly over the medium term from an average of 2.9 percent in the current quarter to 4.4 percent by the end of 2020. This path has been revised down about 25 basis points on average relative to the March Tealbook, reflecting the lower-than-expected readings for the 10-year Treasury yield over the intermeeting period along with the flatter projected trajectory for the federal funds rate.
- The 30-year fixed mortgage rate and the triple-B corporate bond rate are also forecast to rise significantly over the medium term. The paths for these two rates were revised down mostly in line with revisions to the path of the 10-year Treasury yield.

Equity Prices and Home Prices

- Equity prices are projected to end the current quarter 1½ percent lower than was projected in the March Tealbook, reflecting the recent declines in broad equity price indexes. Beyond the current quarter, we project stock prices to rise at an average annual rate of ¾ percent, similar to our previous projection.
- We expect annual house price appreciation to slow from 6 percent last year to an average of about 3¾ percent over the next three years, as interest rates rise.

Foreign Economic Activity and the Dollar

- We estimate that real GDP in the foreign economies rose 3 percent at an annual rate in the first quarter, a touch faster than in the second half of last year. This first-quarter estimate is about the same as in the March Tealbook, as softer economic indicators in some advanced foreign economies were about offset by positive surprises in several Asian economies. Foreign growth is

projected to stay close to this 3 percent pace in 2018 and then edge down slightly over the remainder of the forecast period to near its potential rate of 2¾ percent in 2020.

- The broad nominal dollar has depreciated about ½ percent since the time of the March Tealbook. We project the broad real dollar to appreciate at an annual rate of about 1¾ percent through the forecast period, as market expectations for the federal funds rate move up toward the staff forecast. This rate of appreciation is somewhat lower than in the March projection, reflecting the downward revision of the staff's projected path for U.S. policy rates. This lower rate of projected appreciation, along with the recent realized depreciation, leaves the broad real dollar about 1¼ percent lower at the end of the forecast relative to the March Tealbook.

Oil and Commodity Prices

- The spot price of Brent crude oil has risen \$9 per barrel on net since the March Tealbook, closing most recently at \$73 per barrel, while the price of the December 2020 futures contract rose \$4 to \$61 per barrel. The increase in oil prices, especially in the near term, is primarily attributable to heightened geopolitical risk following recent events in Syria as well as increased tensions between Saudi Arabia and Iran. Informed by both the futures market and our forecast of an appreciating dollar, our forecast for the price of imported oil has been revised up \$7 in the near term to \$65 per barrel; thereafter, we expect oil prices to decline about \$12 over the remainder of the forecast period, reaching \$53 per barrel by the end of 2020, only \$2 higher than in our March Tealbook forecast.
- Metals prices have moved up since the March Tealbook. The largest increases were seen for aluminum, with prices up 21 percent since our March projection, largely in response to U.S. sanctions on Russia that targeted one of the world's largest aluminum producers.

THE OUTLOOK FOR REAL GDP AND AGGREGATE SUPPLY

We estimate that real GDP increased at an annual rate of 1¾ percent in the first quarter after rising 3 percent in the fourth quarter; this deceleration is more than

Federal Reserve System Nowcasts of 2018:Q1 Real GDP Growth
(Percent change at annual rate from previous quarter)

Federal Reserve Entity	Type of model	Nowcast as of April 18, 2018
Federal Reserve Bank		
Boston	<ul style="list-style-type: none"> Mixed-frequency BVAR 	2.8
New York	<ul style="list-style-type: none"> Factor-augmented autoregressive model combination Factor-augmented autoregressive model combination, financial factors only Dynamic factor model 	2.3 2.5 2.9
Cleveland	<ul style="list-style-type: none"> Bayesian regressions with stochastic volatility Tracking model 	3.3 0.5
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) 	2.0
Chicago	<ul style="list-style-type: none"> Dynamic factor models Bayesian VARs 	2.0 2.0
St. Louis	<ul style="list-style-type: none"> Dynamic factor models News index model Let-the-data-decide regressions 	2.8 3.4 2.7
Kansas City	<ul style="list-style-type: none"> Accounting-based tracking estimate 	1.4
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) 	1.7 3.2 2.7
Memo: Median of Federal Reserve System nowcasts		2.6

accounted for by a marked slowdown in real PCE growth.² We see the soft PCE reading in the first quarter as mostly temporary and project real GDP growth to move back up to a 3 percent pace this quarter. GDP growth over the first half of the year is about $\frac{1}{4}$ percentage point less than in the March Tealbook but still faster than its trend pace. Similarly, the recent labor market data, on balance, suggest that resource utilization has continued to tighten, though by a little less than we had anticipated at the time of the March Tealbook. All told, we project that output will be $1\frac{3}{4}$ percent above its potential level in the current quarter—about $\frac{1}{4}$ percentage point lower than we had previously forecast. For the second half of the year, real GDP is projected to rise at an annual rate of about 3 percent; this rate is also a little lower than in the March Tealbook, largely reflecting a somewhat slower pace of PCE growth due to weaker incoming indicators of disposable income.³

- After increasing at a 4 percent annual rate in the fourth quarter, real PCE appears to have risen only $1\frac{1}{4}$ percent in the first quarter—about $\frac{1}{4}$ percentage point less than we had anticipated in the March Tealbook.⁴ We continue to believe that most of the weakness in first-quarter consumption growth reflects payback for the exceptionally strong fourth-quarter growth and, therefore, see the slowdown last quarter as mostly transitory. Correspondingly, we anticipate that PCE growth will step up to a $2\frac{1}{4}$ percent pace in the current quarter and then to $2\frac{1}{2}$ percent in the second half, supported by continued job gains and the boost to disposable income from the recently implemented personal income tax cuts and consistent with positive readings on consumer sentiment.

² The BEA's first estimate of GDP growth for 2018:Q1 will be released on Friday, April 27, before the FOMC meeting.

³ Incoming data on tax collections and transfer payments point to lower disposable income than we had previously expected, which restrains projected PCE growth throughout the year. (The tax receipts in the incoming data were stronger than anticipated, which could instead be interpreted as a signal of stronger income; however, those receipts often fail to track measured income closely at monthly or quarterly frequencies.) These incoming receipts data are unrelated to the effect of the recently enacted tax cuts.

⁴ March retail sales came in weaker than we anticipated. We were expecting a strong rebound in March because we judged that February retail sales had been held down by a timing shift of income tax refunds to EITC claimants in that month. We have interpreted some of the March miss as indicating a smaller and more delayed effect on spending from the timing shift of tax refunds than we had originally assumed. Accordingly, we took a little bit of signal from the negative surprise for the pace of consumer spending and nudged down projected PCE growth in the second quarter.

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

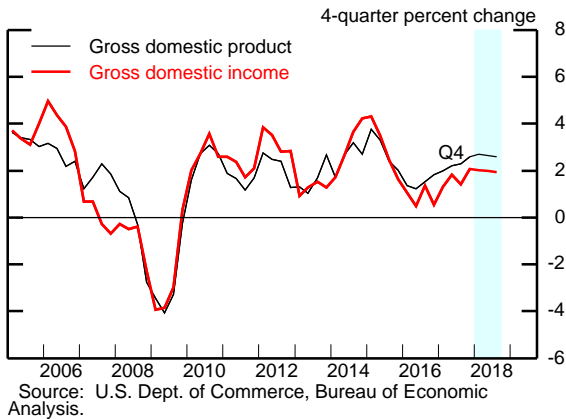
Domestic Econ Devel & Outlook

Measure	2018:Q1		2018:Q2		2018:H2	
	Previous Tealbook	Current Tealbook	Previous Tealbook	Current Tealbook	Previous Tealbook	Current Tealbook
Real GDP	2.1	1.7	3.1	2.9	3.3	2.9
Private domestic final purchases	1.6	1.6	3.4	2.8	3.4	3.1
Personal consumption expenditures	1.5	1.2	2.6	2.2	2.9	2.5
Residential investment	-4.4	-4.1	2.7	-2.1	4.1	5.0
Nonres. private fixed investment	4.2	5.7	8.2	8.0	5.9	5.6
Government purchases	-3	-1.2	.8	1.2	2.2	2.4
<i>Contributions to change in real GDP</i>						
Inventory investment ¹	.8	1.0	-.2	.1	-.1	-.4
Net exports ¹	.0	-.5	.2	.1	.1	.2
Unemployment rate²	4.1	4.1	3.9	4.0	3.5	3.6
PCE chain price index	2.5	2.8	1.5	2.2	1.6	1.7
Ex. food and energy	2.3	2.5	2.0	2.2	1.8	1.7

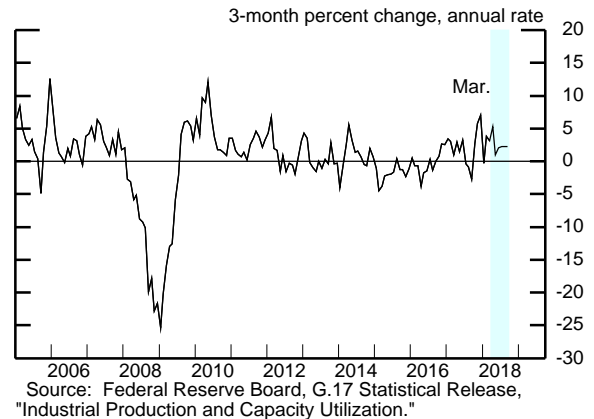
1. Percentage points.
2. Percent, average for the final quarter in the period.

Recent Nonfinancial Developments (1)

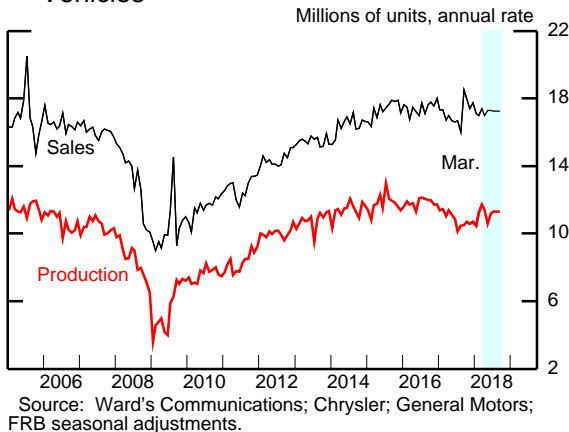
Real GDP and GDI



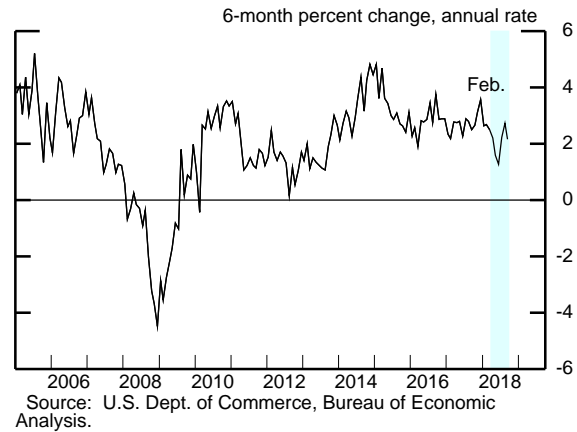
Manufacturing IP ex. Motor Vehicles and Parts



Sales and Production of Light Motor Vehicles

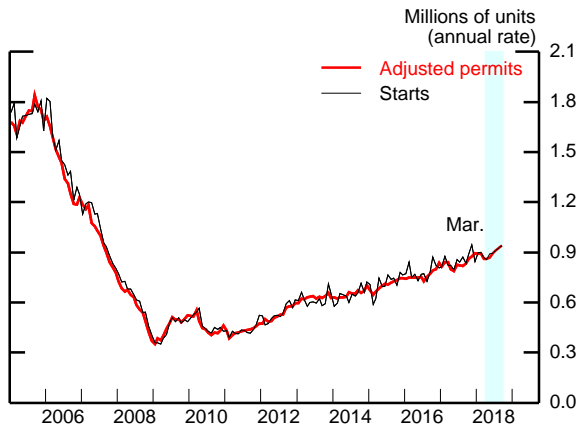


Real PCE Growth



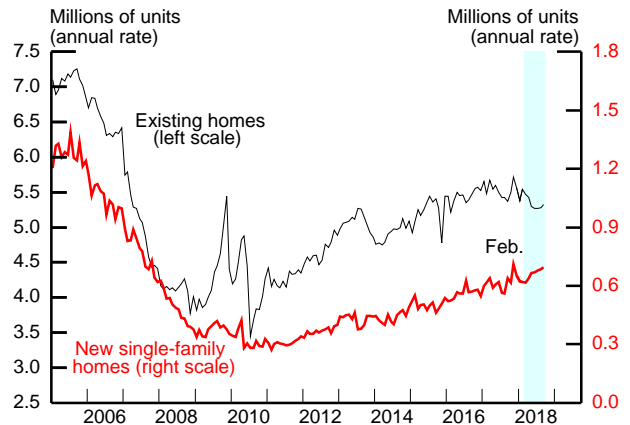
Recent Nonfinancial Developments (2)

Single-Family Housing Starts and Permits



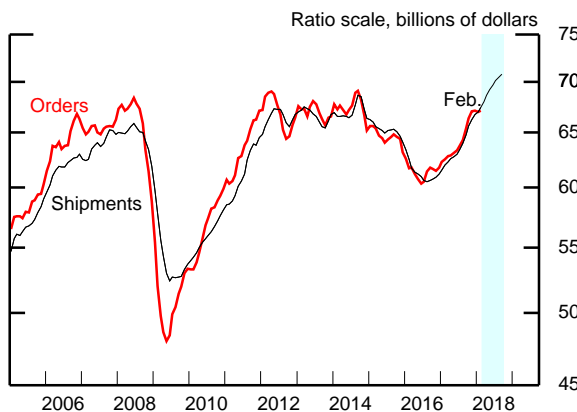
Note: Adjusted permits equal permit issuance plus starts outside of permit-issuing areas.
Source: U.S. Census Bureau.

Home Sales



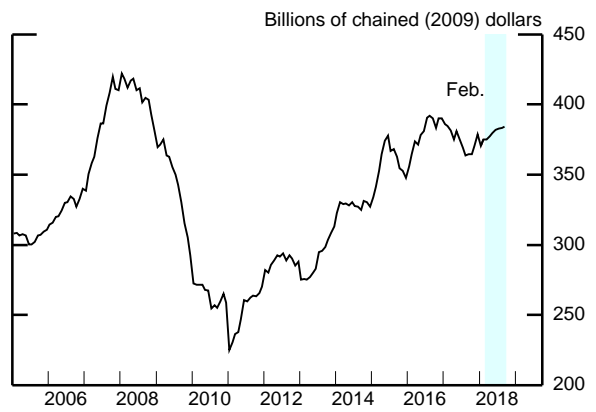
Source: For existing, National Association of Realtors; for new, U.S. Census Bureau.

Nondefense Capital Goods ex. Aircraft



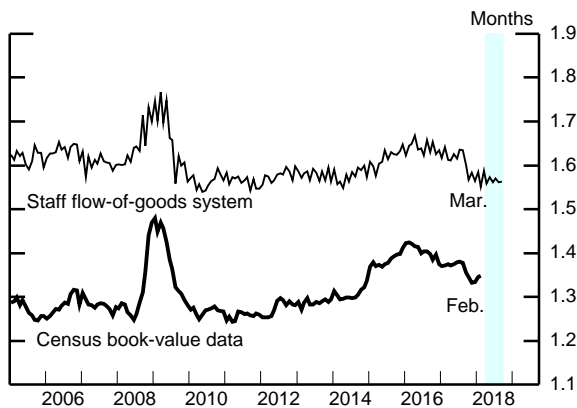
Note: Data are 3-month moving averages.
Source: U.S. Census Bureau.

Nonresidential Construction Put in Place



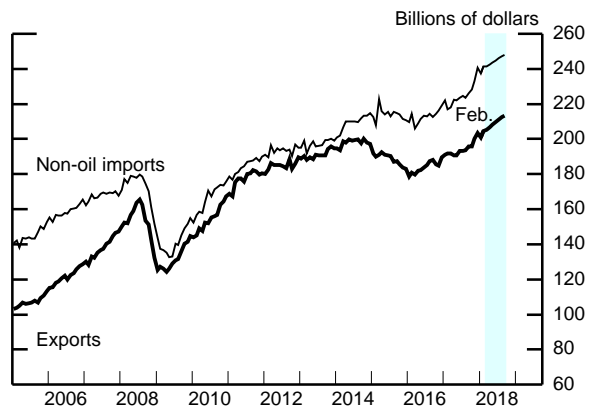
Note: Nominal CPIIP deflated by BEA prices through 2017:Q4 and by the staff's estimated deflator thereafter.
Source: U.S. Census Bureau.

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.

- Business fixed investment appears on track to rise at a solid annual rate of about 6 percent in the first quarter, close to last year's pace. We expect continued robust growth in coming quarters, consistent with rising business output, supportive financial conditions, elevated business sentiment and profit expectations, increases in drilling rigs in operation, and a modest boost from tax legislation.
- Residential investment is projected to edge lower, on net, over the first half of the year. Smoothing through the considerable volatility in these expenditures, we anticipate that housing investment will increase a modest 1 percent this year, held back by rising mortgage rates and a constrained supply of construction workers and developable lots.
- We expect real government purchases to be flat, on net, over the first half of this year and then to rise at a 2½ percent pace over the second half of the year. The acceleration in these purchases largely reflects the recent federal budget legislation.
- After being surprisingly weak for much of last year, imports jumped in the fourth quarter and are estimated to have increased at an annual rate of 5¼ percent in the first quarter. Recent import growth has been broad based, leading us to expect the level of imports to remain elevated. Net exports are now anticipated to subtract 0.2 percentage point from real GDP growth in the first half of the year, compared with a small positive contribution projected in the March Tealbook.
- Manufacturing production increased at a solid annual rate of about 3 percent in the first quarter. Although the national and regional new orders indexes have moved down a bit in recent months, they remain consistent with continued expansion in this sector. Accordingly, we expect that manufacturing output will expand at a moderate pace of about 2½ percent in the current quarter.

Over the medium term, we project that real GDP growth will slow from about 2½ percent this year and next to 2 percent in 2020, as monetary policy continues to tighten. GDP growth over the next few years is supported by expansionary fiscal policy and solid foreign growth.

- Compared with the March Tealbook, our forecast for real GDP growth beyond 2018 is unchanged, as revisions to conditioning assumptions have been offsetting. In particular, the negative effects of the lower trajectory of equity prices and higher oil prices are offset by the positive effects of the lower projected paths for interest rates and the dollar.
- Real GDP growth is projected to outpace potential growth throughout the medium term, resulting in a further tightening of resource utilization. At the end of 2020, real GDP exceeds its potential level by 3¼ percent—nearly ½ percentage point less than in the March Tealbook but still indicative of a very tight economy.
- Given the high degree of resource utilization in this projection, we continue to assume that supply constraints will begin to attenuate the transmission of increased aggregate demand into increased output and will contribute to slightly higher consumer price inflation and wage growth over the medium term. With the small downward revision to aggregate demand in this forecast, we now project these supply constraints to be a little less binding than in the March Tealbook.
- With the federal government expected to run historically large and rising deficits over the medium term, national saving is projected to trend downward as a share of GDP. Nevertheless, private investment trends upward as a share of the economy, with the gap between domestic investment and national saving financed by inflows of foreign capital.
- The box “Tealbook Forecast Errors: An Update through 2017” reviews recent errors in the staff’s forecast for GDP, unemployment, and inflation. (In the Risks and Uncertainty section, we include a related box reviewing the recent performance of the FRB/US and EDO models.)

THE OUTLOOK FOR THE LABOR MARKET

Although the March employment report was not as strong as we had expected, our broad assessment is that the labor market continued to tighten in the first quarter.

- Total nonfarm payrolls rose 103,000 in March after jumping 326,000 in February. For the first quarter as a whole, payrolls increased at an average

Tealbook Forecast Errors: An Update through 2017

Real activity in 2017 was somewhat stronger than anticipated by Tealbook forecasts, although the staff's forecast errors were generally small by historical standards. Real GDP grew at a slightly faster pace than the staff forecast one and two years ago, and the unemployment rate was lower at the end of 2017 than expected. Despite the unexpected strength of real activity, core PCE price inflation last year was a bit lower than anticipated.

The figure on the next page shows data and Tealbook forecasts for four economic variables: real GDP growth, the unemployment rate, and total and core PCE price inflation. For example, the gray bars in the upper-left panel show the currently published Q4/Q4 percent changes in real GDP from 2014 to 2017. The blue squares show Tealbook forecasts for GDP growth made in the April Tealbook one year earlier; green triangles show the forecast from the April Tealbook of the contemporaneous year. The whisker bands demarcate 70 percent forecast error bands, and the top edge of a gray bar falling outside of the whisker band represents an unusually large forecast error.¹ The red dots are BEA estimates of real GDP growth from mid-April of the subsequent year, and the red 70 percent bands show the magnitude of revisions to that estimate relative to the BEA's current estimate.

Real GDP growth in 2017 is currently estimated to be 2.6 percent, higher than Tealbook forecasts from April 2016 and April 2017 (2.4 percent and 2.0 percent, respectively). These forecast errors, however, are historically small, with real GDP well within the 70 percent whisker bands. A possible explanation for faster-than-expected real GDP growth last year is that financial conditions were more supportive of economic growth. For example, the April 2017 Tealbook projected the 10-year Treasury yield to be 2.9 percent in the fourth quarter of that year, whereas the 10-year yield averaged only 2.4 percent in 2017:Q4. Likewise, equity prices ended 2017 roughly 10 percent higher, and investment-grade corporate bond spreads were narrower, than projected by the staff that April.

Consistent with faster-than-expected real GDP growth last year, labor market conditions improved more than anticipated. As seen in the top-right panel, the unemployment rate ended the year at a lower level than the staff had forecast. Because the April 2017 Tealbook forecast of the labor force participation rate was on the mark, the greater-than-expected improvement in the labor market is also reflected in the employment-to-population ratio and private-sector job gains, both of which were higher in 2017 than was forecast in April (not shown).

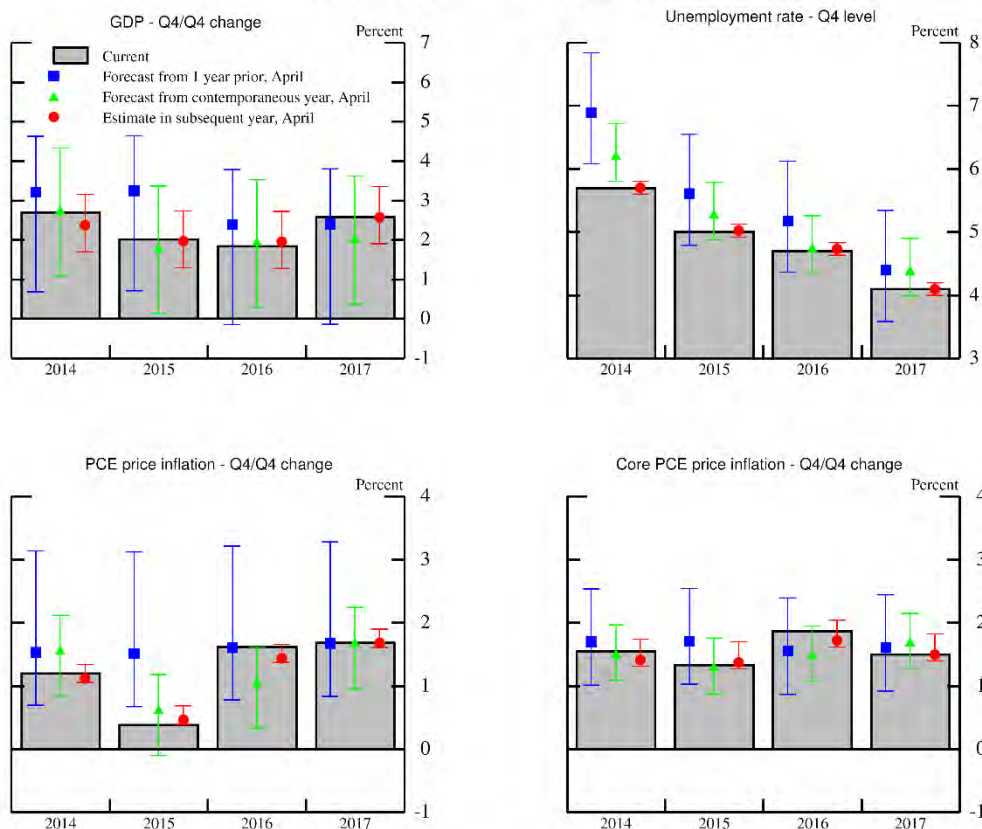
The bottom row of the figure shows staff forecasts for total and core PCE price inflation and their confidence intervals, alongside the latest estimates. Even

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

though the forecast errors for real GDP growth and the unemployment rate suggest that the economy tightened more than the staff expected last year, staff forecasts of the Q4/Q4 percent change in core PCE prices in 2017 were a little too high, as shown in the bottom-right panel. The error in forecasting core PCE price inflation is entirely explained by lower-than-expected core goods prices, which fell notably again last year despite a pickup in core goods import price inflation.² In contrast, the staff’s projection of total PCE price inflation in 2017 was accurate, as higher-than-expected PCE energy prices in the last few months of the year offset lower-than-expected food and core goods prices.

Finally, the faster-than-expected fall in the unemployment rate occurred at the same time that core PCE price inflation was lower than the staff could explain. In response, the staff edged down its estimate of the natural rate of unemployment last year, 0.2 percentage point cumulatively.

Tealbook Forecasts, 2014-2017



Source: Staff forecast, Bureau of Economic Analysis, and Bureau of Labor Statistics.

² The April 2017 Tealbook projection had already incorporated the large downward surprise to wireless telephone services prices seen in the March 2017 CPI release.

monthly pace of about 200,000—somewhat faster than last year’s pace and well above the range of 85,000 to 115,000 that we judge to be consistent with no change in resource utilization.⁵ For the current quarter, we now project that total payroll employment gains will average 195,000 per month—down a bit from our previous projection.

- The unemployment rate was 4.1 percent for a sixth consecutive month in March. In recent months, the unemployment rate has surprised us a little to the upside. In response, we have raised our near-term projection of the jobless rate a bit and now expect the unemployment rate to be 4.0 percent in the current quarter and 3.8 percent next quarter; both rates are 0.1 percentage point higher than in our previous forecast.
- The LFPR ticked down in March but has generally surprised us to the upside in recent months. For the past few years, the participation rate has moved essentially sideways, on net, indicating some tightening along this margin relative to its declining trend.

We continue to expect the labor market to tighten further over the medium term in line with above-trend GDP growth.

- Total payroll gains are projected to slow gradually from an average monthly pace of about 195,000 this year to 160,000 in 2020, as GDP decelerates; this trajectory is a touch lower than in our previous forecast.
- We project the unemployment rate to decline ½ percentage point this year—similar to its decline in 2017—and to reach 3.6 percent in the fourth quarter, 0.1 percentage point above our previous projection. The jobless rate moves down further in 2019, ending the year at 3.3 percent, and then moves sideways in 2020. The projected unemployment rate at the end of 2020 is 0.2 percentage point higher than in our March Tealbook projection, consistent with the somewhat narrower output gap at the end of the medium term.

⁵ This range assumes that the LFPR declines in line with the staff’s estimate of its trend. With an unchanged participation rate, the pace of monthly job gains required to keep the unemployment rate constant ranges from 130,000 to 160,000.

- The LFPR is projected to end this year at 62.7 percent and then move sideways through 2020, as sustained job gains and rising real wages continue to draw individuals into the labor force while also slowing outflows. At the end of 2020, the LFPR is 0.6 percentage point above our estimate of its trend and unchanged from the March Tealbook.
- We have continued to assume that, in an extremely tight labor market, a larger-than-usual amount of the tightening in resource utilization over the medium term will manifest in a higher LFPR and workweek rather than in a lower unemployment rate.⁶
- We project that labor productivity in the business sector will increase an average of about 1 percent per year over the forecast period—a touch faster than its average pace over the past five years, though somewhat less than our estimate of its structural pace.⁷

THE OUTLOOK FOR INFLATION

The incoming information on prices has been consistent with our view that transitory factors held down inflation last year and that inflation is moving up this year. On balance, the latest news on prices has been a touch higher than we anticipated.

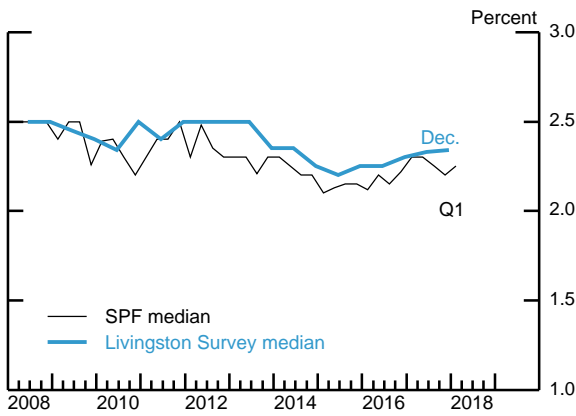
- With the March CPI and PPI now in hand and with the low March 2017 reading dropping out of the calculation, we estimate that the 12-month change in core PCE prices stepped up to 1.9 percent last month, 0.1 percentage point higher than we had projected in the March Tealbook. We expect the 12-month change to edge up to 2.1 percent by June, also a little higher than in the March Tealbook.
- We now estimate that total PCE prices rose 2.1 percent over the 12 months ending in March, and we expect the 12-month change to move up to 2.5 percent by June. Total PCE price inflation is higher than core inflation,

⁶ Were we to maintain our usual Okun's law relationship, the unemployment rate at the end of the projection would be $\frac{1}{4}$ percentage point lower.

⁷ Productivity tends to grow more slowly than its structural pace when the labor market becomes tight, possibly because workers hired in a tight labor market have lower productivity, on average, relative to workers hired during a slack labor market.

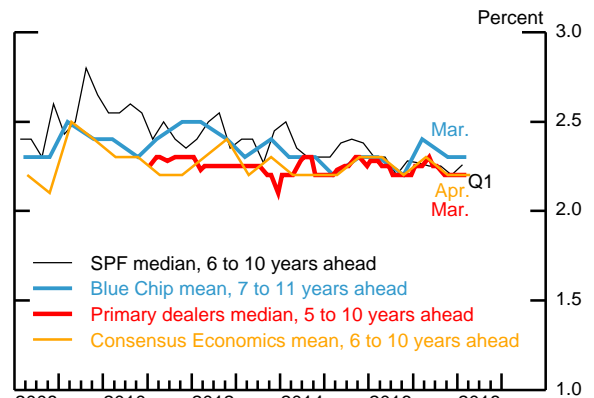
Survey Measures of Longer-Term Inflation Expectations

CPI Next 10 Years



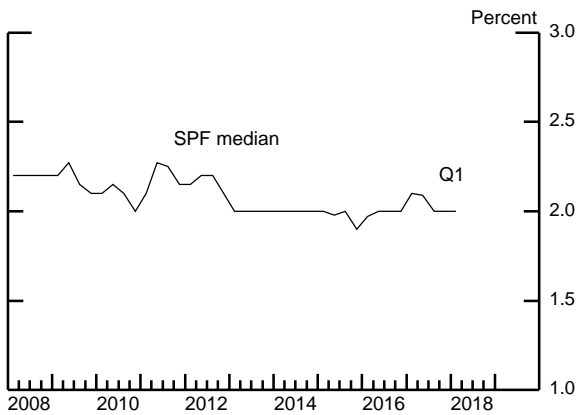
Note: SPF is Survey of Professional Forecasters.
Source: Federal Reserve Bank of Philadelphia.

CPI Forward Expectations



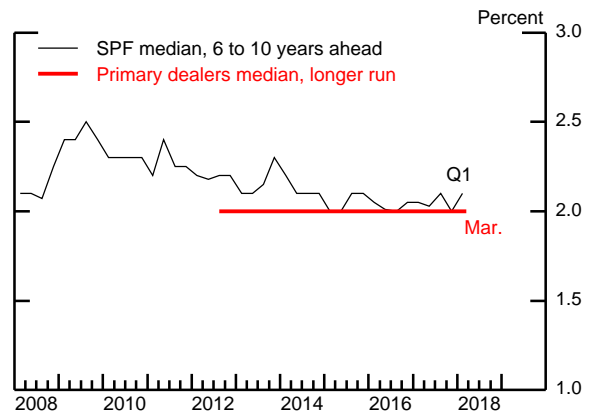
Source: Federal Reserve Bank of Philadelphia; Blue Chip Economic Indicators; Federal Reserve Bank of New York; Consensus Economics.

PCE Next 10 Years



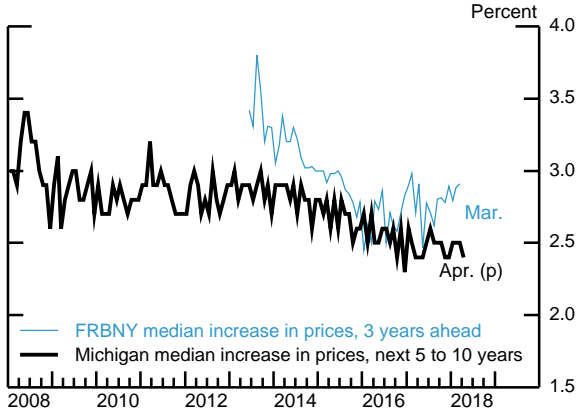
Source: Federal Reserve Bank of Philadelphia.

PCE Forward Expectations



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

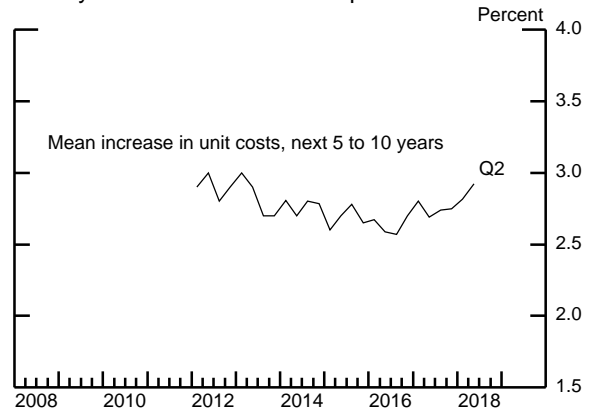
Surveys of Consumers



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

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

Survey of Business Inflation Expectations



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

reflecting previous large increases in consumer energy prices and our expectation for further increases over the next few months.

- We expect core import prices to increase at a 3¼ percent pace in the first half of 2018—up from 1¼ percent in the second half of 2017—supported by recent declines in the dollar and consistent with the incoming trade price data. We project core import price inflation to slow to a 1¼ percent pace in the second half and to about ½ percent in 2019 and 2020, in line with moderate foreign inflation, a gradually appreciating dollar, and slowly declining commodity prices.
- Incoming data on longer-term inflation expectations have moved little, on balance, since the March Tealbook. Median expectations over the next 5 to 10 years from the University of Michigan Surveys of Consumers were unchanged at 2.5 percent in March and edged down to 2.4 percent in the preliminary April reading, close to where they have been over the past couple of years. The Federal Reserve Bank of New York’s Survey of Consumer Expectations reported that the median inflation expectation 3 years ahead was unchanged in March at 2.9 percent. Finally, the TIPS-based measure of 5-to-10-year-forward inflation compensation edged up since the March meeting and stands at 2.2 percent.

Core PCE price inflation is on track to rise to 2.0 percent in 2018, as the transitory factors that had been suppressing inflation last year abate and resource utilization continues to tighten. Core inflation then edges up to 2.1 percent in 2019 and 2020, as the further tightening of the economy and a gradual increase in our judgmental underlying inflation trend more than offset restraint from the projected deceleration in core import prices.

- With oil prices expected to edge lower over the medium term, we project total PCE price inflation to run a bit below core inflation after this year and to be 2.0 percent in 2020.
- Relative to the March Tealbook, the medium-term forecasts for both core and total PCE price inflation have revised down a touch, reflecting the slightly lower degree of resource utilization in this projection. Nonetheless, we continue to assume that the supply constraints that attenuate the transmission

of aggregate demand into output in an extremely tight economy will also result in slightly higher inflation than would otherwise be the case.

We received little data on wages since the March Tealbook.⁸ Overall, we continue to view the information on labor compensation as consistent with a gradual acceleration over the past few years.

- Average hourly earnings rose 2.7 percent over the year ending in March, close to our estimate in the March Tealbook. We expect the 12-month change in average hourly earnings to remain close to this pace through the summer.
- The Federal Reserve Bank of Atlanta’s Wage Growth Tracker ticked up to 3.3 percent in March, near the middle of its range over the past couple of years but up from before then.
- Over the medium term, growth in compensation per hour (CPH) is projected to step up from a pace of 3½ percent this year to around 4 percent in each of the next two years, as resource utilization tightens further. Meanwhile, the ECI, which is notably less cyclical than the CPH measure, steps up from a 2½ percent pace this year to 2¾ percent in 2019 and 2020. Compared with the March Tealbook, these projections are revised down a little, reflecting the slightly lower level of resource utilization in this forecast.

THE LONG-TERM OUTLOOK

- We continue to assume that the natural rate of unemployment will be 4.7 percent, and that potential output growth will be 1.7 percent per year in the longer run.
- We have maintained our assumption that the real equilibrium federal funds rate that will prevail in the longer run will be ½ percent. Yields on 10-year Treasury securities in the longer run are assumed to stand at 3.4 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

⁸ The ECI for March will be released on April 27. The GDP release on the same day will also contain information on labor compensation in the first quarter.

extent over time. The SOMA portfolio is projected to have returned to a normal size by mid-2021.

- With these assumptions, real GDP growth slows further to 1½ percent in 2021 and 1 percent in 2022 and 2023, as the federal funds rate is above its neutral level and the support from fiscal policy starts to wane. The unemployment rate moves up gradually from 3¼ percent in 2020 toward its assumed natural rate in subsequent years.
- PCE price inflation hovers around 2.1 percent in 2022 and 2023 before edging back down to the Committee’s long-run objective in later years.
- With output materially above its potential level and inflation slightly above the Committee’s 2 percent objective, the nominal federal funds rate rises to about 5 percent at the end of 2021—2½ percentage points higher than its assumed long-run value. Thereafter, the federal funds rate moves gradually back toward its long-run value.

