

# MONETARY POLICY REPORT

February 23, 2018



Board of Governors of the Federal Reserve System



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# LETTER OF TRANSMITTAL

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BOARD OF GOVERNORS OF THE  
FEDERAL RESERVE SYSTEM

Washington, D.C., February 23, 2018

THE PRESIDENT OF THE SENATE  
THE SPEAKER OF THE HOUSE OF REPRESENTATIVES

The Board of Governors is pleased to submit its *Monetary Policy Report* pursuant to section 2B of the Federal Reserve Act.

Sincerely,

A handwritten signature in black ink that reads "Jerome H. Powell". The signature is written in a cursive style with a large initial "J".

Jerome H. Powell, Chairman

# STATEMENT ON LONGER-RUN GOALS AND MONETARY POLICY STRATEGY

*Adopted effective January 24, 2012; as amended effective January 30, 2018*

The Federal Open Market Committee (FOMC) is firmly committed to fulfilling its statutory mandate from the Congress of promoting maximum employment, stable prices, and moderate long-term interest rates. The Committee seeks to explain its monetary policy decisions to the public as clearly as possible. Such clarity facilitates well-informed decisionmaking by households and businesses, reduces economic and financial uncertainty, increases the effectiveness of monetary policy, and enhances transparency and accountability, which are essential in a democratic society.

Inflation, employment, and long-term interest rates fluctuate over time in response to economic and financial disturbances. Moreover, monetary policy actions tend to influence economic activity and prices with a lag. Therefore, the Committee's policy decisions reflect its longer-run goals, its medium-term outlook, and its assessments of the balance of risks, including risks to the financial system that could impede the attainment of the Committee's goals.

The inflation rate over the longer run is primarily determined by monetary policy, and hence the Committee has the ability to specify a longer-run goal for inflation. The Committee reaffirms its judgment that inflation at the rate of 2 percent, as measured by the annual change in the price index for personal consumption expenditures, is most consistent over the longer run with the Federal Reserve's statutory mandate. The Committee would be concerned if inflation were running persistently above or below this objective. Communicating this symmetric inflation goal clearly to the public helps keep longer-term inflation expectations firmly anchored, thereby fostering price stability and moderate long-term interest rates and enhancing the Committee's ability to promote maximum employment in the face of significant economic disturbances. The maximum level of employment is largely determined by nonmonetary factors that affect the structure and dynamics of the labor market. These factors may change over time and may not be directly measurable. Consequently, it would not be appropriate to specify a fixed goal for employment; rather, the Committee's policy decisions must be informed by assessments of the maximum level of employment, recognizing that such assessments are necessarily uncertain and subject to revision. The Committee considers a wide range of indicators in making these assessments. Information about Committee participants' estimates of the longer-run normal rates of output growth and unemployment is published four times per year in the FOMC's Summary of Economic Projections. For example, in the most recent projections, the median of FOMC participants' estimates of the longer-run normal rate of unemployment was 4.6 percent.

In setting monetary policy, the Committee seeks to mitigate deviations of inflation from its longer-run goal and deviations of employment from the Committee's assessments of its maximum level. These objectives are generally complementary. However, under circumstances in which the Committee judges that the objectives are not complementary, it follows a balanced approach in promoting them, taking into account the magnitude of the deviations and the potentially different time horizons over which employment and inflation are projected to return to levels judged consistent with its mandate.

The Committee intends to reaffirm these principles and to make adjustments as appropriate at its annual organizational meeting each January.

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**NOTE: This report reflects information that was publicly available as of noon EST on February 22, 2018.** Unless otherwise stated, the time series in the figures extend through, for daily data, February 21, 2018; for monthly data, January 2018; and, for quarterly data, 2017:Q4. In bar charts, except as noted, the change for a given period is measured to its final quarter from the final quarter of the preceding period.

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## SUMMARY

Economic activity increased at a solid pace over the second half of 2017, and the labor market continued to strengthen. Measured on a 12-month basis, inflation has remained below the Federal Open Market Committee's (FOMC) longer-run objective of 2 percent. The FOMC raised the target range for the federal funds rate twice in the first half of 2017, resulting in a range of 1 to 1¼ percent by the end of its June meeting. With the federal funds rate rising toward more normal levels, at its September meeting, the FOMC decided to initiate a program of gradually and predictably reducing the size of its balance sheet. At its meeting in December, the Committee judged that current and prospective economic conditions called for a further increase in the target range for the federal funds rate, to 1¼ to 1½ percent.

### *Economic and Financial Developments*

**The labor market.** The labor market has continued to strengthen since the middle of last year. Payroll employment has posted solid gains, averaging 182,000 per month in the seven months starting in July 2017, about the same as the average pace in the first half of 2017. Although net job creation last year was slightly slower than in 2016, it has remained considerably faster than what is needed, on average, to absorb new entrants into the labor force. The unemployment rate declined from 4.3 percent in June to 4.1 percent in January—somewhat below the median of FOMC participants' estimates of its longer-run normal level. Other measures of labor utilization also suggest that the labor market has tightened since last summer. Nonetheless, wage growth has been moderate, likely held down in part by the weak pace of productivity growth in recent years.

**Inflation.** Consumer price inflation has remained below the FOMC's longer-run

objective of 2 percent. The price index for personal consumption expenditures increased 1.7 percent over the 12 months ending in December 2017, about the same as in 2016. The 12-month measure of inflation that excludes food and energy items (so-called core inflation), which historically has been a better indicator of where overall inflation will be in the future than the headline figure, was 1.5 percent in December—0.4 percentage point lower than it had been one year earlier. However, monthly readings on core inflation were somewhat higher during the last few months of 2017 than earlier in the year. Measures of longer-run inflation expectations have, on balance, been generally stable, although some measures remain low by historical standards.

**Economic growth.** Real gross domestic product (GDP) is reported to have increased at an annual rate of nearly 3 percent in the second half of 2017 after rising slightly more than 2 percent in the first half. Consumer spending expanded at a solid rate in the second half, supported by job gains, rising household wealth, and favorable consumer sentiment. Business investment growth was robust, and indicators of business sentiment have been strong. The housing market has continued to improve slowly. Foreign activity remained solid and the dollar depreciated further in the second half, but net exports subtracted from real U.S. GDP growth as imports of consumer and capital goods surged late in the year.

**Financial conditions.** Financial conditions for businesses and households have eased on balance since the middle of 2017 amid an improving global growth outlook. Notwithstanding financial market developments in recent weeks, broad measures of equity prices are higher, and spreads of yields on corporate bonds over those of comparable-maturity Treasury securities have narrowed. Most types of consumer loans

remained widely available, though credit was still difficult to access in credit card and mortgage markets for borrowers with low credit scores or harder-to-document incomes. Longer-term nominal Treasury yields and mortgage rates have moved up on net. The dollar depreciated, on average, against the currencies of our trading partners. In foreign financial markets, equity prices generally increased in the second half of 2017, and most of those indexes remain higher, on net, despite recent declines. Most longer-term yields rose noticeably.

**Financial stability.** Vulnerabilities in the U.S. financial system are judged to be moderate on balance. Valuation pressures continue to be elevated across a range of asset classes even after taking into account the current level of Treasury yields and the expectation that the reduction in corporate tax rates should generate an increase in after-tax earnings. Leverage in the nonfinancial business sector has remained high, and net issuance of risky debt has climbed in recent months. In contrast, leverage in the household sector has remained at a relatively low level, and household debt in recent years has expanded only about in line with nominal income. Moreover, U.S. banks are well capitalized and have significant liquidity buffers.