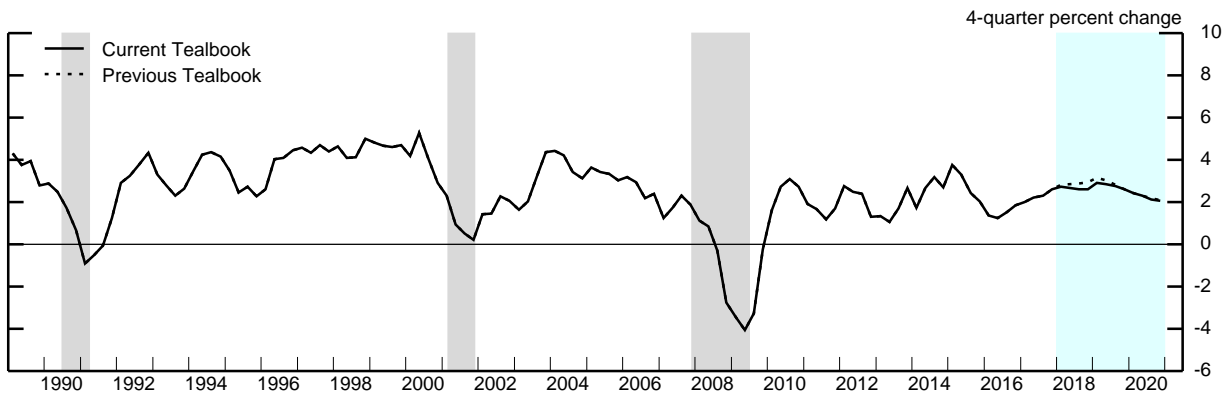
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Projections of Real GDP and Related Components
 (Percent change at annual rate from final quarter
 of preceding period except as noted)

Measure	2017	2018		2018	2019	2020
		H1	H2			
Real GDP	2.6	2.3	2.9	2.6	2.6	2.1
Previous Tealbook	2.6	2.6	3.3	2.9	2.6	2.1
Final sales	2.9	1.7	3.3	2.5	2.7	2.1
Previous Tealbook	2.9	2.3	3.4	2.8	2.7	2.1
Personal consumption expenditures	2.8	1.7	2.5	2.1	2.7	2.5
Previous Tealbook	2.9	2.0	2.9	2.4	2.8	2.5
Residential investment	2.6	-3.1	5.0	.9	1.7	3.3
Previous Tealbook	2.5	-.9	4.1	1.6	.5	4.2
Nonresidential structures	5.0	9.5	5.9	7.7	2.0	.5
Previous Tealbook	4.9	7.4	3.4	5.4	2.8	.9
Equipment and intangibles	6.7	6.1	5.5	5.8	4.2	2.0
Previous Tealbook	6.8	5.9	6.6	6.2	4.1	2.1
Federal purchases	1.0	-1.2	4.8	1.8	4.1	3.3
Previous Tealbook	1.0	-.8	4.4	1.8	4.1	3.2
State and local purchases	.5	.7	1.0	.9	1.0	1.0
Previous Tealbook	.5	.9	1.0	.9	1.0	1.0
Exports	5.0	4.2	6.3	5.2	5.2	3.6
Previous Tealbook	4.9	4.1	6.2	5.2	5.0	3.4
Imports	4.7	4.4	3.5	3.9	4.4	4.8
Previous Tealbook	4.6	2.7	4.1	3.4	4.7	4.9
Contributions to change in real GDP (percentage points)						
Inventory change	-.3	.6	-.4	.1	-.1	.0
Previous Tealbook	-.3	.3	-.1	.1	-.1	-.1
Net exports	-.1	-.2	.2	.0	.0	-.3
Previous Tealbook	-.1	.1	.1	.1	-.1	-.3

Domestic Econ Devel & Outlook

Real GDP

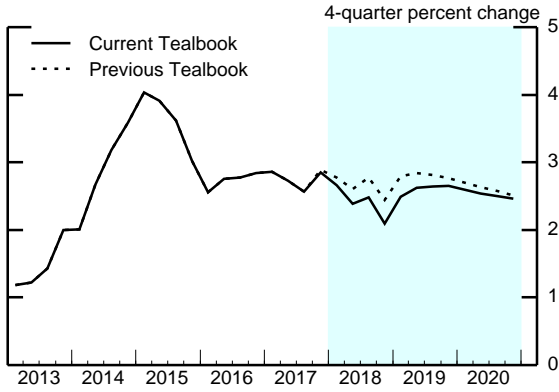


Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

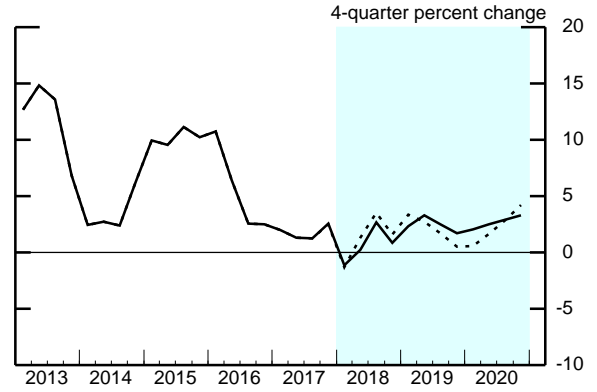
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Components of Final Demand

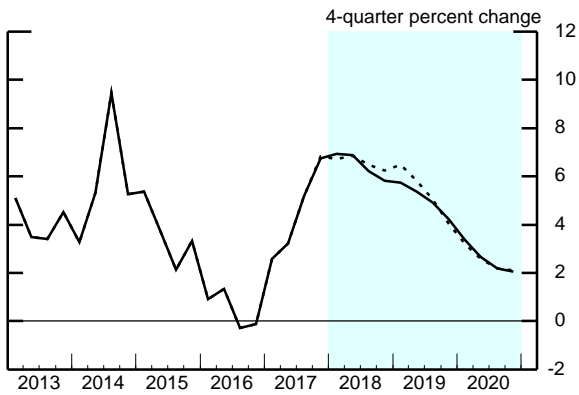
Personal Consumption Expenditures



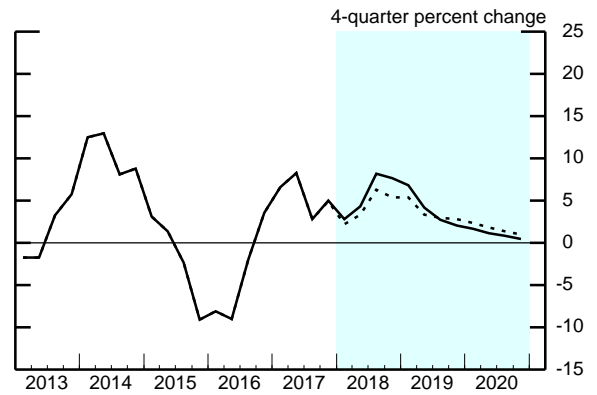
Residential Investment



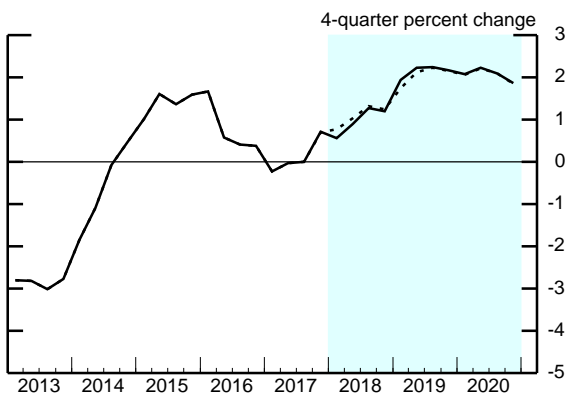
Equipment and Intangibles



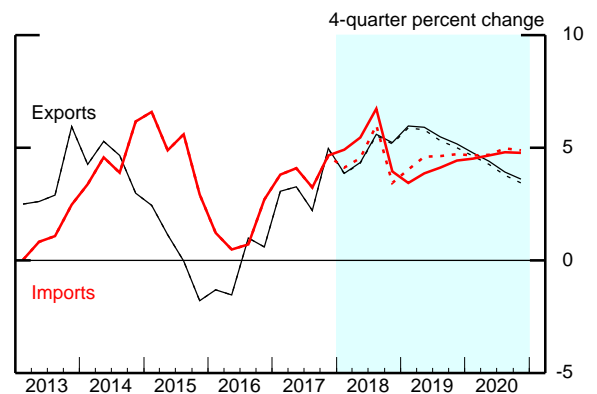
Nonresidential Structures



Government Consumption and Investment



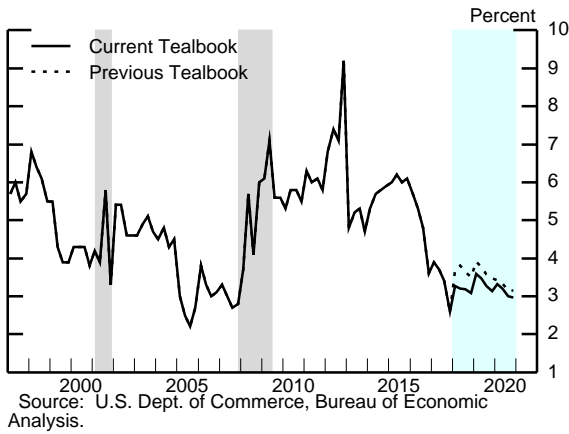
Exports and Imports



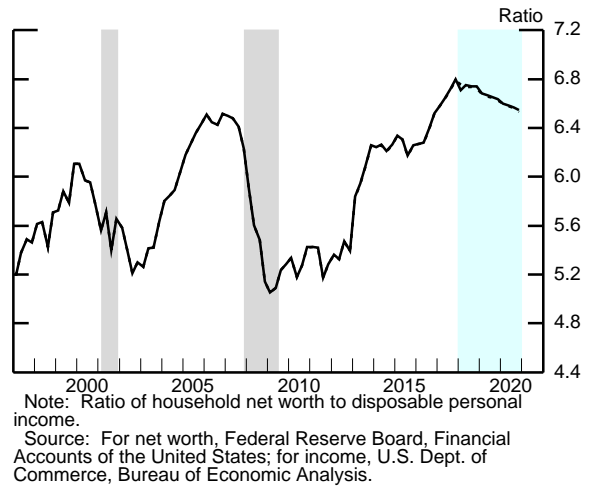
Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Aspects of the Medium-Term Projection

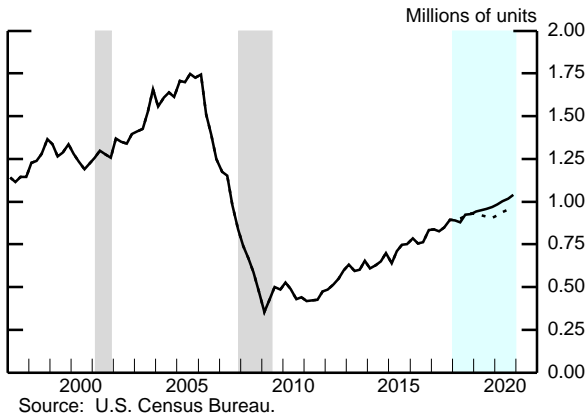
Personal Saving Rate



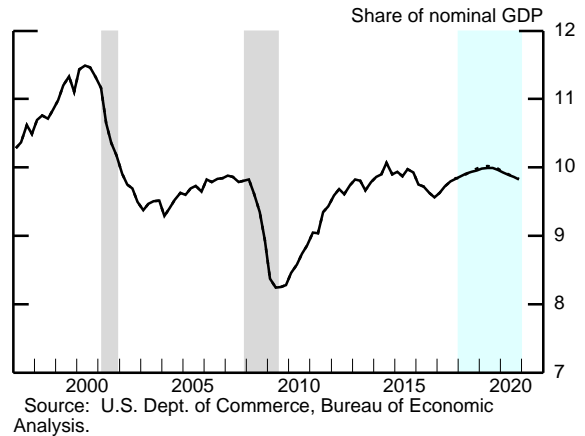
Wealth-to-Income Ratio



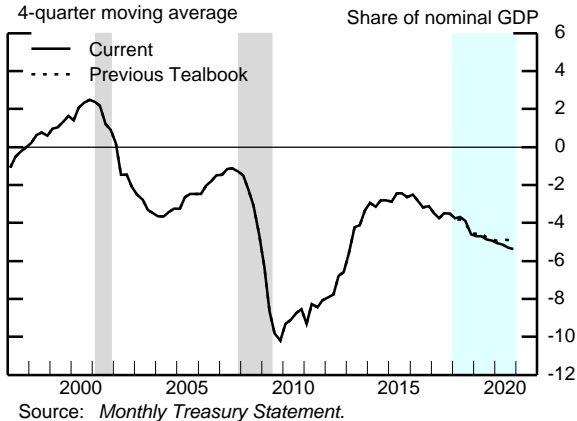
Single-Family Housing Starts



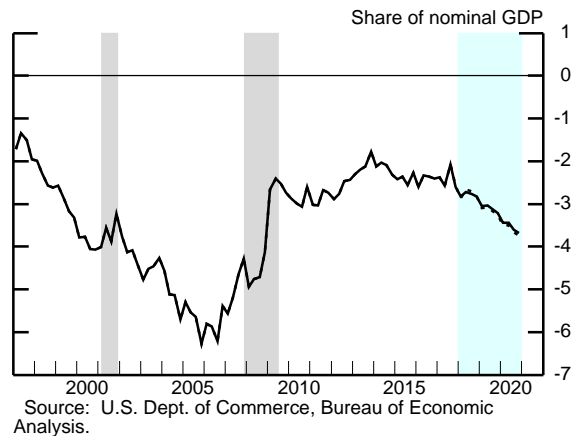
Equipment and Intangibles Spending



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)

Domestic Econ Devel & Outlook

Measure	1974-95	1996-2000	2001-07	2008-10	2011-15	2016	2017	2018	2019	2020
Potential real GDP	3.1	3.4	2.6	1.6	1.2	1.4	1.5	1.7	1.9	1.9
Previous Tealbook	3.1	3.4	2.6	1.6	1.2	1.4	1.5	1.6	1.9	1.9
<i>Selected contributions¹</i>										
Structural labor productivity ²	1.6	2.9	2.8	1.4	.8	.8	1.0	1.1	1.2	1.3
Previous Tealbook	1.6	2.9	2.8	1.4	.8	.8	1.0	1.1	1.2	1.3
Capital deepening	.6	1.5	1.0	.3	.5	.5	.5	.5	.6	.5
Multifactor productivity	.7	1.0	1.5	.9	.1	.1	.3	.4	.5	.6
Structural hours	1.6	1.2	.8	.0	.6	.8	.2	.7	.6	.6
Previous Tealbook	1.6	1.2	.8	.0	.6	.8	.2	.7	.6	.6
Labor force participation	.4	-.1	-.2	-.5	-.6	-.3	-.3	-.3	-.2	-.2
Previous Tealbook	.4	-.1	-.2	-.5	-.6	-.3	-.3	-.3	-.2	-.2
Memo:										
Output gap ³	-1.9	2.4	.8	-4.2	-.1	.3	1.4	2.4	3.1	3.2
Previous Tealbook	-1.9	2.4	.8	-4.2	-.1	.3	1.4	2.7	3.5	3.6

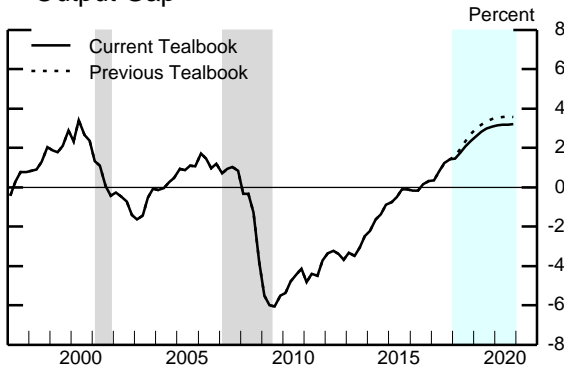
Note: For multiyear periods, the percent change is the annual average from Q4 of the year preceding the first year shown to Q4 of the last year shown.

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.

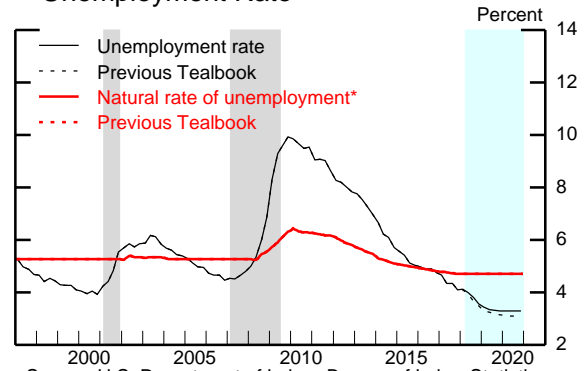
Output Gap



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

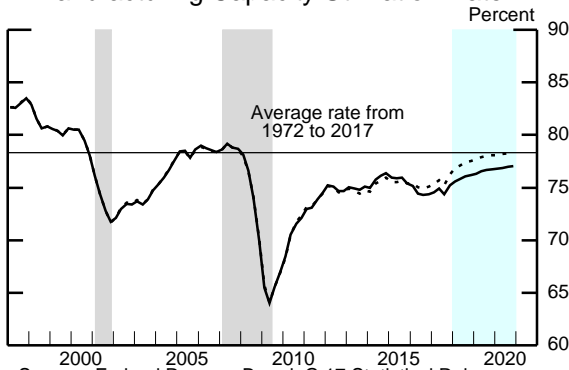
Source: U.S. Department of Commerce, Bureau of Economic Analysis; staff assumptions.

Unemployment Rate



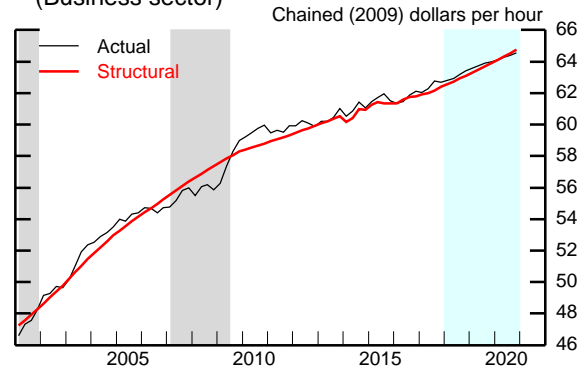
Source: U.S. Department of Labor, Bureau of Labor Statistics; staff assumptions. *Staff estimate including the effect of EEB.

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	2017	2018		2018	2019	2020
		H1	H2			
Output per hour, business ¹	.9	.7	1.6	1.2	.9	.9
Previous Tealbook	.9	.5	1.9	1.2	.9	.9
Nonfarm payroll employment ²	183	199	191	195	181	160
Previous Tealbook	183	232	196	214	186	165
Private employment ²	180	197	180	188	170	150
Previous Tealbook	180	224	185	205	175	155
Labor force participation rate ³	62.7	62.8	62.7	62.7	62.7	62.7
Previous Tealbook	62.7	62.8	62.7	62.7	62.7	62.7
Civilian unemployment rate ³	4.1	4.0	3.6	3.6	3.3	3.3
Previous Tealbook	4.1	3.9	3.5	3.5	3.1	3.1

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

2. Thousands, average monthly changes.

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

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

Inflation Projections

Measure	2017	2018		2018	2019	2020
		H1	H2			
<i>Percent change at annual rate from final quarter of preceding period</i>						
PCE chain-weighted price index	1.7	2.5	1.7	2.1	1.9	2.0
Previous Tealbook	1.7	2.0	1.6	1.8	2.0	2.1
Food and beverages	.7	.9	2.1	1.5	2.3	2.3
Previous Tealbook	.7	1.4	2.2	1.8	2.4	2.4
Energy	7.6	7.6	-.4	3.5	-1.9	-1.1
Previous Tealbook	7.6	.8	-1.6	-.4	-.7	-.1
Excluding food and energy	1.5	2.4	1.7	2.0	2.1	2.1
Previous Tealbook	1.5	2.1	1.8	1.9	2.1	2.2
Prices of core goods imports ¹	1.3	3.2	1.3	2.3	.6	.6
Previous Tealbook	1.3	3.1	1.1	2.1	.7	.6
	Mar. 2018 ²	Apr. 2018 ²	May 2018 ²	June 2018 ²	July 2018 ²	Aug. 2018 ²
<i>12-month percent change</i>						
PCE chain-weighted price index	2.1	2.1	2.4	2.5	2.5	2.4
Previous Tealbook	2.0	1.9	2.1	2.2		
Excluding food and energy	1.9	1.9	2.0	2.1	2.1	2.1
Previous Tealbook	1.8	1.8	1.9	1.9		

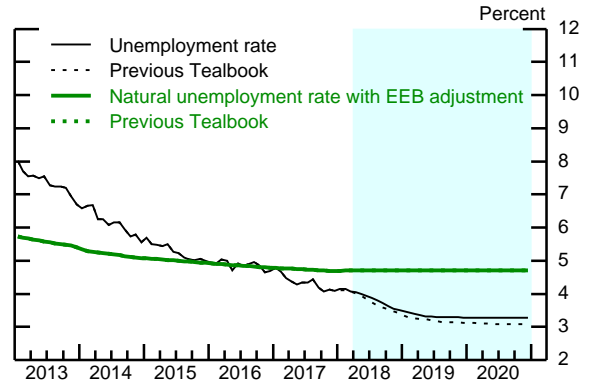
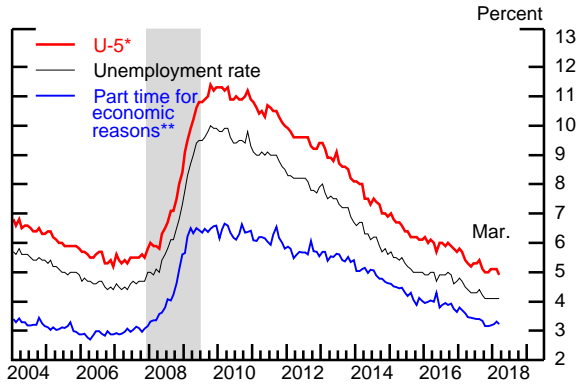
1. Core goods imports exclude computers, semiconductors, oil, and natural gas.

2. Staff forecast.

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

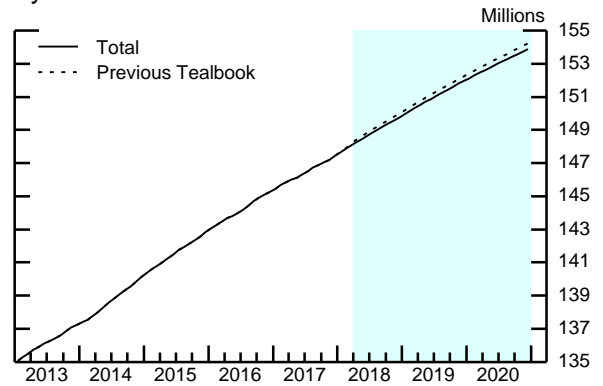
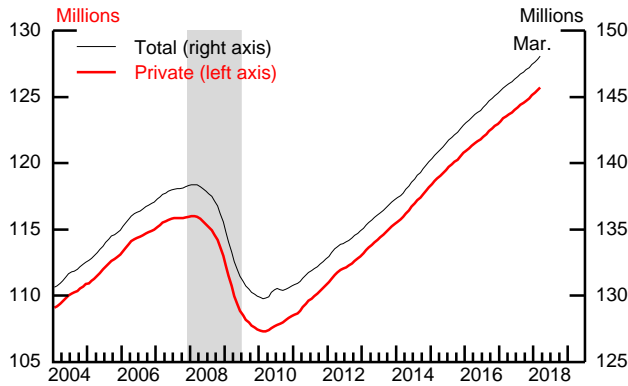
Labor Market Developments and Outlook (1)

Measures of Labor Underutilization



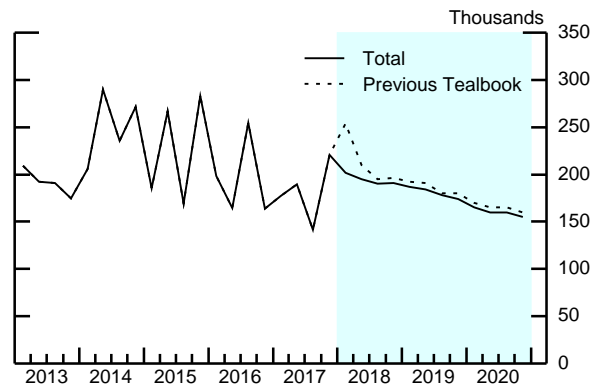
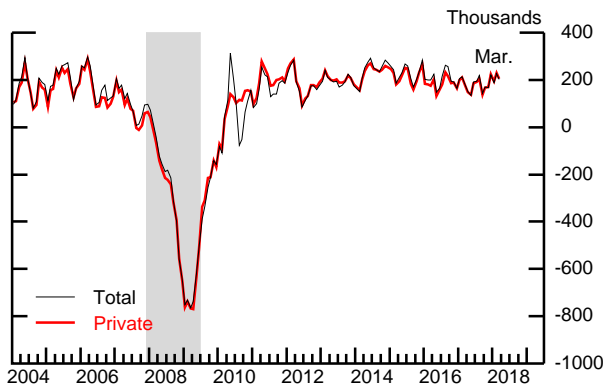
* U-5 measures total unemployed persons plus all marginally attached to the labor force, as a percent of the labor force plus persons marginally attached to the labor force.
 ** Percent of Current Population Survey employment.
 EEB Extended and emergency unemployment benefits.
 Source: U.S. Department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

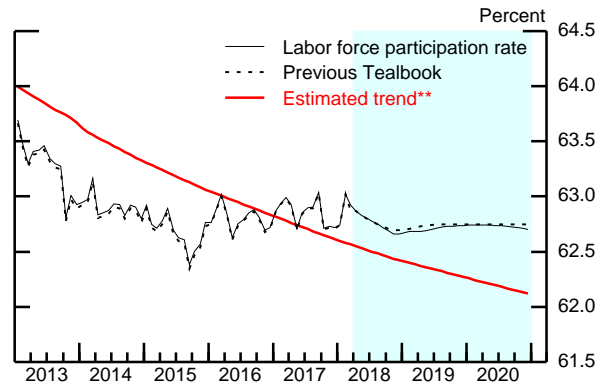
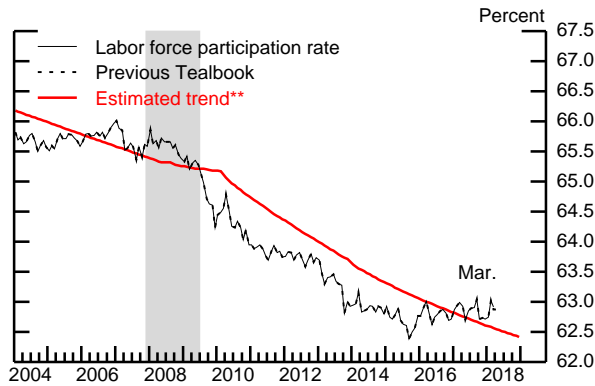


* 3-month moving averages.
 Source: U.S. Department of Labor, Bureau of Labor Statistics.

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

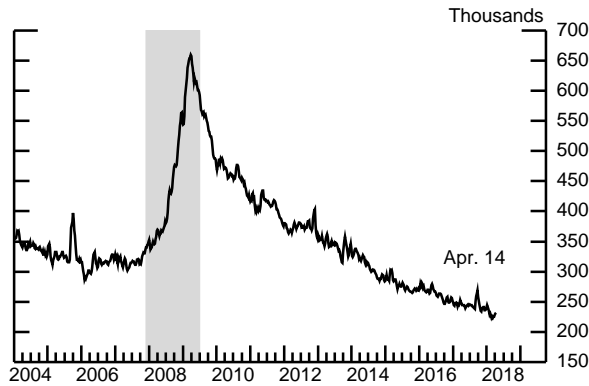
Labor Market Developments and Outlook (2)

Labor Force Participation Rate*



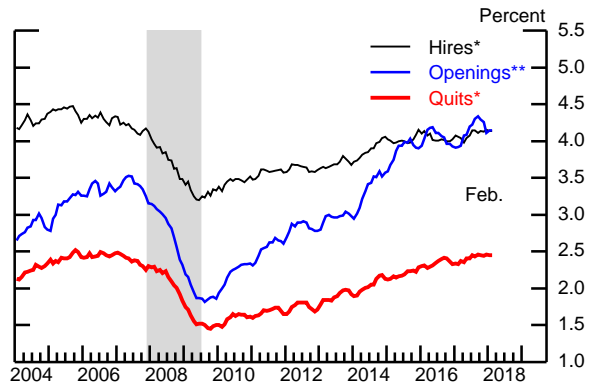
* Published data adjusted by staff to account for changes in population weights.
 ** Includes staff estimate of the effect of extended and emergency unemployment benefits.
 Source: U.S. Department of Labor, Bureau of Labor Statistics; staff assumptions.

Initial Unemployment Insurance Claims*



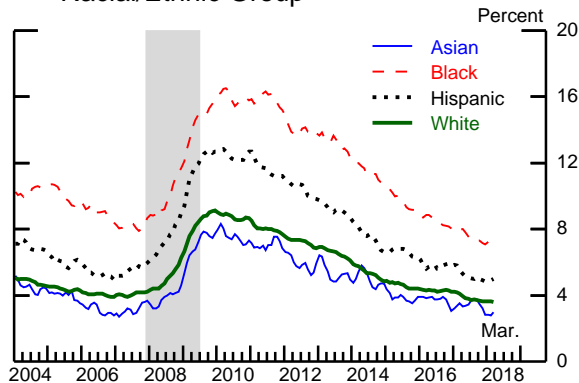
* 4-week moving average.
 Source: U.S. Department of Labor, Employment and Training Administration.

Hires, Quits, and Job Openings



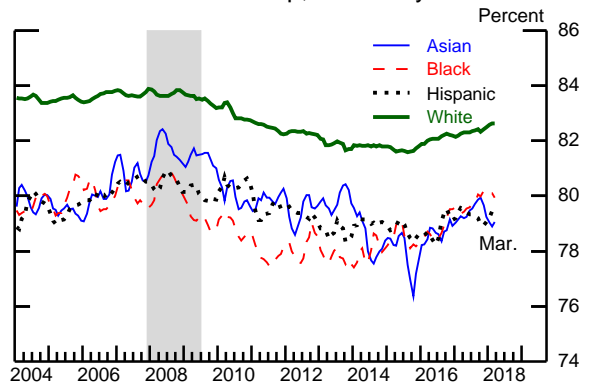
* Percent of private nonfarm payroll employment, 3-month moving average.
 ** Percent of private nonfarm payroll employment plus unfilled jobs, 3-month moving average.
 Source: Job Openings and Labor Turnover Survey.

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, 25 to 54 years old

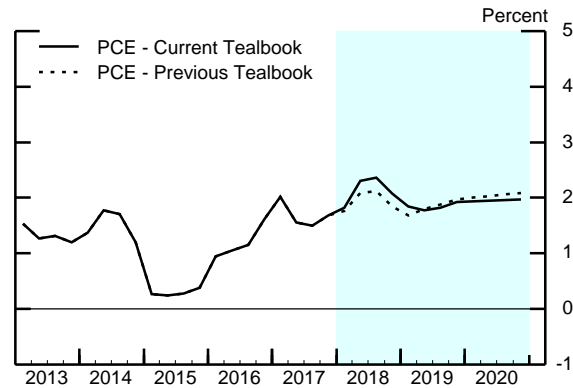
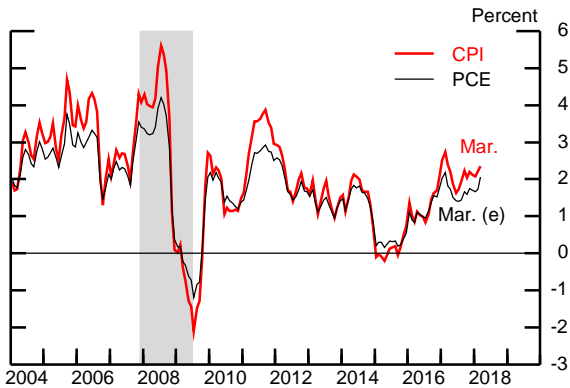


Note: These categories are not mutually exclusive, as the ethnicity Hispanic may include people of any race. The Current Population Survey defines Hispanic ethnicity as those who report their origin is Mexican, Puerto Rican, Cuban, Central American, or South American (and some others). 3-month moving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

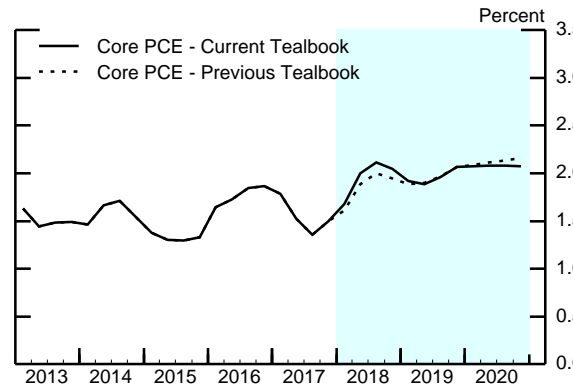
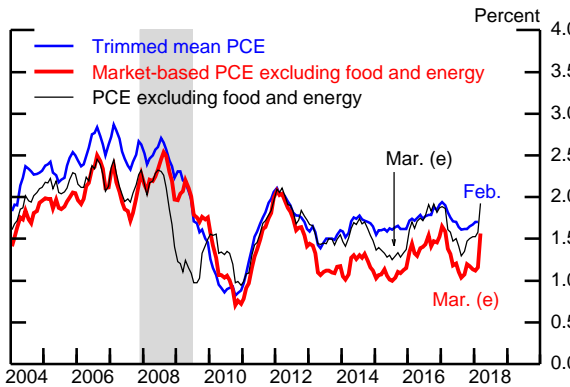
Headline Consumer Price Inflation



Note: PCE prices from January to March 2018 are staff estimates (e).

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

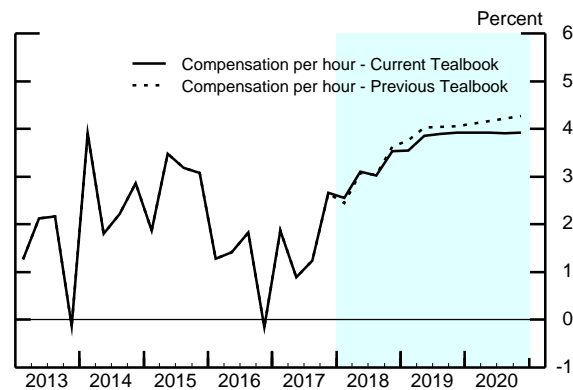
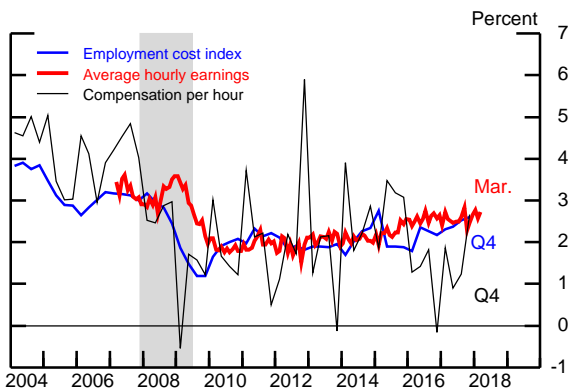
Measures of Underlying PCE Price Inflation



Note: Core PCE prices from January to March 2018 are staff estimates (e).

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

Labor Cost Growth



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

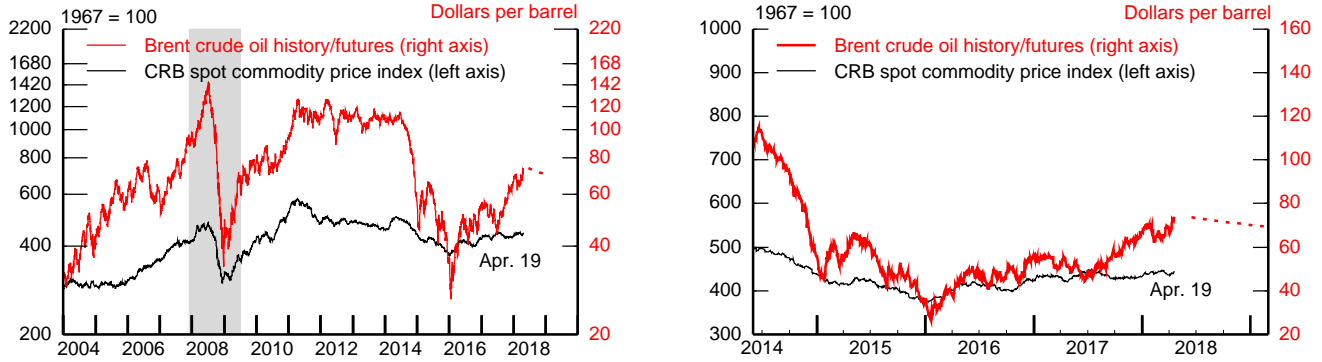
Source: U.S. Department of Labor, Bureau of Labor Statistics.

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

Inflation Developments and Outlook (2)

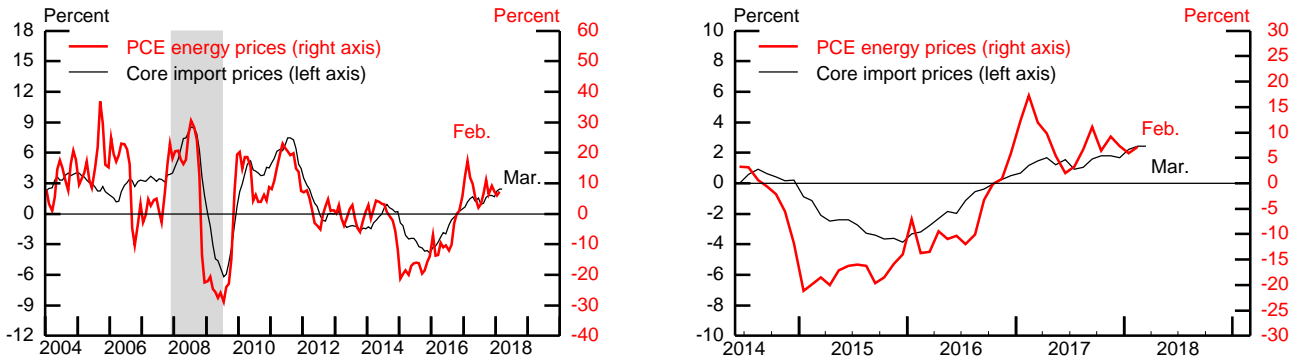
(Percent change from year-earlier period, except as noted)

Commodity and Oil Price Levels



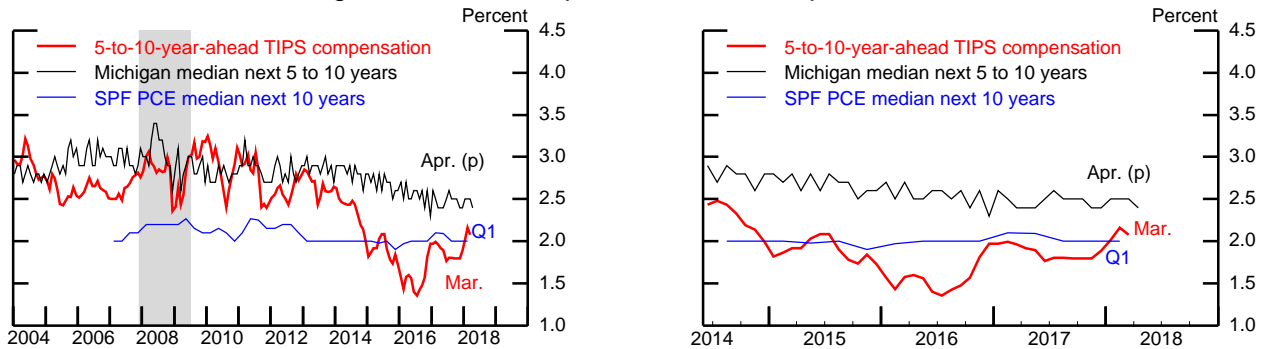
Note: Futures prices (dotted lines) are the latest observations on monthly futures contracts.
 Source: For oil prices, U.S. Department of Energy, Energy Information Agency; for commodity prices, Commodity Research Bureau (CRB).

Energy and Import Price Inflation



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

Long-Term Inflation Expectations and Compensation



Note: Based on a comparison of an estimated TIPS (Treasury Inflation-Protected Securities) yield curve with an estimated nominal off-the-run Treasury yield curve, with an adjustment for the indexation-lag effect.
 (p) Preliminary.

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

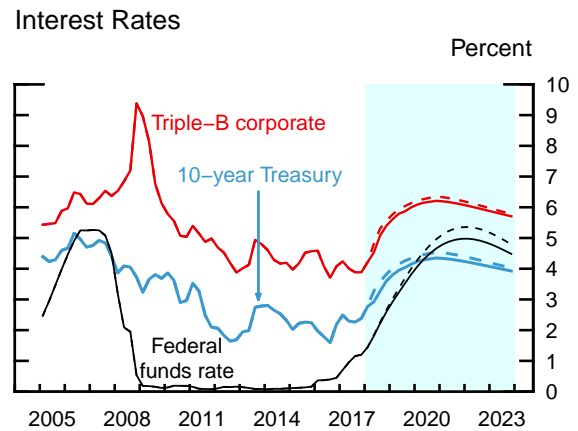
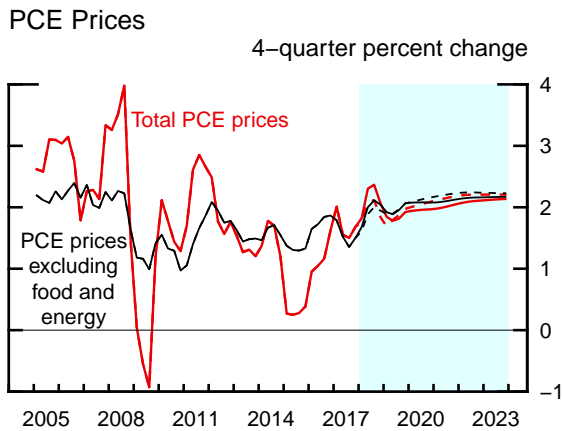
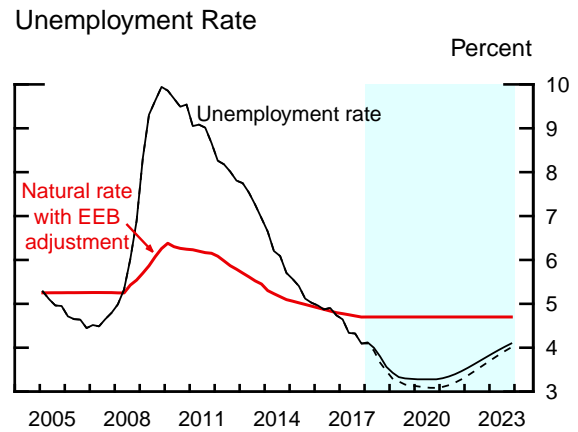
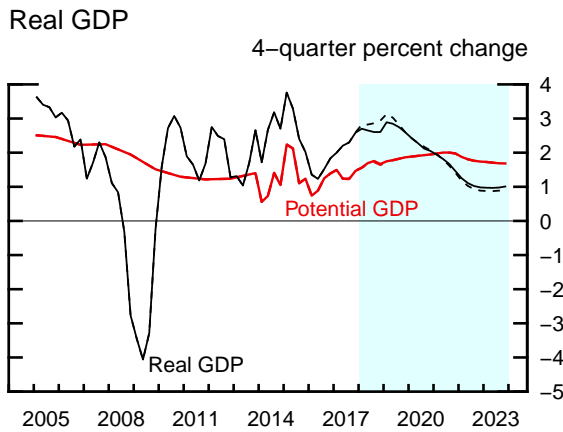
Note: The gray shaded bars indicate a period of business recession as defined by the National Bureau of Economic Research.

The Long-Term Outlook

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

Measure	2018	2019	2020	2021	2022	2023	Longer run
Real GDP	2.6	2.6	2.1	1.5	1.0	1.0	1.7
Previous Tealbook	2.9	2.6	2.1	1.4	.9	.9	1.7
Civilian unemployment rate ¹	3.6	3.3	3.3	3.5	3.8	4.1	4.7
Previous Tealbook	3.5	3.1	3.1	3.3	3.6	4.0	4.7
PCE prices, total	2.1	1.9	2.0	2.0	2.1	2.1	2.0
Previous Tealbook	1.8	2.0	2.1	2.2	2.2	2.2	2.0
Core PCE prices	2.0	2.1	2.1	2.1	2.2	2.2	2.0
Previous Tealbook	1.9	2.1	2.2	2.2	2.2	2.2	2.0
Federal funds rate ¹	2.59	3.82	4.66	4.97	4.85	4.48	2.50
Previous Tealbook	2.66	4.01	4.96	5.35	5.22	4.79	2.50
10-year Treasury yield ¹	3.6	4.2	4.4	4.3	4.1	3.9	3.4
Previous Tealbook	3.8	4.3	4.5	4.4	4.2	4.0	3.4

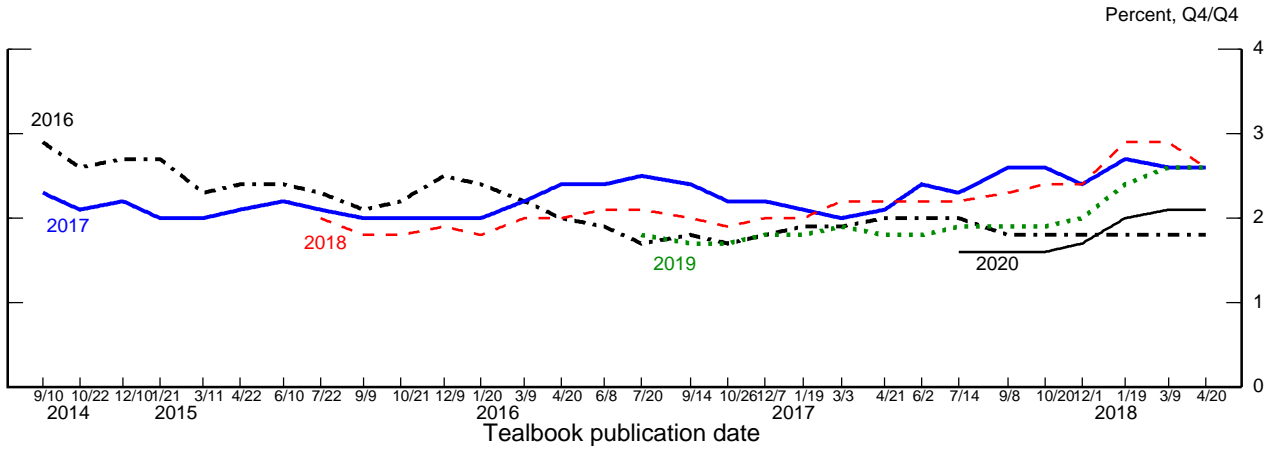
1. Percent, average for the final quarter of the period.



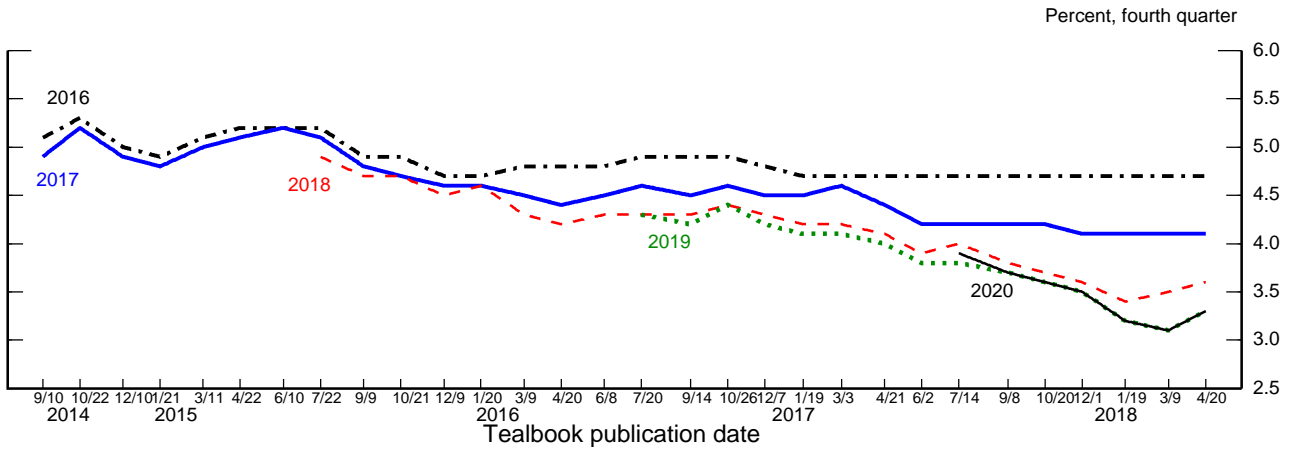
Note: In each panel, shading represents the projection period, and dashed lines are the previous Tealbook.

Evolution of the Staff Forecast

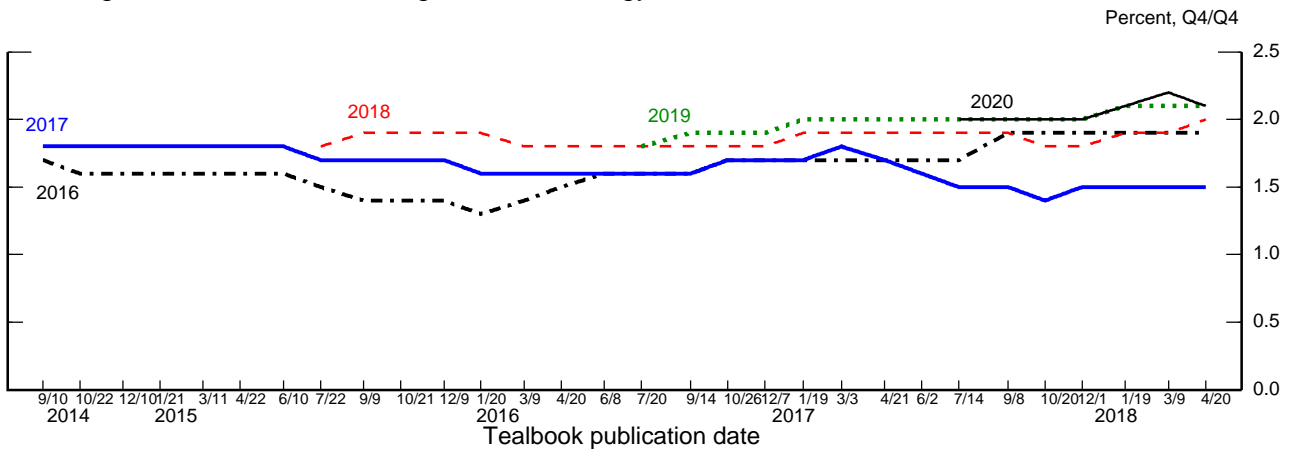
Change in Real GDP



Unemployment Rate



Change in PCE Prices excluding Food and Energy



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International Economic Developments and Outlook

The foreign economies appear set for another year of strong growth in 2018, with growth projected to be close to 3 percent, virtually unchanged from 2017. In the advanced foreign economies (AFEs), we estimate that, after growing a rapid 2½ percent last year, GDP rose at a still-solid annual rate of 2 percent in the first quarter, and we see growth maintaining this pace for the remainder of the year. In the emerging market economies (EMEs), GDP growth looks to have picked up from 3.4 percent in the fourth quarter to almost 4 percent in the first quarter and should come in at nearly that pace in the next few quarters. Beyond 2018, we see aggregate foreign growth edging down a touch to settle at around its potential rate of 2¾ percent in 2020.