## *Monetary Policy*

**Interest rate policy.** The FOMC continued to gradually increase the target range for the federal funds rate. After having raised it twice in the first half of 2017, the Committee raised the target range for the federal funds rate again in December, bringing it to the current range of 1¼ to 1½ percent. The decision to increase the target range for the federal funds rate reflected the solid performance of the economy. Even with this rate increase, the stance of monetary policy remains accommodative, thereby supporting strong labor market conditions and a sustained return to 2 percent inflation.

The FOMC expects that, with further gradual adjustments in the stance of monetary policy, economic activity will expand at a moderate pace and labor market conditions will remain strong. Inflation on a 12-month basis is expected to move up this year and to stabilize around the Committee's 2 percent objective over the next few years. The federal funds rate is likely to remain, for some time, below levels that are expected to prevail in the longer run. Consistent with this outlook, in the most recent Summary of Economic Projections (SEP), which was compiled at the time of the December FOMC meeting, the median of participants' assessments for the appropriate level of the federal funds rate through the end of 2019 remains below the median projection for its longer-run level. (The December SEP is presented in Part 3 of this report.) However, as the Committee has continued to emphasize, the actual path of the federal funds rate will depend on the economic outlook as informed by incoming data. In particular, with inflation having persistently run below the 2 percent longer-run objective, the Committee will carefully monitor actual and expected inflation developments relative to its symmetric inflation goal.

**Balance sheet policy.** In the second half of 2017, the Committee initiated the balance sheet normalization program that is described in the Addendum to the Policy Normalization Principles and Plans the Committee issued in June.<sup>1</sup> Specifically, since October, the Federal Reserve has been gradually reducing its holdings of Treasury and agency securities by decreasing the reinvestment of principal payments it receives from these securities.

## *Special Topics*

**How tight is the labor market?** Although there is no way to know with precision, the

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1. The June addendum is available on the Board's website at [https://www.federalreserve.gov/monetarypolicy/files/FOMC\\_PolicyNormalization.20170613.pdf](https://www.federalreserve.gov/monetarypolicy/files/FOMC_PolicyNormalization.20170613.pdf).



labor market appears to be near or a little beyond full employment at present. The unemployment rate is somewhat below most estimates of its longer-run normal rate, and the labor force participation rate is relatively close to many estimates of its trend. Although employers report having more difficulties finding qualified workers, hiring continues apace, and serious labor shortages would likely have brought about larger wage increases than have been evident to date. (See the box “How Tight Is the Labor Market?” in Part 1.)

**Low global inflation.** Inflation has generally come in below central banks’ targets in the advanced economies for several years now. Resource slack and commodity prices—as well as, for the United States, movements in the U.S. dollar—appear to explain inflation’s behavior fairly well. But our understanding is imperfect, and other, possibly more persistent, factors may be at work. Resource slack at home and abroad might be greater than it appears to be, or inflation expectations could be lower than suggested by the available indicators. Moreover, some observers have pointed to increased competition from online retailers or international developments—

such as global economic slack or the integration of emerging economies into the world economy—as contributing to lower inflation. Policymakers remain attentive to the possibility of such forces leading to continued low inflation; they also are watchful regarding the opposite risk of inflation moving undesirably high. (See the box “Low Inflation in the Advanced Economies” in Part 1.)

**Monetary policy rules.** Monetary policymakers consider a wide range of information on current economic conditions and the outlook before deciding on a policy stance they deem most likely to foster the FOMC’s statutory mandate of maximum employment and stable prices. They also routinely consult monetary policy rules that connect prescriptions for the policy interest rate with variables associated with the dual mandate. The use of such rules requires careful judgments about the choice and measurement of the inputs into these rules as well as the implications of the many considerations these rules do not take into account. (See the box “Monetary Policy Rules and Their Role in the Federal Reserve’s Policy Process” in Part 2.)



## PART 1 RECENT ECONOMIC AND FINANCIAL DEVELOPMENTS

### Domestic Developments

#### The labor market strengthened further during the second half of 2017 and early this year

Payroll employment has continued to post solid gains, averaging 182,000 per month in the seven months starting in July 2017, about the same pace as in the first half of 2017.<sup>2</sup> Although net job creation last year was slightly slower than in 2016, it has remained considerably faster than what is needed, on average, to absorb new entrants to the labor force and is therefore consistent with the view that the labor market has strengthened further (figure 1). The strength of the labor market is also evident in the decline in the unemployment rate to 4.1 percent in January,  $\frac{1}{4}$  percentage point below its level in June 2017 and about  $\frac{1}{2}$  percentage point below the median of Federal Open Market Committee (FOMC) participants' estimates of its longer-run normal level (figure 2).

Other indicators also suggest that labor market conditions have continued to tighten. The labor force participation rate (LFPR)—that is, the share of adults either working or actively looking for work—was 62.7 percent in January. The LFPR is little changed, on net, since early 2014 (figure 3). However, the average age of the population is continuing to increase. In particular, the members of the baby-boom cohort increasingly are moving into their retirement years, a time when labor force participation typically is low. That development implies that a sustained period in which the demand for and supply of labor were in balance would be associated with a downward trend in the overall participation rate. Accordingly, the flat profile of the LFPR

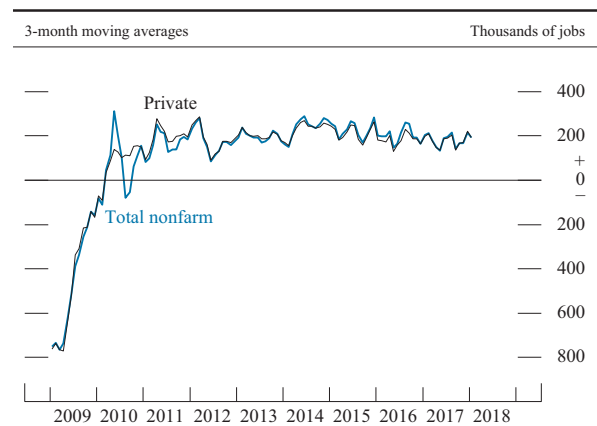
2. The hurricanes that struck the United States during the second half of last year caused substantial variation in the month-to-month pattern of job gains, but the average performance over the period as a whole was probably substantially unaffected.

during the past few years is consistent with an overall picture of improving labor market conditions. In line with this perspective, the LFPR for individuals aged 25 to 54—which is much less sensitive to population aging—has been rising since 2015. The employment-to-population ratio for individuals 16 and older—that is, the share of people who are working—was 60.1 percent in January and has been increasing since 2011; this gain primarily reflects the decline in the unemployment rate. (The box “How Tight Is the Labor Market?” describes the available measures of labor market slack in more detail.)

Other indicators are also consistent with continuing strong labor demand. The number of people filing initial claims for unemployment insurance has remained near its lowest level in decades.<sup>3</sup> As reported in the Job Openings and Labor Turnover Survey, the rate of job openings remained elevated in the second half of 2017, while the rate of layoffs remained low. In addition, the rate of quits stayed high, an indication that workers are able to obtain a new job when they seek one.

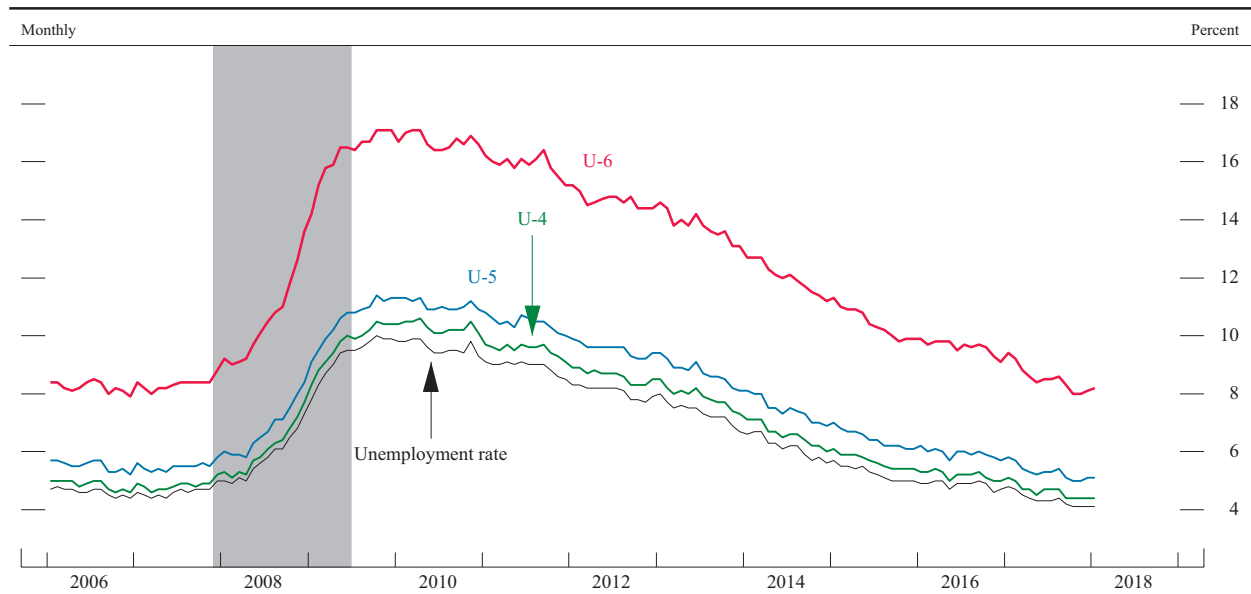
3. Initial claims jumped in the fall of 2017 as a consequence of disruptions from the hurricanes and then returned to a low level.

#### 1. Net change in payroll employment



SOURCE: Bureau of Labor Statistics via Haver Analytics.

2. Measures of labor underutilization



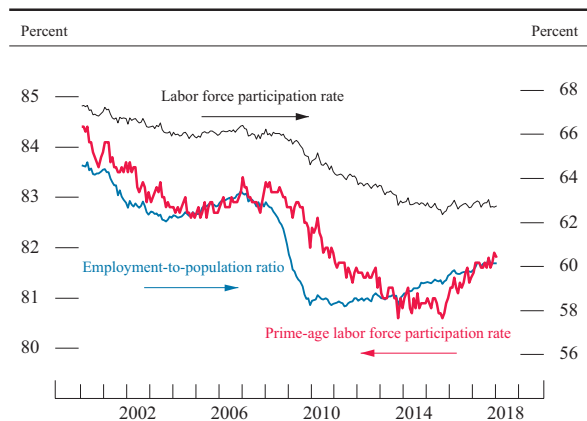
NOTE: Unemployment rate measures total unemployed as a percentage of the labor force. U-4 measures total unemployed plus discouraged workers, as a percentage of the labor force plus discouraged workers. Discouraged workers are a subset of marginally attached workers who are not currently looking for work because they believe no jobs are available for them. U-5 measures total unemployed plus all marginally attached to the labor force, as a percentage of the labor force plus persons marginally attached to the labor force. Marginally attached workers are not in the labor force, want and are available for work, and have looked for a job in the past 12 months. U-6 measures total unemployed plus all marginally attached workers plus total employed part time for economic reasons, as a percentage of the labor force plus all marginally attached workers. The shaded bar indicates a period of business recession as defined by the National Bureau of Economic Research.

SOURCE: Bureau of Labor Statistics via Haver Analytics.

**Unemployment rates have declined across demographic groups, but unemployment remains high for some groups**

Unemployment rates have trended downward across racial and ethnic groups (figure 4). The decline in the unemployment rate for blacks or African Americans over the past few years has been particularly notable. This broad pattern is typical: The unemployment rates for blacks and Hispanics tend to rise considerably more than the rates for whites and Asians during recessions, and then they decline more rapidly during expansions. Yet even with the recent narrowing, the disparities in unemployment rates across demographic groups remain substantial and largely the same as before the recession. The unemployment rate for whites has averaged 3.7 percent since the middle of 2017 and the rate for Asians has been about 3.3 percent, while the unemployment rates for Hispanics or Latinos (5.0 percent) and blacks (7.3 percent) have been substantially higher. In addition, the labor force participation rates for blacks, Hispanics, and Asians have generally been lower than those for whites of the same age group. As the labor market

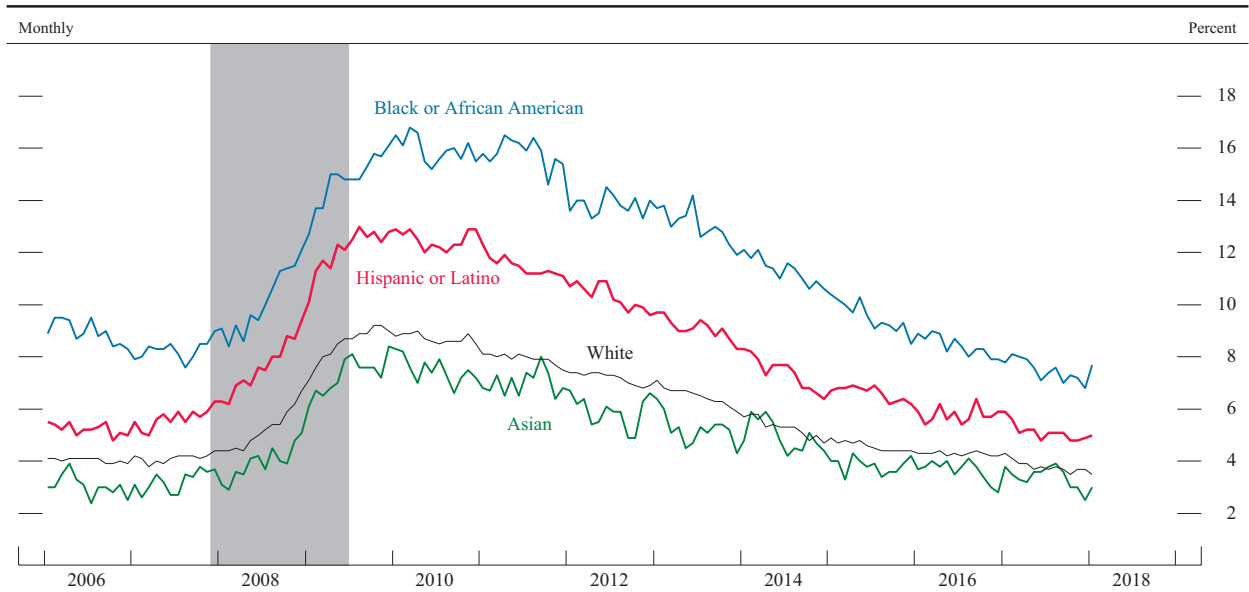
3. Labor force participation rates and employment-to-population ratio



NOTE: The data are monthly. The prime-age labor force participation rate is a percentage of the population aged 25 to 54. The labor force participation rate and the employment-to-population ratio are percentages of the population aged 16 and over.

SOURCE: Bureau of Labor Statistics via Haver Analytics.

4. Unemployment rate by race and ethnicity



NOTE: Unemployment rate measures total unemployed as a percentage of the labor force. Persons whose ethnicity is identified as Hispanic or Latino may be of any race. The shaded bar indicates a period of business recession as defined by the National Bureau of Economic Research.  
 SOURCE: Bureau of Labor Statistics via Haver Analytics.