Our foreign outlook is little changed from the March Tealbook on balance. Although economic indicators in the AFEs have come in a little weaker than expected, we have seen positive surprises in some emerging Asian economies. So far this year we have not seen the sequence of upward revisions to our outlook that occurred last year. Nevertheless, we cannot exclude the possibility that foreign growth could again exceed expectations, leading to a weakening of the dollar and a boost to the U.S. economy. We explore such a development in the “Stronger Foreign Growth and Weaker Dollar” alternative scenario in the Risks and Uncertainty section.

In the AFEs, rising retail energy prices helped boost headline inflation to an annual rate of 2½ percent in the first quarter, ½ percentage point higher than projected in March. AFE inflation in the current quarter has also been revised up to 2 percent on account of higher oil prices. Core inflation has picked up in Canada over the past few quarters but remains subdued in the euro area and Japan. With inflation pressures remaining contained over the next few years, we continue to assume only a gradual withdrawal of monetary policy stimulus in the AFEs. In particular, the European Central Bank (ECB) is not expected to raise its policy rate until the second quarter of 2019. Moreover, we do not see the ECB, the Bank of England (BOE), or the Bank of Japan (BOJ) starting to reduce the size of their balance sheets any time soon.

In the EMEs, monetary policies are more diverse. Some Asian central banks, after a period of very low policy rates, are now raising rates with a pickup in growth. In contrast, some central banks in Latin America, such as Brazil’s, have been cutting their

policy rates in response to weakness in their economies. The Bank of Mexico (BOM) remains in a tightening cycle in response to significant overshooting of inflation relative to target and is expected to lower its policy rate only next year.

Further monetary policy tightening by the Federal Reserve, as well as eventual policy normalization by other major central banks, will lead to an increase in global interest rates. In our baseline, we expect global financial markets to take this normalization in stride, with sovereign, corporate, and household debtors able to adjust to higher debt service needs. However, a more substantial policy tightening by the Federal Reserve than in our baseline, perhaps prompted by a faster-than-expected rise in inflation, could lead to turbulence in global financial markets and create problems for debtors, especially EME corporates. The consequences of such an outcome are discussed in our “Global Tightening Tantrum” alternative scenario in the Risks and Uncertainty section; additionally, the EME corporate debt situation is analyzed in the box “How Risky Is Corporate Debt in Emerging Market Economies?” Finally, we remain attuned to other risks, including an eruption of trade wars or a sharp escalation of the geopolitical tensions in the Middle East that have recently pushed up oil prices.

ADVANCED FOREIGN ECONOMIES

- ***Euro area.*** Recent indicators, such as industrial production and exports through February, suggest that real GDP growth stepped down from 2.7 percent in the fourth quarter to about 2 percent in the first. However, with PMIs and confidence indicators for March still at levels consistent with solid economic activity, we project GDP growth to edge up to 2¼ percent in the current quarter. GDP growth should then gradually slow to 1¾ percent in 2020, a bit above its potential rate. Compared with the March Tealbook, this forecast is about ½ percentage point lower in the first quarter of 2018 and little changed thereafter.

Headline inflation increased to 2.1 percent at an annual rate in the first quarter, temporarily boosted by a surge in energy prices. Core inflation rose to 1.4 percent in the first quarter from an unusually low print of 0.2 percent in the fourth. We expect both headline and core inflation to decelerate somewhat and then edge up to 1¾ percent only by 2020, as resource slack gradually diminishes and wage growth firms. Given this subdued inflation outlook, the ECB has continued to communicate the need for ample monetary policy accommodation. Accordingly, we expect the

ECB to continue its asset purchases until the end of 2018 and increase its policy rate only in the second quarter of 2019 by 0.15 percentage point to negative 0.25 percent.

- **United Kingdom.** U.K. indicators also suggest that GDP growth has slowed a bit, to 1¼ percent in the first quarter from 1.6 percent in the fourth. This estimate is ¼ percentage point lower than in the March Tealbook, on weaker-than-expected construction and services indicators, partly reflecting adverse weather conditions. Growth is expected to increase to about 1¾ percent in the current quarter, supported by a recent pickup in real wages.

As we expected, the European Union (EU) and British authorities agreed last month on a 21-month transition period after the official U.K. withdrawal from the EU next March. During this transition the United Kingdom will stay in the EU's customs union and single market but will be able to negotiate trade deals with other countries. As Brexit uncertainty fades, supporting business confidence, and with the help of accommodative monetary policy, economic activity should continue to expand at just above its potential rate of 1½ percent throughout the forecast horizon. This projection is a touch weaker than in the March Tealbook, mostly because of appreciation of the pound.

Inflation in the first quarter declined to 2.5 percent from 3 percent in the fourth, mainly because of waning effects of past currency depreciation. We continue to expect that inflation will gradually fall to the BOE's 2 percent target by the end of 2020. We anticipate that the BOE will gradually raise its policy rate from its current level of 0.5 percent, reaching 1¾ percent by the end of 2020.

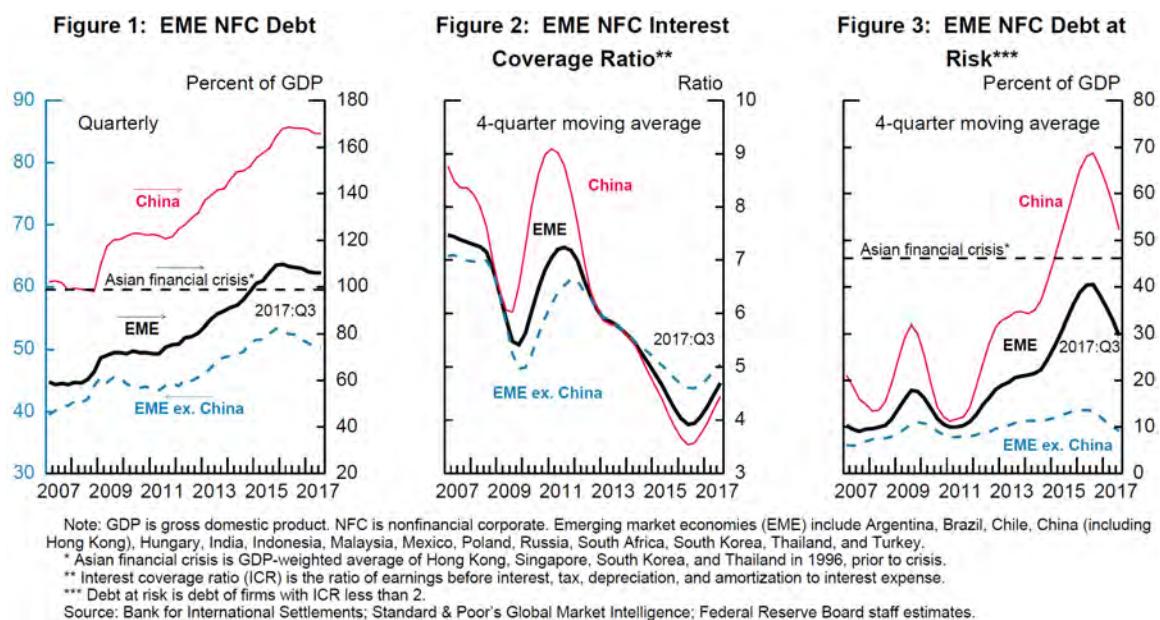
- **Canada.** With the auto industry recovering from earlier strikes and maintenance shutdowns, we estimate that GDP growth edged up to 2 percent in the first quarter. Although this pace is somewhat below our March Tealbook forecast—partly owing to disruptions in the oil industry—recent indicators, including the Labour Force Survey and manufacturing PMI through March, point to continued solid momentum. We see growth staying close to 2 percent through the forecast horizon.

Inflation increased to 3.6 percent in the first quarter, reflecting higher retail energy prices and increasing resource utilization. We expect inflation to remain elevated at 2½ percent in the current quarter before slowing to 2 percent by next year. The Bank

How Risky Is Corporate Debt in Emerging Market Economies?

Since 2007, nonfinancial corporate (NFC) debt in emerging markets (EMEs) has tripled in dollar value, reaching \$28 trillion in the third quarter of 2017. Although EME corporate debt as a share of GDP has declined slightly since 2016, it remains elevated at around 110 percent of GDP (figure 1). A large majority of the increase since 2007 is accounted for by China (the red line), where NFC debt has risen to 170 percent of GDP. But NFC debt in the other EMEs has also risen notably (note the different scale). The rapid increase in corporate debt has raised concerns about the risks this debt might pose to EMEs and the global economy. In particular, rising global interest rates, in part as advanced economies tighten monetary policy, could lead to higher EME debt-servicing burdens, weaker currencies, capital outflows, and lower earnings. Such developments could weigh on EME corporates, especially those that are highly leveraged or have high levels of dollar-denominated debt, potentially triggering loan losses, bond defaults, and broader financial stress.

We evaluate the overall riskiness of EME corporate debt using the interest coverage ratio (ICR), or the ratio of earnings to interest expense, which measures the capacity of firms to meet their interest payments out of earnings. Firms that are more profitable, are less leveraged, or have lower borrowing costs will have higher ICRs, indicating a greater capacity to service their debt. An ICR of 2 or less is typically associated with an increased likelihood of distress.¹ As shown in figure 2, since 2008, the ICR for EME corporates has declined, on average, amid weaker earnings and higher leverage. As a result, risky debt of EME corporates—measured as the debt of firms with ICRs less than 2—has increased as a share of GDP, with most of that rise occurring in China (figure 3). Over the past two years, the firming of global growth has improved earnings, lowering the amount of risky debt and facilitating the orderly deleveraging process currently under way.



¹ For example, just before the Asian financial crisis, firms in Korea, Thailand, and Indonesia had an average ICR of 2; see Michael Pomerleano (1998) “Corporate Finance Lessons from the East Asian Crisis,” Viewpoint: Public Policy for the Private Sector Note 155 (Washington: World Bank, October), <https://openknowledge.worldbank.org/handle/10986/11531>.

Nevertheless, the share of risky debt in China remains above what was observed in the East Asian economies before the Asian financial crisis. In other EMEs, debt at risk appears manageable at less than 10 percent of GDP. However, the threshold at which debt at risk starts to be problematic can differ across countries. For example, while a country may not have as much vulnerability with respect to its corporate debt as, say, China, it may also have relatively less resources to address problems that may arise.

How vulnerable are EME NFCs to an increase in borrowing costs, perhaps related to monetary policy tightening in the advanced economies? To gauge these effects, we use firm-level data and stress each firm’s financials by increasing the average borrowing cost 1 percentage point (the effects of which are shown by the solid red portion of the bars in figure 4).² Except for China, where debt at risk is estimated to rise 20 percentage points of GDP, this increase in borrowing costs by itself would not be problematic. But higher global interest rates might be accompanied by broader financial stress and slower EME growth, similar to what is presented in our “Global Tightening Tantrum” alternative scenario in the Risks and Uncertainty section. To model these effects, we consider two additional shocks: reducing earnings 20 percent (the effects are shown by the red cross-hatched portion of the bars) and imposing a 20 percent exchange rate devaluation on the amount of debt that is denominated in foreign currency (the red hatched portion of the bars). Taken together, the shocks double the share of overall EME risky debt in GDP to around the level observed for the East Asian economies before the Asian financial crisis. The increase mostly reflects China. But even outside of China, the shocks more than double the amount of risky debt in many EMEs.

All told, a gradual normalization of monetary policy in the advanced economies, driven by faster economic growth, is not likely to cause significant financing problems for EME corporates. But a sharper rise in interest rates accompanied by broader financial stress could be quite severe for EME corporates. Such problems could threaten financial stability if they spill over to banks and create an adverse feedback loop that the authorities have trouble containing.

Figure 4: Emerging Market Nonfinancial Corporate Debt at Risk, 2017:Q3



Note: GDP is gross domestic product. Debt at risk is debt of firms with ratio of earnings before interest, tax, depreciation, and amortization to interest expense less than 2.
 * Exchange rate shock is 20 percent depreciation of the local currency against the dollar.
 ** Asian financial crisis is GDP-weighted average of Hong Kong, Singapore, South Korea, and Thailand in 1996, prior to crisis.
 Source: Diana Ayala, Milan Nedeljkovic, and Christian Saborowski (2015), “What Slice of the Pie? The Corporate Bond Market Boom in Emerging Economies,” IMF Working Paper WP/15/148 (Washington: International Monetary Fund, July).
<https://www.imf.org/en/Publications/WP/Issues/2016/12/31/What-Slice-of-the-Pie-The-Corporate-Bond-Market-Boom-in-Emerging-Economies-43060>;
 Bank for International Settlements; Standard & Poor’s Global Market Intelligence; Federal Reserve Board staff estimates.

² Although on the face of it this shock does not seem too large, it is applied to the average interest rate on the entire existing debt, not just on new debt. Given that the average interest rate for EME firms is about 4¾ percent, a 1 percentage point rise increases the interest expense about one-fifth.

of Canada is expected to gradually raise its policy rate from 1.25 percent to 3 percent by mid-2020.

- **Japan.** Recent readings of industrial production and the manufacturing PMI point to a step-down in Japanese GDP growth to 1¼ percent in the first quarter from 1.6 percent in the fourth. We see GDP growth edging down further to just below 1 percent, still slightly above its potential rate, by mid-2019 before temporarily turning negative as a result of a long-planned consumption tax hike. Compared with the March Tealbook, this projection is just a touch down in the first half of 2018 and unchanged thereafter.

Inflation picked up further to 2.5 percent in the first quarter, as retail energy and food prices rose rapidly. Still, with core inflation remaining quite subdued, we expect overall inflation to fall back to ¾ percent over the remainder of the year. Excluding the effects of the consumption tax hike on inflation in the fourth quarter of 2019, inflation is expected to stabilize around 1 percent through 2020, well short of the BOJ's 2 percent target. We expect the BOJ to keep its deposit rate slightly negative throughout the forecast period and to continue with asset purchases.

EMERGING MARKET ECONOMIES

- **China.** Real GDP growth picked up to 7.1 percent in the first quarter, ½ percentage point higher than in the March Tealbook. Growth was boosted by a recovery of industrial activity, as temporary curbs on production in heavily polluting industries were lifted. Exports also picked up from an already strong fourth quarter. We expect growth to slow to 6¼ percent in the second half of the year and to 6 percent by 2020, as export growth normalizes and as the authorities' efforts to reduce financial risks and rein in local government spending weigh on domestic demand.

We estimate that the proposed U.S. section 301 tariffs on imports from China would have a limited effect on the Chinese economy because the targeted goods, valued roughly at \$50 billion, account for a small share of China's GDP. (These tariffs would be on top of the recently levied steel and aluminum tariffs, which should have even more limited effects.) However, a substantial extension of tariffs—for example, to all Chinese imports into the United States—would indeed pose a material risk to the outlook for China and the emerging Asian region as a whole.

Inflation fell to 1.5 percent in the first quarter, almost one-half the fourth-quarter rate, mainly because of a decline in pork prices. We see inflation moving back up to its longer-term trend of 2½ percent by the middle of this year. Although China’s proposed retaliatory tariffs on its imports from the United States add an upside risk to this forecast, we expect the effect of these tariffs on prices to be limited.

- **Other Emerging Asia.** After slowing significantly at the end of last year as high-tech exports moderated, real GDP growth is estimated to have jumped to 4½ percent in the first quarter from 3.2 percent in the fourth, driven by renewed strength in the region’s overall exports. While export growth and industrial production have been strong, recent PMIs point to weaker momentum going into the second quarter. We expect growth to moderate to a trend pace of 3¾ percent by next year.
- **Mexico.** Recent solid indicators, such as construction through February as well as both manufacturing and services PMIs, suggest a continued recovery from the hurricanes and earthquakes that occurred last year. We estimate that GDP expanded 2¾ percent in the first quarter, a small step-down from 3.2 percent in the fourth, mainly because of a slower expansion of exports through February. We see growth picking back up to about 3 percent by early 2019, held up by strong external demand, diminished drag from fiscal consolidation, and stronger private consumption as falling inflation boosts real wages.

Headline inflation declined to 4.1 percent in the first quarter from over 5 percent in the second half of last year and nearly 10 percent a year ago. The decline in inflation over the past few months reflects the effects of monetary policy tightening, peso appreciation, and the fading effect of previous hikes in food prices. Despite falling inflation, the BOM kept its policy rate on hold at 7.5 percent in mid-April rather than cutting rates, citing continued concerns that adverse developments, such as an unfavorable outcome of NAFTA negotiations or financial volatility associated with Mexican elections in July, could lead to renewed peso depreciation.

- **Brazil.** After taking a breather in the fourth quarter, Brazil’s economy appears to have resumed its gradual climb out of the country’s deepest recession on record. We have penciled in growth of 2¼ percent in the first quarter amid a surge in exports, solid PMI readings, and improved consumer confidence. We expect the pace of activity to pick up gradually and reach 3 percent by 2019, supported by global demand, particularly for Brazil’s commodity exports. Political uncertainty remains

the major downside risk, especially given the urgent need for policymakers to tackle the country's fiscal problems amid an unpredictable outcome of the upcoming October presidential election. The front-runner of this election, former President Luiz Inácio Lula da Silva, was imprisoned earlier this month for corruption and is likely to be eliminated from the race.

Amid considerable economic slack, inflation remained subdued at about an annual rate of 3.1 percent in the first quarter, somewhat below the inflation target. The central bank is expected to cut its policy rate at its next meeting in May to a record low of 6.25 percent.

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The Foreign GDP Outlook

Real GDP*

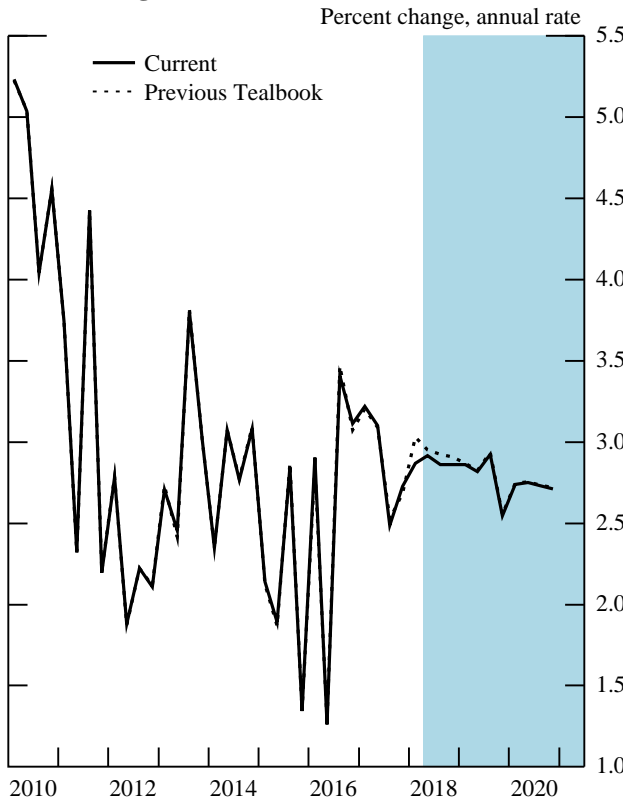
Percent change, annual rate

	2017			2018			2019	2020
	H1	Q3	Q4	Q1	Q2	H2		
1. Total Foreign	3.2	2.5	2.7	2.9	2.9	2.9	2.8	2.7
Previous Tealbook	3.1	2.5	2.7	3.0	3.0	2.9	2.8	2.7
2. Advanced Foreign Economies	3.1	2.1	2.0	1.9	2.1	2.0	1.8	1.7
Previous Tealbook	3.1	2.1	1.9	2.2	2.2	2.1	1.8	1.8
3. Canada	4.2	1.5	1.7	2.0	2.3	2.1	2.0	1.9
4. Euro Area	2.8	2.8	2.7	1.9	2.2	2.1	1.8	1.7
5. Japan	2.1	2.4	1.6	1.2	1.1	1.0	.3	.9
6. United Kingdom	1.1	1.9	1.6	1.3	1.7	1.7	1.6	1.7
7. Emerging Market Economies	3.2	2.8	3.4	3.9	3.7	3.7	3.8	3.7
Previous Tealbook	3.2	2.9	3.4	3.8	3.7	3.7	3.8	3.7
8. China	7.0	6.6	6.4	7.1	6.8	6.3	6.2	5.9
9. Emerging Asia ex. China	4.2	5.1	3.2	4.4	3.9	4.0	3.8	3.7
10. Mexico	1.7	-.7	3.2	2.7	2.8	2.8	2.9	3.0
11. Brazil	3.8	1.0	.2	2.3	2.5	2.5	3.0	2.6

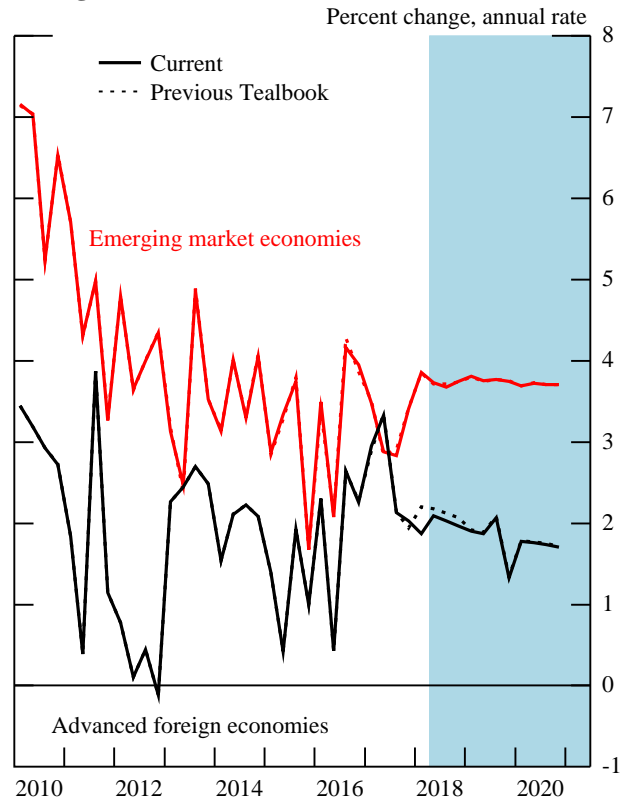
* GDP aggregates weighted by shares of U.S. merchandise exports.

Int'l Econ Devel & Outlook

Total Foreign GDP



Foreign GDP



The Foreign Inflation Outlook

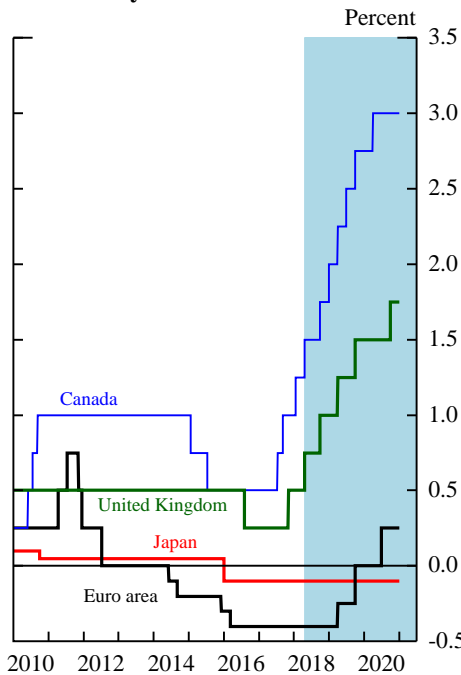
Consumer Prices*	Percent change, annual rate							
	2017			2018			2019	2020
	H1	Q3	Q4	Q1	Q2	H2		
1. Total Foreign	2.5	2.3	3.0	2.6	2.6	2.5	2.5	2.4
Previous Tealbook	2.4	2.3	3.0	2.6	2.6	2.5	2.5	2.4
2. Advanced Foreign Economies	1.3	1.2	2.1	2.6	1.9	1.6	1.8	1.7
Previous Tealbook	1.3	1.2	2.1	2.1	1.5	1.5	1.8	1.7
3. Canada	1.4	1.4	3.0	3.6	2.6	2.1	2.0	2.0
4. Euro Area	1.5	1.1	1.7	2.1	1.9	1.4	1.5	1.7
5. Japan	-1	.7	1.9	2.5	.7	.7	2.3	1.0
6. United Kingdom	3.4	2.4	3.0	2.5	2.3	2.3	2.2	2.1
7. Emerging Market Economies	3.3	3.1	3.7	2.7	3.1	3.2	3.0	2.9
Previous Tealbook	3.2	3.1	3.7	2.9	3.4	3.3	3.0	2.9
8. China	1.0	2.2	2.9	1.5	2.2	2.6	2.5	2.5
9. Emerging Asia ex. China	2.0	2.0	3.2	2.3	3.0	3.2	3.1	3.0
10. Mexico	8.0	5.4	5.0	4.1	4.0	3.7	3.3	3.2
11. Brazil	2.7	2.3	3.6	3.1	3.4	4.3	4.3	4.3

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

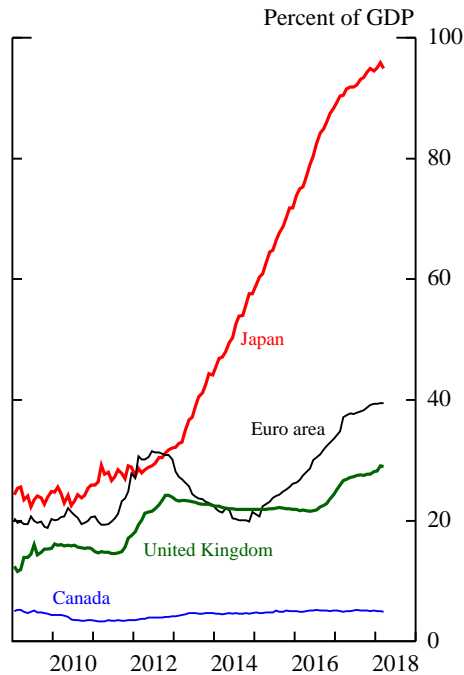
Int'l Econ Devel & Outlook

Foreign Monetary Policy

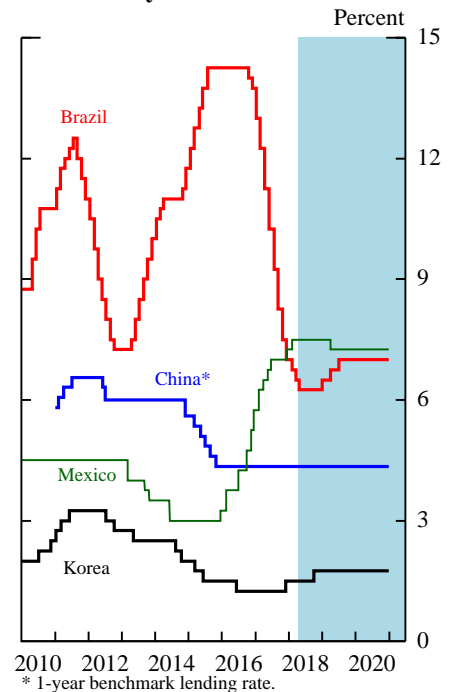
AFE Policy Rates



AFE Central Bank Balance Sheets

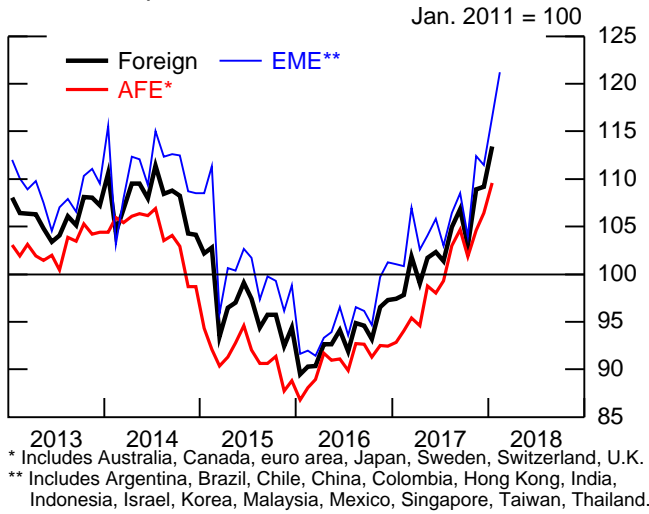


EME Policy Rates

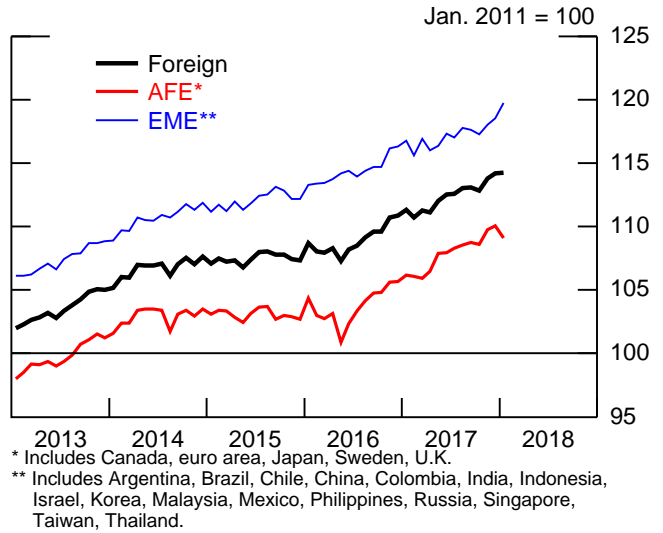


Recent Foreign Indicators

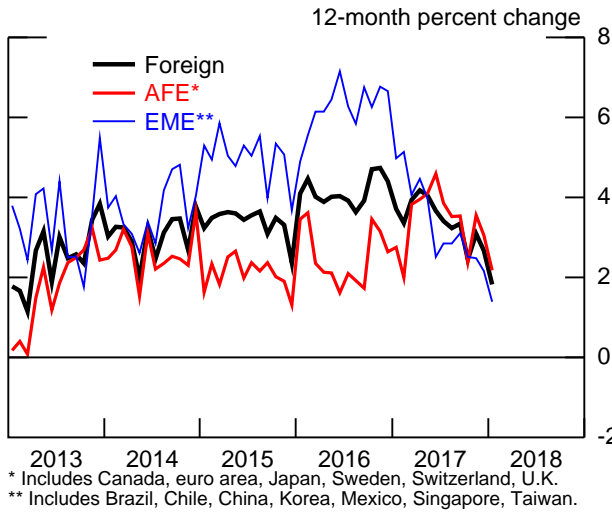
Nominal Exports



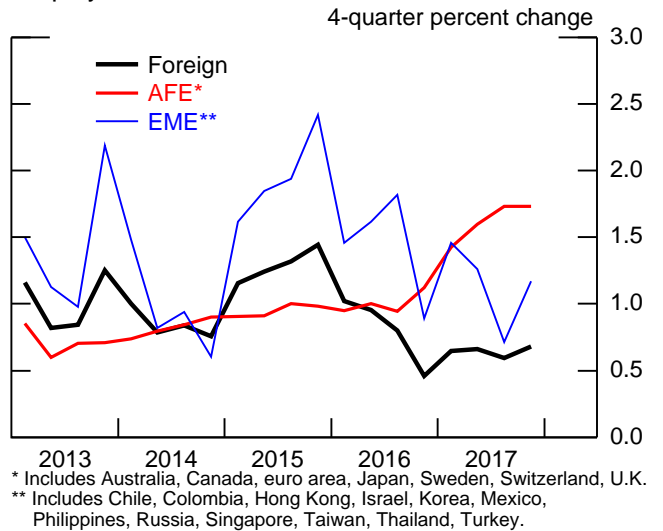
Industrial Production



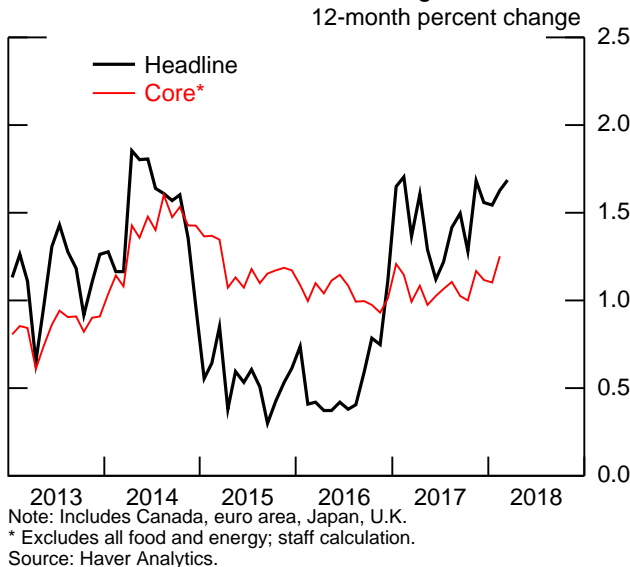
Retail Sales



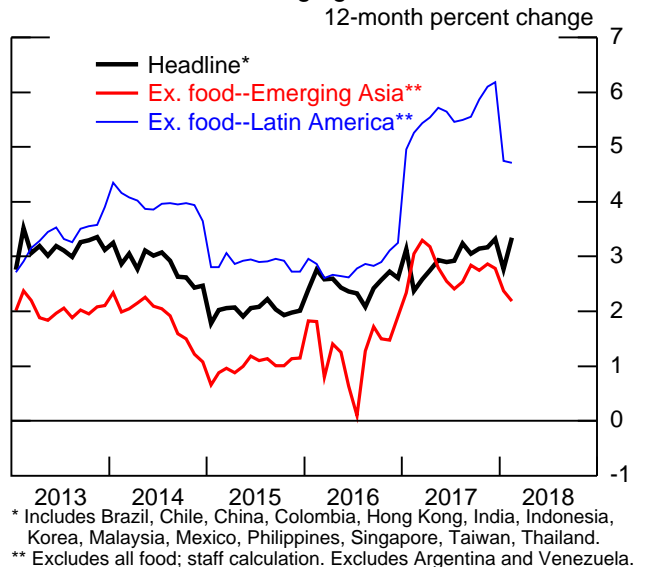
Employment



Consumer Prices: Advanced Foreign Economies

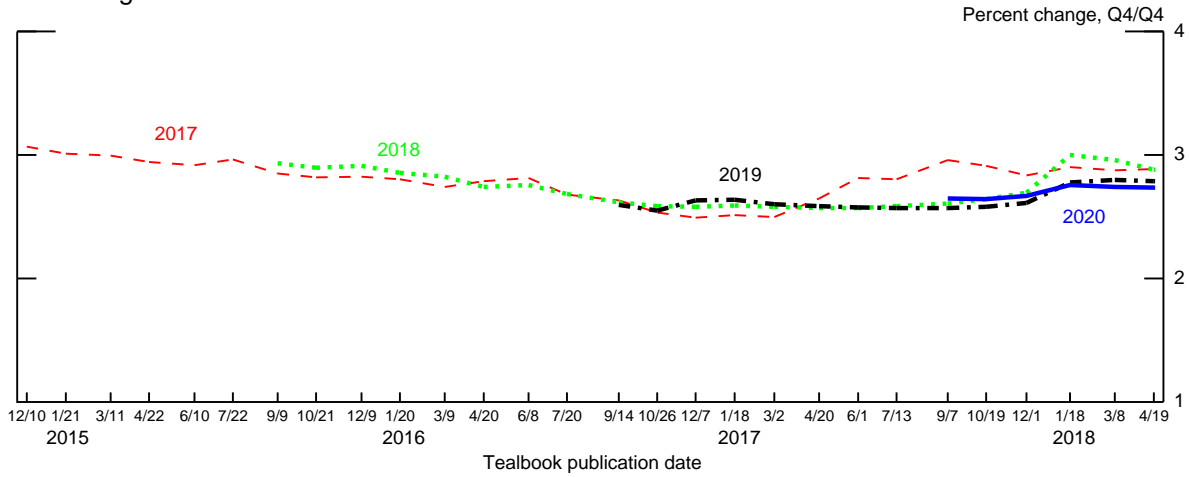


Consumer Prices: Emerging Market Economies

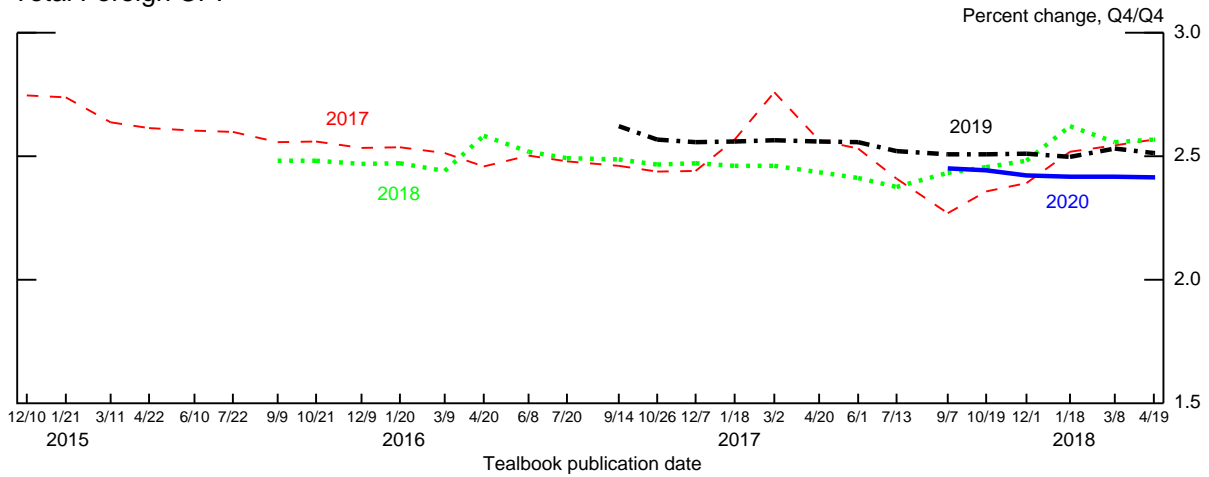


Evolution of Staff's International Forecast

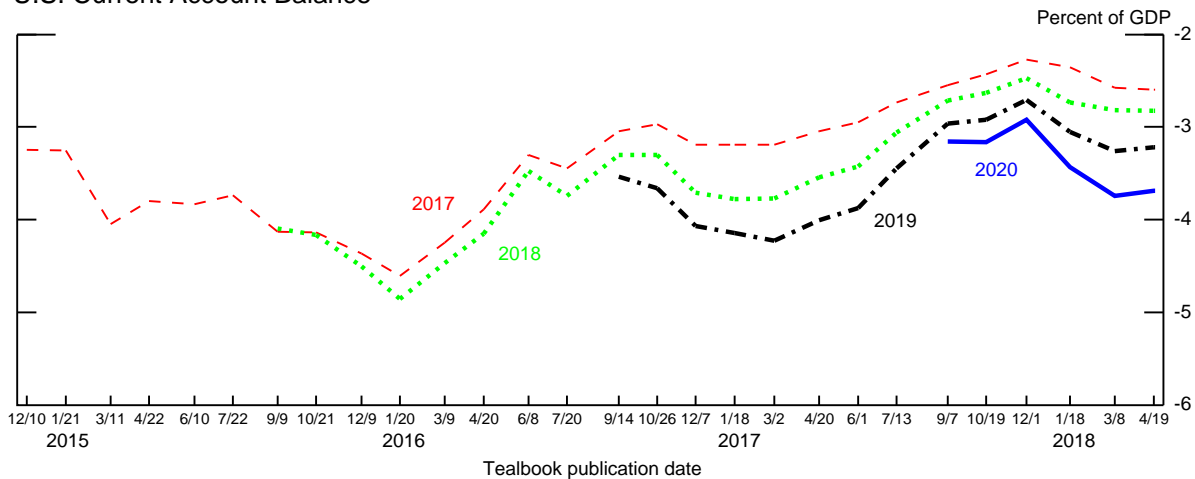
Total Foreign GDP



Total Foreign CPI



U.S. Current Account Balance



Int'l Econ Devel & Outlook

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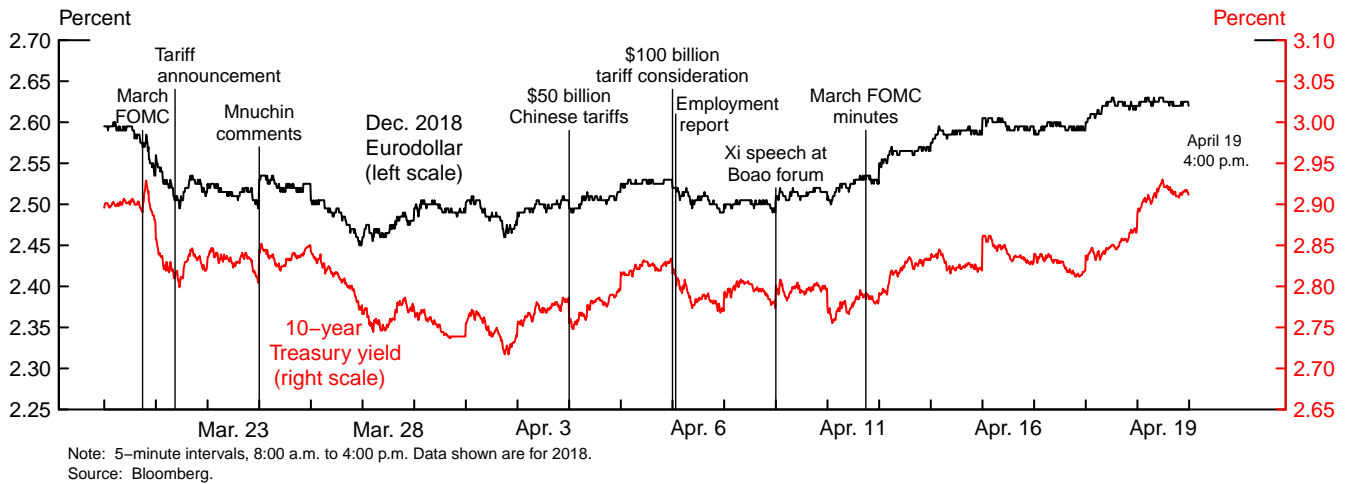
Financial Market Developments

Domestic equity markets continued to experience heightened volatility over the intermeeting period as a result of developments in U.S.–China trade policy and the technology sector, though they were considerably less volatile than in early February. On net, however, market participants’ outlook for monetary policy and economic growth appears to be largely unchanged.