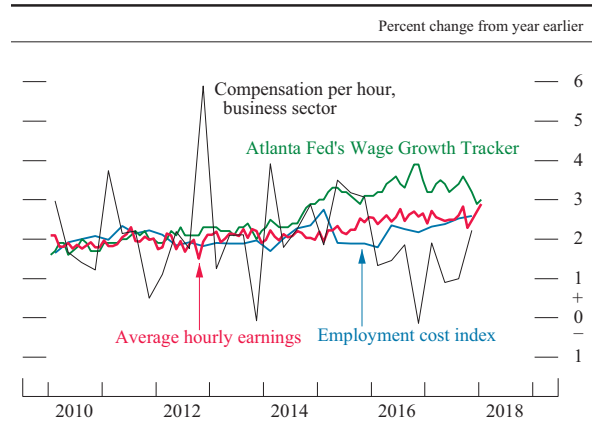
has strengthened over the past few years, the participation rates for prime-age individuals in each of these groups have risen.

**Growth of labor compensation has been moderate . . .**

Despite the strong labor market, the available indicators generally suggest that the growth of hourly compensation has been moderate. Growth of compensation per hour in the business sector—a broad-based measure of wages, salaries, and benefits that is quite volatile—was 2¼ percent over the four quarters ending in 2017:Q4 (figure 5), well above the low reading in 2016 but about in line with the average annual increase from 2010 to 2015.<sup>4</sup> The employment cost index—which also measures both wages and the cost to employers of providing benefits—was up about 2½ percent in the fourth quarter of 2017 relative to its year-ago level, roughly

4. The compensation per hour measure of wages and salaries declined at the end of 2016, possibly reflecting the shifting of bonuses or other types of income into 2017 in anticipation of a possible cut in personal income tax rates.

5. Measures of change in hourly compensation



NOTE: Business-sector compensation is on a four-quarter percentage change basis. For the employment cost index, change is over the 12 months ending in the last month of each quarter; for average hourly earnings, change is from 12 months earlier; for the Atlanta Fed's Wage Growth Tracker, the data are shown as a 3-month moving average of the 12-month percent change.

SOURCE: Bureau of Labor Statistics via Haver Analytics; Federal Reserve Bank of Atlanta, Wage Growth Tracker.

## How Tight Is the Labor Market?

Any assessment of labor market tightness is inherently uncertain, as it involves comparing current labor market conditions with an estimate of conditions that would prevail under full employment, where the latter circumstance cannot be directly observed or measured and can change over time. Many economists would describe the labor market as being at full employment when the unemployment rate has reached an “equilibrium” level, sometimes called the natural rate of unemployment or the longer-run normal rate of unemployment. In judging the level of full employment, one may also consider additional margins of labor utilization—including the labor force participation rate (LFPR), the share of workers employed part time who would like to be working full time, and individuals who are classified as marginally attached to the labor force—as compared with trends in these measures. While the uncertainty around the “normal” trends in all of these variables is substantial, the labor market in early 2018 appears to be near or a little beyond full employment.

The unemployment rate is now somewhat below most estimates of its natural rate. Specifically, the unemployment rate in January, at 4.1 percent, is ½ percentage point below the median of Federal Open Market Committee (FOMC) participants’ estimates of the longer-run normal rate of unemployment, which was reported to have been 4.6 percent as of the December 2017 FOMC meeting. The unemployment rate is also about ½ percentage point below the Congressional Budget Office’s (CBO) current estimate of the natural rate; by this measure, the labor market is about as tight as it was in the late 1980s but less tight than in the late 1990s (figure A). That said, the median of FOMC participants’ estimates of the longer-run normal rate of unemployment and the CBO’s estimate of the natural rate of unemployment have both been revised down by about 1 percentage point over the past few years, one indication of the substantial uncertainty surrounding estimates of the “full employment” rate of unemployment.<sup>1</sup>

As discussed in the main text, the LFPR has been roughly unchanged, on net, over the past four years, representing an important cyclical improvement relative to its declining trend. While estimates of the trend LFPR are subject to substantial uncertainty and differ among analysts, the current level of the LFPR is relatively close to many estimates of its trend.<sup>2</sup>

1. As another indication of this uncertainty, the range of FOMC participants’ estimates of the longer-run normal rate of unemployment was 4.3 to 5.0 percent in December 2017.

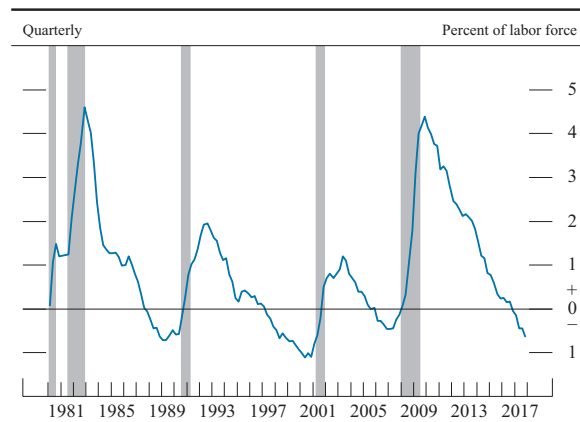
2. For a variety of approaches to assessing the level of trend LFPR and the associated range of estimates, see Stephanie Aaronson, Tomaz Cajner, Bruce Fallick, Felix

The fact that the LFPR for prime-age men remains below its pre-recession levels might suggest that slack remains along this dimension; however, the lower level of the LFPR for prime-age men primarily seems to reflect the continuation of a decades-long secular decline rather than a cyclical shortfall in their LFPR. In addition, the U-6 measure of labor utilization—which includes the unemployed, those marginally attached to the labor force, and those employed part time who would like full-time work—rose even more steeply than the unemployment rate during and immediately after the recession and has since recovered to near its pre-recession level. Although there is substantial uncertainty about the trends in each of the components of U-6, its current level can be cautiously interpreted as consistent with a labor market close to full employment.

One can also look at less-direct indicators of labor market tightness. For example, the share of small businesses with at least one job opening that they view as hard to fill is now close to its record levels in the late 1990s (as seen in the black line in figure B), consistent with the notion that as the labor market tightens, businesses find it increasingly difficult to hire additional workers. Similarly, survey measures of households’

Galbis-Reig, Christopher Smith, and William Wascher (2014), “Labor Force Participation: Recent Developments and Future Prospects,” *Brookings Papers on Economic Activity*, Fall, pp. 197–275, [https://www.brookings.edu/wp-content/uploads/2016/07/Fall2014BPEA\\_Aaronson\\_et\\_al.pdf](https://www.brookings.edu/wp-content/uploads/2016/07/Fall2014BPEA_Aaronson_et_al.pdf). Estimates of trend LFPR are also provided by the CBO in their recurring publication *The Budget and Economic Outlook* and its updates.

### A. Unemployment rate gap



NOTE: The unemployment rate gap is the unemployment rate minus the Congressional Budget Office’s estimate of the natural rate of unemployment. The shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research.

SOURCE: For unemployment rate, Bureau of Labor Statistics; for natural rate of unemployment, Congressional Budget Office; all via Haver Analytics.

perceptions about job availability are currently at high levels, as shown by the blue line in figure B.

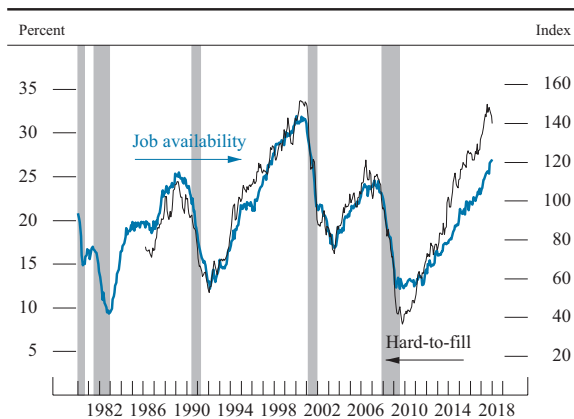
However, despite reports that employers are now having more difficulties finding qualified workers, hiring has continued apace. Although payroll employment gains have gradually slowed over time from about 250,000 per month, on average, in 2014 to about 180,000 per month, on average, in 2017, job growth remains consistent with further strengthening in the labor market.<sup>3</sup> Finally, the pace of wage gains has been moderate; while wage gains have likely been held down by the sluggish pace of productivity growth in recent years, serious labor shortages would probably bring about larger increases than have been observed thus far.

It is possible that labor shortages have arisen in certain pockets of the economy, which could be an early indication of bottlenecks that are not yet readily apparent in the aggregate labor market. However, even at the industry level it is difficult to see much evidence of emerging supply constraints.<sup>4</sup> In some industries, such as trade and transportation as well as leisure and hospitality, employment growth has slowed markedly and it has

3. Payroll gains in the range of about 90,000 to 120,000 per month are estimated to be consistent with a constant unemployment rate and a decline in the labor force participation rate in line with its demographically driven trend.

4. The analysis behind this statement considered six broad industries—construction, manufacturing, trade and

**B. Job availability and hard-to-fill positions**



NOTE: Job availability is the proportion of households believing jobs are plentiful minus the proportion believing jobs are hard to get, plus 100. Hard-to-fill is the three-month moving average of the percent of small businesses surveyed with at least one hard-to-fill job opening, and it is seasonally adjusted by Federal Reserve Board staff. Monthly hard-to-fill data from the National Federation of Independent Business start in January 1986. The shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research. Data are monthly.

SOURCE: For job availability, Conference Board; for hard-to-fill, National Federation of Independent Business.

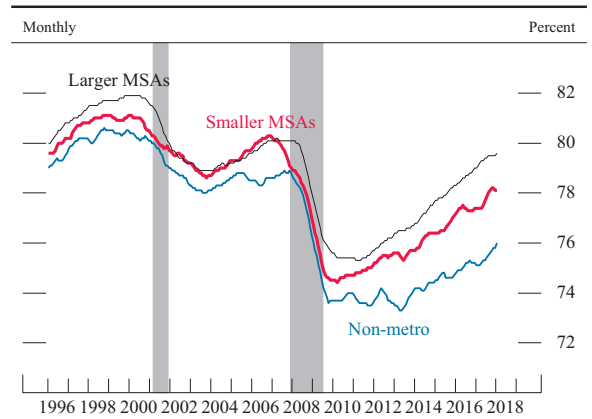
taken longer for businesses to find workers in recent years, yet wage growth has remained steady or slowed.

Finally, while the aggregate labor market appears to be modestly tight at the moment, not all individuals have benefited equally from these developments. As discussed in the main text, noticeable differences in labor market outcomes remain present across racial and ethnic groups. Moreover, the labor market improvement in recent years has not been sufficient to make important progress in narrowing income inequality. Finally, regional disparities are also striking, and in certain aspects these disparities have widened in recent years; for example, the employment-to-population ratio for prime-age individuals has recovered less for those outside of metro areas than for those in metro areas (figure C).<sup>5</sup>

transportation, health and education, leisure and hospitality, and professional and business services.

5. See Alison Weingarden (2017), "Labor Market Outcomes in Metropolitan and Non-metropolitan Areas: Signs of Growing Disparities," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, September 25), <https://www.federalreserve.gov/econres/notes/feds-notes/labor-market-outcomes-in-metropolitan-and-non-metropolitan-areas-signs-of-growing-disparities-20170925.htm>.

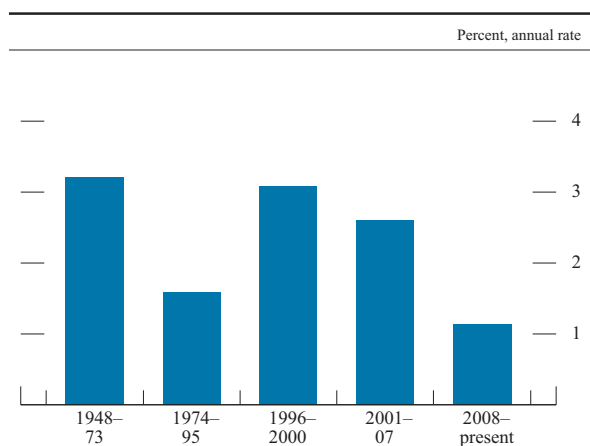
**C. Prime-age employment-to-population ratio by metropolitan status**



NOTE: The data are 12-month centered moving averages. Larger metropolitan statistical areas (MSAs) consist of 500,000 people or more, and smaller MSAs consist of 100,000 to 500,000 people. The shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research.

SOURCE: Alison Weingarden (2017), "Labor Market Outcomes in Metropolitan and Non-metropolitan Areas: Signs of Growing Disparities," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, September 25), [www.federalreserve.gov/econres/notes/feds-notes/labor-market-outcomes-in-metropolitan-and-non-metropolitan-areas-signs-of-growing-disparities-20170925.htm](http://www.federalreserve.gov/econres/notes/feds-notes/labor-market-outcomes-in-metropolitan-and-non-metropolitan-areas-signs-of-growing-disparities-20170925.htm). Calculations use data from the U.S. Census Bureau, Current Population Survey; note that the Bureau of Labor Statistics is involved in the survey process for the Current Population Survey.

## 6. Change in business-sector output per hour



NOTE: Changes are measured from Q4 of the year immediately preceding the period through Q4 of the final year of the period. The final period is measured from 2007:Q4 through 2017:Q4.

SOURCE: Bureau of Labor Statistics via Haver Analytics.

½ percentage point faster than its gain a year earlier. Among measures that do not take account of benefits, average hourly earnings rose slightly less than 3 percent through January of this year, a gain that was somewhat faster than the average increase in the preceding few years. Similarly, the measure of wage growth computed by the Federal Reserve Bank of Atlanta that tracks median 12-month wage growth of individuals reporting to the Current Population Survey showed an increase of about 3 percent in January, similar to its readings from the past three years and above the average increase in the preceding few years.<sup>5</sup>

### ... and likely was restrained by slow growth of labor productivity

These moderate rates of compensation gain likely reflect the offsetting influences of a tightening labor market and persistently weak productivity growth. Since 2008, labor productivity has increased only a little more than 1 percent per year, on average, well below the average pace from 1996 through 2007 and also below the gains in the 1974–95 period (figure 6). Considerable debate remains about the reasons for the general slowdown in productivity growth and whether it will persist. The slowdown may be partly attributable to the sharp pullback in capital investment during the most recent recession and the relatively long period of modest growth in investment that followed, but a reduced pace of capital deepening can explain only a portion of the step-down. Beyond that, some economists think that more recent technological advances, such as information technology, have been less revolutionary than earlier general-purpose technologies, such as electricity and internal combustion. Others have pointed to a slowdown in the speed at which capital and labor are reallocated toward their most productive uses, which is reflected in fewer business start-ups and a reduced

5. The Atlanta Fed's measure differs from others in that it measures the wage growth only of workers who were employed both in the current survey month and 12 months earlier.



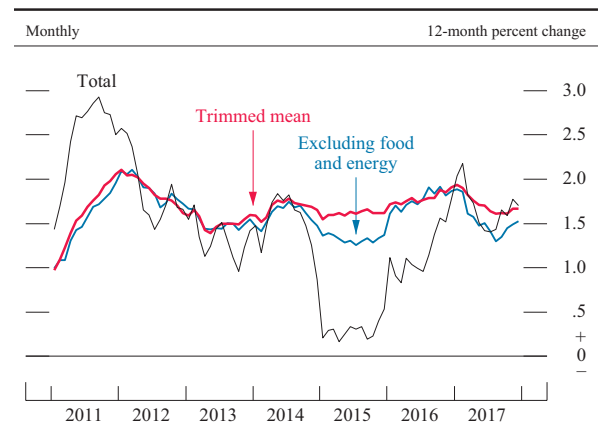
pace of hiring and investment by the most innovative firms. Still others argue that there have been important innovations in many fields in recent years, from energy to medicine, often underpinned by ongoing advances in information technology, which augurs well for productivity growth going forward. However, those economists note that such productivity gains may appear only slowly as new firms emerge to exploit the new technologies and as incumbent firms invest in new vintages of capital and restructure their businesses.