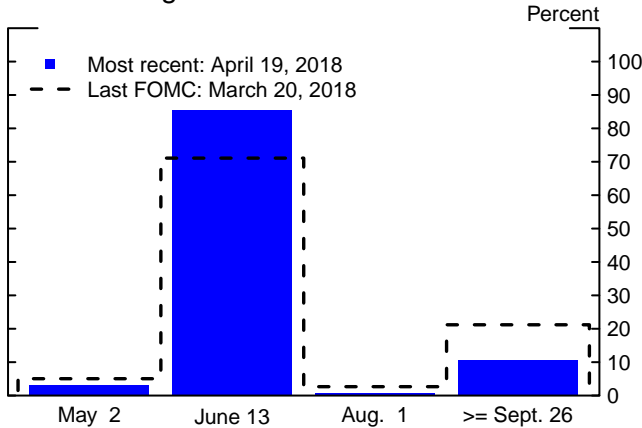
- A straight read of market quotes shows that the probability of a rate hike at the June meeting increased somewhat to 85 percent, with two hikes priced in between now and the end of this year.
- The nominal Treasury yield curve continued to flatten, driven primarily by an increase in short-term yields, as longer-term yields were roughly unchanged. Carry-adjusted TIPS-based measures of inflation compensation increased over the period.
- Broad U.S. equity price indexes edged down on net. The VIX has declined since the March FOMC meeting, though it is high compared with last year, and realized volatility of equity prices remained elevated relative to its average over the past few years. Credit spreads on investment-grade corporate bonds were little changed, while those on speculative-grade bonds narrowed a bit.
- Conditions in foreign financial markets were not much changed since the last FOMC meeting. Foreign equity prices exhibited notable fluctuations and ended the period modestly higher outside of emerging Asia. Longer-term foreign sovereign yields moved little, and the broad dollar depreciated slightly.
- Rates in short-term dollar funding markets remained elevated but do not seem to indicate credit risk concerns. Changes in rates and volumes over quarter-end were relatively muted.

Policy Expectations and Treasury Yields

Selected Interest Rates

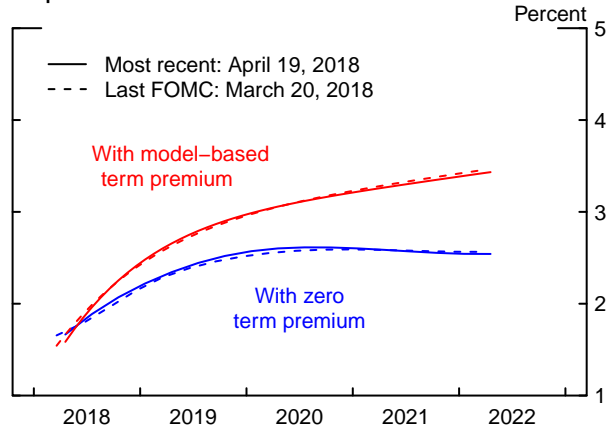


Market-Implied Probability Distribution of the Timing of Next Rate Increase



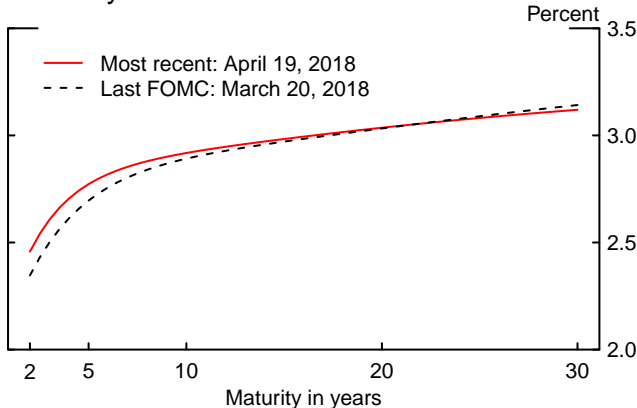
Note: Probabilities implied by a binomial tree fitted to settlement prices on federal funds futures contracts, assuming the next policy action is either no change or a 25 basis point increase in rates and no intermeeting moves. The effective federal funds rate until the next FOMC meeting is assumed to be equal to the observed rate on the previous non-month-end business day.
Source: CME Group; Federal Reserve Board staff estimates.

Implied Federal Funds Rate



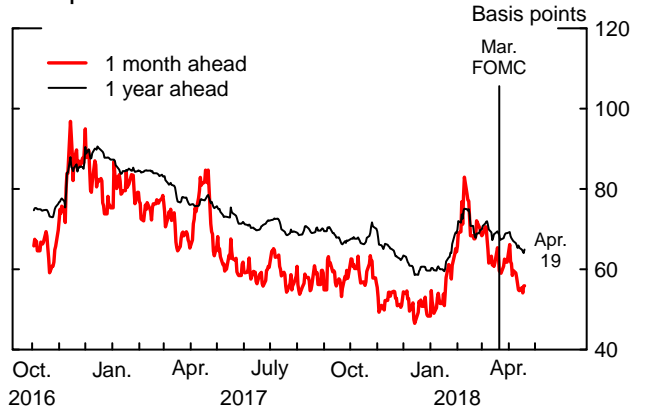
Note: Zero term premium path is estimated using overnight index swap quotes with a spline approach and a term premium of zero basis points. Model-based term premium path is estimated using a term structure model maintained by Board staff and corrects for term premium.
Source: Bloomberg; Federal Reserve Board staff estimates.

Treasury Yield Curve



Note: Smoothed yield curve estimated from off-the-run Treasury coupon securities. Yields shown are those on notional par Treasury securities with semiannual coupons.
Source: Federal Reserve Bank of New York; Federal Reserve Board staff estimates.

Option-Implied Volatilities on 10-Year Swap Rate



Note: Implied volatility on the 10-year swap rate 1 month and 1 year ahead is derived from swaptions.
Source: Barclays; Federal Reserve Board staff estimates.

Financial Markets

POLICY EXPECTATIONS AND ASSET MARKET DEVELOPMENTS

Domestic Developments

FOMC communications over the intermeeting period were generally viewed by market participants as reflecting an overall upbeat outlook for economic growth and as consistent with a continued gradual removal of monetary policy accommodation. The FOMC's decision to raise the target range for the federal funds rate 25 basis points at the March meeting was widely anticipated. Nevertheless, the market reaction to the March FOMC communications was consistent with slightly more accommodative policy than expected, as the median target rate path in the March SEP implied three rate hikes in 2018 whereas some investors had anticipated four rate hikes. Some investors pointed to the median of participants' SEP projections for core PCE inflation rising above 2 percent in both 2019 and 2020 as an indication of the Committee's willingness to continue along a gradual path of increases in the target range for the federal funds rate even if inflation temporarily moves above target. Market reaction to the release of the March FOMC minutes later in the intermeeting period was minimal.

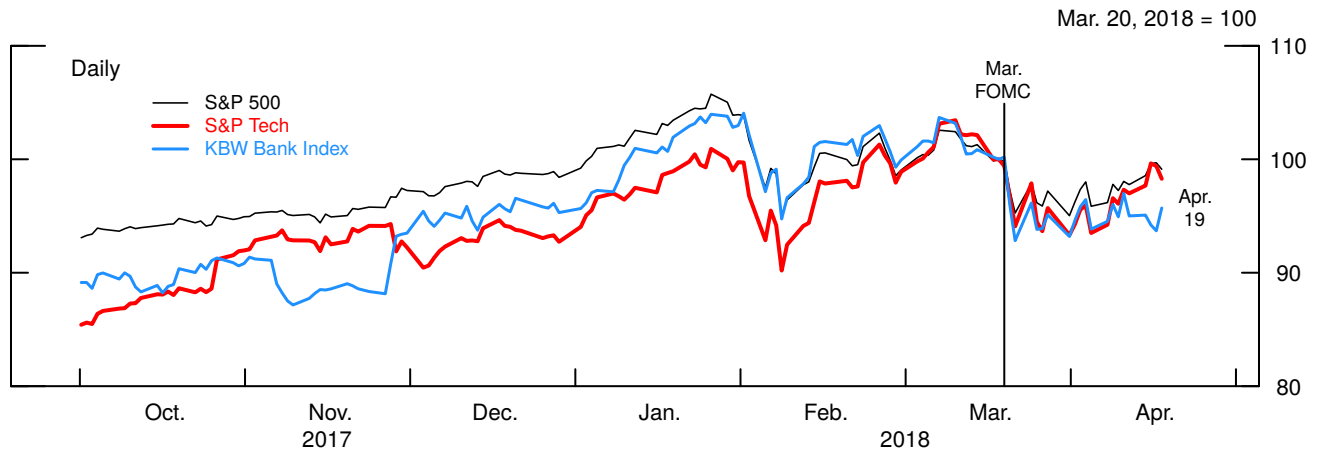
Domestic data releases over the intermeeting period generally elicited limited market reaction. Total nonfarm payroll employment in the March Employment Situation report came in notably below reported market expectations, but market commentaries attributed the weakness in part to weather-related effects. The average hourly earnings component of the March employment report and the March CPI both printed largely in line with expectations.

A straight read of quotes on federal funds futures contracts shows that the market-implied probability for the next rate hike occurring at the June FOMC meeting moved up to around 85 percent since the March FOMC meeting. OIS-implied federal funds rates unadjusted for term premiums suggest that two rate hikes are priced in between now and the end of this year, while a staff model that adjusts for term premiums implies three hikes. Implied rates at the end of 2019 and 2020 were about unchanged.

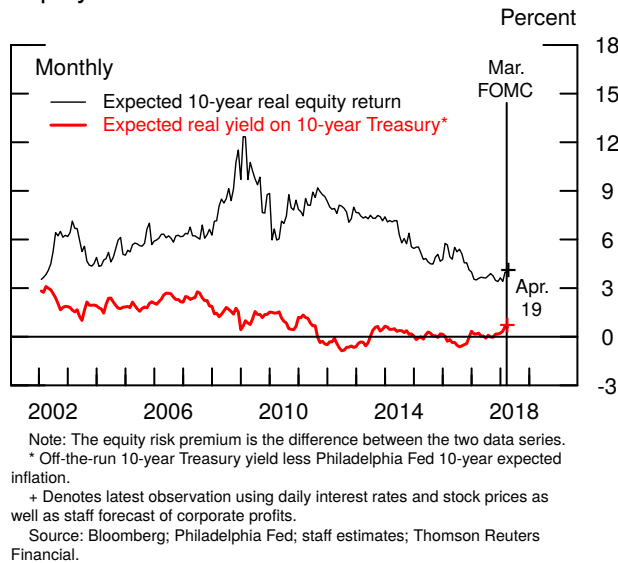
The nominal Treasury yield curve flattened a bit further over the intermeeting period, with yields on 2-year Treasury securities up 11 basis points and yields on 10-year Treasury securities higher by 3 basis points. The spread between 10-year and 2-year Treasury securities stands at about the 20th percentile of its distribution since 1990. If adjusted for term premiums, the difference between the two rates is currently at about the

Corporate Asset Market Developments

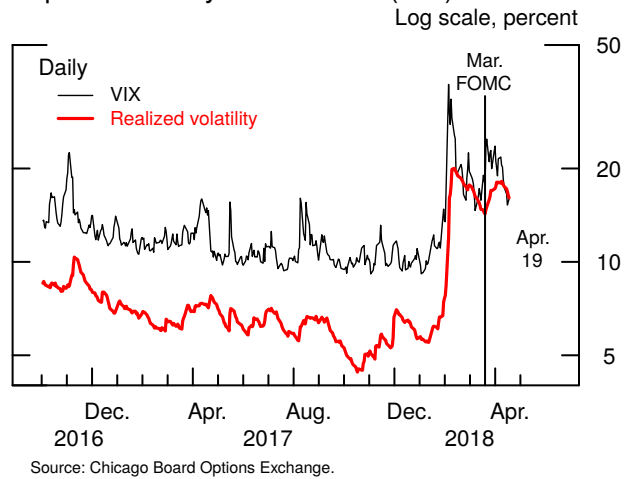
S&P 500 Stock Price Index



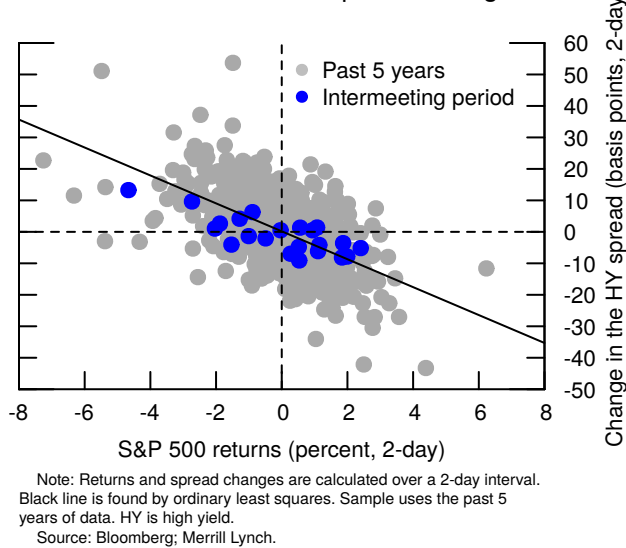
Equity Risk Premium



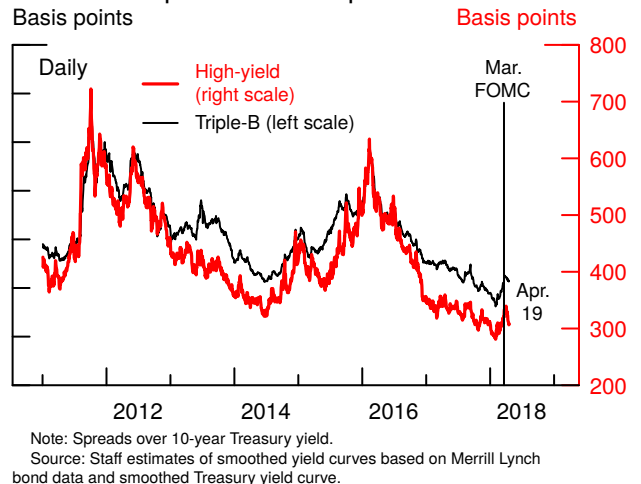
Implied Volatility on S&P 500 (VIX)



S&P 500 Returns vs. HY Spread Changes



10-Year Corporate Bond Spreads



40th percentile of its distribution since 1990.¹ TIPS-based measures of inflation compensation increased on net.

Measures of option-implied volatility on long-term rates continued to decline over the intermeeting period after their marked increase earlier this year, and they are now close to the levels seen late last year.

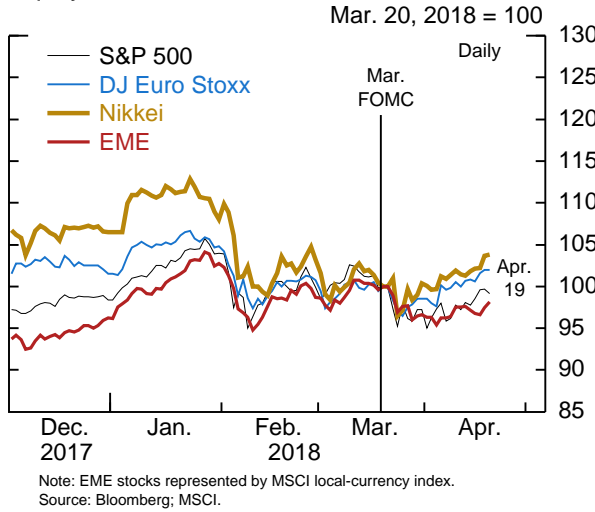
Following the sharp increase in early February, realized volatility in the equity market remained somewhat elevated due in large part to news related to trade policy. However, the S&P 500 index declined only a bit over the period on net. Equity prices deteriorated as trade tensions between the U.S. and China escalated early in the intermeeting period, although prices subsequently improved as tensions showed signs of easing. Additionally, negative technology sector–related news and concerns about increased government oversight of the sector reportedly weighed on investor sentiment, though the sector ended the period only slightly lower than the broader index. Bank equity prices declined about 4 percent over the intermeeting period and underperformed broad equity indexes, on net, likely reflecting concerns about trade policy, tepid loan growth, and weaker-than-expected trading revenues. One-month-ahead option-implied volatility on the S&P 500 index—the VIX—declined but remained at elevated levels relative to the previous year, ending the period at approximately 16 percent.

Volatility in the equity market did not spill over into the corporate bond market. On days with large negative equity returns, spreads on high-yield corporate bonds changed less than would be expected from their historical relationship with stock prices. On net, spreads on yields of investment- and speculative-grade corporate bonds over comparable-maturity Treasury securities increased 3 basis points and declined 13 basis points, respectively.

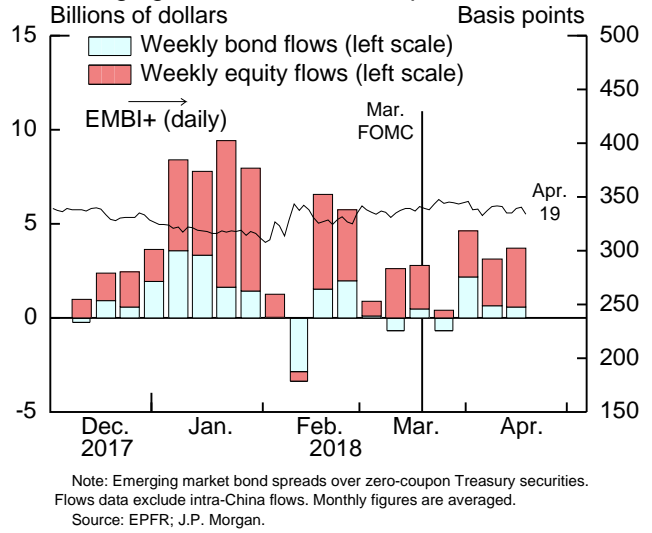
¹ For more on the information content of the term premium portion of the term spread for economic activity, see Peter Johansson and Andrew Meldrum (2018), “Predicting Recession Probabilities Using the Slope of the Yield Curve,” FEDS Notes (Washington: Board of Governors of the Federal Reserve System, March 1), <https://www.federalreserve.gov/econres/notes/feds-notes/predicting-recession-probabilities-using-the-slope-of-the-yield-curve-20180301.htm>; and Michael D. Bauer and Thomas W. Mertens (2018), “Economic Forecasts with the Yield Curve,” FRBSF Economic Letter 2018-07 (San Francisco: Federal Reserve Bank of San Francisco, March), <https://www.frbsf.org/economic-research/publications/economic-letter/2018/march/economic-forecasts-with-yield-curve>.

Foreign Developments

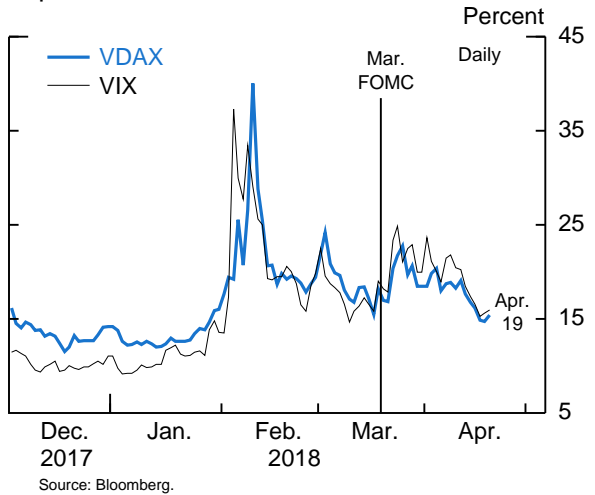
Equity Indexes



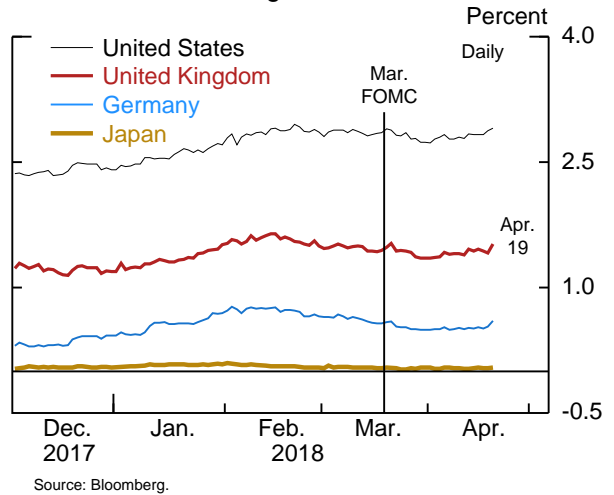
Emerging Market Flows and Spreads



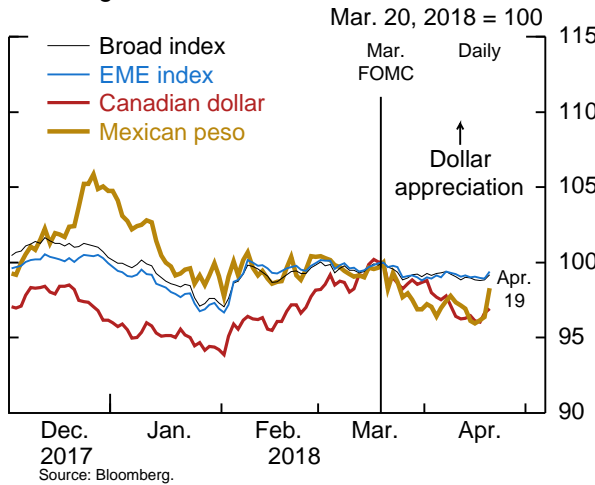
Implied Volatilities



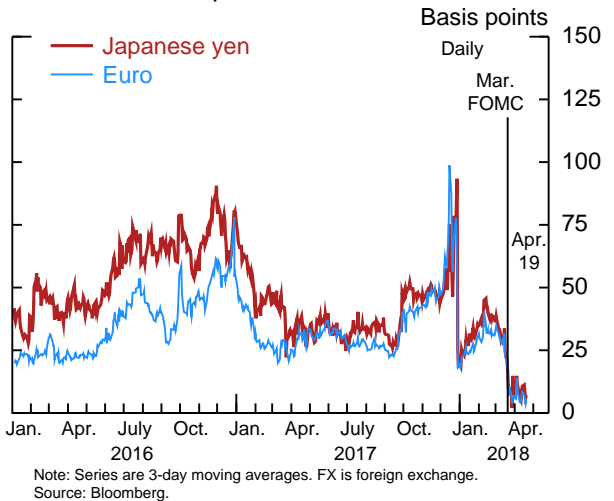
10-Year AFE Sovereign Yields



Exchange Rates



3-Month FX Swap Bases



Financial Markets

Foreign Developments

Global equity markets were volatile since the March FOMC meeting, with investors in foreign markets also attuned to developments related to trade policies between the United States and China and to news about the U.S. technology sector. On balance, foreign equity price movements were mixed, long-term foreign sovereign yields were generally little changed, and the broad dollar depreciated slightly over the period. In Russia, although the currency depreciated sharply and equity prices fell following the introduction of the new round of U.S. sanctions, stresses in Russian markets did not spill over to other financial markets.

Net changes in foreign equity prices did not exhibit a strong overall pattern. Japanese and European broad equity indexes outperformed their U.S. counterparts, ending the period somewhat higher. Equity price indexes in Mexico and other Latin American countries were modestly higher, while those in some emerging Asian countries—which may be more directly affected by a potential deterioration in U.S.–China trade relations—were lower. On balance, capital continued to flow into emerging market mutual funds and emerging market bond spreads were little changed. Measures of implied volatilities of foreign equities fluctuated since the previous FOMC meeting and ended the period somewhat lower.

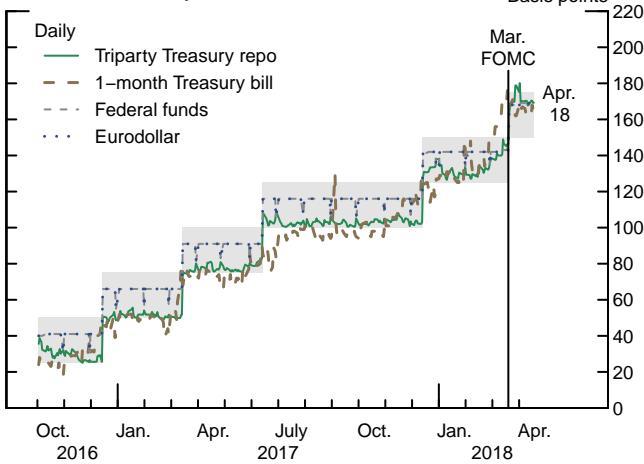
Over the intermeeting period, market-based measures of policy expectations were generally little changed in the advanced foreign economies, with most of their central banks still expected to gradually move toward less accommodative monetary policy over the next couple of years. Long-term sovereign yields in the advanced foreign economies also showed little movement.

On net, the broad dollar index declined about $\frac{3}{4}$ percent, largely because relatively positive news about the current round of NAFTA negotiations led to appreciation of the Mexican peso and Canadian dollar, two currencies with large weights in the dollar index.

At the March quarter-end, money market conditions in Europe and Japan were characterized as in line with expectations and consistent with previous quarter-end dynamics. Over the intermeeting period, three-month currency swap basis spreads, which at times have indicated dollar funding pressures abroad, narrowed to the lowest levels in recent years. Market participants attributed the decline to continued decreases in

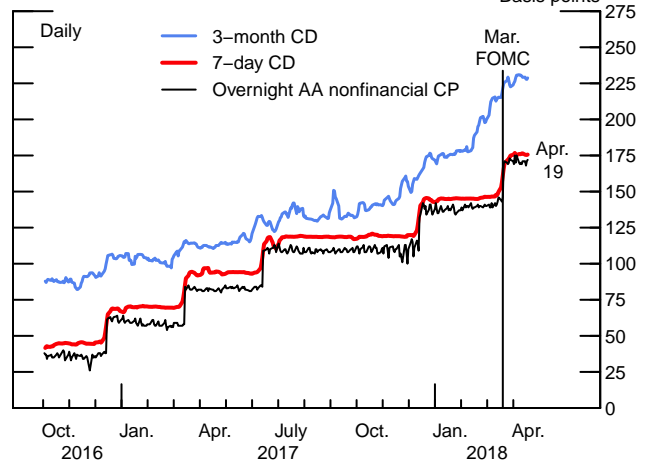
Short-Term Funding Markets and Federal Reserve Operations

Selected Money Market Rates



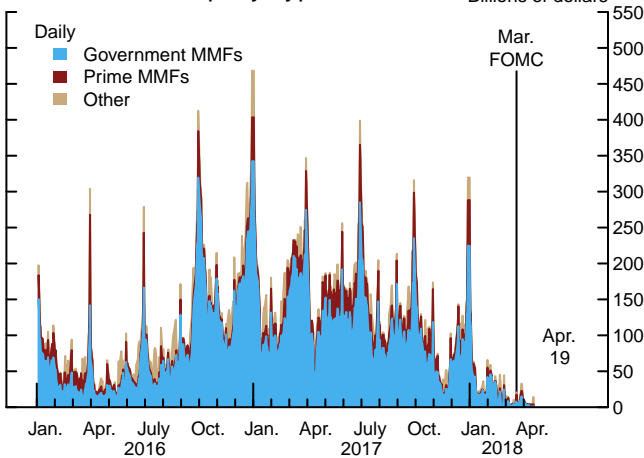
Note: Federal funds rate is a weighted median. Shaded area is the target range for the federal funds rate. Repo is repurchase agreement.
 Source: Federal Reserve Bank of New York; Federal Reserve Board, Form FR 2420, Report of Selected Money Market Rates.

CP and CD rates



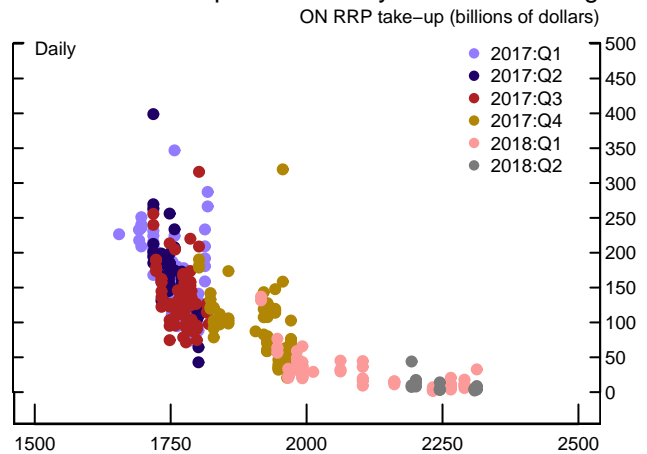
Note: CD rates are a 5-day moving average. CP is commercial paper; CD is certificate of deposit.
 Source: Depository Trust & Clearing Corporation.

ON RRP Take-Up, by Type



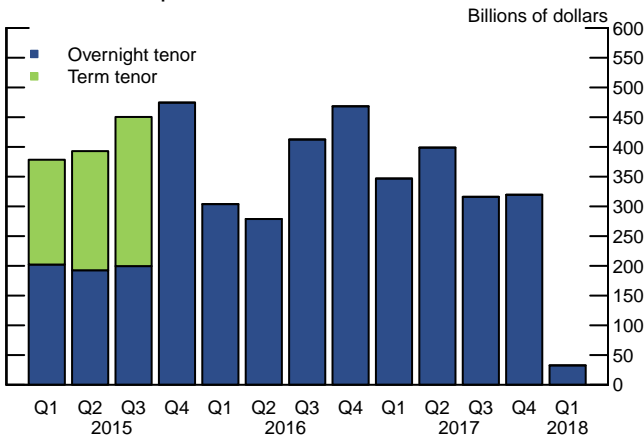
Note: ON RRP is reverse repurchase agreement; MMF is money market fund.
 Source: Federal Reserve Bank of New York.

ON RRP Take-Up and Treasury Bills Outstanding



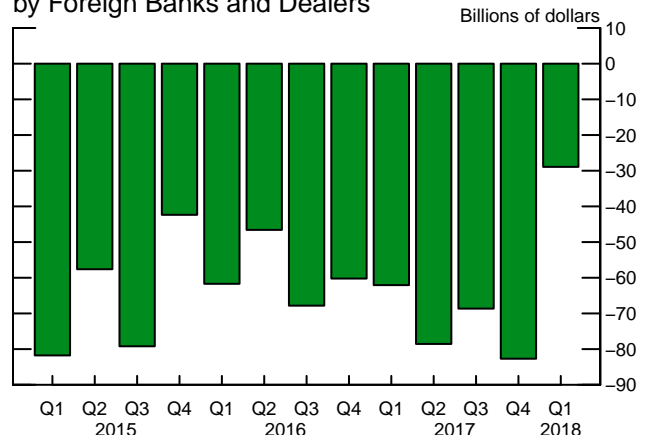
Note: ON RRP is overnight reverse repurchase agreement. Treasury bills outstanding = gross amount issued – gross amount matured + outstanding; calculated between Jan. 2017 and Apr. 2018.
 Source: Federal Reserve Bank of New York; Department of the Treasury.

RRP Take-Up on Quarter-Ends



Note: RRP is reverse repurchase agreement.
 Source: Federal Reserve Bank of New York.

Drops in Outstanding Volumes on Quarter-Ends, by Foreign Banks and Dealers



Note: The drop in outstanding volumes equals the sum of triparty Treasury repo and federal funds volumes. The drop on quarter-end is calculated as positions on quarter-end less positions on the business day immediately before quarter-end. This graph considers March 29, 2018, as the quarter-end date of 2018:Q1.
 Source: Federal Reserve Bank of New York.

demand for dollar hedges by foreign investment accounts, as well as reduced dollar borrowing through the currency swap market by foreign banks.

SHORT-TERM FUNDING MARKETS AND FEDERAL RESERVE OPERATIONS

Conditions in short-term funding markets remained generally stable over the intermeeting period despite the continuation of notably elevated spreads in segments of the money market (see the box “Recent Pressures in Money Markets”). Both the effective federal funds rate and the overnight bank funding rate continued to trade in the upper third of the target range, while repo and Treasury bill rates remained elevated. Because elevated rates on other short-term investments offered an attractive alternative for market participants, take-up at the Federal Reserve’s ON RRP facility remained subdued, averaging about \$7 billion per day excluding quarter-end.

The Federal Reserve Bank of New York began publishing three new overnight Treasury repo rates on April 3, 2018 (see the box “New Overnight Treasury Repo Rates”).

Money market dynamics over quarter-end were muted relative to previous quarter-ends. The effective federal funds rate dropped only 1 basis point, in contrast to the typically observed decline of around 9 basis points.² Foreign banks and dealers usually reduce their activity in funding markets on quarter-end to improve their regulatory ratios around reporting dates. Such behavior was muted at the end of March, which reportedly led to relatively small movements in rates and volumes, and contributed to the all-time-low quarter-end ON RRP take-up of \$33 billion.

The Federal Reserve’s balance sheet normalization has continued as scheduled. Market participants reported no notable effect on money markets, Treasury yields, or option-adjusted spreads on current-coupon MBS as a result of the normalization process. Since the start of balance sheet normalization through March 2018, the Federal Reserve’s holdings of Treasury securities have decreased by \$40 billion, and its holdings of agency securities have decreased by \$16 billion. Consistent with the Committee’s Policy Normalization Principles and Plans, the monthly caps on reductions of Treasury and agency securities increased in April to \$18 billion and \$12 billion, respectively.

² The Good Friday market holiday on March 30 coincided with the March quarter-end and could have contributed to these atypical dynamics.

Recent Pressures in Money Markets

The upward pressure on private money market rates, beyond that driven by expected monetary policy, persisted over the intermeeting period. In unsecured markets, the London interbank offered rate (LIBOR) and rates on commercial paper (CP) and negotiable certificates of deposit (CDs) remained abnormally high relative to overnight index swap (OIS) rates of comparable maturities, particularly at tenors exceeding one month. In secured markets, Treasury repo rates remained elevated relative to the effective federal funds rate, and the spread is also very high by historical standards. Table 1 shows that a variety of private spreads are currently near the top ends of their historical ranges. Since the March FOMC meeting, however, spreads on Treasury bills narrowed some, widening the gap between private money market rates and those on Treasury bills, as shown in figure 1.

Several factors may have contributed to the wide spreads for private instruments, although none appears to fully explain the unusually high level of current spreads. First, the surge in Treasury bill supply in the first quarter appears to have pushed Treasury and unsecured private rates higher, and the effects on private rates may be lingering temporarily even as bill issuance has slowed and rates have edged down. Consistent with such a view, spreads on forward rate agreements, or FRAs, over

Table 1. Current Private Spreads and Historical Ranges

Spread	Value as of 4/16/2018 (bps)	Percentile of Historical Distribution (%) ¹
1. 3m LIBOR—3m OIS	59	90
2. 3m T-bill—3m OIS	-3	92
3. 3m A2/P2 nonfin CP—3m OIS ²	94	92
4. 3m AA nonfin CP—3m OIS	20	96
5. 3m CD—3m OIS	57	99
6. BBG: 3m CD—3m OIS	56	88
7. PD Treas. Repo—EFFR	4	90

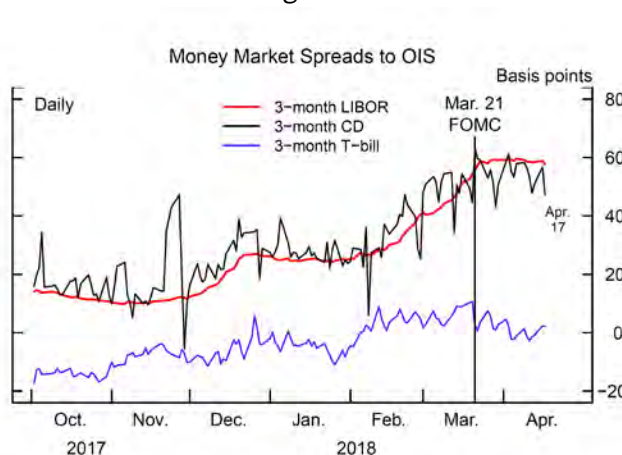
¹ The sample periods begin on 12/4/2001 for lines 1 to 4 and line 6, 12/14/2015 for line 5, and 1/3/1972 for line 7.

² Data as of 4/9/2018.

Note: BBG is Bloomberg, PD is Primary Dealer, and EFFR is effective federal funds rate.

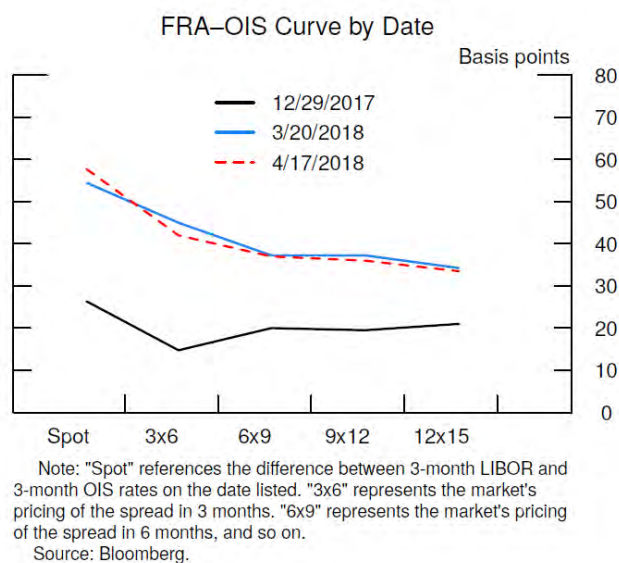
Source: Depository Trust & Clearing Corporation; Federal Reserve Board, H.15.

Figure 1



Source: Depository Trust & Clearing Corporation. Federal Reserve Board.

Figure 2



OIS, shown in figure 2, suggest that the LIBOR–OIS spread is expected to narrow in coming months. Increased Treasury supply also appears to be an important factor in pressuring secured rates higher, as dealers had to finance sizable issuance in February and March.

In unsecured markets, a second possible factor is that anticipated tax-induced repatriation flows may have reduced offshore demand for private money market securities with longer tenors, and aggregate demand for these securities would fall if repatriated cash is put to other uses. Anecdotal reports from dealers suggest that cash-rich nonfinancial firms have shifted holdings toward very short-dated instruments. In contrast, data from the offshore money market fund (OMMF) sector only weakly support the repatriation story. OMMF assets under management have declined in recent weeks, but the funds do not appear to be shifting away from longer-dated assets in anticipation of further outflows, as weighted average maturities are little changed.

Other possible explanations are less compelling. Some market participants have suggested that the base erosion anti-abuse tax, or BEAT, which may effectively penalize foreign banks that raise funds through foreign affiliates—and thus encourage raising short-term funds in U.S. markets—might eventually boost unsecured rates. But the effects of the tax are unlikely to have materialized yet, and issuance of CP and CDs has not increased in recent months. Another possibility is that credit risk has driven rates higher. However, staff analysis of the historical relationship between changes in three-month LIBOR–OIS spreads and aggregate credit default swap (CDS) spreads of the largest banks indicates that the recent modest widening of these CDS spreads explains only a trivial fraction of the LIBOR–OIS widening. Moreover, conversations with market participants have not suggested any heightened credit-risk concerns.

New Overnight Treasury Repo Rates

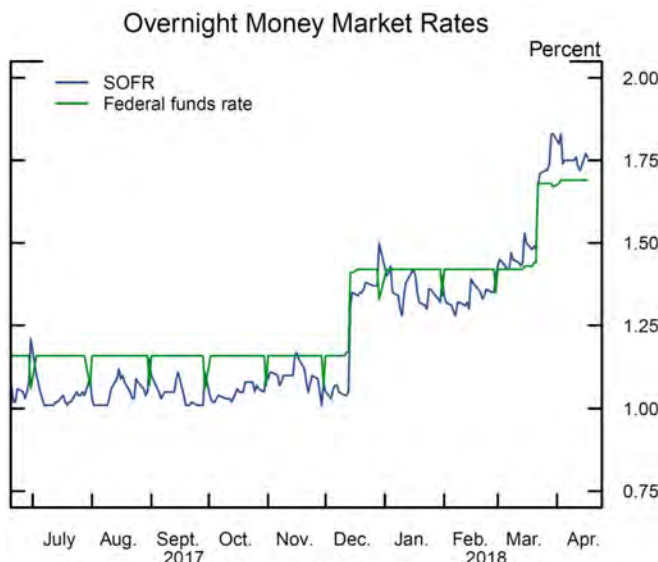
On April 3, 2018, the Federal Reserve Bank of New York began publishing three new overnight Treasury repo rates. The purpose of the new rates is to increase the transparency of repo market trading by providing interest rate and volume measures that cross the major repo market segments. All of the repo rates exclude transactions in which the Federal Reserve is a counterparty, such as take-up at the ON RRP facility.

The Tri-Party General Collateral Rate (TGCR) covers the “triparty” segment in which securities dealers borrow cash directly from investors, including money market funds, in trades facilitated by a third-party clearing bank. The Broad General Collateral Rate (BGCR) includes all transactions in the TGCR and also includes blind-brokered transactions between dealers that occur on the Fixed Income Clearing Corporation’s (FICC) GCF Repo service.

The Secured Overnight Financing Rate (SOFR)—the blue line in the chart—measures the general cost of financing Treasury securities overnight across all repo market segments for which data are available, providing the broadest coverage of the repo market. A broad Treasury repo rate was previously not available to the public. The SOFR is calculated from all transactions in the BGCR, as well as bilateral transactions that are cleared by the FICC. The SOFR excludes bilateral transactions that are executed at very low rates because such trades tend to be motivated by the lender’s need to obtain a specific security as collateral rather than the need to invest cash.

In June 2017, the Alternative Reference Rates Committee selected the SOFR as its recommended alternative to U.S. dollar LIBOR, which is currently referenced in derivatives contracts with about \$190 trillion of notional value as well as \$10 trillion of loans and securities. The transition from LIBOR to SOFR is expected to take a number of years, and daily publication of the rate is a key step in the process.

Financial Markets



Note: The published value of the SOFR is shown beginning April 2, 2018. Previous values of the SOFR are indicative rates produced before the start of SOFR publication.
Source: Federal Reserve Bank of New York.

Financing Conditions for Businesses and Households

Data received over the intermeeting period continue to indicate that financing conditions for businesses and households remain supportive of economic activity.

- Financing conditions for nonfinancial corporations remained accommodative. Gross issuance of corporate bonds and leveraged loans was strong in March, and equity issuance was robust. The extension of bank credit to businesses increased following relatively weak growth in January and February.
- Conditions in the residential mortgage market remained supportive of financing for most borrowers. For borrowers with low credit scores, conditions remained tight but have continued to ease gradually.
- Growth in consumer loans moderated early this year from the more rapid pace seen late last year, and banks responding to the April Senior Loan Officer Opinion Survey on Bank Lending Practices (SLOOS) reported tighter standards for both credit card and auto loans. Nonetheless, on the whole, financing conditions in consumer credit markets remained largely supportive of growth in household spending.

BUSINESS FINANCING CONDITIONS

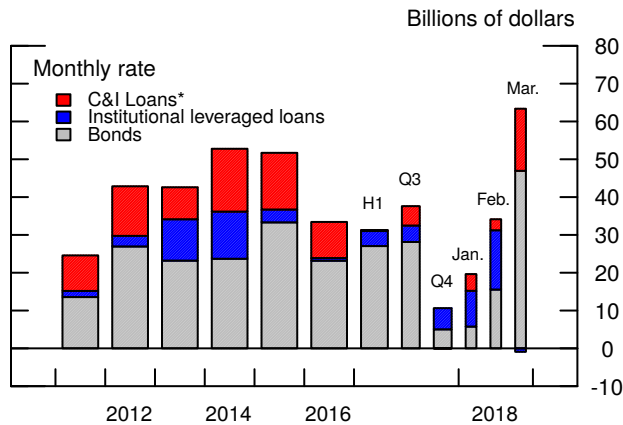
Nonfinancial Corporations

Financing conditions for nonfinancial corporations remained accommodative over the intermeeting period. Corporate bond spreads continued to be low by historical standards, and following a somewhat subdued start to the year, gross issuance of investment-grade corporate bonds was strong in March.¹ Issuance of speculative-grade debt was also solid in March, in line with its average volume over the past few years. Institutional leveraged loan issuance in February and March was strong, largely reflecting strength in demand from investors, including considerable funding for M&A activity. Spreads on new issues of lower-rated institutional loans were roughly unchanged over the intermeeting period, while spreads for higher-rated loans narrowed a little further.

¹ In particular, one very large M&A-related issue of \$40 billion was reportedly well received by investors, suggesting that substantial market demand remains for investment-grade corporate debt.

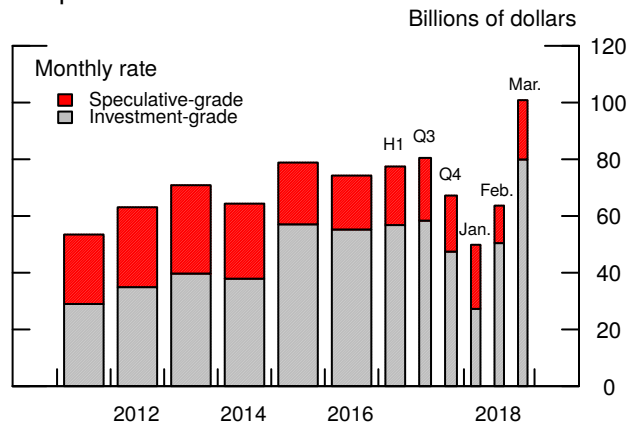
Business Finance

Selected Components of Net Debt Financing, Nonfinancial Firms



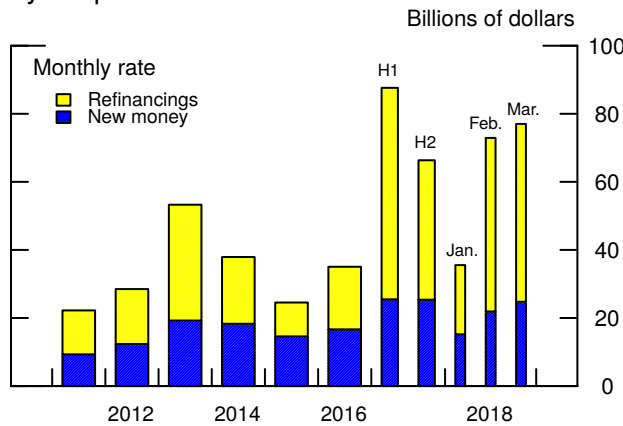
Note: C&I is commercial and industrial.
 * Period-end basis.
 Source: Depository Trust & Clearing Corporation; Mergent Fixed Income Securities Database; Federal Reserve Board.

Gross Issuance of Nonfinancial Corporate Bonds



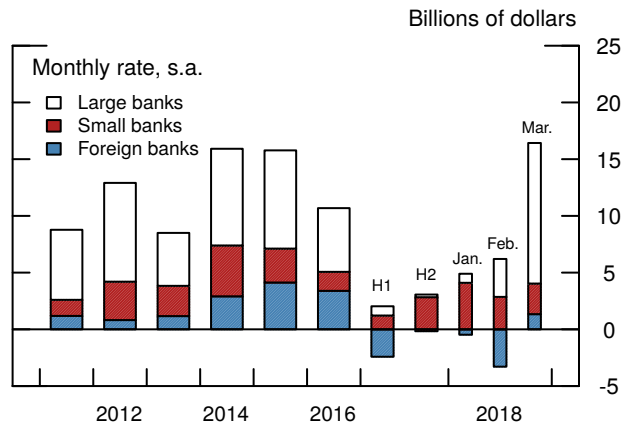
Note: Bonds are categorized by Moody's, Standard & Poor's, and Fitch.
 Source: Mergent Fixed Income Securities Database.

Institutional Leveraged Loan Issuance, by Purpose



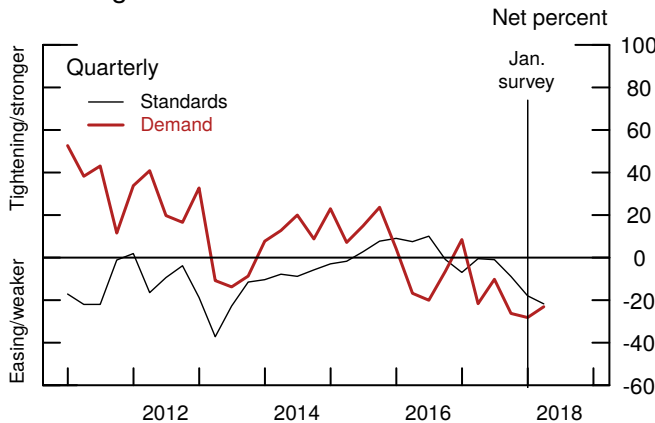
Source: Thomson Reuters LPC LoanConnector.

Commercial and Industrial Loans



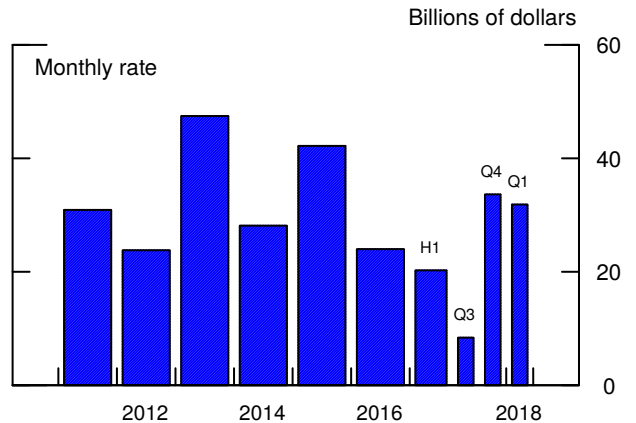
Source: Staff calculations, Federal Reserve Board, Form FR 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

Commercial and Industrial Loans: Changes in Standards and Demand



Note: Banks' responses are weighted by their sizes in the relevant loan categories.
 Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Announced Share Repurchases, Nonfinancial Firms



Source: Securities Data Company.

Growth in banks' commercial and industrial (C&I) loans strengthened in March, following relatively weak growth in January and February. Nonetheless, respondents to the April SLOOS reported that C&I loan demand continued to weaken over the first quarter. Banks that experienced subdued demand often reported that businesses were generating more funds internally or shifting their borrowing to other lenders. (For a discussion of the effect of the recent rise in short-term funding rates on financing conditions more generally, see the box "Possible Effects of the Recent Increase in Short-Term Funding Rates on Financing Conditions for Businesses and Households.") SLOOS respondents continued to report easing standards and terms on C&I loans, most often citing increased competition from other lenders as the reason for doing so.

The credit quality of nonfinancial corporations was essentially stable over the intermeeting period, although the ratio of aggregate debt to assets remains near multidecade highs. The six-month trailing bond default rate ticked up in March to a level in line with that seen about a year ago, while the KMV expected year-ahead default rate for March was roughly unchanged from February and stood just below the median of its historical range. The outlook for corporate earnings remains very favorable. Wall Street analyst forecasts imply that earnings for S&P 500 firms are expected to be about 20 percent higher in 2018 than in 2017, with part of the increase reflecting lower corporate taxes.

The pace of equity issuance through initial and seasoned offerings was robust in the first quarter. Announced stock repurchases over the past two quarters were at their highest levels in two years, suggesting that companies are expecting to distribute to shareholders at least part of the increased cash they anticipate from lower corporate taxes and repatriation of earnings held abroad.

Small Businesses

Small business credit conditions remained fairly accommodative over the intermeeting period. Standards for C&I loans to small businesses eased modestly in the April SLOOS. Although credit demand remains weak relative to pre-crisis levels, it has shown signs of strengthening, and lending activity has increased in recent months. Loan originations—as measured by the three-month moving average of the Thomson Reuters/PayNet Small Business Lending Index—rose in February, leaving the series about 10 percent higher than a year ago. Loan performance in this sector remains strong.

Possible Effects of the Recent Increase in Short-Term Funding Rates on Financing Conditions for Businesses and Households

The elevated level of short-term funding rates relative to what would normally occur with monetary policy tightening—as discussed in the box “Recent Pressures in Money Markets” in the Financial Market Developments section—could serve to tighten financing conditions for business and households. Here we assess the channels through which this might occur.

One potential channel is an increase in the direct cost of borrowing new funds or servicing existing debt. Borrowers’ financing costs could increase in short-term funding markets, such as commercial paper, or on financing instruments whose costs are tied to short-term rates, such as floating-rate loans or lines of credit.¹ Longer-term borrowing rates could also increase if lenders expect short-term rates to remain elevated over a longer period. To date, longer-term borrowing rates have not appeared much affected by recently elevated short-term spreads. Moreover, forward contracts suggest that investors do not expect the elevated spreads to persist for long.

For households, a relatively modest share of debt is tied to short-term rates that have experienced abnormal upward market pressure. Fewer than 20 percent of outstanding residential mortgages have adjustable rates, and fewer than 10 percent of new originations have adjustable rates. The majority of adjustable-rate mortgages are indexed to LIBOR, and a minority of households with adjustable-rate mortgages could experience higher costs as their loan rates reset. In contrast, floating interest rates on credit cards and home equity lines of credit are typically indexed to the prime rate—an administered rate that has risen with the federal funds rate but has not experienced abnormal upward market pressure. Most of the outstanding auto and student loans have fixed rates and, thus, do not have rates that would directly increase along with recently elevated short rates.

For businesses, direct borrowing in commercial paper represents a very small proportion—around 2 percent—of total borrowing by nonfinancial firms. However, floating-rate loans are common for businesses, and costs on such loans have increased with elevated short rates. As the table on the next page shows, around 80 percent of commercial and industrial (C&I) and commercial real estate (CRE) loans outstanding at the largest banks have floating rates. The majority of these floating-rate loans are tied to LIBOR—typically, the three-month LIBOR. While borrowing through floating-rate debt is more common for businesses, for many firms it still represents a relatively small share of their total borrowing. Over 60 percent of borrowing by large firms occurs through corporate bond markets in which interest rates are longer-term fixed rates, and around one-third of CRE borrowing occurs through nonbank loans or CMBS with fixed rates. Smaller firms tend to be more dependent on bank loans for financing.

¹ Higher short-term rates could also serve to boost the income of investors in these funding instruments. The extent to which this extra investment income serves to offset higher borrowing costs of businesses and households depends on the marginal propensities of these investors to spend additional investment income relative to the marginal propensities of the borrowers to spend.

Overall, while some businesses have experienced higher financing costs, the recent increase in some short rates will not likely result in a large, direct increase in debt service burdens. Staff analysis on the potential effects of a larger and more persistent rise in short-term rates than has actually occurred indicates that debt service burdens for businesses and households would only rise a modest amount.² Moreover, borrowers who do rely more heavily on floating-rate debt could potentially substitute toward fixed-rate debt or switch to floating-rate debt tied to short-term rates not experiencing the same upward pressures, such as the one-month LIBOR, serving to reduce the effects of elevated short-term spreads on direct financing costs.

A second, less direct channel through which the recent upward pressure on short-term rates could tighten financing conditions is reduced lending or higher-cost lending by financial institutions experiencing higher funding costs. For example, financial institutions originating new loans could set loan rates higher to offset any increase in their funding costs or could choose to originate less loans. The extent to which this may occur depends on how much of an increase in funding costs financial institutions experience. At present, it does not appear that banks' funding costs have risen appreciably, as most such funding comes in the form of deposits, but banks and other financial institutions that are more reliant on wholesale funding could see an increase in their funding costs.

Overall, the recent upward pressure on short-term rates does not appear to have affected the borrowing costs or capacity of most households and businesses, and staff analysis suggests that elevated short-term rates will not have a long-term effect on financing conditions. The staff will continue to track developments in short-term funding markets and monitor changes in financing conditions.

Percentage of Outstanding Bank Business Loans with Floating Rates

	C&I Loans	CRE Loans
Share of outstanding loans with floating rates	78	80
Share of loans with floating rates indexed to:		
LIBOR	83	91
Prime rate	6	4
Treasury index	1	1
Other	10	4

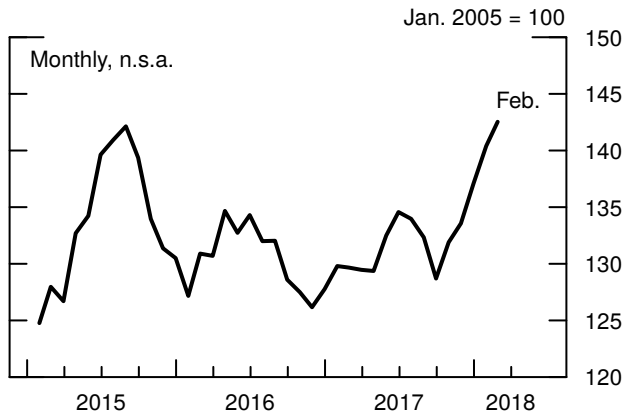
Note: Figures have been weighted by loan amounts outstanding.

Source: Federal Reserve Board, Form FR Y-14Q, Capital Assessments and Stress Testing, as of 2017:Q4.

² See John Driscoll, Aurel Hizmo, Ashish Kumbhat, Francisco Palomino, Ander Perez-Orive, and Maya Shaton (2017), "The Response of Consumer and Corporate Debt Interest Payments to Changes in the Target Range for the Federal Funds Rate," memorandum, Board of Governors of the Federal Reserve System, Divisions of Monetary Affairs and Research and Statistics, April 7; and Christine Dobridge, Francisco Palomino, Ander Perez-Orive, Charles Press, Gustavo Suarez, and Jason Wu (2018), "Assessing Vulnerabilities in Nonfinancial Corporate Credit," memorandum, Board of Governors of the Federal Reserve System, Divisions of Monetary Affairs and Research and Statistics, April 13.

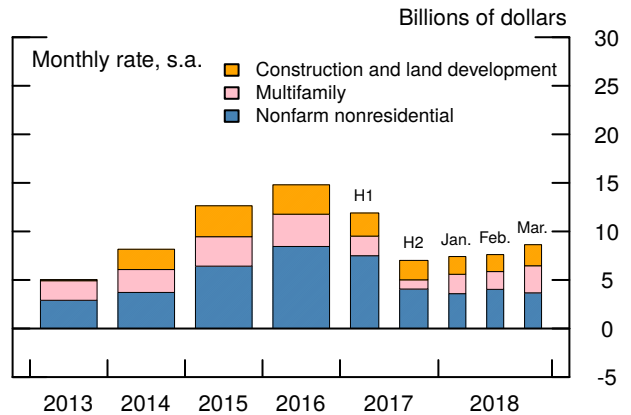
Small Business Finance and Commercial Real Estate Lending

Thomson Reuters/PayNet Small Business Lending Index



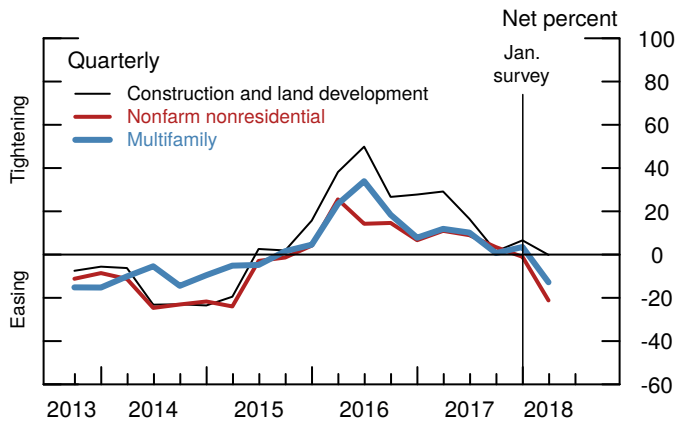
Note: 3-month moving average.
Source: Thomson Reuters, Thomson Reuters/PayNet Small Business Lending Index.

Commercial Real Estate Loans



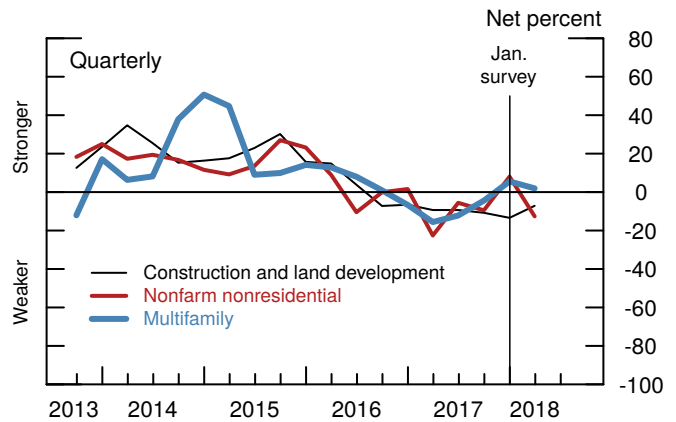
Source: Staff calculations, Federal Reserve Board, Form FR 2644, Weekly Report of Selected Assets and Liabilities of Domestically Chartered Commercial Banks and U.S. Branches and Agencies of Foreign Banks.

Changes in Standards for CRE Loans



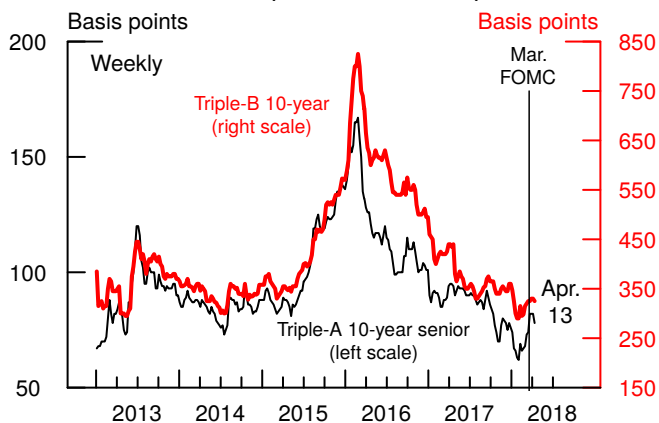
Note: Banks' responses are weighted by their sizes in the relevant loan categories. CRE is commercial real estate.
Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Changes in Demand for CRE Loans



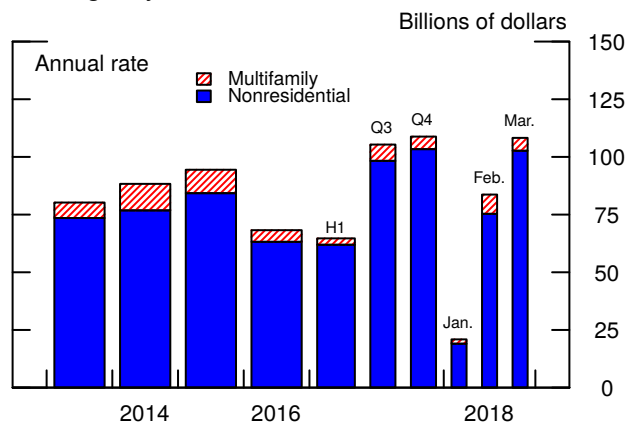
Note: Banks' responses are weighted by their sizes in the relevant loan categories. CRE is commercial real estate.
Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

10-Year CMBS Spreads over Swaps



Note: CMBS is commercial mortgage-backed securities.
Source: J.P. Morgan.

Non-agency CMBS Issuance



Note: Multifamily excludes agency issuance. CMBS is commercial mortgage-backed securities.
Source: Consumer Mortgage Alert.

Commercial Real Estate

Conditions for commercial real estate (CRE) financing remained accommodative over the intermeeting period. CRE loan growth at banks ticked up in the first quarter, driven mainly by strong growth at small domestic and foreign banks. Regarding the components of CRE loans, construction and land development loan growth weakened, while growth in nonfarm nonresidential loans and in multifamily property loans rose. Respondents to the April SLOOS reported easing standards on multifamily and nonfarm nonresidential loans, along with somewhat weaker demand for nonfarm nonresidential loans and construction and land development loans.

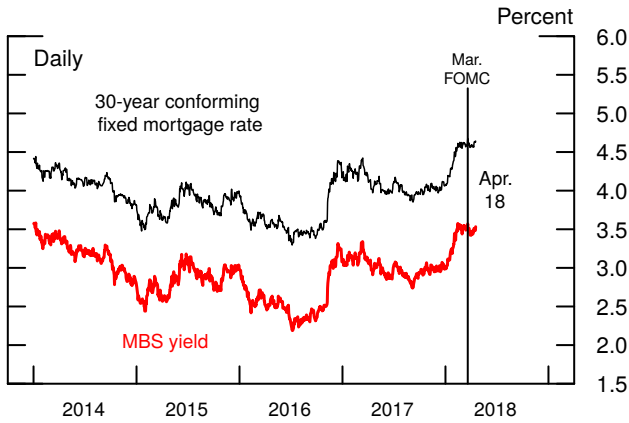
Taking a longer-term view, banks responding to special questions in the April SLOOS about changes to CRE lending policies and demand over the past year reported having eased lending terms, including offering lower spreads of loan rates over the cost of funds and larger maximum loan sizes, across all three major CRE loan categories. Almost all banks that eased CRE credit policies cited more aggressive competition from other institutions as an important reason. Banks reporting weaker demand for CRE loans cited shifts in borrowing to other credit sources and rising interest rates as prominent reasons.

Spreads on commercial mortgage-backed securities (CMBS) were little changed over the intermeeting period and remained near their post-crisis lows. CMBS issuance has continued to be strong through March, although the low volume of loans maturing in coming quarters may reduce demand for refinancing (and hence issuance) going forward.

MUNICIPAL GOVERNMENT FINANCING CONDITIONS

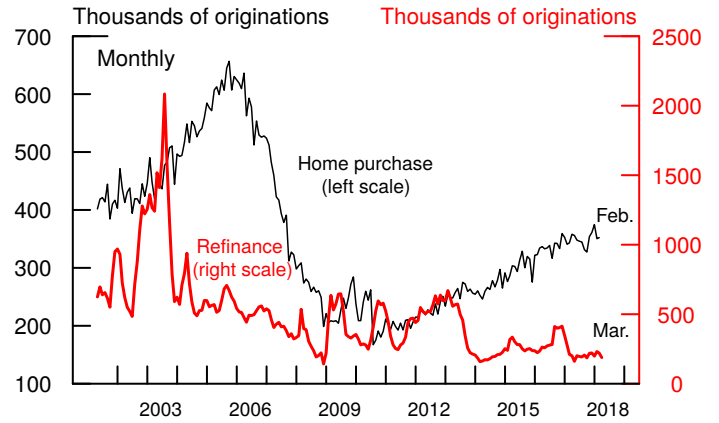
Credit conditions in municipal bond markets remained accommodative, on balance, over the intermeeting period. Spreads on general obligation bonds over comparable-maturity Treasury securities were roughly unchanged. Gross issuance of municipal bonds in March recovered a bit from its low January and February levels but was still somewhat below levels typically seen in March. The weak municipal bond issuance so far this year likely is a consequence of very high December issuance, which was driven by concern that pending tax legislation would remove the tax-exempt status of private activity bonds. (The final legislation did not alter the tax status of such bonds.)

Mortgage Rate and MBS Yield



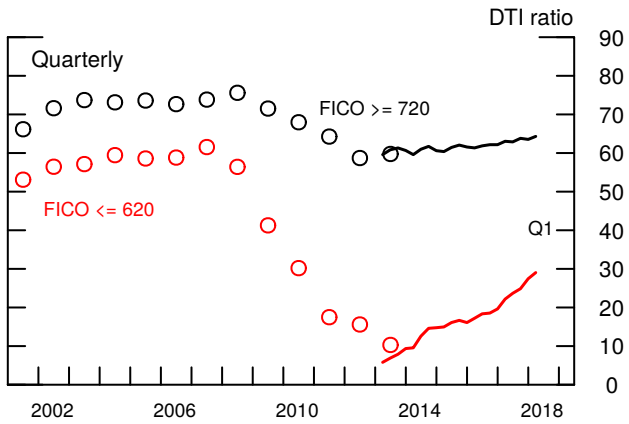
Note: The mortgage-backed securities (MBS) yield is the Fannie Mae 30-year current-coupon rate.
 Source: For MBS yield, Barclays; for mortgage rate, Optimal Blue.

Purchase and Refinance Activity



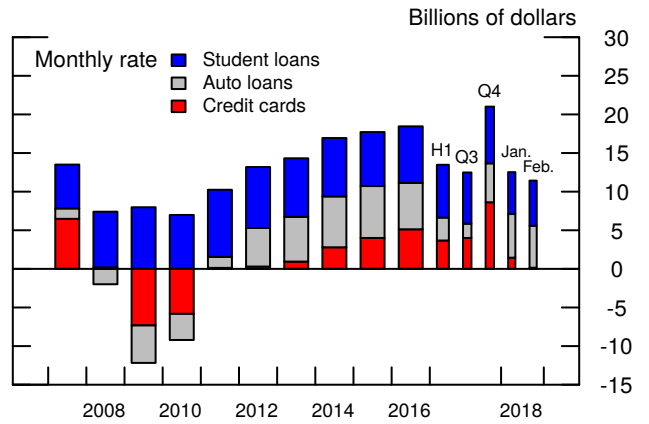
Note: The data are seasonally adjusted by Federal Reserve Board staff.
 Source: For values prior to 2017, data reported under the Home Mortgage Disclosure Act of 1975; for values in and after 2017, staff estimates.

Maximum Allowed Debt-Service-to-Income Ratio for Residential Mortgages



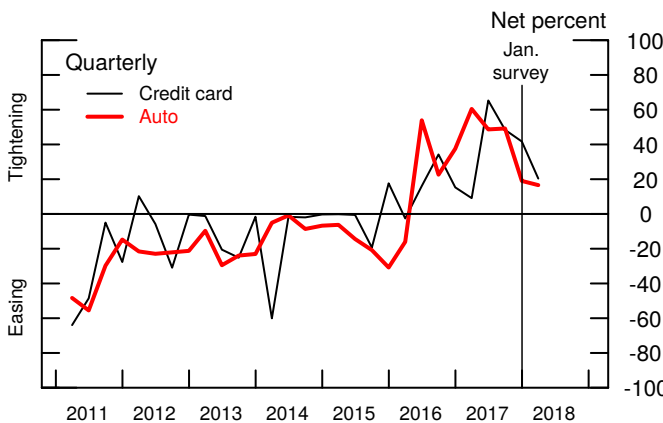
Source: For frontiers shown with circles, McDash and CoreLogic; for frontiers shown with solid lines, Optimal Blue.

Consumer Credit Flows



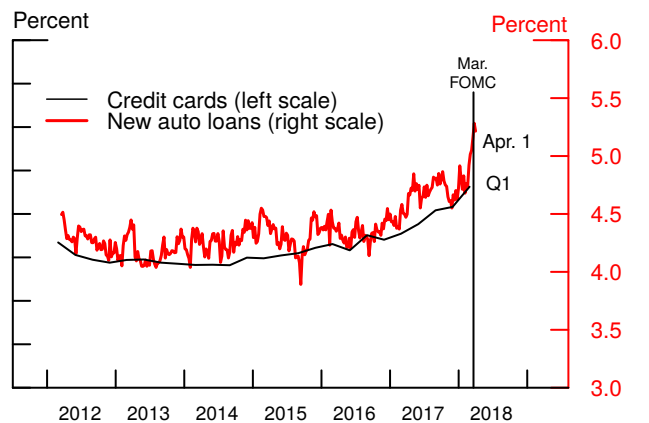
Note: The data are seasonally adjusted by Federal Reserve Board staff.
 Source: Federal Reserve Board.

Changes in Standards for Consumer Loans



Note: Banks' responses are weighted by their sizes in the relevant loan categories.
 Source: Federal Reserve Board, Senior Loan Officer Opinion Survey on Bank Lending Practices.

Consumer Interest Rates



Note: Credit card data reflect rates at commercial banks on all credit card plans; data are reported quarterly and not seasonally adjusted. Auto loans data are reported weekly and seasonally adjusted.
 Source: For credit cards, Federal Reserve Board; for auto loans, J.D. Power.

HOUSEHOLD FINANCING CONDITIONS

Residential Real Estate

Financing conditions in the residential mortgage market remained accommodative for most borrowers. For borrowers with low credit scores, conditions have continued to ease. For example, the maximum debt-service-to-income ratio that low-score mortgage borrowers can obtain has risen steadily for the past several years. However, credit still remains relatively tight for these borrowers, and the volume of mortgage loans extended to this group remains low. For the overall mortgage market, rates on 30-year conforming mortgages edged down about 5 basis points since the March FOMC, roughly in line with yields on longer-term Treasury securities. However, mortgage rates remained around 60 basis points higher than in December and more than 100 basis points higher than in the fall of 2016. Consistent with these higher rates, refinancing activity continues to be muted, and the growth in mortgages for home purchases has slowed over the past year. Banks responding to the April SLOOS reported weaker demand across most residential real estate (RRE) loan categories, while standards were reportedly about unchanged for most RRE loan types.

Consumer Credit

Financing conditions for consumer credit have, on balance, remained supportive of growth in household spending. However, some indicators continue to point to a tightening trend in the past several quarters.

Growth in consumer loan balances has moderated from the more rapid pace seen late last year. In particular, credit card loan growth slowed significantly in early 2018 after growing briskly in the fourth quarter of 2017. Indeed, respondents to the April SLOOS reported that standards and terms on credit card loans tightened further, and demand for these loans weakened in the first quarter. In addition, interest rates on credit card accounts continued to trend up, reflecting in part pass-through from tightening monetary policy. Nonetheless, on balance, credit card debt remained readily available to prime-rated borrowers but tight for subprime borrowers.

Respondents to the April SLOOS continued to report tighter standards and terms on auto loans at banks as well as weaker demand. That said, across all lenders, growth in auto loan balances remained solid over the past few months, although originations of auto loans to consumers with nonprime credit scores appeared to continue to shrink. In addition, evidence from the Michigan survey suggests that only a modest share of consumers cited tightening credit conditions or rising interest rates as factors discouraging car purchases.

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Risks and Uncertainty

ASSESSMENT OF RISKS

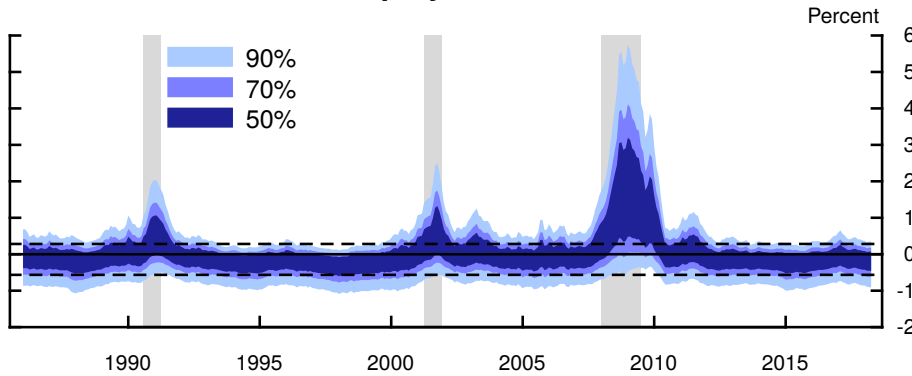
As in the March Tealbook, we view the uncertainty around our forecast of economic activity as being in line with the average over the past 20 years, the benchmark used by the FOMC. Although financial market volatility remains elevated—reportedly reflecting, in part, uncertainty about trade policy—uncertainty about fiscal policy has diminished with the enactment of the appropriations bill that funds government operations through September.

We continue to judge the risks around our projection for real GDP growth as being balanced. On the upside, recent fiscal policy changes could lead to a greater expansion in economic activity than expected in the baseline. On the downside, given that the economy is already operating above its potential level and resource utilization is projected to tighten further, those fiscal policy changes could provide less impetus to the economy than assumed in the baseline. Similarly, we see the risks around our unemployment rate forecast as balanced. Although we assume, with the economy operating above the level associated with full employment, that the unemployment rate will decline a bit less than would be expected given the rise in the output gap, the shift toward other margins of resource utilization could be greater than we anticipate. Alternatively, it is possible that the unemployment rate will exhibit a more typical relationship with the output gap—or decline even more if the high-pressure economy leads to a further reduction in the natural rate of unemployment.

Consistent with our judgmental assessment, estimates of the distribution of risks around our GDP and unemployment rate forecasts conditional on available indicators, shown in the exhibit “Time-Varying Macroeconomic Risk,” are not particularly wide or skewed. Indeed, one important source of downside risk to real activity has diminished significantly in recent years: As presented in the exhibit “Effective Lower Bound Risk Estimate,” stochastic simulations around the baseline path in the FRB/US model indicate that the risk of returning to the effective lower bound (ELB) sometime over the next three years is only about 9 percent. If the ELB risk were computed around the median federal funds rate path from the FOMC’s March SEP, the estimated probability would be 17 percent.

Time-Varying Macroeconomic Risk

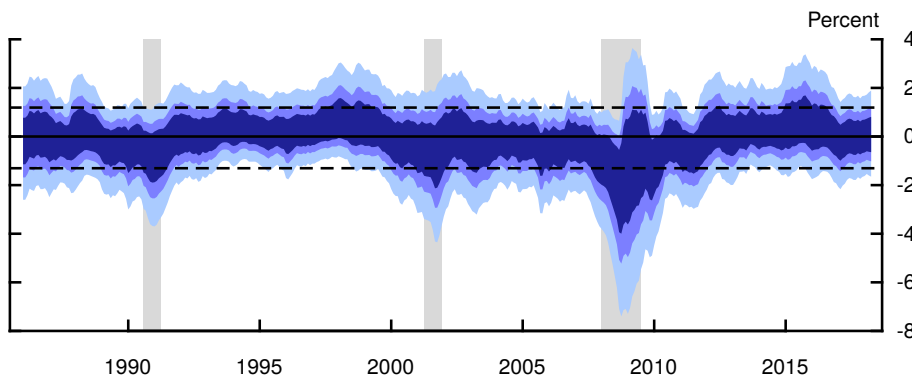
Unemployment Rate



April 2018

95th	0.4
85th	0.2
50th	-0.2
15th	-0.6
5th	-0.9

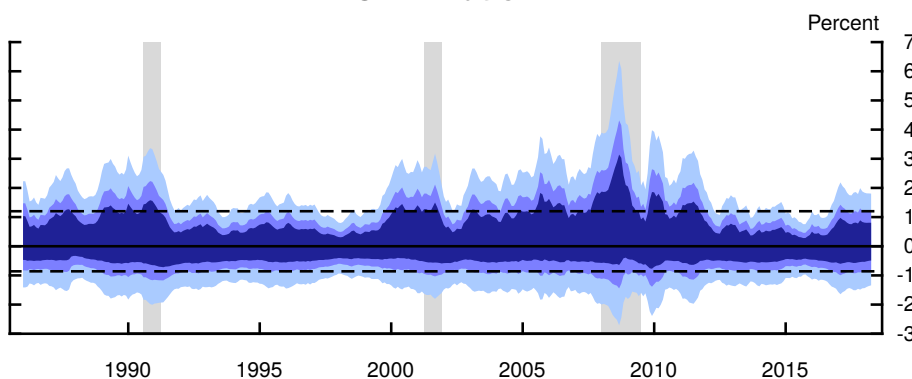
GDP Growth



April 2018

95th	1.9
85th	1.2
50th	0.1
15th	-1.0
5th	-1.7

CPI Inflation

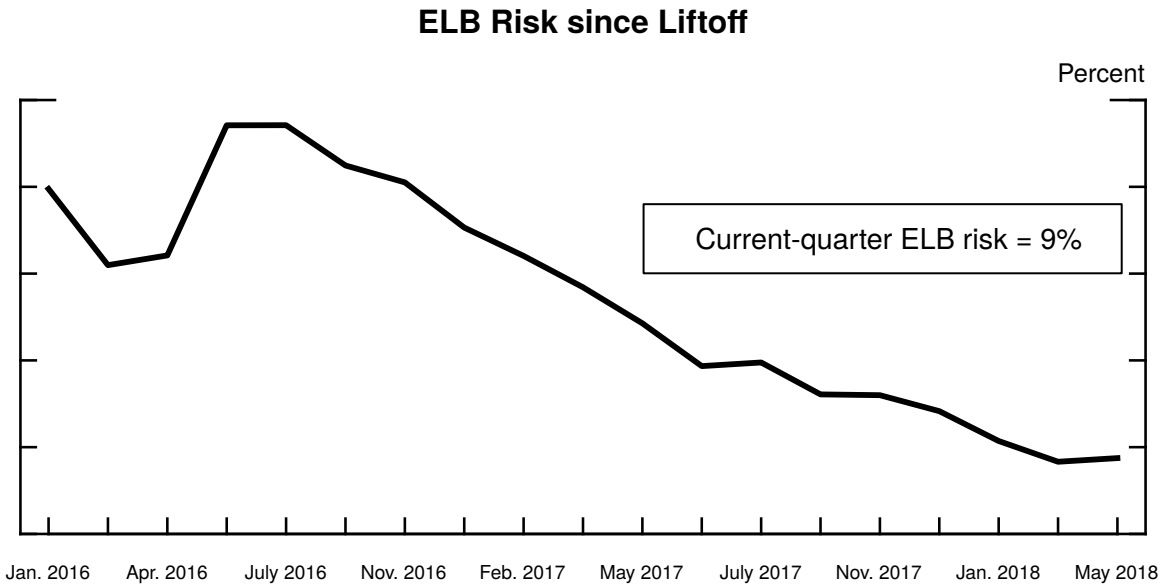


April 2018

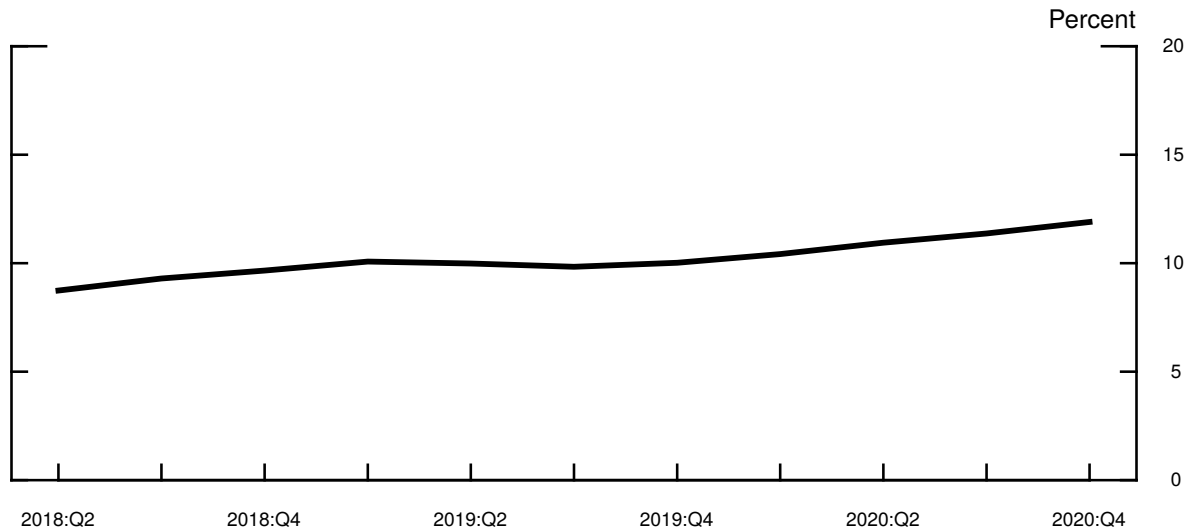
95th	1.8
85th	1.2
50th	0.1
15th	-0.8
5th	-1.3

Note: The exhibit shows estimates of quantiles of the distribution of errors for four-quarter-ahead staff forecasts. The estimates are conditioned on indicators of real activity, inflation, financial market strain, and the volatility of high-frequency macroeconomic indicators. The tables show selected quantiles of the predictive distributions for the respective variables as of the current Tealbook. Dashed lines denote the median 15th and 85th percentiles. Gray shaded bars indicate recession periods as defined by the National Bureau of Economic Research.

Effective Lower Bound Risk Estimate



ELB Risk over the Projection Period



Note: The 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. The lower panel computes ELB risk over a forward-looking moving 3-year window using stochastic simulations in FRB/US beginning in the current quarter. The simulations are computed around the Tealbook baseline.

With regard to inflation, we still see average uncertainty and balanced risks around our projection. With the estimated 12-month change in core PCE prices having moved up to 1.9 percent in March, the risk that last year’s softness in inflation could prove to be more persistent than we assumed has abated somewhat. However, there is still a risk that the inflation expectations relevant for wage and price setting could currently be lower than in the baseline or may not edge up in the coming years as we have assumed. To the upside, with the economy projected to be moving further 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. Our judgmental assessments of typical uncertainty and balanced risks are consistent with the statistical estimates of the time-varying risks for the inflation forecast.

Our view of the risks to the economic outlook is informed by the staff’s quarterly quantitative surveillance (QS) assessment, which judges the overall financial vulnerabilities in the United States and overseas to be moderate. Vulnerabilities from leverage in the U.S. financial system, as well as from liquidity and maturity transformation, appear low; in particular, banks are highly capitalized and hold substantial amounts of high-quality liquid assets. However, asset valuation pressures in the U.S. are elevated despite easing since early February’s period of increased market volatility, and they also appear stretched in a number of foreign economies. In addition, there are some potential sources of vulnerability in the U.S. nonfinancial corporate business sector. In particular, corporate debt relative to nominal GDP is at the upper end of historical experience and risk premiums on corporate bonds are compressed relative to their average since the mid-1990s.

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 outcomes of a recession in which the effects are amplified by leverage constraints on financial intermediaries that curtail the supply of credit. The second scenario examines the negative consequences of supply constraints that could arise when labor markets are very tight for an extended period. In contrast, in the third scenario, running the economy “hot” for a while leads to persistent positive effects on the productive capacity of the economy—a form of “positive hysteresis.” In the fourth scenario, we illustrate a downside risk to inflation associated with the possibility that households and businesses

have lower inflation expectations than in the baseline because they perceive that monetary policy will be too tight to sustainably return inflation to the FOMC’s 2 percent objective over the medium term. In the fifth scenario, we consider the possibility that faster tightening in U.S. monetary policy, 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 of stronger foreign growth and a weaker dollar.

We simulate each of these scenarios using one of five staff models that embed different macroeconomic structures and dynamics.¹ (For a discussion of forecast errors over the past year from two staff models, see the box “FRB/US and EDO Forecast Errors” at the end of this section.) In all scenarios, the federal funds rate is governed by the same policy rule as in the baseline. In addition, the size and composition of the SOMA portfolio are assumed to follow the baseline paths in all of the scenarios.

Financial-Based Recession [Gertler, Karadi Model]²

The last three QS reports have highlighted that asset valuations are elevated and that leverage in the nonfinancial business sector is an area of potential vulnerability, although overall financial vulnerabilities are judged to be moderate and commercial banks are well capitalized. In this scenario, we move beyond regulated deposit-taking institutions and consider risks to the intermediation sector, including shadow banks. We assume that there is a correction in asset prices that reduces intermediaries’ capital, which tightens leverage constraints and further disrupts the supply of credit. In addition, this

¹ The five models used are: (1) a version of the model by Mark L. Gertler and Peter Karadi (2011), “A Model of Unconventional Monetary Policy,” *Journal of Monetary Economics*, vol. 58 (1), pp. 17–34; (2) a calibrated New Keynesian DSGE model with search and matching frictions in the labor market similar to that described in Mark L. Gertler, Luca Sala, and Antonella Trigari (2008), “An Estimated Monetary DSGE Model with Unemployment and Staggered Nominal Wage Bargaining,” *Journal of Money, Credit and Banking*, vol. 40 (8), pp. 1713–64; (3) an estimated medium-scale New Keynesian DSGE model of the U.S. economy based on Marco Del Negro, Marc P. Giannoni, and Frank Schorfheide (2015), “Inflation in the Great Recession and New Keynesian Models,” *American Economic Journal: Macroeconomics*, vol. 7 (January), pp. 168–96; (4) FRB/US, which is a large-scale macroeconomic model of the U.S. economy; and (5) SIGMA, which is a calibrated multicountry DSGE model.

² In this scenario, the model is augmented with search and matching frictions in the labor market as in Mark L. Gertler, Luca Sala, and Antonella Trigari (2008), “An Estimated Monetary DSGE Model with Unemployment and Staggered Nominal Wage Bargaining,” *Journal of Money, Credit and Banking*, vol. 40 (8), pp. 1713–64.