### Price inflation remains below 2 percent, but the monthly readings picked up toward the end of 2017

Consumer price inflation, as measured by the 12-month change in the price index for personal consumption expenditures (PCE), remained below the FOMC's longer-run objective of 2 percent during most of 2017. The PCE price index increased 1.7 percent over the 12 months ending in December 2017, about the same as in 2016 (figure 7). Core inflation, which typically provides a better indication than the headline measure of where overall inflation will be in the future, was 1.5 percent over the 12 months ending in December 2017—0.4 percentage point lower than it had been one year earlier.

Both measures of inflation reflected some weak readings in the spring and summer of 2017. A portion of those weak readings seemed attributable to idiosyncratic events, such as a steep 1-month decline in the price index for wireless telephone services. However, the monthly readings on core inflation were somewhat higher during the last few months of 2017, in contrast to the more typical pattern that has prevailed in recent years in which readings around the end of the year have tended to be slightly below average. Moreover, the 12-month change in the trimmed mean PCE price index—an alternative indicator of underlying inflation produced by the Federal Reserve Bank of Dallas that may be less sensitive to idiosyncratic price movements—was 1.7 percent in December 2017 and has slowed by less than core PCE price inflation

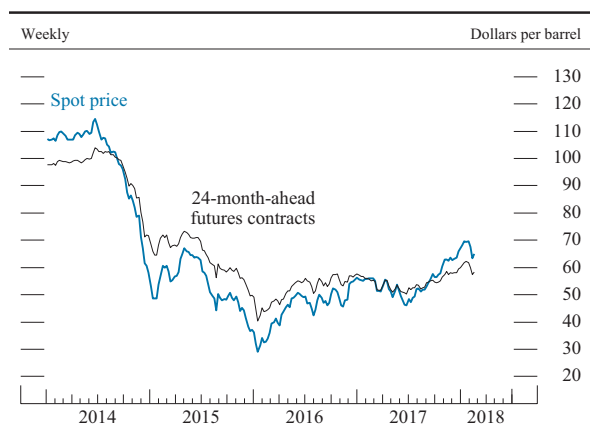
7. Change in the price index for personal consumption expenditures



NOTE: The data extend through December 2017; changes are from one year earlier.

SOURCE: For trimmed mean, Federal Reserve Bank of Dallas; for all else, Bureau of Economic Analysis; all via Haver Analytics.

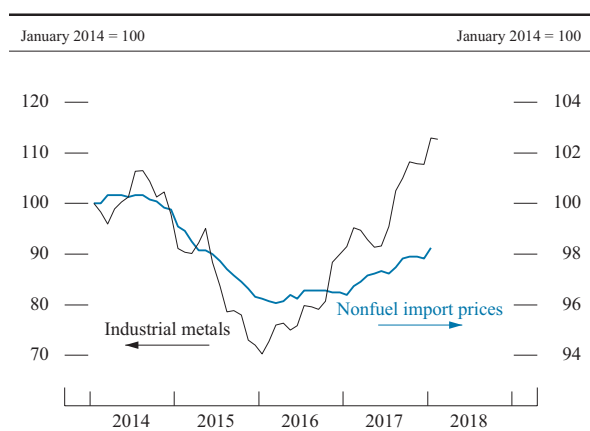
## 8. Brent spot and futures prices



NOTE: The data are weekly averages of daily data and extend through February 21, 2018.

SOURCE: ICE Brent Futures via Bloomberg.

## 9. Nonfuel import prices and industrial metals indexes



NOTE: The data for nonfuel import prices are monthly. The data for industrial metals are a monthly average of daily data and extend through February 21, 2018.

SOURCE: For nonfuel import prices, Bureau of Labor Statistics; for industrial metals, S&P GSCI Industrial Metals Spot Index via Haver Analytics.

over the past 12 months.<sup>6</sup> (For more discussion of inflation both in the United States and abroad, see the box “Low Inflation in the Advanced Economies.”)

## Oil and metals prices increased notably

Headline inflation was a little higher than core inflation last year, which reflected a rise in consumer energy prices. The price of crude oil rose from \$48 per barrel at the end of June to a peak of about \$70 per barrel early in the year and, even after recent declines, remains more than 30 percent above its mid-2017 level (figure 8). The upswing in oil prices appears to have been driven primarily by strengthening global demand as well as OPEC’s decision to further extend its November 2016 production cuts through the end of 2018. The higher oil prices fed through to moderate increases in the cost of gasoline and heating oil.

Inflation momentum was also supported by nonfuel import prices, which rose throughout 2017 in part because of dollar depreciation (figure 9). That development marked a turn from the past several years, during which nonfuel import prices declined or held flat. In addition to the decline in the dollar, nonfuel import prices were driven higher by a substantial increase in the price of industrial metals. Despite recent volatility, metals prices remain higher, on net, boosted primarily by improved prospects for global demand and also by government policies that restrained production in China.

In contrast, headline inflation has been held down by consumer food prices, which increased only about ½ percent in 2017 after having declined in 2016. Food prices have

6. The trimmed mean index excludes whatever prices showed the largest increases or decreases in a given month; for example, the sharp decline in prices for wireless telephone services in March 2017 was excluded from this index.

been restrained by softness in the prices of farm commodities, which in turn has reflected robust supply in the United States and abroad. Although the harvests for many crops in the United States declined in 2017, they were larger than had been expected earlier in the year.

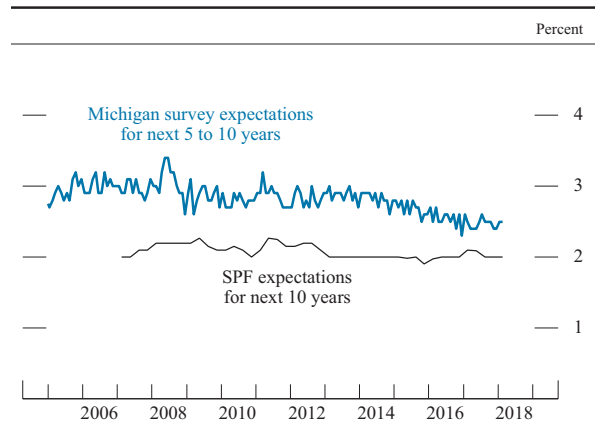
**Survey-based measures of inflation expectations have been generally stable...**

Expectations of inflation likely influence actual inflation by affecting wage- and price-setting decisions. Survey-based measures of inflation expectations at medium- and longer-term horizons have remained generally stable. In the Survey of Professional Forecasters conducted by the Federal Reserve Bank of Philadelphia, the median expectation for the annual rate of increase in the PCE price index over the next 10 years has been around 2 percent for the past several years (figure 10). In the University of Michigan Surveys of Consumers, the median value for inflation expectations over the next 5 to 10 years—which had drifted downward starting in 2014—has held about flat since the end of 2016 at a level that is a few tenths lower than had prevailed through 2014.

**... and market-based measures of inflation compensation have increased in recent months but remain relatively low**

Inflation expectations can also be gauged by market-based measures of inflation compensation, though the inference is not straightforward because market-based measures can be importantly affected by changes in premiums that provide compensation for bearing inflation and liquidity risks. Measures of longer-term inflation compensation—derived either from differences between yields on nominal Treasury securities and those on comparable Treasury Inflation-Protected Securities (TIPS) or from inflation swaps—have increased since June, returning to levels seen in early 2017, but

10. Median inflation expectations



NOTE: The Michigan survey data are monthly and extend through February; the February data are preliminary. The SPF data for inflation expectations for personal consumption expenditures are quarterly and extend from 2007:Q1 through 2018:Q1.