Alternative Scenarios

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

Measure and scenario	2018		2019	2020	2021	2022	2023
	H1	H2					
<i>Real GDP</i>							
Extended Tealbook baseline	2.3	2.9	2.6	2.1	1.5	1.0	1.0
Financial-based recession	1.8	.7	.5	2.7	1.5	.8	.9
Supply constraints	2.3	2.9	2.8	2.0	.8	.7	.9
Positive hysteresis	2.3	2.9	2.9	2.5	2.0	1.3	1.1
Lower inflation expectations	1.8	2.7	2.7	2.1	1.5	1.0	1.0
Global tightening tantrum	2.2	2.1	1.1	1.6	1.8	1.5	1.4
Strong foreign growth and weaker dollar	2.3	3.3	3.1	2.3	1.3	.7	.8
<i>Unemployment rate¹</i>							
Extended Tealbook baseline	4.0	3.6	3.3	3.3	3.5	3.8	4.1
Financial-based recession	4.0	4.1	6.7	4.9	4.3	4.4	4.7
Supply constraints	4.1	3.9	3.9	3.9	4.2	4.5	4.8
Positive hysteresis	4.0	3.6	3.2	3.1	3.1	3.4	3.8
Lower inflation expectations	4.1	3.7	3.4	3.4	3.5	3.8	4.1
Global tightening tantrum	4.0	3.7	4.0	4.3	4.4	4.5	4.6
Strong foreign growth and weaker dollar	4.0	3.5	3.0	2.8	3.0	3.4	3.7
<i>Total PCE prices</i>							
Extended Tealbook baseline	2.5	1.7	1.9	2.0	2.0	2.1	2.1
Financial-based recession	2.5	1.5	1.7	1.9	1.9	2.0	2.0
Supply constraints	2.6	2.2	2.9	3.1	2.9	2.8	2.8
Positive hysteresis	2.5	1.7	1.9	2.0	2.1	2.1	2.1
Lower inflation expectations	2.3	1.3	1.6	1.6	1.7	1.8	1.8
Global tightening tantrum	2.6	2.3	2.3	2.2	2.2	2.2	2.2
Strong foreign growth and weaker dollar	2.6	2.2	2.5	2.3	2.2	2.2	2.2
<i>Core PCE prices</i>							
Extended Tealbook baseline	2.4	1.7	2.1	2.1	2.1	2.2	2.2
Financial-based recession	2.3	1.6	1.8	2.0	2.0	2.0	2.0
Supply constraints	2.5	2.3	3.0	3.2	3.0	2.9	2.9
Positive hysteresis	2.4	1.7	2.1	2.1	2.2	2.2	2.2
Lower inflation expectations	2.2	1.4	1.7	1.7	1.8	1.8	1.8
Global tightening tantrum	2.5	2.5	2.7	2.3	2.2	2.2	2.2
Strong foreign growth and weaker dollar	2.4	2.1	2.5	2.4	2.3	2.3	2.3
<i>Federal funds rate¹</i>							
Extended Tealbook baseline	1.8	2.6	3.8	4.7	5.0	4.9	4.5
Financial-based recession	1.8	2.3	.7	1.0	2.1	2.6	2.7
Supply constraints	1.8	2.5	3.9	4.9	5.0	4.7	4.2
Positive hysteresis	1.8	2.6	3.8	4.6	4.9	4.8	4.3
Lower inflation expectations	1.8	2.4	3.4	4.1	4.4	4.3	3.9
Global tightening tantrum	1.8	3.0	4.1	4.0	3.8	3.8	3.7
Strong foreign growth and weaker dollar	1.8	2.8	4.5	5.5	5.8	5.5	5.0

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

credit crunch is accompanied by a loss in confidence by businesses that is reflected in the model by exogenous shocks to investment.

Under these circumstances, intermediaries' net worth falls 20 percent and corporate bond spreads increase 200 basis points during 2018. Investment drops 10 percent and GDP contracts at the end of this year and continues to fall until the end of 2019 before rebounding. The unemployment rate rises $\frac{1}{2}$ percentage point above the baseline at the end of 2018 and peaks at 7 percent in 2019 before slowly returning toward the baseline. Inflation slows only a little relative to the baseline, because the Phillips curve is flat and monetary policy provides substantial accommodation. Even under the inertial Taylor rule assumed here, the federal funds rate decreases 2 percentage points in response to the rapid increase in slack and comes within 25 basis points of the ELB.

Supply Constraints [Gertler, Sala, Trigari Model]

In the baseline projection, the unemployment rate declines to $3\frac{1}{4}$ percent by the end of 2019 and remains below the staff's estimate of the natural rate for a number of years. However, with the economy operating so far above its potential, it is possible that supply constraints will begin to emerge and that these constraints are not fully captured in the baseline projection. In particular, when the unemployment rate is unusually low, filling a vacancy becomes more difficult, which could imply a reduced pace of hiring and a substantially steeper rise in wage growth. In this scenario, we illustrate these risks using simulations from a nonlinear New Keynesian model with costly search and matching frictions in the labor market.³ In this model, recruiting costs and wages are higher when the unemployment rate is low because firms have to spend more time and resources looking for workers and have to raise wages to attract them.

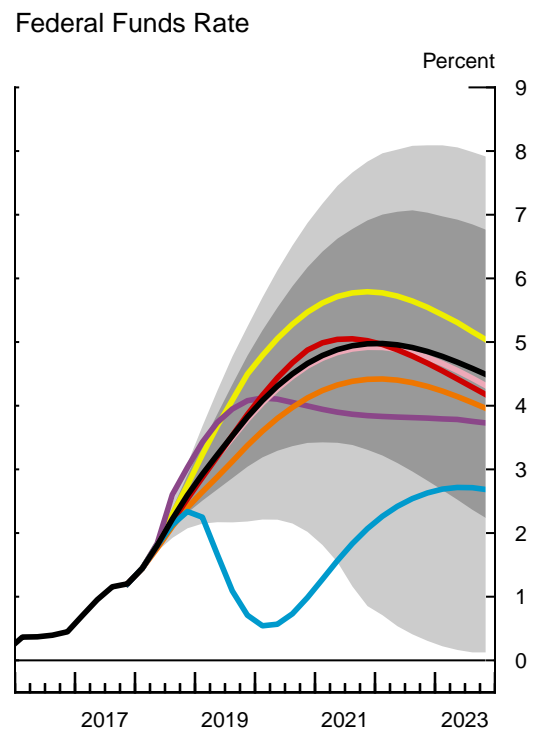
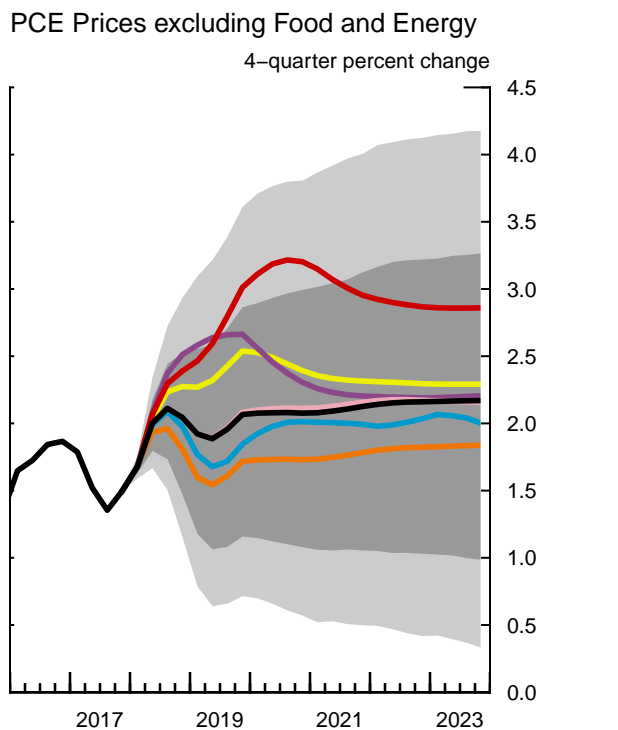
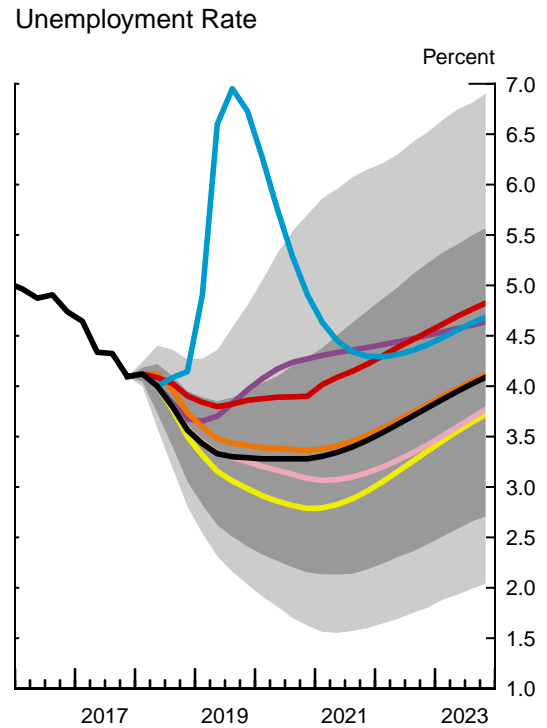
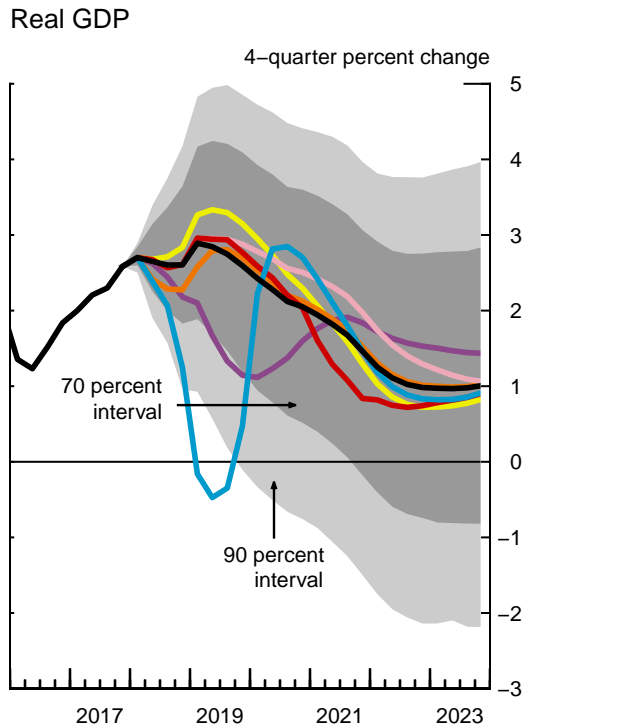
In such an environment, the unemployment rate stays roughly constant at 4 percent until the end of 2020, $\frac{1}{2}$ percentage point above the baseline; thereafter, it returns to its natural rate. GDP growth is close to the baseline until the end of 2020 because, in this model, more-intense utilization of capital compensates for the reduction in labor input. Growth slows after 2020 as the unemployment rate rises toward its natural

³ See also Nicolas Petrosky-Nadeau and Lu Zhang (2017), "Solving the Diamond-Mortensen-Pissarides Model Accurately," *Quantitative Economics*, vol. 8 (2), pp. 611–50, who show that simulations from a standard search-and-matching model deliver state-dependent responses to shocks: The unemployment rate responds less to shocks when the initial state of the economy is "hot" compared to an initial state with substantial labor market slack.

Forecast Confidence Intervals and Alternative Scenarios

Confidence Intervals Based on FRB/US Stochastic Simulations

- Extended Tealbook baseline
- Financial-based recession
- Supply constraints
- Positive hysteresis
- Lower inflation expectations
- Global tightening tantrum
- Strong foreign growth and weaker dollar



rate. Inflation is significantly higher because of stronger wage growth and peaks at 3¼ percent in 2020. Monetary policymakers are assumed to infer resource slack from the unemployment rate, and consequently the federal funds rate is kept close to the baseline as the effects of higher inflation and less tightness in the labor market are largely offsetting.

Positive Hysteresis [FRB/US]

In contrast to the previous scenario, the hot labor market in the baseline projection is assumed in this scenario to have persistent positive effects on the productive capacity of the economy, a phenomenon often referred to as “positive hysteresis.” Specifically, we assume that persistent exposure to a hot economy reduces exits from the labor force and generates additional entrants, causing the trend labor force participation rate to rise about 1 percentage point above the baseline by the end of 2023. Furthermore, we assume that the experience that workers gain through greater employment lowers the natural rate of unemployment ½ percentage point by the end of 2023. Both of these favorable developments are assumed to be recognized in real time by monetary policymakers.⁴

In this scenario, potential output rises, on average, about ¼ percentage point more per year over the projection period than in the baseline. This additional room to grow allows real GDP growth to run at a similar increment above the baseline. As a result, the output gap is little changed. The unemployment rate is close to the baseline until the end of 2019 because increases in labor force participation offset gains in employment. After 2019, the unemployment rate follows a lower trajectory and is about ¼ percentage point below the staff projection by 2023. With inflation and the output gap roughly at the baseline, the federal funds rate is little changed.⁵

⁴ We modeled this alternative scenario by augmenting the usual specifications in FRB/US for the natural rate of unemployment and the trend labor force participation rate with endogenous hysteresis-generating components.

⁵ If we instead assumed that policymakers learn only slowly about the improvement in potential output, the federal funds rate would follow a steeper trajectory than shown in this scenario, reaching 5¼ percent by the end of 2021. In that case, real GDP growth would be ¼ percentage point lower, on average, between 2020 and 2023 than in this scenario, with the unemployment rate ¼ percentage point higher than in this scenario. Inflation would still remain close to the baseline.

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

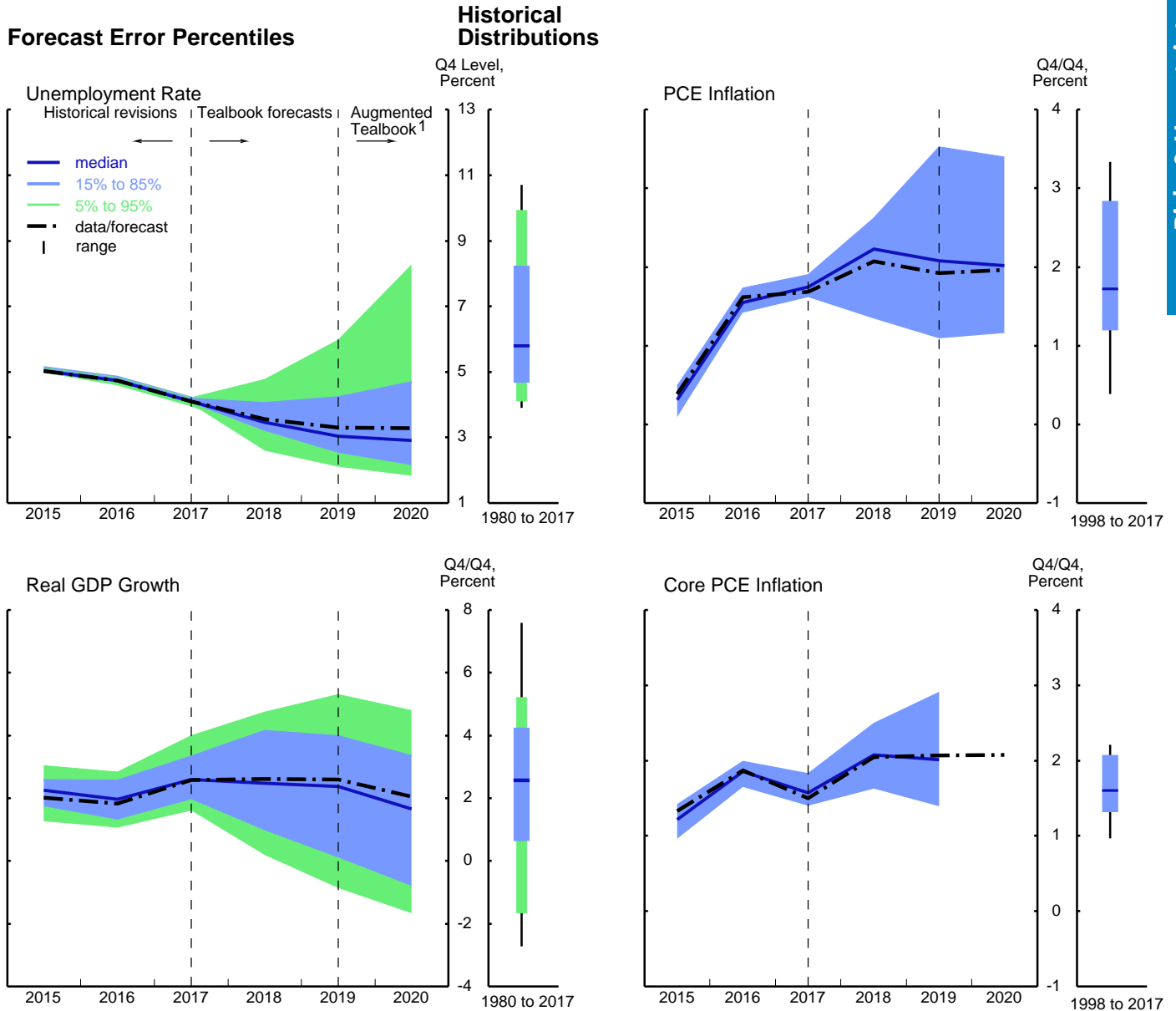
Measure	2018	2019	2020	2021	2022	2023
<i>Real GDP</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	2.6	2.6	2.1	1.5	1.0	1.0
Confidence interval						
Tealbook forecast errors	.9–4.2	.1–4.0	-.9–3.4	...	...	...
FRB/US stochastic simulations	1.8–3.6	1.2–4.1	.5–3.6	-.2–3.1	-.7–2.8	-.8–2.8
<i>Civilian unemployment rate</i>						
<i>(percent, Q4)</i>						
Projection	3.6	3.3	3.3	3.5	3.8	4.1
Confidence interval						
Tealbook forecast errors	3.1–4.1	2.5–4.2	2.1–4.7	...	...	...
FRB/US stochastic simulations	3.1–3.9	2.4–4.0	2.2–4.3	2.2–4.7	2.4–5.2	2.7–5.6
<i>PCE prices, total</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	2.1	1.9	2.0	2.0	2.1	2.1
Confidence interval						
Tealbook forecast errors	1.3–2.6	1.1–3.5	1.2–3.4	...	...	...
FRB/US stochastic simulations	1.4–2.6	.9–2.8	.9–3.0	.9–3.1	.9–3.2	.9–3.3
<i>PCE prices excluding food and energy</i>						
<i>(percent change, Q4 to Q4)</i>						
Projection	2.0	2.1	2.1	2.1	2.2	2.2
Confidence interval						
Tealbook forecast errors	1.6–2.5	1.4–2.9	...	...	...	...
FRB/US stochastic simulations	1.5–2.5	1.2–2.9	1.1–3.0	1.1–3.1	1.0–3.2	1.0–3.3
<i>Federal funds rate</i>						
<i>(percent, Q4)</i>						
Projection	2.6	3.8	4.7	5.0	4.9	4.5
Confidence interval						
FRB/US stochastic simulations	2.3–2.9	3.0–4.8	3.4–6.2	3.3–6.9	2.8–7.0	2.2–6.8

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 2020 using information from the Blue Chip survey and forecasts from the CBO and CEA.

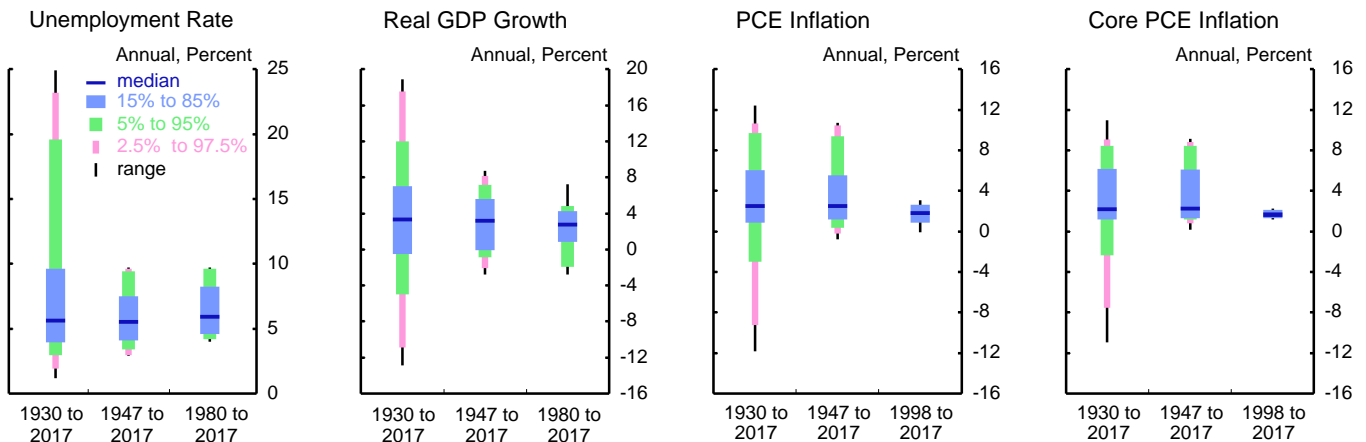
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Prediction Intervals Derived from Historical Tealbook Forecast Errors

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 2020.

Lower Inflation Expectations [Del Negro, Giannoni, Schorfheide Model]

Headline inflation, as measured by the change in PCE prices, has been below the Committee's 2 percent objective for most of the past five years and averaged only about 1¼ percent during that period. In the baseline projection, we have assumed a small, gradual rise in inflation expectations. However, in light of the persistently low inflation of the past several years, there is a risk that the public perceives the stance of monetary policy as being too tight to sustainably achieve the 2 percent objective. In this scenario, we assume that current longer-run inflation expectations are ¼ percentage point lower than in the baseline and remain that low for an extended period of time.

Lower inflation expectations cause actual inflation to run ¼ percentage point below its baseline path during the simulation period. Consequently, the federal funds rate increases less than in the baseline; even so, expected real interest rates are initially slightly higher because inertia in the assumed policy rule prevents the federal funds rate from adjusting more rapidly. As a result, real GDP growth is a touch lower in 2018 than in the baseline, and the unemployment rate runs slightly higher through 2023.

Global Tightening Tantrum [SIGMA]

In our baseline, we see the spillovers of ongoing U.S. policy tightening as likely to be manageable for most foreign economies. However, there remains a significant risk that faster U.S. policy tightening than investors expect could exert sizable disruptive effects on global financial markets and the global economy. This scenario considers the possibility that higher-than-expected U.S. inflation causes investors to quickly revise their expectations about the stance of U.S. monetary policy, causing global bond term premiums to rise and the prices of risky assets to decline, with pronounced adverse spillovers especially to emerging market economies (EMEs).

Specifically, our scenario assumes that U.S. core PCE inflation runs at around 2½ percent through 2018 and prompts the FOMC to remove policy accommodation somewhat faster than in the baseline.⁶ These developments boost term premiums on longer-term government bonds as well as spreads on corporate bonds in both the United States and abroad. Tighter global financial conditions weigh on foreign economies and

⁶ The scenario embeds transient monetary policy shocks, which allow for a somewhat faster initial rise in the federal funds rate than implied by the inertial Taylor rule.

progressively turn investor attention to underlying EME vulnerabilities, including stretched asset valuations and elevated corporate debt levels in some economies. EMEs experience large capital outflows and sizable depreciations of their currencies later this year as declining confidence fuels an ongoing flight from EME assets. All told, foreign GDP growth runs 1½ percentage points below the baseline in 2019, while the broad real dollar appreciates by about 7 percent.

Weaker foreign activity, the appreciation of the dollar, and tighter financial conditions restrain the pace of economic expansion in the United States. U.S. GDP growth moderates to 1 percent in 2019, about 1½ percentage points less than in the baseline. Core PCE inflation peaks at 2¾ percent in 2019 and then moves down toward the 2 percent target. Starting in 2020, the federal funds rate edges down, falling below the baseline path.

Stronger Foreign Growth and Weaker Dollar [SIGMA]

Over the past year, the dollar has fallen despite higher U.S. interest rates and prospects for substantial U.S. fiscal stimulus. In part, this depreciation reflects solid foreign growth and the anticipation of policy normalization abroad. Going forward, our baseline forecast is for the dollar to appreciate, as the federal funds rate rises more steeply than markets expect. However, it is possible that foreign growth will exceed expectations and put further downward pressure on the dollar. In this scenario, we assume that foreign GDP growth rises to about 3½ percent in 2018 and 2019, and thus averages about ¾ percentage point higher per year than under our baseline projection. Increased optimism about the durability of the foreign expansion—and the perception of diminished tail risks—cause the broad dollar to depreciate by 10 percent relative to baseline by the end of 2019, reversing most of the rise in the dollar that began in mid-2014.

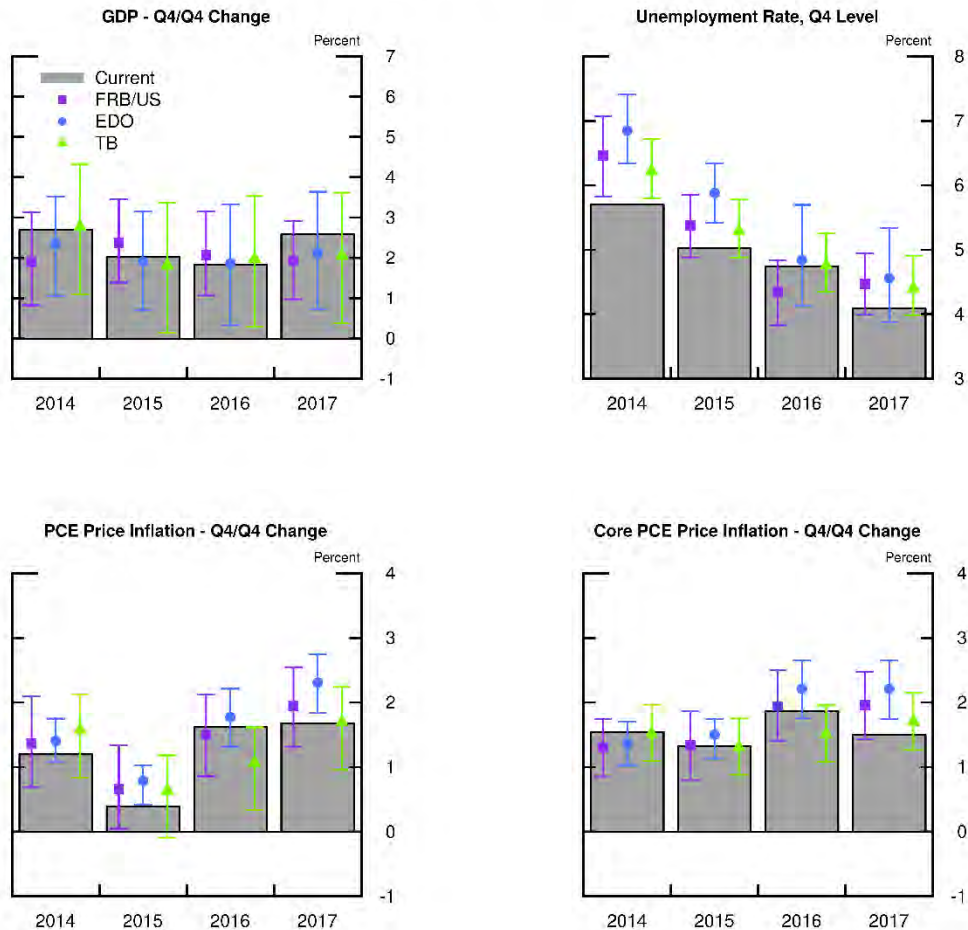
U.S. real GDP expands around 3 percent in 2019, about ½ percentage point more than in the baseline, as the weaker dollar and stronger foreign growth boost U.S. real net exports. The unemployment rate falls to 2¾ percent by the end of 2020. Higher import prices and heightened resource pressures cause core PCE inflation to reach 2½ percent in 2019. The federal funds rate rises more quickly than in the baseline, increasing to 5½ percent by the end of 2020.

FRB/US and EDO Forecast Errors

This discussion reports real-time forecast errors for the FRB/US and EDO models over the past four years and compares them with the errors in the judgmental Tealbook projection. The forecast errors from the models are then decomposed into contributions from the structural shocks inferred by the models to identify the key drivers of the misses.

The figure reports the point forecasts and 70 percent confidence intervals of the Tealbook projection and of the FRB/US and EDO model projections of real GDP growth, the unemployment rate, and total and core PCE inflation for 2014 through 2017, computed using the Tealbook and model forecasts as of the April Tealbook of the corresponding year.

Model Forecasts



Note: Green triangles and whisker bands correspond to those shown in the box "Tealbook Forecast Errors: An Update through 2017" in the Domestic Economic Developments and Outlook section.
 Source: Staff forecast; Bureau of Economic Analysis; Bureau of Labor Statistics.

In the figure, the gray bars represent the currently published data, the purple squares and whisker bands show the real-time forecasts and 70 percent confidence intervals of FRB/US, the blue circles and whisker bands show the counterparts for EDO, and the green triangles and whisker bands show the counterparts for the Tealbook forecasts.¹

The FRB/US and EDO forecast errors are, on average, somewhat larger than the Tealbook forecast errors, and neither model uniformly dominates the other one in forecasting performance. Overall, like the Tealbook forecast, both models underpredicted real GDP growth and overpredicted the unemployment rate in 2017, with the largest error for GDP growth found in FRB/US and the largest error for the unemployment rate found in EDO. These forecast errors are within the 70 percent real-time confidence intervals of these models as indicated by the whisker bands. However, the realized unemployment rate is located very close to the lower bounds of the 70 percent confidence intervals of all the forecasts, including the Tealbook projection.²

FRB/US did well in forecasting both total and core PCE inflation. From 2014 to 2017, its root mean squared errors are 0.2 percentage point and 0.3 percentage point, respectively, which are smaller than or equal to those of the EDO and Tealbook projections. That said, both models viewed inflation as having been surprisingly weak in 2017 and to a greater extent than the judgmental projection, particularly in the case of core inflation. It is notable that both models made forecast errors for core PCE inflation outside of or very close to the lower bounds of the 70 percent confidence intervals.³

The FRB/US model attributes the higher-than-expected GDP growth in 2017 to stronger-than-expected private spending and stronger foreign factors, such as a weaker dollar and stronger net exports. The EDO model largely attributes the upward surprise in GDP growth last year to a low risk premium and a somewhat stronger transient improvement in productivity. Because the two sources of stronger GDP growth have opposite implications for slack, the EDO model attributes the bulk of the forecast errors in both total and core PCE inflation to “own” shocks in the non-energy price equations; in other words, the surprise could not primarily be explained by the forecast errors in other conditioning variables such as slack. The FRB/US model also views the downside surprises in inflation as originating directly from the price equations.

¹ The confidence intervals for EDO and FRB/US are generated via stochastic simulations. For FRB/US, the simulations sample from historical equation residuals. For EDO, they draw from the distributions of shocks, model parameters, and latent state variables.

² The improvement in the forecasting accuracy for unemployment in the EDO model in 2016 relative to the two previous years is linked to a revision of the assumed steady-state level of unemployment to align it with the Tealbook assumptions about the natural rate of unemployment at that time.

³ Note that the staff had seen the very low March CPI by the time of the April Tealbook in 2017, even though the PCE prices for March were not themselves published yet, so that information was built into the Tealbook projection. While the staff took on board the implication of the weak incoming data for the second quarter core PCE inflation, the models did not, which could be one source of the larger model forecast errors for core PCE inflation.

Assessment of Key Macroeconomic Risks

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	.06	.07	.05	.09
Previous Tealbook	.05	.05	.04	.07
<i>Less than 1 percent</i>				
Current Tealbook	.13	.10	.06	.12
Previous Tealbook	.19	.15	.09	.15

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	.00	.02	.16	.06
Previous Tealbook	.00	.01	.20	.06
<i>Decrease by 1 percentage point</i>				
Current Tealbook	.35	.04	.05	.02
Previous Tealbook	.45	.07	.03	.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	.02	.05	.05	.02
Previous Tealbook	.00	.02	.06	.04	.00

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

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 a sample starting in 1980, yielding percentiles of the sizes of the forecast errors. For PCE and core PCE inflation, errors based on a sample beginning in 1998 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 discuss a range of strategies for setting the federal funds rate and compare the associated interest rate paths and macroeconomic outcomes with those in the Tealbook baseline projection. In the near term, the revisions to the strategies' prescriptions are small. Over the medium term, the Tealbook baseline projection features slightly lower levels of resource utilization and inflation than the projection made in March; consequently, all strategies call for lower policy rates during coming years than their counterparts in the previous Tealbook. A special exhibit reports the prescriptions of several flexible price-level targeting rules.

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 (1999) rule (also known as the “balanced approach” rule), the Taylor (1993) rule, a first-difference rule, and a nominal income targeting (NIT) rule. These near-term prescriptions take as given the staff's baseline projections for the output gap and core inflation, shown by the black lines in the middle panels. The top and middle panels also provide the staff's baseline path for the federal funds rate, which is constructed using an inertial version of the Taylor (1999) rule.¹

- The near-term prescriptions of the Taylor (1999) and the Taylor (1993) rules are about unchanged from their March Tealbook levels because the effects of the staff's small downward revision to the output gap offset those of the staff's modest upward revision to inflation in coming quarters.
- The prescriptions of the Taylor (1999) and Taylor (1993) rules, which do not feature interest rate smoothing terms, remain well above the corresponding policy rates in the Tealbook baseline.

¹ We provide details on each of these simple rules in the appendix to this section. Except for the first-difference rule, which has no intercept term, the simple rules examined here use intercept terms that are consistent with a real federal funds rate of 50 basis points in the longer run.

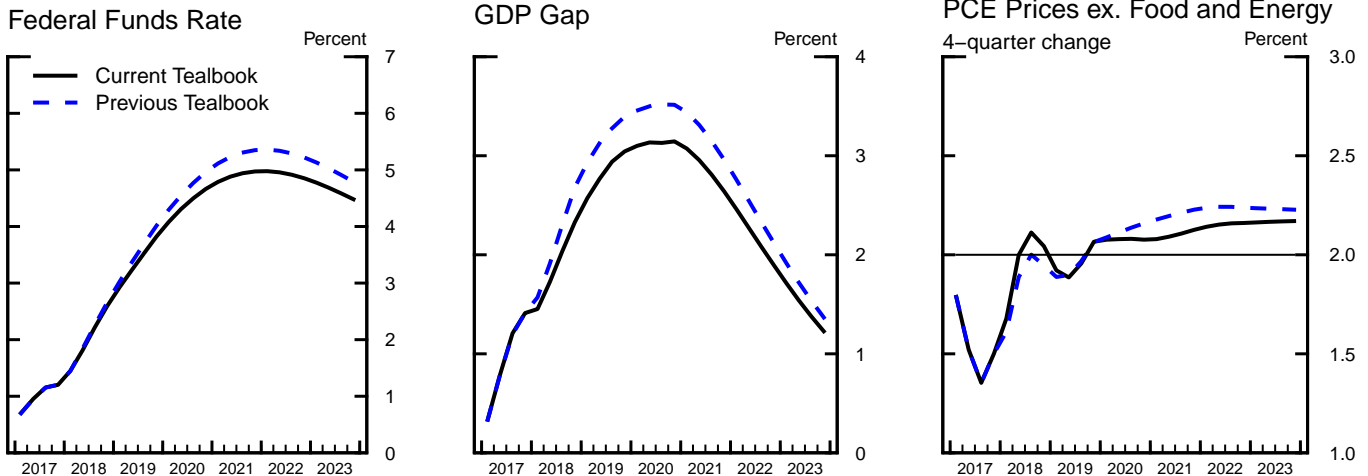
Policy Rules and the Staff Projection

Near-Term Prescriptions of Selected Simple Policy Rules¹

	(Percent)	
	2018:Q2	2018:Q3
Taylor (1999) rule	4.12	4.57
<i>Previous Tealbook</i>	4.14	4.67
Taylor (1993) rule	3.30	3.60
<i>Previous Tealbook</i>	3.23	3.58
First-difference rule	1.94	2.38
<i>Previous Tealbook projection</i>	2.04	2.57
Nominal income targeting rule	1.52	1.64
<i>Previous Tealbook projection</i>	1.52	1.65
<i>Addendum:</i>		
Tealbook baseline	1.81	2.22

Monetary Policy Strategies

Key Elements of the Staff Projection



A Medium-Term Notion of the Equilibrium Real Federal Funds Rate²

	(Percent)		
	Current Value	Current-Quarter Estimate Based on Previous Tealbook	Previous Tealbook
Tealbook baseline			
FRB/US r^*	3.40	3.83	3.62
Average projected real federal funds rate	1.53	1.71	1.45
SEP-consistent baseline			
FRB/US r^*	1.49		
Average projected real federal funds rate	.61		

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 "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 given either the Tealbook or SEP-consistent projection. The SEP-consistent baseline corresponds to the March 2018 median SEP responses. The "Average projected real federal funds rate" is calculated under the Tealbook and SEP-consistent baseline projections over the same 12-quarter period as FRB/US r^* .

- The prescriptions of the first-difference rule are a bit lower than in March because the output gap is now projected to widen at a slower rate over the coming year.
- Under the NIT rule, the federal funds rate responds to the output gap and the shortfall of the GDP price deflator from the level it would have attained had it increased at an annual rate of 2 percent since the end of 2011; the shortfall in the GDP price deflator in coming quarters is about 2¼ percent. Unlike the other rules and the Tealbook baseline policy, which call for raising the federal funds rate in the near term, the NIT rule, in an effort to eliminate the shortfall in the GDP price deflator, prescribes a level for the federal funds rate in the second and third quarters that remains within the current target range.

A MEDIUM-TERM NOTION OF THE EQUILIBRIUM REAL FEDERAL FUNDS RATE

The bottom panel of the first exhibit reports estimates of a medium-term concept of the equilibrium real federal funds rate generated under two baselines: the Tealbook baseline and a projection consistent with the medians in the March 2018 Summary of Economic Projections (SEP).² In both cases, simulations of the FRB/US model are used to generate an estimate of r^* . The r^* concept, labeled “FRB/US r^* ,” corresponds to the level of the real federal funds rate that, if maintained over a 12-quarter period starting in the current quarter, would bring the output gap to zero in the final quarter of that period. This concept of r^* is a summary of the projected underlying strength of the real economy; because it is based on a single criterion, it does not take into account other considerations, such as achieving the inflation objective or avoiding sharp changes in the federal funds rate.

- At a bit under 3½ percent, the estimate of Tealbook-consistent FRB/US r^* in this quarter is almost ½ percentage point below the corresponding value computed using information from the March Tealbook. The downward revision reflects the fact that the projected output gap in the current Tealbook

² To construct a baseline projection consistent with median SEP responses for the FRB/US model, the staff interpolated annual SEP information to a quarterly frequency and assumed that, beyond 2020 (the final year reported in the March 2018 SEP), the economy transitions to the longer-run values in a smooth and monotonic way. The staff also posited economic relationships to project variables not covered in the SEP. For example, the staff assumed an Okun’s law relationship to recover an output gap from the deviation of the median SEP unemployment rate from the median SEP estimate of its longer-run value.

is a bit more than $\frac{1}{4}$ percentage point lower, on average, through 2021 than in the March Tealbook.

- At about $1\frac{1}{2}$ percent, the SEP-consistent FRB/US r^* is significantly lower than the Tealbook-consistent FRB/US r^* . The difference stems from the fact that the SEP-consistent projection has output exceeding potential by a considerably smaller amount over the medium term than does the current Tealbook forecast. This smaller anticipated output gap occurs despite the fact that the median path for the real federal funds rate implied by SEP projections averages almost 1 percentage point lower than the corresponding path in the Tealbook.

SIMPLE POLICY RULE SIMULATIONS

The second exhibit reports results from dynamic simulations of the FRB/US model under the Taylor (1999) rule, the Taylor (1993) rule, the first-difference rule, and the NIT rule. These simulations reflect the endogenous responses of the output gap and inflation to the different federal funds rate paths implied by the policy rules.³ The simulations for each rule are carried out under the assumptions that policymakers commit to following the prescriptions of that rule in the future and that financial market participants, price setters, and wage setters anticipate that monetary policy will follow through on this commitment and are aware of the implications for interest rates and the macroeconomy.⁴ The exhibit also reports the extended Tealbook baseline projection.

- Under the Tealbook baseline, the federal funds rate rises to about $2\frac{1}{2}$ percent by the end of this year. Over the subsequent two years, it increases by about 1 percentage point per year, bringing the rate close to $4\frac{3}{4}$ percent in the fourth quarter of 2020.
- The Taylor (1999) rule calls for an immediate and substantial increase in the federal funds rate, and the prescribed values remain above the corresponding

³ Because of the endogenous responses of the output gap and inflation to the different federal funds rate paths, the near-term prescriptions from the dynamic simulations can differ from those shown in the top panel of the first exhibit.

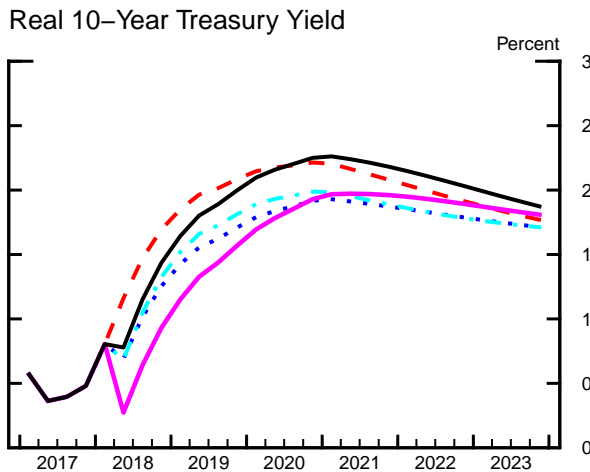
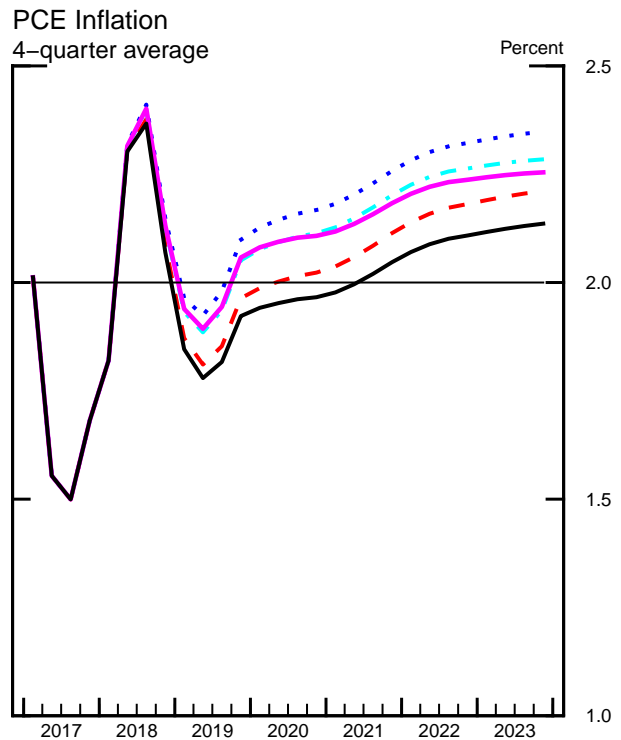
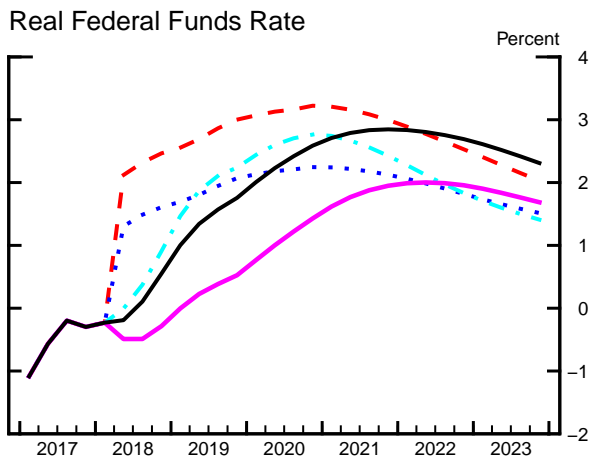
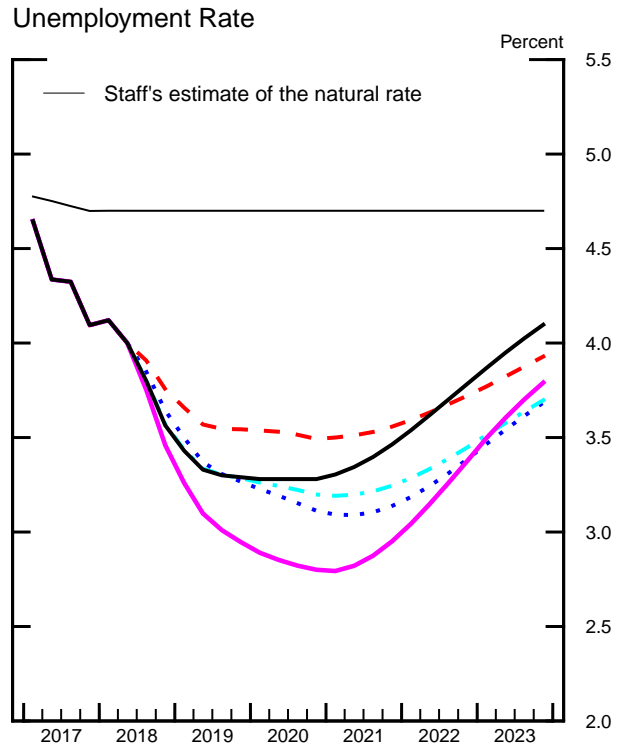
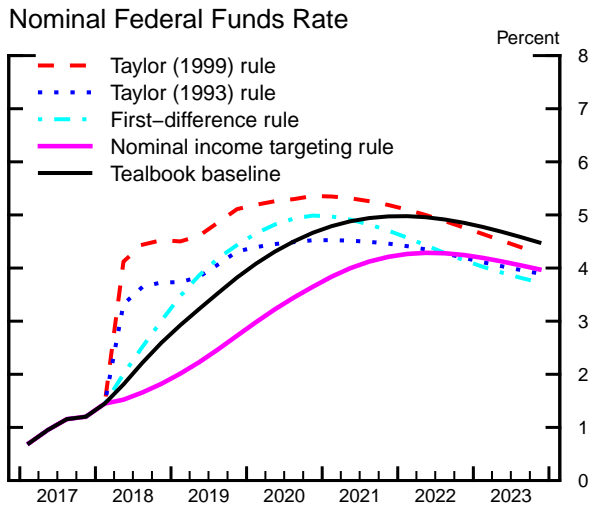
⁴ In generating these simulations, we assume that the public immediately and correctly understands the implications of the FOMC adopting a particular policy strategy. In the real world, the adoption of a particular policy strategy by the FOMC might well entail a period during which the public learns the new strategy and its macroeconomic implications. We abstract from considerations of this kind.

Tealbook baseline values through early 2022. This higher path is associated with only a modestly higher trajectory for the real 10-year Treasury yield than in the baseline through the middle of 2020, as the Taylor (1999) rule calls for somewhat lower values of the federal funds rate for a sustained period later in the simulation period. Because wage and price setting today is influenced by expected future outcomes in FRB/US, current inflation is a touch higher as a result of the somewhat more accommodative policy stance later in the simulation relative to the Tealbook baseline projection. The resulting path for the unemployment rate lies above the Tealbook baseline path over the next few years, but subsequently takes a bit longer to return to its natural rate.

- The Taylor (1993) rule also calls for an immediate sharp increase in the federal funds rate. Because the Taylor (1993) rule responds less strongly to projected output exceeding its assumed potential level, the prescriptions of this rule are lower than those of the Taylor (1999) rule over the period shown, though they are higher than the Tealbook baseline over the next two years. Starting in the fourth quarter of 2020, the path for the federal funds rate falls below the baseline path for a sustained period. As a result, current inflation is higher, and the real 10-year Treasury yield is lower, than their corresponding values in the Tealbook projection. The more accommodative conditions engender a more pronounced undershooting of the unemployment rate below its natural rate beyond the medium term.
- The path for the federal funds rate prescribed by the first-difference rule is somewhat above the path in the Tealbook baseline through early 2020 but runs below the baseline path for some years thereafter. The 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 projected output exceeding its assumed potential level by progressively smaller amounts beyond the next three years. The associated lower path of the federal funds rate, in conjunction with expectations of higher inflation in the future, implies lower longer-term real interest rates 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 lower, and outcomes for inflation that are higher, than the corresponding outcomes in the Tealbook baseline projection.

Simple Policy Rule Simulations

Monetary Policy Strategies



Note: The policy rule simulations in this exhibit are based on rules that respond to core inflation rather than to headline 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.

- The NIT rule seeks to compensate for the cumulative shortfall of inflation (as measured by the rate of increase in the GDP price deflator) from an annual rate of 2 percent since the end of 2011. Compared with the Tealbook baseline, the NIT rule calls for a markedly slower pace of increases in the federal funds rate in order to generate a somewhat higher rate of inflation in coming years and thereby gradually undo the 2¼ percent cumulative shortfall of inflation from 2 percent since the end of 2011. Because the simulation embeds the assumptions that policymakers can credibly commit to closing this gap and that financial market participants, price setters, and wage setters correctly anticipate the ensuing long period of low federal funds rates, the path of the real 10-year Treasury rate is lower than under the other policy rules and the Tealbook baseline for several years. Accordingly, the path for the unemployment rate is substantially lower than in the Tealbook baseline and all other simulations shown, dropping to 2¾ percent in 2021.
- Relative to the March Tealbook, the prescriptions of the simple rules are between ¼ and ½ percentage point lower by the end of 2021 because of the lower projected path of the output gap.

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; such a constraint may result in improved economic outcomes.⁶

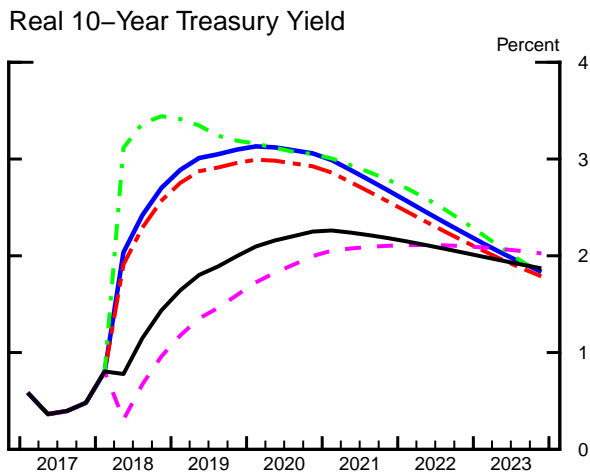
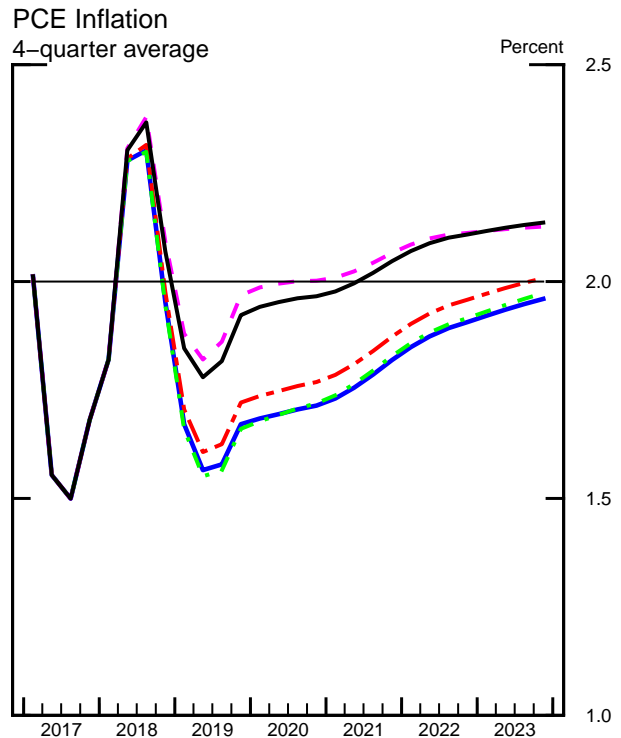
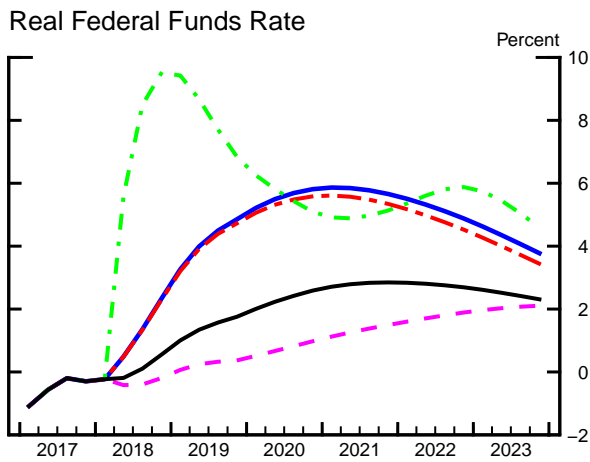
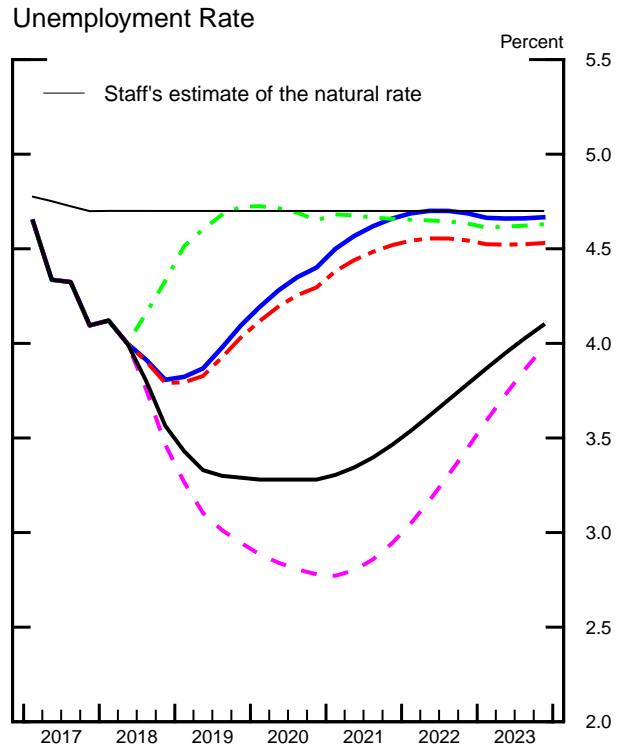
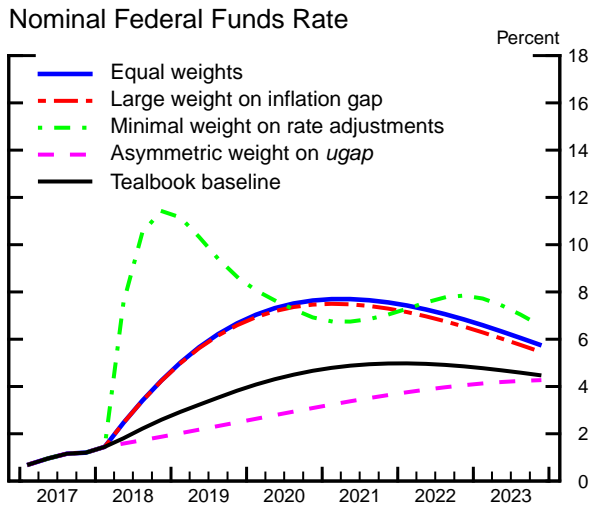
Three of the four optimal control policies prescribe much higher paths for the federal funds rate than the path in the baseline staff projection, for two reasons. First, high levels of the real federal funds rate are necessary to push the unemployment rate up to its natural rate, because in the FRB/US model, the unemployment rate does not

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, policymakers achieve the displayed economic outcomes by making promises that bind future policymakers to take actions that will not be optimal from the perspective of those future policymakers (that is, the promises are time inconsistent). It is assumed that these promises are taken as credible by wage and price setters and by financial market participants.

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 4-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.

respond strongly to changes in real interest rates, a feature that is consistent with recent historical experience. Second, because monetary policy actions are assumed to be understood and fully credible, the front-loading of policy tightening is not disruptive. However, in practice, if the FOMC were to raise the real federal funds rate as high and as quickly as prescribed by the first three optimal control policies, macroeconomic outcomes could be less benign than shown here because of the confusion and financial market disruption that such an abrupt change in policy might engender.⁷ In contrast, the fourth optimal control policy allows the unemployment rate to decline to levels last experienced during the 1950s; such a development might also entail outcomes different from those predicted by the simulations.

- The first simulation, labeled “Equal weights,” presents the case in which policymakers are assumed to place equal 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 path in order to temper the projected sizable undershooting by the unemployment rate of its natural rate over the next several years in the Tealbook baseline—an outcome that policymakers with the equal-weights loss function judge to be costly.⁸ The small projected deviations of inflation from 2 percent in the Tealbook baseline entail relatively small losses and so have little influence on optimal policy. Moreover, a relatively rapid closing of the unemployment gap generates only slightly lower inflation because, in the FRB/US model, the reaction of inflation to the level of resource utilization is limited.
- The second simulation, “Large weight on inflation gap,” is based on a loss function that assigns a cost to deviations of inflation from 2 percent that is five times larger than the specification with equal weights but is otherwise

⁷ The simulation results hinge on the assumptions that agents in the model have perfect foresight and are certain that policymakers will implement the prescribed path for the federal funds rate. While these assumptions may be reasonable approximations under some circumstances, they may not be valid for historically extreme changes in the federal funds rate, particularly those prescribed by the optimal control exercise that places only a minimal penalty on adjustments in the federal funds rate.

⁸ When we use the March 2018 SEP-consistent baseline as the underlying projection, the federal funds rate under the optimal control simulation with equal weights peaks at around 5 percent, compared with about 8 percent under the Tealbook baseline.

identical to that specification. The resulting optimal strategy is only marginally more accommodative than in the “Equal weights” case, even though the losses associated with undershooting the inflation objective are larger in coming years. There are two reasons that the prescribed path for the federal funds rate is not materially altered even though the weight on inflation losses is substantially higher than in the “Equal weights” case. First, inflation is already close to the Committee’s 2 percent objective, and, second, in the FRB/US model, policymakers face an unappealing tradeoff because inflation responds only weakly to resource utilization.

- The third simulation, “Minimal weight on rate adjustments,” uses a loss function that assigns only a very small cost to changes in the federal funds rate but that is otherwise identical to the loss function with equal weights. This simulation seeks to return the unemployment rate to its natural rate even faster than under the equal-weights specification. As a result, the federal funds rate soars to about 11½ percent at the end of 2018 and then averages around 7 percent from 2020 through 2023.
- The fourth 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 below the natural rate, but the loss function 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 the path in the optimal control simulation with equal weights and below the Tealbook baseline path throughout the period shown. With the asymmetric loss function, policymakers choose this initially more accommodative path for the policy rate because their desire to raise inflation to 2 percent is not tempered by an aversion to undershooting the natural rate of unemployment. The tighter labor market helps bring inflation to 2 percent more quickly than in the case of equal weights. Starting in the middle of the 2020s (not shown), the unemployment rate runs a little above its natural rate for several years as policymakers act to contain the inflationary pressures stemming from the prolonged period of elevated resource utilization.

ILLUSTRATING FLEXIBLE PRICE-LEVEL TARGETING RULES

The following pages discuss several monetary policy rules that target the *price level* rather than the inflation rate. Price-level targeting rules aim to reverse deviations of inflation from policymakers' objective rather than letting "bygones be bygones." Such rules have been studied as a form of commitment to making up shortfalls of policy accommodation following an episode when the policy rate was constrained by the lower bound or, more generally, as a means for increasing the predictability of future price levels. The NIT rule discussed earlier is an example of a flexible price-level targeting (FPLT) rule that not only seeks to stabilize an aggregate price index around a target path but also responds to a measure of resource slack. The nominal income gap can be decomposed into the sum of a price gap (the difference between the output price index and a target path) and the output gap; under the NIT rule, by design, equally sized movements in these gaps call for the same adjustments in the federal funds rate.⁹ In the NIT rule simulation shown in the exhibits, the target path for prices is anchored in 2011:Q4, just before the Committee announced its 2 percent inflation objective, and grows at a 2 percent annual rate thereafter.¹⁰

Because it is derived from nominal GDP, the NIT rule uses a GDP-based price measure for its price gap along with the output gap as its measure of real activity. However, under FPLT rules, the interest rate could respond to other price indices or measures of resource utilization. As an illustration, the fourth exhibit considers three FPLT rules that respond to the price gap measured using core PCE prices and to the unemployment rate gap.¹¹ The three FPLT rules vary in their response coefficients to the price gap and the unemployment rate gap and in the reference date for their target path for the price level. The first rule, "FPLT, large response to *ugap* (2011:Q4)," responds twice as much to the unemployment rate gap as to the price gap, while the second rule, "FPLT, equal responses," reacts to both gaps in equal measure. As in the NIT rule, both

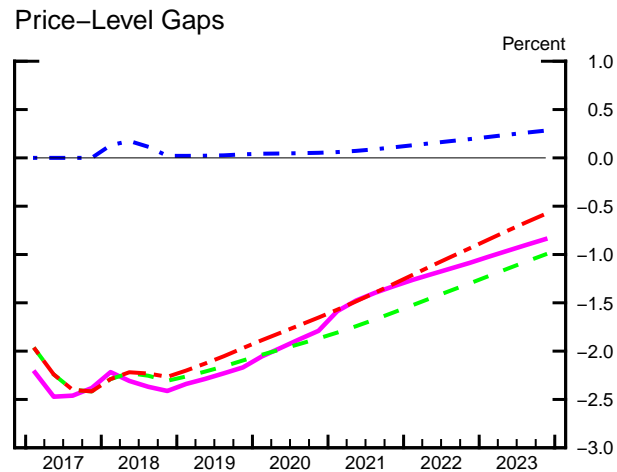
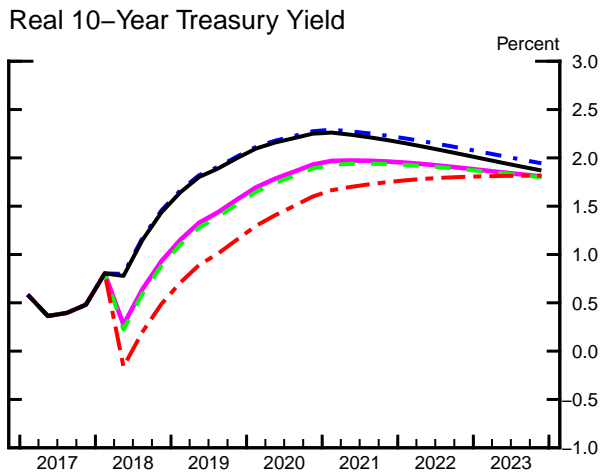
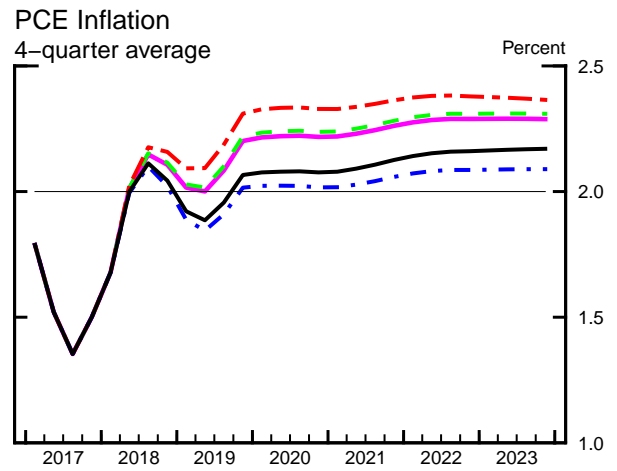
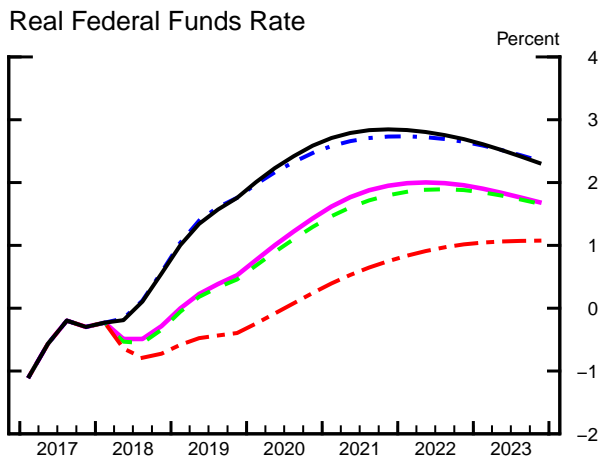
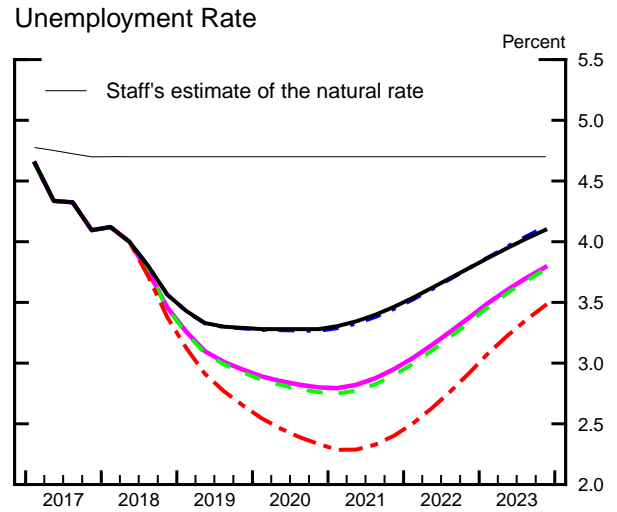
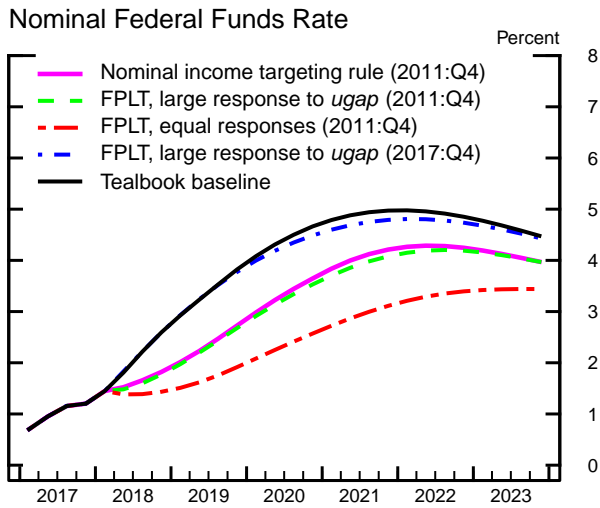
⁹ Under this implementation of the NIT rule, the target path of nominal GDP is adjusted for changes in potential output growth. Nominal GDP targeting is sometimes understood as targeting a path for nominal GDP that grows at a constant rate, in which case variations in potential output would call for offsetting adjustments in inflation.

¹⁰ As shown in the appendix to this section, these assumptions imply that the price gap can be expressed as the cumulative miss of output price inflation from 2 percent since the beginning of 2012.

¹¹ The unemployment rate gap is defined as the unemployment rate minus the natural rate of unemployment. The FPLT rules respond to this gap with a negative coefficient, so that when the unemployment rate is higher (lower) than its natural rate, the FPLT rule prescribes a lower (higher) interest rate.

Illustrating Flexible Price–Level Targeting Rules

Monetary Policy Strategies



of these FPLT rules seek to make up deviations in inflation from its 2 percent objective since the beginning of 2012.¹² The third rule, “FPLT, large response to *ugap* (2017:Q4),” reacts to the unemployment rate and price gaps as in the “FPLT, large response to *ugap* (2011:Q4) rule,” but seeks to make up deviations in inflation from 2 percent only since the beginning of this year. The panels in the fourth exhibit report results from dynamic simulations of the FRB/US model under the FPLT rules, the NIT rule, and the Tealbook baseline rule.

- The economic outcomes under the “FPLT, large response to *ugap* (2011:Q4)” rule are very close to those under the NIT rule because the initial price gaps measured using core PCE prices and GDP prices are very similar, at about 2¼ percent, and because these two rules respond roughly equivalently to the cyclical position of the economy.¹³ Both FPLT rules call for a more gradual increase in the federal funds rate than the Tealbook baseline projection. Given a more accommodative policy—and because, in these simulations, policymakers credibly commit to sustaining accommodation until the price gap is significantly reduced—inflation increases immediately and runs higher than in the Tealbook baseline for a number of years. Low real interest rates also spur faster growth of economic activity, and the unemployment rate undershoots the baseline projection by about ½ percentage point in 2021.
- Under the “FPLT, equal responses (2011:Q4)” rule, the path for policy is even more accommodative than the path under the “FPLT, large response to *ugap* (2011:Q4)” rule because policymakers lean less strongly against the unemployment rate undershooting its natural rate. As a result, inflation rises and real activity booms, with the unemployment rate dropping to nearly 2¼ percent in 2021, about 1 percentage point below the baseline projection. The price-level gap is closed notably more rapidly in this instance than under the “FPLT, large response to *ugap* (2011:Q4)” rule.
- The “FPLT, large response to *ugap* (2017:Q4)” rule prescribes a path for the federal funds rate that is nearly identical to the Tealbook baseline path.

¹² The appendix to this section details the calibration of the FPLT rules.

¹³ In particular, the FRB/US model roughly satisfies the empirical regularity known as Okun’s law by generating changes in the unemployment gap that are roughly half as large and of the opposite sign as changes in the output gap. Hence, a coefficient of negative 2 on the unemployment gap has similar implications to a coefficient of 1 on the output gap in a FPLT rule.

Unlike the rules with a 2011:Q4 anchor date for the price level, there is only a small initial price gap to which policymakers would respond. Moreover, in the baseline projection, inflation remains close to 2 percent, and the responsiveness of this FPLT rule to resource slack is about the same as in the inertial Taylor (1999) rule that is used to construct the baseline projection. As a result, the paths for the unemployment rate and inflation under this FPLT rule and the baseline rule are very similar. Relative to the policy prescriptions from the other two FPLT rules, the path of the federal funds rate is considerably higher.

- While the outcomes for the “FPLT rule, large response to *ugap* (2017:Q4)” and the inertial Taylor (1999) rule under the baseline projection are very similar, the prescriptions from these two rules could diverge markedly in other scenarios. For example, in the face of a large and negative demand shock, the FPLT rule shown here would be considerably more accommodative than the inertial Taylor (1999) rule, leading to higher output and lower unemployment for some time after the shock.¹⁴
- Overall, the simulations show that the FPLT rules that respond to a price gap measured using core PCE prices and the unemployment rate gap can give rise to a variety of economic outcomes, including outcomes similar to those under the baseline Tealbook projection. In a downturn with a prolonged period of inflation below the 2 percent target, all of the FPLT rules would provide a large amount of accommodation compared with rules in which inflation bygones are bygones, such as the inertial Taylor (1999) rule. Of course, the efficacy of FPLT rules relies heavily on the assumptions that policymakers can not only credibly commit to such policies and communicate them clearly but also that the public understands and anticipates their effects.

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

¹⁴ The March 2016 Monetary Policy Strategies section of Tealbook B examined flexible price-level targeting rules in the context of a recession scenario.

Outcomes of Simple Policy Rule Simulations
(Percent change, annual rate, from end of preceding period except as noted)

Outcome and strategy	2018	2019	2020	2021	2022	2023
<i>Nominal federal funds rate¹</i>						
Taylor (1999)	4.5	5.1	5.4	5.2	4.8	4.3
Taylor (1993)	3.7	4.3	4.5	4.5	4.2	3.9
First-difference	3.0	4.4	5.0	4.7	4.1	3.7
Nominal income targeting	1.8	2.7	3.6	4.2	4.2	4.0
Extended Tealbook baseline	2.6	3.8	4.7	5.0	4.9	4.5
<i>Real GDP</i>						
Taylor (1999)	2.3	2.4	2.1	1.7	1.2	1.2
Taylor (1993)	2.5	2.8	2.3	1.7	1.1	1.1
First-difference	2.6	2.7	2.2	1.7	1.2	1.2
Nominal income targeting	2.8	3.1	2.3	1.5	.9	.9
Extended Tealbook baseline	2.6	2.6	2.1	1.5	1.0	1.0
<i>Unemployment rate¹</i>						
Taylor (1999)	3.8	3.5	3.5	3.6	3.7	3.9
Taylor (1993)	3.6	3.3	3.1	3.1	3.4	3.7
First-difference	3.6	3.3	3.2	3.2	3.4	3.7
Nominal income targeting	3.5	2.9	2.8	3.0	3.4	3.8
Extended Tealbook baseline	3.6	3.3	3.3	3.5	3.8	4.1
<i>Total PCE prices</i>						
Taylor (1999)	2.1	2.0	2.0	2.1	2.2	2.2
Taylor (1993)	2.1	2.1	2.2	2.3	2.3	2.3
First-difference	2.1	2.1	2.1	2.2	2.3	2.3
Nominal income targeting	2.1	2.1	2.1	2.2	2.2	2.3
Extended Tealbook baseline	2.1	1.9	2.0	2.0	2.1	2.1
<i>Core PCE prices</i>						
Taylor (1999)	2.1	2.1	2.1	2.2	2.2	2.2
Taylor (1993)	2.1	2.2	2.3	2.3	2.4	2.4
First-difference	2.1	2.2	2.2	2.3	2.3	2.3
Nominal income targeting	2.1	2.2	2.2	2.3	2.3	2.3
Extended Tealbook baseline	2.0	2.1	2.1	2.1	2.2	2.2

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

Outcomes of Simple Policy Rule Simulations, Quarterly

(4-quarter percent change, except as noted)

Outcome and strategy	2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Nominal federal funds rate¹</i>								
Taylor (1999)	1.4	4.1	4.4	4.5	4.5	4.6	4.9	5.1
Taylor (1993)	1.4	3.3	3.6	3.7	3.7	3.8	4.1	4.3
First-difference	1.4	2.0	2.5	3.0	3.5	3.9	4.2	4.4
Nominal income targeting	1.4	1.5	1.7	1.8	2.0	2.2	2.5	2.7
Extended Tealbook baseline	1.4	1.8	2.2	2.6	2.9	3.2	3.5	3.8
<i>Real GDP</i>								
Taylor (1999)	2.7	2.6	2.4	2.3	2.5	2.4	2.4	2.4
Taylor (1993)	2.7	2.6	2.6	2.5	2.8	2.8	2.8	2.8
First-difference	2.7	2.6	2.6	2.6	2.9	2.9	2.8	2.7
Nominal income targeting	2.7	2.6	2.7	2.8	3.3	3.3	3.3	3.1
Extended Tealbook baseline	2.7	2.6	2.6	2.6	2.9	2.8	2.7	2.6
<i>Unemployment rate¹</i>								
Taylor (1999)	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5
Taylor (1993)	4.1	4.0	3.8	3.6	3.5	3.4	3.3	3.3
First-difference	4.1	4.0	3.8	3.6	3.4	3.3	3.3	3.3
Nominal income targeting	4.1	4.0	3.8	3.5	3.3	3.1	3.0	2.9
Extended Tealbook baseline	4.1	4.0	3.8	3.6	3.4	3.3	3.3	3.3
<i>Total PCE prices</i>								
Taylor (1999)	1.8	2.3	2.4	2.1	1.9	1.8	1.9	2.0
Taylor (1993)	1.8	2.3	2.4	2.1	2.0	1.9	2.0	2.1
First-difference	1.8	2.3	2.4	2.1	1.9	1.9	1.9	2.1
Nominal income targeting	1.8	2.3	2.4	2.1	1.9	1.9	1.9	2.1
Extended Tealbook baseline	1.8	2.3	2.4	2.1	1.8	1.8	1.8	1.9
<i>Core PCE prices</i>								
Taylor (1999)	1.7	2.0	2.1	2.1	1.9	1.9	2.0	2.1
Taylor (1993)	1.7	2.0	2.2	2.1	2.0	2.0	2.1	2.2
First-difference	1.7	2.0	2.1	2.1	2.0	2.0	2.1	2.2
Nominal income targeting	1.7	2.0	2.1	2.1	2.0	2.0	2.1	2.2
Extended Tealbook baseline	1.7	2.0	2.1	2.0	1.9	1.9	2.0	2.1

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)

Outcome and strategy	2018	2019	2020	2021	2022	2023
<i>Nominal federal funds rate¹</i>						
Equal weights	4.3	6.7	7.6	7.6	6.8	5.8
Large weight on inflation gap	4.2	6.6	7.5	7.3	6.5	5.5
Minimal weight on rate adjustments	11.4	8.6	6.9	7.0	7.8	6.6
Asymmetric weight on <i>ugap</i>	1.9	2.5	3.1	3.6	4.1	4.3
Extended Tealbook baseline	2.6	3.8	4.7	5.0	4.9	4.5
<i>Real GDP</i>						
Equal weights	2.1	1.4	1.5	1.4	1.4	1.4
Large weight on inflation gap	2.1	1.5	1.5	1.5	1.4	1.4
Minimal weight on rate adjustments	1.3	1.0	2.1	1.9	1.5	1.3
Asymmetric weight on <i>ugap</i>	2.8	3.1	2.3	1.4	.7	.7
Extended Tealbook baseline	2.6	2.6	2.1	1.5	1.0	1.0
<i>Unemployment rate¹</i>						
Equal weights	3.8	4.1	4.4	4.7	4.7	4.7
Large weight on inflation gap	3.8	4.0	4.3	4.5	4.5	4.5
Minimal weight on rate adjustments	4.3	4.7	4.7	4.7	4.6	4.6
Asymmetric weight on <i>ugap</i>	3.5	2.9	2.8	2.9	3.4	4.0
Extended Tealbook baseline	3.6	3.3	3.3	3.5	3.8	4.1
<i>Total PCE prices</i>						
Equal weights	2.0	1.7	1.7	1.8	1.9	2.0
Large weight on inflation gap	2.0	1.7	1.8	1.9	2.0	2.0
Minimal weight on rate adjustments	1.9	1.7	1.7	1.8	1.9	2.0
Asymmetric weight on <i>ugap</i>	2.1	2.0	2.0	2.1	2.1	2.1
Extended Tealbook baseline	2.1	1.9	2.0	2.0	2.1	2.1
<i>Core PCE prices</i>						
Equal weights	1.9	1.8	1.8	1.9	2.0	2.0
Large weight on inflation gap	1.9	1.9	1.9	2.0	2.0	2.0
Minimal weight on rate adjustments	1.9	1.8	1.8	1.9	2.0	2.0
Asymmetric weight on <i>ugap</i>	2.1	2.1	2.1	2.1	2.2	2.2
Extended Tealbook baseline	2.0	2.1	2.1	2.1	2.2	2.2

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

Outcomes of Optimal Control Simulations under Commitment, Quarterly

(4-quarter percent change, except as noted)

Outcome and strategy	2018				2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Nominal federal funds rate¹</i>								
Equal weights	1.4	2.5	3.4	4.3	5.0	5.7	6.2	6.7
Large weight on inflation gap	1.4	2.5	3.4	4.2	5.0	5.6	6.2	6.6
Minimal weight on rate adjustments	1.4	7.6	10.5	11.4	11.2	10.3	9.4	8.6
Asymmetric weight on <i>ugap</i>	1.4	1.6	1.7	1.9	2.0	2.2	2.3	2.5
Extended Tealbook baseline	1.4	1.8	2.2	2.6	2.9	3.2	3.5	3.8
<i>Real GDP</i>								
Equal weights	2.7	2.7	2.3	2.1	2.0	1.7	1.6	1.4
Large weight on inflation gap	2.7	2.7	2.4	2.1	2.1	1.8	1.7	1.5
Minimal weight on rate adjustments	2.7	2.7	2.0	1.3	1.0	.5	.7	1.0
Asymmetric weight on <i>ugap</i>	2.7	2.6	2.7	2.8	3.3	3.3	3.2	3.1
Extended Tealbook baseline	2.7	2.6	2.6	2.6	2.9	2.8	2.7	2.6
<i>Unemployment rate¹</i>								
Equal weights	4.1	4.0	3.9	3.8	3.8	3.9	4.0	4.1
Large weight on inflation gap	4.1	4.0	3.9	3.8	3.8	3.8	3.9	4.0
Minimal weight on rate adjustments	4.1	4.0	4.2	4.3	4.5	4.6	4.7	4.7
Asymmetric weight on <i>ugap</i>	4.1	4.0	3.8	3.5	3.3	3.1	3.0	2.9
Extended Tealbook baseline	4.1	4.0	3.8	3.6	3.4	3.3	3.3	3.3
<i>Total PCE prices</i>								
Equal weights	1.8	2.3	2.3	2.0	1.7	1.6	1.6	1.7
Large weight on inflation gap	1.8	2.3	2.3	2.0	1.7	1.6	1.6	1.7
Minimal weight on rate adjustments	1.8	2.3	2.3	1.9	1.7	1.6	1.6	1.7
Asymmetric weight on <i>ugap</i>	1.8	2.3	2.4	2.1	1.9	1.8	1.9	2.0
Extended Tealbook baseline	1.8	2.3	2.4	2.1	1.8	1.8	1.8	1.9
<i>Core PCE prices</i>								
Equal weights	1.7	2.0	2.0	1.9	1.7	1.7	1.7	1.8
Large weight on inflation gap	1.7	2.0	2.1	1.9	1.8	1.7	1.8	1.9
Minimal weight on rate adjustments	1.7	2.0	2.0	1.9	1.7	1.7	1.7	1.8
Asymmetric weight on <i>ugap</i>	1.7	2.0	2.1	2.1	2.0	1.9	2.0	2.1
Extended Tealbook baseline	1.7	2.0	2.1	2.0	1.9	1.9	2.0	2.1

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 THE MONETARY POLICY STRATEGIES SECTION

The table "Simple Rules" that follows gives expressions for four simple policy rules routinely reported in the Monetary Policy Strategies section. It also reports the expression for the inertial version of the Taylor (1999) rule; the staff uses that inertial version, augmented with a small temporary intercept adjustment, in the construction of the Tealbook baseline projection. R_t denotes the nominal federal funds rate prescribed by a strategy for quarter t ; for quarters prior to the projection period under consideration, R_t corresponds to the historical data in the economic projection. 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.

The nominal income targeting rule responds to a nominal income gap, which is defined as the difference between nominal income, denoted yn_t and measured as 100 times the log of the level of nominal GDP, and a target value, denoted yn_t^* and measured as 100 times the log of target nominal GDP. Target nominal GDP in 2011:Q4 is set equal to the staff's current estimate of potential real GDP in that quarter multiplied by the GDP deflator in that quarter; subsequently, target nominal GDP grows 2 percentage points per year faster than the staff's estimate of potential GDP. These assumptions imply that the nominal income gap can be approximated as the sum of the current estimate of the output gap and the shortfall of the GDP deflator from the level it would have attained had it grown at a 2 percent annual pace since 2011:Q4.¹

Simple Rules

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

The first two of the selected rules were studied by Taylor (1993, 1999), whereas the inertial version of the Taylor (1999) rule and the nominal income targeting rules have been featured prominently in analysis by Board staff.²

Where applicable, the intercepts of the simple rules, denoted r^{LR} , are constant and chosen so that they are consistent with a 2 percent longer-run inflation objective and an equilibrium real federal funds rate in the longer run of 0.5 percent.³ 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).

¹ That is, these assumptions imply that $yn_t - yn_t^* \approx ygap_t + \frac{1}{4} \sum_{s=2012:Q1}^t (\Delta GDPdef_s - 2)$, where $\Delta GDPdef_s$ denotes the annualized quarterly rate of growth of the GDP deflator for quarter s .

² For applications, see, for example, Erceg and others (2012).

³ 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.

NEAR-TERM PRESCRIPTIONS OF SELECTED POLICY RULES

The “Near-Term Prescriptions of Selected Policy Rules” reported in the first exhibit 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.

A MEDIUM-TERM NOTION OF THE EQUILIBRIUM REAL FEDERAL FUNDS RATE

The bottom panel of the exhibit “Policy Rules and the Staff Projection” provides estimates of one notion of the equilibrium real federal funds rate that uses alternative baselines: the Tealbook baseline and another one consistent with median responses to the latest Summary of Economic Projections (SEP). The simulations are conducted using the FRB/US model, the staff’s large-scale econometric model of the U.S. economy. “FRB/US r^* ” is 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, given either the Tealbook or the SEP-consistent economic projection.⁴ This measure depends on a broad array of economic factors, some of which take the form of projected values of the model’s exogenous variables. The 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” for the Tealbook baseline and the SEP-consistent baseline reported in the panel are the corresponding averages of the real federal funds rate under the Tealbook baseline projection and SEP-consistent projection, respectively, calculated over the same 12-quarter period as the Tealbook-consistent and SEP-consistent FRB/US r^* . For a given economic projection, the average projected real federal funds rates and the FRB/US r^* may be associated with somewhat different macroeconomic outcomes even when their values are identical. The reason is that, in the FRB/US r^* simulation, the real federal funds rate is held constant over the entire 12-quarter period, whereas, in the economic projection, 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

⁴ For a discussion of the equilibrium real federal funds rates in the longer run and other concepts of equilibrium interest rates, see Gust and others (2016).

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, "Large weight on inflation gap," attaches a relatively large weight to inflation gaps. The third specification, "Minimal weight on rate adjustments," places almost no weight on changes in the federal funds rate.⁵ The fourth 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 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.

⁵ The inclusion of a minimal but strictly positive weight on changes in the federal funds rate helps ensure a well-behaved numerical solution.

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

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 sees 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.

FLEXIBLE PRICE-LEVEL TARGETING RULES

The table "FPLT Rules" shown below gives expressions for two flexible price-level targeting rules reported in the exhibit, "Illustrating Flexible Price-Level Targeting Rules." In the table, R_t denotes the nominal federal funds rate prescribed by a rule 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, π_t , and the longer-run real interest rate, r^{LR} . The price gap is computed as the difference between the core PCE price level, p_t , and the target path, p_t^* . For the rules in the exhibit with the 2011:Q4 anchor date, the 2011:Q4 value of the target path is set to the 2011:Q4 value of the core PCE price level, and, subsequently, p_t^* is assumed to grow at a 2 percent annual rate. The target path is set in an analogous fashion for the rule with the 2017:Q4 anchor date. The unemployment gap is the difference between the unemployment rate, u_t , and the staff's estimate of its natural rate, u_t^* .