SOURCE: University of Michigan Surveys of Consumers; Federal Reserve Bank of Philadelphia, Survey of Professional Forecasters (SPF).

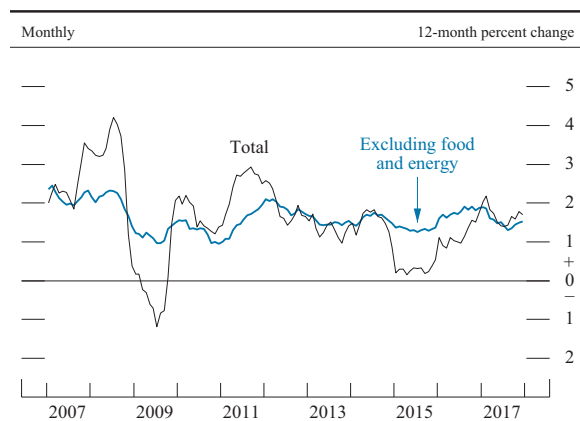
## Low Inflation in the Advanced Economies

Inflation has been persistently low in recent years across many advanced economies. In the United States, both overall inflation and core (excluding food and energy prices) inflation, as measured by the price index for personal consumption expenditures, have run below 2 percent for most of the period since 2008 (figure A). In other advanced economies, measures of core inflation have run even lower in some cases, with core inflation in the euro area currently at around 1 percent and in Japan at close to zero (figure B).

What explains this period of low inflation? Across the advanced economies, the main factors holding inflation down likely include the extended period of economic slack following the Great Recession and the falling prices of oil and other commodities from around mid-2014 to early 2016. In the United States, inflation also has been held down by the rise in the foreign exchange value of the dollar from mid-2014 through 2016. The low core U.S. inflation in 2017 has been more of a puzzle (albeit modest in magnitude) and harder to associate with an identifiable cause.<sup>1</sup> As is discussed in the December 2017 Summary of Economic Projections (Part 3 of this report), most Federal Reserve policymakers view these recent low inflation readings as likely to prove transitory and project U.S. inflation this year to move closer to their 2 percent objective. Many private forecasters appear to share this view.

1. For additional discussion of the reasons for low inflation in the United States, see Janet Yellen (2017), “Inflation, Uncertainty, and Monetary Policy,” speech delivered at “Prospects for Growth: Reassessing the Fundamentals,” 59th Annual Meeting of the National Association for Business Economics, Cleveland, Ohio, September 26, <https://www.federalreserve.gov/newsevents/speech/yellen20170926a.htm>.

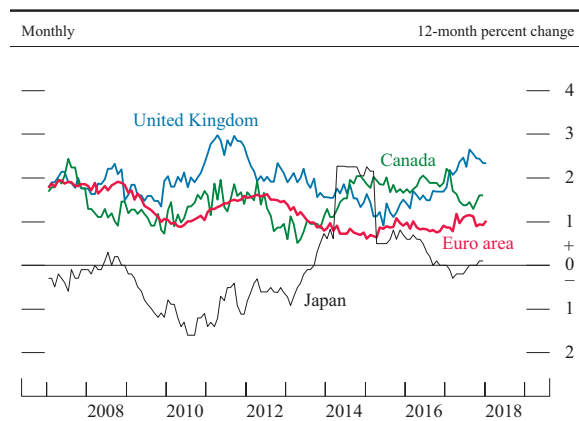
### A. Change in the price index for personal consumption expenditures



NOTE: The data extend through December 2017; changes are from one year earlier.

SOURCE: Bureau of Economic Analysis via Haver Analytics.

### B. Inflation excluding food and energy in selected advanced foreign economies



NOTE: The data for the euro area incorporate the flash estimate for January 2018. The data for Canada and Japan extend through December 2017.

SOURCE: For the United Kingdom, Office for National Statistics; for Japan, Ministry of International Affairs and Communications; for the euro area, Statistical Office of the European Communities; for Canada, Statistics Canada; all via Haver Analytics.

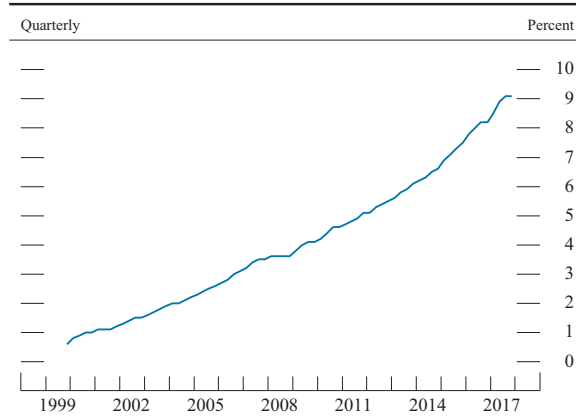
But our understanding of the forces that drive inflation is imperfect, and the fact that many advanced economies are experiencing low inflation at the same time suggests that other, possibly more persistent, factors may be at work. As one possibility, the natural rate of unemployment—the rate at which labor markets exert neither upward nor downward pressure on inflation—is highly uncertain, and it could be lower in many economies than most economists estimate. Alternatively, inflation expectations could be lower than suggested by the available indicators.

More-fundamental changes in the global economy could also be contributing to the recent stretch of lower inflation. First, anecdotal reports suggest that technological changes could be reducing pricing power in many industries, holding down inflation as that occurs.<sup>2</sup> For example, the increased prevalence of Internet shopping allows consumers to compare prices more easily across sellers, possibly implying greater competition that could be putting downward pressure on consumer prices (figure C). While this hypothesis is certainly plausible, it does not easily square with the observation that, at least within the United States, profit margins have been high (figure D).<sup>3</sup>

2. Goldman Sachs (2017), “The Amazon Effect in Perspective,” *U.S. Economics Analyst* (New York: Goldman Sachs, September 30).

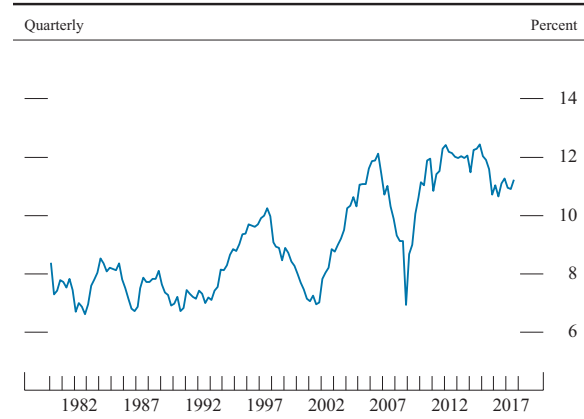
3. See Council of Economic Advisers (2016), “Benefits of Competition and Indicators of Market Power,” Council of Economic Advisers Issue Brief (Washington: CEA, April), [https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160414\\_cea\\_competition\\_issue\\_brief.pdf](https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160414_cea_competition_issue_brief.pdf).

C. E-commerce sales as a share of retail sales



NOTE: E-commerce sales are sales of goods and services where an order is placed by the buyer or where the price and terms of sale are negotiated over an online system. Payment may or may not be made online.  
SOURCE: Retail Indicators Branch, U.S. Census Bureau.

D. Corporate profits as a share of gross national product



NOTE: The data extend through 2017:Q3. Corporate profits include inventory valuation and capital consumption adjustments.  
SOURCE: Bureau of Economic Analysis via Haver Analytics.