FPLT Rules

FPLT, large response to $ugap$	$R_t = 0.85R_{t-1} + 0.15(r^{LR} + \pi_t + (p_t - p_t^*) - 2(u_t - u_t^*))$
FPLT, equal responses	$R_t = 0.85R_{t-1} + 0.15(r^{LR} + \pi_t + (p_t - p_t^*) - (u_t - u_t^*))$

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

Interval	Nominal GDP		Real GDP		PCE price index		Core PCE price index		Unemployment rate ¹	
	03/09/18	04/19/18	03/09/18	04/19/18	03/09/18	04/19/18	03/09/18	04/19/18	03/09/18	04/19/18
<i>Quarterly</i>										
2017:Q1	3.3	3.3	1.2	1.2	2.2	2.2	1.8	1.8	4.6	4.6
Q2	4.1	4.1	3.1	3.1	.3	.3	.9	.9	4.3	4.3
Q3	5.3	5.3	3.2	3.2	1.5	1.5	1.3	1.3	4.3	4.3
Q4	5.3	5.3	2.9	2.9	2.7	2.7	1.9	1.9	4.1	4.1
2018:Q1	4.4	4.4	2.1	1.7	2.5	2.8	2.3	2.5	4.1	4.1
Q2	4.9	4.7	3.1	2.9	1.5	2.2	2.0	2.2	3.9	4.0
Q3	5.3	4.8	3.3	3.0	1.7	1.8	1.8	1.8	3.7	3.8
Q4	5.1	4.7	3.2	2.9	1.6	1.5	1.7	1.7	3.5	3.6
2019:Q1	5.1	5.1	2.9	2.9	1.9	1.9	2.0	2.0	3.3	3.4
Q2	4.8	4.8	2.7	2.7	2.0	1.9	2.1	2.1	3.2	3.3
Q3	4.6	4.7	2.5	2.6	2.0	1.9	2.1	2.1	3.2	3.3
Q4	4.4	4.3	2.3	2.3	2.0	2.0	2.1	2.1	3.1	3.3
<i>Two-quarter²</i>										
2017:Q2	3.7	3.7	2.1	2.1	1.2	1.2	1.4	1.4	-4	-4
Q4	5.3	5.3	3.0	3.0	2.1	2.1	1.6	1.6	-2	-2
2018:Q2	4.6	4.6	2.6	2.3	2.0	2.5	2.1	2.4	-2	-1
Q4	5.2	4.8	3.3	2.9	1.6	1.7	1.8	1.7	-4	-4
2019:Q2	5.0	4.9	2.8	2.8	1.9	1.9	2.0	2.1	-3	-3
Q4	4.5	4.5	2.4	2.4	2.0	1.9	2.1	2.1	-1	.0
<i>Four-quarter³</i>										
2016:Q4	3.4	3.4	1.8	1.8	1.6	1.6	1.9	1.9	-3	-3
2017:Q4	4.5	4.5	2.6	2.6	1.7	1.7	1.5	1.5	-6	-6
2018:Q4	4.9	4.7	2.9	2.6	1.8	2.1	1.9	2.0	-6	-5
2019:Q4	4.7	4.7	2.6	2.6	2.0	1.9	2.1	2.1	-4	-3
2020:Q4	4.3	4.2	2.1	2.1	2.1	2.0	2.2	2.1	.0	.0
<i>Annual</i>										
2016	2.8	2.8	1.5	1.5	1.2	1.2	1.8	1.8	4.9	4.9
2017	4.1	4.1	2.3	2.3	1.7	1.7	1.5	1.5	4.4	4.4
2018	4.9	4.8	2.9	2.6	1.9	2.1	1.9	2.0	3.8	3.9
2019	4.9	4.8	2.9	2.8	1.8	1.8	2.0	2.0	3.2	3.3
2020	4.4	4.4	2.2	2.2	2.0	2.0	2.1	2.1	3.1	3.3

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	2017				2018				2019				2017 ¹	2018 ¹	2019 ¹	2020 ¹
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4					
												Q2					Q3	Q4	Q1	Q2	Q3	Q4
Real GDP	3.1	3.2	2.9	1.7	2.9	3.0	2.9	2.9	2.7	2.6	2.3	2.6	2.6	2.6	2.1	
<i>Previous Tealbook</i>	3.1	3.2	2.9	2.1	3.1	3.3	3.2	2.9	2.7	2.5	2.3	2.9	2.9	2.6	2.1	
Final sales	3.0	2.4	3.4	.7	2.8	3.3	3.3	3.1	2.8	2.5	2.5	2.9	2.5	2.7	2.1	
<i>Previous Tealbook</i>	3.0	2.4	3.6	1.3	3.3	3.3	3.5	3.0	2.7	2.6	2.4	2.9	2.8	2.7	2.1	
Priv. dom. final purch.	3.3	2.2	4.8	1.6	2.8	3.2	3.0	3.0	2.9	2.7	2.5	3.3	2.6	2.8	2.4	
<i>Previous Tealbook</i>	3.3	2.2	5.0	1.6	3.4	3.4	3.3	3.1	2.9	2.7	2.4	3.4	2.9	2.8	2.5	
Personal cons. expend.	3.3	2.2	4.0	1.2	2.2	2.6	2.5	2.8	2.7	2.6	2.5	2.8	2.1	2.7	2.5	
<i>Previous Tealbook</i>	3.3	2.2	4.2	1.5	2.6	2.9	2.9	2.8	2.8	2.7	2.6	2.9	2.4	2.8	2.5	
Durables	7.6	8.6	13.7	-1.4	4.2	4.6	3.8	2.3	2.2	2.1	2.0	7.3	2.8	2.1	1.9	
Nondurables	4.2	2.3	4.8	-1.2	1.0	2.3	2.7	2.8	2.8	2.7	2.6	3.1	1.2	2.7	2.6	
Services	2.3	1.1	2.3	2.3	2.2	2.3	2.2	2.8	2.8	2.7	2.6	2.1	2.3	2.7	2.5	
Residential investment	-7.3	-4.7	12.8	-4.1	-2.1	5.0	5.1	1.6	1.6	1.8	1.8	2.6	.9	1.7	3.3	
<i>Previous Tealbook</i>	-7.3	-4.7	12.4	-4.4	2.7	4.0	4.1	2.5	.3	-1	-8	2.5	1.6	.5	4.2	
Nonres. priv. fixed invest.	6.7	4.7	6.8	5.7	8.0	6.2	5.0	4.7	4.3	3.5	2.3	6.3	6.2	3.7	1.7	
<i>Previous Tealbook</i>	6.7	4.7	7.1	4.2	8.2	6.2	5.5	4.9	4.3	3.4	2.4	6.4	6.0	3.8	1.8	
Equipment & intangibles	6.6	8.4	7.0	5.8	6.4	5.8	5.3	5.5	4.8	4.0	2.6	6.7	5.8	4.2	2.0	
<i>Previous Tealbook</i>	6.6	8.4	7.4	4.5	7.2	6.8	6.4	5.5	4.6	3.7	2.4	6.8	6.2	4.1	2.1	
Nonres. structures	7.0	-7.0	6.3	5.6	13.5	7.5	4.2	2.3	2.7	1.8	1.4	5.0	7.7	2.0	.5	
<i>Previous Tealbook</i>	7.0	-7.0	6.2	3.4	11.6	4.0	2.8	3.1	3.5	2.5	2.1	4.9	5.4	2.8	.9	
Net exports ²	-614	-598	-654	-676	-671	-663	-651	-642	-650	-659	-663	-622	-665	-654	-696	
<i>Previous Tealbook</i> ²	-614	-598	-653	-654	-647	-643	-637	-638	-649	-657	-661	-622	-645	-651	-702	
Exports	3.5	2.1	7.0	2.9	5.5	7.1	5.5	5.8	5.3	5.3	4.4	5.0	5.2	5.2	3.6	
Imports	1.5	-7	14.1	5.3	3.5	4.3	2.7	3.3	5.2	5.4	3.9	4.7	3.9	4.4	4.8	
Gov't. cons. & invest.	-.2	.7	3.0	-1.2	1.2	2.2	2.7	1.7	2.3	2.2	2.4	.7	1.2	2.2	1.9	
<i>Previous Tealbook</i>	-.2	.7	3.0	-.3	.8	1.8	2.7	1.7	2.3	2.2	2.4	.7	1.2	2.1	1.8	
Federal	1.9	1.3	3.2	-3.8	1.4	4.0	5.6	3.0	4.6	4.2	4.7	1.0	1.8	4.1	3.3	
Defense	4.7	2.4	5.5	-5.3	2.4	5.2	7.0	3.1	5.8	5.1	5.5	2.3	2.2	4.9	3.6	
Nondefense	-1.9	-2	-1	-1.6	.0	2.4	3.5	2.8	2.9	3.0	3.5	-9	1.1	3.0	2.7	
State & local	-1.5	.2	2.9	.3	1.0	1.1	1.0	1.0	1.0	1.0	1.0	.5	.9	1.0	1.0	
Change in priv. inventories ²	5	39	16	58	62	47	30	20	16	18	10	15	49	16	5	
<i>Previous Tealbook</i> ²	5	39	10	44	38	37	28	24	22	18	14	14	37	19	8	

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	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real GDP	1.7	1.3	2.7	2.7	2.0	1.8	2.6	2.6	2.6	2.1
<i>Previous Tealbook</i>	1.7	1.3	2.7	2.7	2.0	1.8	2.6	2.9	2.6	2.1
Final sales	1.5	1.7	2.0	2.9	2.0	1.9	2.9	2.5	2.7	2.1
<i>Previous Tealbook</i>	1.5	1.7	2.0	2.9	2.0	1.9	2.9	2.8	2.7	2.1
Priv. dom. final purch.	2.6	2.3	2.6	4.1	2.9	2.5	3.3	2.6	2.8	2.4
<i>Previous Tealbook</i>	2.6	2.3	2.6	4.1	2.9	2.5	3.4	2.9	2.8	2.5
Personal cons. expend.	1.5	1.3	2.0	3.6	3.0	2.8	2.8	2.1	2.7	2.5
<i>Previous Tealbook</i>	1.5	1.3	2.0	3.6	3.0	2.8	2.9	2.4	2.8	2.5
Durables	4.8	7.2	5.2	8.7	6.4	7.0	7.3	2.8	2.1	1.9
Nondurables	.4	.8	2.6	2.8	2.8	2.5	3.1	1.2	2.7	2.6
Services	1.4	.6	1.3	3.0	2.6	2.3	2.1	2.3	2.7	2.5
Residential investment	6.0	15.7	6.8	6.3	10.3	2.5	2.6	.9	1.7	3.3
<i>Previous Tealbook</i>	6.0	15.7	6.8	6.3	10.3	2.5	2.5	1.6	.5	4.2
Nonres. priv. fixed invest.	9.0	5.2	4.8	6.1	.3	.7	6.3	6.2	3.7	1.7
<i>Previous Tealbook</i>	9.0	5.2	4.8	6.1	.3	.7	6.4	6.0	3.8	1.8
Equipment & intangibles	9.2	5.5	4.5	5.3	3.3	-1	6.7	5.8	4.2	2.0
<i>Previous Tealbook</i>	9.2	5.5	4.5	5.3	3.3	-1	6.8	6.2	4.1	2.1
Nonres. structures	8.0	4.1	5.8	8.8	-9.1	3.5	5.0	7.7	2.0	.5
<i>Previous Tealbook</i>	8.0	4.1	5.8	8.8	-9.1	3.5	4.9	5.4	2.8	.9
Net exports ¹	-459	-447	-405	-428	-545	-586	-622	-665	-654	-696
<i>Previous Tealbook¹</i>	-459	-447	-405	-428	-545	-586	-622	-645	-651	-702
Exports	4.2	2.2	5.9	3.0	-1.8	.6	5.0	5.2	5.2	3.6
Imports	3.5	.3	2.5	6.2	2.9	2.7	4.7	3.9	4.4	4.8
Gov't. cons. & invest.	-3.0	-2.2	-2.8	.5	1.6	.4	.7	1.2	2.2	1.9
<i>Previous Tealbook</i>	-3.0	-2.2	-2.8	.5	1.6	.4	.7	1.2	2.1	1.8
Federal	-4.0	-2.1	-6.7	-1.2	1.2	-3	1.0	1.8	4.1	3.3
Defense	-4.1	-3.9	-7.1	-4.0	.0	-1.4	2.3	2.2	4.9	3.6
Nondefense	-3.9	1.0	-6.0	3.5	2.9	1.2	-9	1.1	3.0	2.7
State & local	-2.3	-2.3	-1	1.5	1.9	.8	.5	.9	1.0	1.0
Change in priv. inventories ¹	38	55	79	68	101	33	15	49	16	5
<i>Previous Tealbook¹</i>	38	55	79	68	101	33	14	37	19	8

1. Billions of chained (2009) dollars.

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

Item	2017				2018				2019				2017 ¹	2018 ¹	2019 ¹	2020 ¹	
	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4					
Real GDP <i>Previous Tealbook</i>	3.1 3.1	3.2 3.2	2.9 2.9		1.7 2.1	2.9 3.1	3.0 3.3	2.9 3.2		2.9 2.9	2.7 2.7	2.6 2.5	2.3 2.3	2.6 2.6	2.6 2.9	2.6 2.6	2.1 2.1
Final sales <i>Previous Tealbook</i>	2.9 2.9	2.4 2.4	3.4 3.6		.7 1.3	2.7 3.2	3.3 3.3	3.3 3.4		3.1 3.0	2.7 2.7	2.5 2.6	2.5 2.4	2.9 2.9	2.5 2.8	2.7 2.7	2.1 2.1
Priv. dom. final purch. <i>Previous Tealbook</i>	2.8 2.8	1.9 1.9	4.1 4.2		1.4 1.4	2.4 2.9	2.7 2.9	2.6 2.8		2.6 2.7	2.5 2.5	2.3 2.3	2.1 2.1	2.8 2.9	2.3 2.5	2.4 2.4	2.0 2.1
Personal cons. expend. <i>Previous Tealbook</i>	2.2 2.2	1.5 1.5	2.8 2.9		.8 1.0	1.5 1.8	1.8 2.0	1.7 2.0		1.9 2.0	1.9 1.9	1.8 1.9	1.7 1.8	2.0 2.0	1.4 1.7	1.8 1.9	1.7 1.7
Durables	.6	.6	1.0		-1	.3	.3	.3		.2	.2	.2	.1	.5	.2	.2	.1
Nondurables	.6	.3	.7		-2	.1	.3	.4		.4	.4	.4	.4	.5	.2	.4	.4
Services	1.1	.5	1.1		1.1	1.1	1.1	1.0		1.3	1.3	1.3	1.2	1.0	1.1	1.3	1.2
Residential investment <i>Previous Tealbook</i>	-.3 -.3	-.2 -.2	.5 .5		-.2 -.2	-.1 .1	.2 .2	.2 .2		.1 .1	.1 .0	.1 .0	.1 .0	.1 .0	.0 .1	.1 .0	.1 .2
Nonres. priv. fixed invest. <i>Previous Tealbook</i>	.8	.6	.8		.7	1.0	.8	.6		.6	.6	.5	.3	.8	.8	.5	.2
Equipment & intangibles <i>Previous Tealbook</i>	.6	.8	.7		.6	.6	.6	.5		.5	.5	.4	.3	.6	.6	.4	.2
Nonres. structures <i>Previous Tealbook</i>	.2	-.2	.2		.2	.4	.2	.1		.1	.1	.1	.0	.1	.2	.1	.0
Net exports <i>Previous Tealbook</i>	.2	.4	-1.2		-.5	.1	.2	.3		.2	-.1	-.2	.0	-.1	.0	.0	-.3
Exports	.2	.4	-1.2		.0	.2	.1	.2		.0	-.2	-.1	-.1	-.1	.1	-.1	-.3
Imports	.4	.3	.8		.4	.7	.9	.7		.7	.7	.7	.5	.6	.6	.6	.4
Gov't. cons. & invest. <i>Previous Tealbook</i>	-.2	.1	-2.0		-.8	-.5	-.7	-.4		-.5	-.8	-.8	-.6	-.7	-.6	-.7	-.7
Federal	.0	.1	.5		-.2	.2	.4	.5		.3	.4	.4	.4	.1	.2	.4	.3
Defense	.0	.1	.5		.0	.1	.3	.5		.3	.4	.4	.4	.1	.2	.4	.3
Nondefense	.1	.1	.2		-.2	.1	.3	.4		.2	.3	.3	.3	.1	.1	.3	.2
State & local	.2	.1	.2		-.2	.1	.2	.3		.1	.2	.2	.2	.1	.1	.2	.1
Change in priv. inventories <i>Previous Tealbook</i>	-.1 .1	.0 .8	.0 -.3		.0 .8	.0 .1	.1 -.2	.1 .0		.1 -.1	.1 .0	.1 .0	.1 -.1	.0 -.1	.0 .1	.1 -.1	.1 -.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	2017				2018				2019				2017 ¹	2018 ¹	2019 ¹	2020 ¹
	Q2	Q3	Q4		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
GDP chain-wt. price index <i>Previous Tealbook</i>	1.0	2.1	2.3		2.7	1.8	1.8	1.8	2.2	2.0	2.0	2.0	1.9	2.0	2.1	2.1
PCE chain-wt. price index <i>Previous Tealbook</i>	.3	1.5	2.7		2.8	2.2	1.8	1.5	1.9	1.9	1.9	2.0	1.7	2.1	1.9	2.0
Energy <i>Previous Tealbook</i>	-16.0	8.4	27.7		12.7	2.6	1.4	-2.2	-2.3	-1.8	-1.7	-1.6	7.6	3.5	-1.9	-1.1
Food <i>Previous Tealbook</i>	2.0	.2	.2		.2	1.6	2.0	2.3	2.3	2.3	2.3	2.3	.7	1.5	2.3	2.3
Ex. food & energy <i>Previous Tealbook</i>	.9	1.3	1.9		2.5	2.2	1.8	1.7	2.0	2.1	2.1	2.1	1.5	2.0	2.1	2.1
Ex. food & energy, market based <i>Previous Tealbook</i>	.3	1.0	1.5		2.3	2.2	1.7	1.4	1.8	1.9	1.9	1.9	1.2	1.9	1.9	1.9
CPI <i>Previous Tealbook</i>	.1	2.1	3.3		3.5	2.2	2.2	1.8	2.1	2.2	2.2	2.2	2.1	2.4	2.2	2.3
Ex. food & energy <i>Previous Tealbook</i>	.8	1.8	2.2		3.0	2.3	2.3	2.1	2.4	2.5	2.5	2.5	1.7	2.4	2.5	2.5
ECI, hourly compensation ² <i>Previous Tealbook</i> ²	.8	1.8	2.2		3.0	2.5	2.2	2.1	2.4	2.4	2.4	2.5	1.7	2.5	2.4	2.6
Business sector	2.2	3.1	1.9		2.6	2.4	2.4	2.4	2.6	2.7	2.7	2.7	2.6	2.5	2.7	2.7
Output per hour <i>Previous Tealbook</i>	1.6	3.2	-.4		.8	.7	1.6	1.6	.9	1.0	.9	.6	.9	1.2	.9	.9
Compensation per hour <i>Previous Tealbook</i>	.5	4.1	1.7		3.9	2.7	3.8	3.8	3.9	3.9	3.9	3.9	2.7	3.5	3.9	3.9
Unit labor costs <i>Previous Tealbook</i>	-1.0	.9	2.2		3.5	3.0	4.0	4.0	4.1	4.1	4.1	4.1	2.7	3.6	4.1	4.3
Core goods imports chain-wt. price index ³ <i>Previous Tealbook</i> ³	-1.0	.9	2.3		3.0	2.0	2.2	2.1	2.9	2.9	3.0	3.3	1.8	2.3	3.0	3.0
	2.5	1.1	1.5		3.1	2.4	2.0	2.0	2.9	3.1	3.3	3.4	1.8	2.4	3.1	3.4
	2.5	1.1	1.6		2.8	3.6	1.8	.9	.7	.6	.6	.5	1.3	2.3	.6	.6
					2.8	3.4	1.3	.9	.7	.7	.6	.6	1.3	2.1	.7	.6

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	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GDP chain-wt. price index <i>Previous Tealbook</i>	1.9 1.9	1.9 1.9	1.6 1.6	1.6 1.6	1.0 1.0	1.5 1.5	1.9 1.9	2.0 1.9	2.1 2.1	2.1 2.2
PCE chain-wt. price index <i>Previous Tealbook</i>	2.7 2.7	1.8 1.8	1.2 1.2	1.2 1.2	.4 .4	1.6 1.6	1.7 1.7	2.1 1.8	1.9 2.0	2.0 2.1
Energy <i>Previous Tealbook</i>	12.0 12.0	2.3 2.3	-2.5 -2.5	-6.5 -6.5	-16.2 -16.2	2.2 2.2	7.6 7.6	3.5 -4	-1.9 -7	-1.1 -1
Food <i>Previous Tealbook</i>	5.1 5.1	1.2 1.2	.7 .7	2.6 2.6	.3 .3	-1.7 -1.7	.7 .7	1.5 1.8	2.3 2.4	2.3 2.4
Ex. food & energy <i>Previous Tealbook</i>	1.9 1.9	1.8 1.8	1.5 1.5	1.5 1.5	1.3 1.3	1.9 1.9	1.5 1.5	2.0 1.9	2.1 2.1	2.1 2.2
Ex. food & energy, market based <i>Previous Tealbook</i>	1.9 1.9	1.5 1.5	1.1 1.1	1.2 1.2	1.1 1.1	1.5 1.5	1.2 1.2	1.9 1.8	1.9 1.9	1.9 2.0
CPI <i>Previous Tealbook</i>	3.3 3.3	1.9 1.9	1.2 1.2	1.2 1.2	.4 .4	1.8 1.8	2.1 2.1	2.4 2.3	2.2 2.2	2.3 2.4
Ex. food & energy <i>Previous Tealbook</i>	2.2 2.2	1.9 1.9	1.7 1.7	1.7 1.7	2.0 2.0	2.2 2.2	1.7 1.7	2.4 2.5	2.5 2.4	2.5 2.6
ECI, hourly compensation ¹ <i>Previous Tealbook</i> 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	2.6 2.6	2.5 2.5	2.7 2.8	2.7 3.0
Business sector Output per hour <i>Previous Tealbook</i>	-1 -1	-1 -1	1.9 1.9	.1 .1	.7 .7	1.0 1.0	.9 .9	1.2 1.2	.9 .9	.9 .9
Compensation per hour <i>Previous Tealbook</i>	.5 .5	5.9 5.9	-1 -1	2.9 2.9	3.1 3.1	-2 -2	2.7 2.7	3.5 3.6	3.9 4.1	3.9 4.3
Unit labor costs <i>Previous Tealbook</i>	.6 .6	6.0 6.0	-2.0 -2.0	2.8 2.8	2.4 2.4	-1.2 -1.2	1.8 1.8	2.3 2.4	3.0 3.1	3.0 3.4
Core goods imports chain-wt. price index ² <i>Previous Tealbook</i> ²	4.3 4.3	.1 .1	-1.5 -1.5	.3 .3	-3.7 -3.7	-2 -2	1.3 1.3	2.3 2.1	.6 .7	.6 .6

1. Private-industry workers.

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

Other Macroeconomic Indicators

Item	2017				2018				2019				2017 ¹	2018 ¹	2019 ¹	2020 ¹
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4					
	<i>Employment and production</i>	190	142	221	202	195	190	191	187	184	178	174					182	194	181	160
Nonfarm payroll employment ²	4.3	4.3	4.1	4.1	4.0	3.8	3.6	3.4	3.3	3.3	3.3	4.1	3.6	3.3	3.3	
Unemployment rate ³	4.3	4.3	4.1	4.1	3.9	3.7	3.5	3.3	3.2	3.2	3.1	4.1	3.5	3.1	3.1	
<i>Previous Tealbook³</i>	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	
Natural rate of unemployment ³	4.8	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	
<i>Previous Tealbook³</i>	60.1	60.2	60.1	60.3	60.3	60.4	60.4	60.5	60.6	60.7	60.7	60.1	60.4	60.7	60.7	
Employment-to-Population Ratio ³	59.8	59.7	59.7	59.6	59.6	59.5	59.5	59.5	59.4	59.4	59.4	59.7	59.5	59.4	59.2	
Employment-to-Population Trend ³	.8	1.2	1.4	1.6	1.7	2.1	2.4	2.6	2.8	3.0	3.1	1.4	2.4	3.1	3.2	
Output gap ⁴	.8	1.2	1.4	1.6	1.9	2.3	2.7	3.0	3.2	3.3	3.5	1.4	2.4	3.1	3.6	
<i>Previous Tealbook⁴</i>	5.0	-1.5	7.8	4.5	4.4	2.9	2.9	2.0	1.5	.9	1.0	3.0	3.7	1.4	1.3	
Industrial production ⁵	5.6	-1.2	8.3	5.0	4.4	3.4	2.5	2.1	1.6	.9	1.3	3.5	3.8	1.5	1.5	
<i>Previous Tealbook⁵</i>	2.4	-2.1	5.5	3.1	2.5	2.7	2.1	1.9	2.1	1.7	1.2	1.9	2.6	1.7	1.3	
Manufacturing industr. prod. ⁵	2.6	-2.0	6.3	4.3	2.9	2.9	2.3	2.2	2.2	1.8	1.4	2.2	3.1	1.9	1.3	
<i>Previous Tealbook⁵</i>	74.9	74.4	75.2	75.6	75.8	76.0	76.2	76.3	76.5	76.7	76.7	75.2	76.2	76.7	77.1	
Capacity utilization rate - mfg. ³	75.7	75.2	76.3	76.8	77.1	77.4	77.5	77.7	77.9	78.0	78.1	76.3	77.5	78.1	78.3	
<i>Previous Tealbook³</i>	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.2	1.3	1.3	1.4	
Housing starts ⁶	16.8	17.1	17.7	17.2	17.2	17.3	17.3	17.2	17.1	17.0	16.9	17.1	17.2	17.0	16.7	
Light motor vehicle sales ⁶	4.1	5.3	5.3	4.4	4.7	4.8	4.7	5.1	4.8	4.7	4.3	4.5	4.7	4.7	4.2	
<i>Income and saving</i>	2.7	.7	1.1	4.3	1.7	2.5	2.0	4.9	2.1	1.8	1.9	1.8	2.6	2.7	2.2	
Nominal GDP ⁵	2.7	.7	1.1	6.4	3.0	2.1	2.2	4.5	2.2	1.8	2.2	1.8	3.4	2.7	2.1	
Real disposable pers. income ⁵	3.7	3.4	2.6	3.3	3.2	3.2	3.1	3.6	3.5	3.3	3.1	2.6	3.1	3.1	3.0	
<i>Previous Tealbook⁵</i>	3.7	3.4	2.6	3.7	3.8	3.6	3.5	3.9	3.8	3.6	3.5	2.6	3.5	3.5	3.2	
Personal saving rate ³	2.8	18.1	-2	3.6	3.7	3.9	4.0	5.9	5.8	6.3	3.9	2.7	3.8	5.5	3.7	
<i>Previous Tealbook³</i>	10.9	11.2	11.1	11.1	11.0	11.0	11.0	11.1	11.1	11.2	11.2	11.1	11.0	11.2	11.1	
Corporate profits ⁷	17.2	17.7	16.7	17.0	17.0	16.8	16.8	16.7	16.7	16.6	16.6	16.7	16.8	16.6	16.2	
Profit share of GNP ³	2.0	2.6	1.6	2.0	2.0	1.8	1.8	1.7	1.6	1.5	1.4	1.6	1.8	1.4	.8	
Gross national saving rate ³																
Net national saving rate ³																

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

2. Average monthly change, thousands.

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

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

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

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

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

Greensheets

Other Macroeconomic Indicators

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

Item	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<i>Employment and production</i>										
Nonfarm payroll employment ¹	174	179	192	250	226	195	182	194	181	160
Unemployment rate ²	8.7	7.8	7.0	5.7	5.0	4.7	4.1	3.6	3.3	3.3
<i>Previous Tealbook²</i>	8.7	7.8	7.0	5.7	5.0	4.7	4.1	3.5	3.1	3.1
Natural rate of unemployment ²	5.9	5.6	5.4	5.1	4.9	4.8	4.7	4.7	4.7	4.7
<i>Previous Tealbook²</i>	5.9	5.6	5.4	5.1	4.9	4.8	4.7	4.7	4.7	4.7
Employment-to-Population Ratio ²	58.5	58.7	58.5	59.3	59.4	59.8	60.1	60.4	60.7	60.7
Employment-to-Population Trend ²	60.7	60.3	60.2	60.1	59.9	59.8	59.7	59.5	59.4	59.2
Output gap ³	-3.7	-3.7	-2.5	-9	-1	.3	1.4	2.4	3.1	3.2
<i>Previous Tealbook³</i>	-3.7	-3.7	-2.5	-9	-1	.3	1.4	2.7	3.5	3.6
Industrial production ⁴	3.2	2.2	2.3	3.4	-3.3	-5	3.0	3.7	1.4	1.3
<i>Previous Tealbook⁴</i>	2.8	2.3	2.2	3.4	-2.7	-1	3.5	3.8	1.5	1.5
Manufacturing industr. prod. ⁴	2.8	1.4	1.1	1.4	-1.6	-1	1.9	2.6	1.7	1.3
<i>Previous Tealbook⁴</i>	2.5	1.7	.9	1.5	-6	.3	2.2	3.1	1.9	1.3
Capacity utilization rate - mfg. ²	74.5	74.7	75.1	76.3	75.4	74.4	75.2	76.2	76.7	77.1
<i>Previous Tealbook²</i>	74.4	74.6	74.7	75.9	75.4	75.1	76.3	77.5	78.1	78.3
Housing starts ⁵	.6	.8	.9	1.0	1.1	1.2	1.2	1.3	1.3	1.4
Light motor vehicle sales ⁵	12.7	14.4	15.5	16.5	17.4	17.5	17.1	17.2	17.0	16.7
<i>Income and saving</i>										
Nominal GDP ⁴	3.6	3.2	4.3	4.3	3.1	3.4	4.5	4.7	4.7	4.2
Real disposable pers. income ⁴	1.7	5.1	-2.8	4.9	3.2	.2	1.8	2.6	2.7	2.2
<i>Previous Tealbook⁴</i>	1.7	5.1	-2.8	4.9	3.2	.2	1.8	3.4	2.7	2.1
Personal saving rate ²	5.8	9.2	4.7	5.9	6.1	3.6	2.6	3.1	3.1	3.0
<i>Previous Tealbook²</i>	5.8	9.2	4.7	5.9	6.1	3.6	2.6	3.5	3.5	3.2
Corporate profits ⁶	6.8	.6	4.7	7.4	-11.1	8.7	2.7	3.8	5.5	3.7
Profit share of GNP ²	12.3	12.0	12.0	12.4	10.7	11.3	11.1	11.0	11.2	11.1
Gross national saving rate ²	16.1	18.0	18.2	19.5	19.0	17.2	16.7	16.8	16.6	16.2
Net national saving rate ²	.8	2.9	3.1	4.7	4.1	2.1	1.6	1.8	1.4	.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. Values are for the fourth quarter of the year indicated.

4. Percent change.

5. Level, millions; values are annual averages.

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

Staff Projections of Government-Sector Accounts and Related Items

Item	2015	2016	2017	2018	2019	2020	2017			2018	
							Q3	Q4	Q1	Q2	
Unified federal budget¹											
Receipts	3,250	3,268	3,316	3,310	3,435	3,611	807	770	727	1,038	
Outlays	3,688	3,853	3,982	4,093	4,460	4,774	950	994	1,102	1,029	
Surplus/deficit	-438	-585	-665	-783	-1,025	-1,164	-143	-225	-375	10	
<i>Percent of GDP</i>											
Surplus/deficit	-2.4	-3.2	-3.5	-3.9	-4.9	-5.3	-2.9	-4.6	-7.5	.2	
<i>Previous Tealbook</i>	-2.4	-3.2	-3.5	-4.0	-4.8	-4.9	-2.9	-4.6	-7.8	.0	
Primary surplus/deficit	-1.2	-1.9	-2.1	-2.3	-3.0	-2.9	-2.0	-2.9	-5.9	2.1	
Net interest	1.2	1.3	1.4	1.6	1.9	2.4	.9	1.7	1.6	1.9	
Cyclically adjusted surplus/deficit	-1.9	-2.8	-3.3	-4.2	-5.7	-6.4	-3.0	-4.8	-7.7	-2	
Federal debt held by public	72.9	76.7	76.5	78.0	79.5	81.9	75.2	75.0	77.2	76.8	
Government in the NIPA²											
Purchases	1.6	.4	.7	1.2	2.2	1.9	.7	3.0	-1.2	1.2	
Consumption	1.9	.6	.4	.8	1.6	1.4	1.6	1.3	-.8	.6	
Investment	.4	-.5	2.4	2.8	4.4	3.7	-1.5	10.6	-2.9	3.7	
State and local construction	.0	-2.3	-1.9	1.0	1.0	1.0	-4.2	20.6	-1.5	2.2	
Real disposable personal income	3.2	.2	1.8	2.6	2.7	2.2	.7	1.1	4.3	1.7	
Contribution from transfers ³	.7	.3	.2	.5	.9	.7	.3	-.1	.7	1.3	
Contribution from taxes ³	-1.4	.2	-1.1	-.1	-.7	-.7	-1.5	-1.2	1.6	-.4	
Government employment											
Federal	3	3	-1	0	2	1	-1	-3	-2	-1	
State and local	10	14	3	6	9	9	5	1	0	6	
Fiscal indicators²											
Fiscal effect (FE) ⁴											
Discretionary policy actions (FI)	.4	.4	-.1	.4	.9	.7	-.1	.1	-.4	.6	
<i>Previous Tealbook</i>	.4	.1	.2	.6	.8	.5	.2	.6	.1	.6	
Federal purchases	.4	.1	.2	.6	.8	.5	.2	.6	.3	.5	
State and local purchases	.1	.0	.1	.1	.3	.2	.1	.2	-.2	.1	
Taxes and transfers	.2	.1	.1	.1	.1	.1	.0	.3	.0	.1	
Cyclical	.1	.1	.0	.4	.4	.2	.1	.1	.3	.4	
Other	-.2	.0	-.2	-.2	-.2	.0	-.3	-.2	-.1	-.1	
	.2	.2	-.3	.0	.4	.3	-.1	-.4	-.5	.1	

1. Annual values stated on a fiscal year basis. Quarterly values not seasonally adjusted.
 2. Annual values refer to the change from fourth quarter of previous year to fourth quarter of year indicated.
 3. Percentage point contribution to change in real disposable personal income, annual basis.
 4. The FE measure captures the total contribution of the government sector to the growth of real GDP (excluding multiplier effects). It equals the sum of the direct contributions to real GDP growth from all changes in federal purchases and state and local purchases, plus the estimated contribution to real household consumption and business investment that is induced by changes in transfer and tax policies. FI (fiscal impetus) is the portion of FE attributable to discretionary fiscal policy actions (for example, a legislated change in tax revenues).

Foreign Real GDP and Consumer Prices: Selected Countries

(Quarterly percent changes at an annual rate)

Measure and country	2017				2018				Projected			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Real GDP¹												
Total foreign	3.2	3.1	2.5	2.7	2.9	2.9	2.9	2.9	2.9	2.8	2.9	2.5
<i>Previous Tealbook</i>	3.2	3.1	2.5	2.7	3.0	3.0	2.9	2.9	2.9	2.8	2.9	2.6
Advanced foreign economies	3.0	3.3	2.1	2.0	1.9	2.1	2.0	2.0	1.9	1.9	2.1	1.3
Canada	4.0	4.4	1.5	1.7	2.0	2.3	2.1	2.1	2.1	2.1	2.0	2.0
Japan	1.9	2.4	2.4	1.6	1.2	1.1	1.0	1.0	.9	.9	3.3	-3.6
United Kingdom	1.3	1.0	1.9	1.6	1.3	1.7	1.7	1.6	1.6	1.6	1.6	1.6
Euro area	2.6	2.9	2.8	2.7	1.9	2.2	2.2	2.1	2.0	1.9	1.8	1.7
Germany	3.6	2.6	3.0	2.5	1.9	2.0	1.9	1.7	1.6	1.5	1.4	1.4
Emerging market economies	3.5	2.9	2.8	3.4	3.9	3.7	3.7	3.7	3.8	3.8	3.8	3.8
Asia	5.4	5.1	5.7	4.5	5.4	5.0	4.9	4.9	4.8	4.7	4.7	4.7
Korea	4.0	2.6	5.7	-8	4.0	3.3	3.5	3.5	3.2	3.2	3.1	3.1
China	6.9	7.0	6.6	6.4	7.1	6.8	6.3	6.3	6.3	6.2	6.2	6.1
Latin America	2.3	1.1	.0	2.5	2.4	2.6	2.6	2.7	3.0	2.9	2.9	2.9
Mexico	2.5	1.0	-7	3.2	2.7	2.8	2.8	2.8	2.9	2.9	3.0	3.0
Brazil	5.3	2.3	1.0	.2	2.3	2.5	2.5	2.5	3.0	3.0	3.0	3.0
Consumer prices²												
Total foreign	3.0	2.0	2.3	3.0	2.6	2.6	2.6	2.6	2.4	2.4	2.4	2.8
<i>Previous Tealbook</i>	2.9	2.0	2.3	3.0	2.6	2.6	2.6	2.6	2.5	2.5	2.4	2.8
Advanced foreign economies	2.2	.4	1.2	2.1	2.6	1.9	1.6	1.6	1.6	1.6	1.6	2.6
Canada	2.6	.2	1.4	3.0	3.6	2.6	2.2	2.2	2.1	2.0	2.0	2.0
Japan	-3	.1	.7	1.9	2.5	.7	.7	.8	.9	1.0	1.1	6.4
United Kingdom	3.7	3.0	2.4	3.0	2.5	2.3	2.3	2.2	2.2	2.2	2.3	2.2
Euro area	2.7	.2	1.1	1.7	2.1	1.9	1.4	1.4	1.4	1.4	1.5	1.6
Germany	2.2	.3	1.7	2.3	1.2	2.1	1.7	1.8	1.9	2.0	2.1	2.2
Emerging market economies	3.5	3.1	3.1	3.7	2.7	3.1	3.3	3.2	3.1	3.0	3.0	2.9
Asia	1.2	1.6	2.1	3.0	1.8	2.5	2.8	2.8	2.8	2.7	2.7	2.7
Korea	2.6	.7	2.2	.5	1.6	2.7	3.3	3.3	3.2	3.1	3.1	3.1
China	.0	2.1	2.2	2.9	1.5	2.2	2.6	2.5	2.5	2.5	2.5	2.5
Latin America	9.2	6.8	5.5	5.4	4.7	4.5	4.5	4.1	3.8	3.7	3.6	3.4
Mexico	9.3	6.7	5.4	5.0	4.1	4.0	3.9	3.4	3.4	3.4	3.2	3.2
Brazil	3.2	2.3	2.3	3.6	3.1	3.4	4.3	4.3	4.3	4.3	4.3	4.3

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	Historical										Projected	
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
Real GDP¹												
Total foreign	3.2	2.2	3.0	2.8	2.1	2.7	2.9	2.9	2.8	2.7	2.7	
<i>Previous Tealbook</i>	3.2	2.2	3.0	2.8	2.1	2.7	2.9	3.0	2.8	2.7	2.7	
Advanced foreign economies	1.8	.3	2.5	2.0	1.2	1.9	2.6	2.0	1.8	1.7	1.7	
Canada	3.1	.7	3.6	2.5	.3	2.0	2.9	2.1	2.0	1.9	1.9	
Japan	.2	.3	2.8	-.3	1.2	1.5	2.1	1.1	.3	.9	.9	
United Kingdom	1.3	1.5	2.6	3.3	2.1	2.0	1.4	1.6	1.6	1.7	1.7	
Euro area	.5	-1.1	.8	1.5	2.0	1.9	2.8	2.1	1.8	1.7	1.7	
Germany	2.4	.2	1.6	1.9	1.3	1.9	2.9	1.9	1.5	1.4	1.4	
Emerging market economies	4.6	4.2	3.5	3.6	2.9	3.4	3.2	3.8	3.8	3.7	3.7	
Asia	5.1	5.8	5.4	5.0	4.5	4.9	5.2	5.1	4.7	4.6	4.6	
Korea	2.9	2.1	3.5	2.8	3.2	2.6	2.8	3.5	3.1	3.0	3.0	
China	8.7	8.0	7.6	7.1	6.8	6.8	6.8	6.6	6.2	5.9	5.9	
Latin America	4.0	3.1	1.7	2.5	1.6	2.1	1.5	2.6	2.9	2.9	2.9	
Mexico	3.9	3.0	1.2	3.5	2.7	3.2	1.5	2.8	2.9	3.0	3.0	
Brazil	2.6	2.6	2.6	-.1	-5.5	-2.4	2.2	2.4	3.0	2.6	2.6	
Consumer prices²												
Total foreign	3.4	2.3	2.4	2.0	1.4	1.9	2.6	2.6	2.5	2.4	2.4	
<i>Previous Tealbook</i>	3.4	2.3	2.4	2.0	1.4	1.9	2.6	2.6	2.5	2.4	2.4	
Advanced foreign economies	2.2	1.3	1.0	1.2	.4	.9	1.5	1.9	1.8	1.7	1.7	
Canada	2.7	1.0	1.0	2.0	1.3	1.4	1.8	2.6	2.0	2.0	2.0	
Japan	-.3	-.2	1.4	2.6	.1	.3	.6	1.2	2.3	1.0	1.0	
United Kingdom	4.6	2.6	2.1	.9	.1	1.2	3.0	2.3	2.2	2.1	2.1	
Euro area	2.9	2.3	.8	.2	.2	.7	1.4	1.7	1.5	1.7	1.7	
Germany	2.6	1.9	1.4	.4	.2	1.0	1.6	1.7	2.0	2.2	2.2	
Emerging market economies	4.3	3.1	3.4	2.7	2.1	2.7	3.4	3.0	3.0	2.9	2.9	
Asia	4.4	2.6	3.1	1.8	1.5	2.0	2.0	2.5	2.8	2.7	2.7	
Korea	3.9	1.7	1.1	1.0	.9	1.5	1.5	2.7	3.2	3.0	3.0	
China	4.6	2.1	2.9	1.5	1.5	2.1	1.8	2.2	2.5	2.5	2.5	
Latin America	4.1	4.4	4.2	4.9	3.4	4.3	6.7	4.4	3.6	3.4	3.4	
Mexico	3.5	4.1	3.6	4.2	2.3	3.3	6.6	3.8	3.3	3.2	3.2	
Brazil	6.7	5.6	5.8	6.5	10.4	7.1	2.8	3.8	4.3	4.3	4.3	

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

	2017				2018				Projected-----2019			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
U.S. current account balance	-451.5	-495.0	-405.9	-512.6	-565.1	-548.3	-564.4	-583.7	-639.2	-641.8	-670.5	-696.5
<i>Previous Tealbook</i>	-453.1	-496.5	-405.9	-509.0	-574.0	-538.9	-553.9	-584.0	-648.0	-654.8	-681.6	-707.9
Current account as percent of GDP	-2.4	-2.6	-2.1	-2.6	-2.8	-2.7	-2.8	-2.8	-3.1	-3.0	-3.1	-3.2
<i>Previous Tealbook</i>	-2.4	-2.6	-2.1	-2.6	-2.9	-2.7	-2.7	-2.8	-3.1	-3.1	-3.2	-3.3
Net goods & services	-551.4	-565.8	-541.1	-615.5	-672.2	-661.8	-649.6	-640.8	-649.8	-629.1	-627.9	-636.6
Investment income, net	215.2	217.8	248.9	243.7	247.4	242.8	220.7	188.6	150.9	116.6	92.8	71.6
Direct, net	297.3	294.3	318.1	310.5	324.1	334.9	336.2	327.6	313.6	303.3	304.1	307.1
Portfolio, net	-82.1	-76.5	-69.2	-66.8	-76.7	-92.1	-115.5	-139.0	-162.7	-186.8	-211.3	-235.5
Other income and transfers, net	-115.3	-147.0	-113.8	-140.8	-140.3	-129.3	-135.4	-131.4	-140.3	-129.3	-135.4	-131.4

Billions of dollars, s.a.a.r.

Annual Data

	Projected-----2018										2019		2020
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020			
U.S. current account balance	-444.6	-426.2	-349.5	-373.0	-434.6	-451.7	-466.2	-565.4	-662.0	-787.6			
<i>Previous Tealbook</i>	-444.6	-426.2	-349.5	-373.0	-434.6	-451.7	-466.1	-562.7	-673.1	-803.2			
Current account as percent of GDP	-2.9	-2.6	-2.1	-2.1	-2.4	-2.4	-2.4	-2.8	-3.1	-3.5			
<i>Previous Tealbook</i>	-2.9	-2.6	-2.1	-2.1	-2.4	-2.4	-2.4	-2.8	-3.2	-3.6			
Net goods & services	-548.6	-536.8	-461.9	-489.5	-500.4	-504.8	-568.4	-656.1	-635.8	-670.4			
Investment income, net	219.2	216.1	215.4	221.3	192.7	186.8	231.4	224.9	108.0	16.9			
Direct, net	288.7	285.5	283.3	276.7	266.5	258.8	305.1	330.7	307.0	309.9			
Portfolio, net	-69.5	-69.4	-67.9	-55.4	-73.8	-72.0	-73.7	-105.8	-199.1	-293.0			
Other income and transfers, net	-115.1	-105.5	-103.1	-104.8	-126.9	-133.7	-129.2	-134.1	-134.1	-134.1			

Billions of dollars

Abbreviations

AFE	advanced foreign economy
BEA	Bureau of Economic Analysis
BEAT	base erosion anti-abuse tax
BGCR	Broad General Collateral Rate
BOE	Bank of England
BOJ	Bank of Japan
BOM	Bank of Mexico
CD	certificate of deposit
CDS	credit default swap
C&I	commercial and industrial
CMBS	commercial mortgage-backed securities
CP	commercial paper
CPH	compensation per hour
CPI	consumer price index
CRE	commercial real estate
DSGE	dynamic stochastic general equilibrium
ECB	European Central Bank
ECI	employment cost index
EDO model	Estimated Dynamic Optimization-based model (a medium-scale New Keynesian DSGE model of the U.S. economy)
EITC	earned income tax credit
ELB	effective lower bound
EME	emerging market economy
EU	European Union
FICC	Fixed Income Clearing Corporation
FOMC	Federal Open Market Committee; also, the Committee
FPLT	flexible price-level targeting
FRA	forward rate agreements
FRB/US model	A large-scale macroeconomic model of the U.S. economy

GCF	General Collateral Finance
GDP	gross domestic product
ICR	interest coverage ratio
LFPR	labor force participation rate
LIBOR	London interbank offered rate
M&A	mergers and acquisitions
MBS	mortgage-backed securities
Michigan survey	University of Michigan Surveys of Consumers
NAFTA	North American Free Trade Agreement
NFC	nonfinancial corporate
NIT	nominal income targeting
OIS	overnight index swap
OMMF	offshore money market fund
ON RRP	overnight reverse repurchase agreement
PCE	personal consumption expenditures
PMI	purchasing managers index
PPI	producer price index
QS	quantitative surveillance
repo	repurchase agreement
RRE	residential real estate
SEP	Summary of Economic Projections
SIGMA	A calibrated multicountry DSGE model
SLOOS	Senior Loan Officer Opinion Survey on Bank Lending Practices
SOFR	Secured Overnight Financing Rate
SOMA	System Open Market Account
S&P	Standard & Poor's
SPF	Survey of Professional Forecasters
TGCR	Tri-Party General Collateral Rate
TIPS	Treasury Inflation-Protected Securities
VIX	one-month-ahead option-implied volatility on the S&P 500 index