Second, some observers have pointed to global developments as helping to explain persistent low inflation across countries. These developments include economic slack abroad or the integration of emerging economies into the world economy, leading to increased competition or downward pressures on wages.<sup>4</sup> But the evidence that global slack can help explain inflation in a given country, beyond its effect on commodity and import prices, is mixed at best.<sup>5</sup> Moreover, measures of integration, such as global trade as a fraction of gross domestic product or the participation in global value chains, appear to have leveled off in recent years.

A number of other explanations for low global inflation have been advanced as well. These explanations include some tentative evidence suggesting that the aging of the population could be exerting downward pressure on trend inflation, perhaps because retirees may tend to be more price conscious

than other consumers.<sup>6</sup> Others have pointed to a slowdown in medical services price increases across countries, possibly associated with either health-care reform or fiscal austerity.<sup>7</sup> This slowdown has had a material effect on U.S. inflation, though the extent to which these declines will persist is uncertain.

In summary, while standard economic models appear to explain much of the post–Great Recession period of low inflation, they do not preclude other explanations. Even as most policymakers expect inflation in their economies to move back to their targets over time, they remain attentive to the possibility that factors not included in those models, such as those described here, may keep inflation low. At the same time, they are attentive to the opposite risk of inflation moving undesirably high, should tightening demand conditions lead to faster rises in wages and prices than currently anticipated.

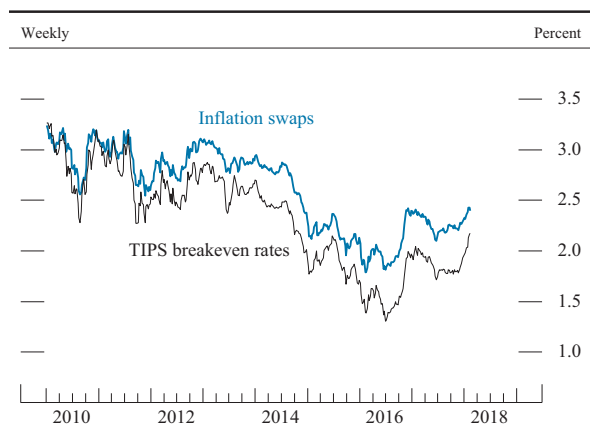
4. See Claudio Borio and Andrew Filardo (2007), “Globalisation and Inflation: New Cross-Country Evidence on the Global Determinants of Domestic Inflation,” BIS Working Papers 227 (Basel, Switzerland: Bank for International Settlements, May), [www.bis.org/publ/work227.pdf](http://www.bis.org/publ/work227.pdf); and Raphael Auer, Claudio Borio, and Andrew Filardo (2017), “The Globalisation of Inflation: The Growing Importance of Global Value Chains,” BIS Working Papers 602 (Basel, Switzerland: Bank for International Settlements, January), [www.bis.org/publ/work602.pdf](http://www.bis.org/publ/work602.pdf).

5. See Jane Ihrig, Steven B. Kamin, Deborah Lindner, and Jaime Marquez (2010), “Some Simple Tests of the Globalization and Inflation Hypothesis,” *International Finance*, vol. 13 (Winter), pp. 343–75; and European Central Bank (2017), “Domestic and Global Drivers of Inflation in the Euro Area,” *ECB Economic Bulletin*, no. 4 (June), pp. 72–96, [https://www.ecb.europa.eu/pub/pdf/other/ebart201704\\_01.en.pdf](https://www.ecb.europa.eu/pub/pdf/other/ebart201704_01.en.pdf).

6. See Jong-Won Yoon, Jinill Kim, and Jungjin Lee (2014), “Impact of Demographic Changes on Inflation and the Macroeconomy,” IMF Working Paper WP/14/210 (Washington: International Monetary Fund, November), <https://www.imf.org/external/pubs/ft/wp/2014/wp14210.pdf>. However, other evidence suggests increased inflationary pressure from an aging population; see Mikael Juselius and Előd Takáts (2015), “Can Demography Affect Inflation and Monetary Policy?” BIS Working Papers 485 (Basel, Switzerland: Bank for International Settlements, February), <https://www.bis.org/publ/work485.pdf>.

7. See Tim Mahedy and Adam Shapiro (2017), “What’s Down with Inflation?” FRBSF Economic Letter 2017-35 (San Francisco: Federal Reserve Bank of San Francisco, November), <https://www.frbsf.org/economic-research/publications/economic-letter/2017/november/contribution-to-low-pce-inflation-from-healthcare>; and Goldman Sachs (2017), “What Can We Learn from Lower Inflation Abroad?” *U.S. Economics Analyst* (New York: Goldman Sachs, November 12)

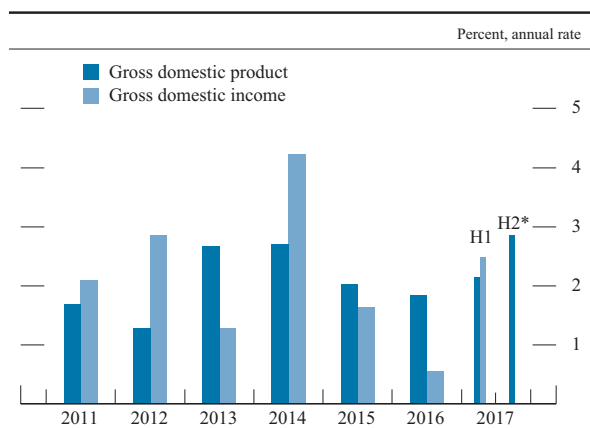
## 11. 5-to-10-year-forward inflation compensation



NOTE: The data are weekly averages of daily data and extend through February 16, 2018. TIPS is Treasury Inflation-Protected Securities.

SOURCE: Federal Reserve Bank of New York; Barclays; Federal Reserve Board staff estimates.

## 12. Change in real gross domestic product and gross domestic income



\* Gross domestic income is not yet available for 2017:H2.

SOURCE: Bureau of Economic Analysis via Haver Analytics.

nevertheless remain relatively low (figure 11).<sup>7</sup> The TIPS-based measure of 5-to-10-year-forward inflation compensation and the analogous measure of inflation swaps are now slightly lower than 2¼ percent and 2½ percent, respectively, with both measures below the ranges that persisted for most of the 10 years before the start of the notable declines in mid-2014.

## Real gross domestic product growth picked up in the second half of 2017

Real gross domestic product (GDP) is reported to have risen at an annual rate of nearly 3 percent in the second half of 2017 after increasing slightly more than 2 percent in the first half of 2017 (figure 12). Much of that faster growth reflects the stabilization of inventory investment, which had slowed considerably in the first half of last year. Private domestic final purchases—that is, final purchases by U.S. households and businesses, which tend to provide a better indication of future GDP growth than most other components of overall spending—rose at a solid annual rate of about 3½ percent in the second half of the year, similar to the first-half pace.

The economic expansion continues to be supported by steady job gains, rising household wealth, favorable consumer sentiment, strong economic growth abroad, and accommodative financial conditions, including the still low cost of borrowing and easy access to credit for many households and businesses. In addition to these factors, very

7. Inflation compensation implied by the TIPS breakeven inflation rate is based on the difference, at comparable maturities, between yields on nominal Treasury securities and yields on TIPS, which are indexed to the headline consumer price index (CPI). Inflation swaps are contracts in which one party makes payments of certain fixed nominal amounts in exchange for cash flows that are indexed to cumulative CPI inflation over some horizon. Focusing on inflation compensation 5 to 10 years ahead is useful, particularly for monetary policy, because such forward measures encompass market participants' views about where inflation will settle in the long term after developments influencing inflation in the short term have run their course.

upbeat business sentiment appears to have supported solid growth over the past year.

**Ongoing improvement in the labor market and gains in wealth continue to support consumer spending . . .**

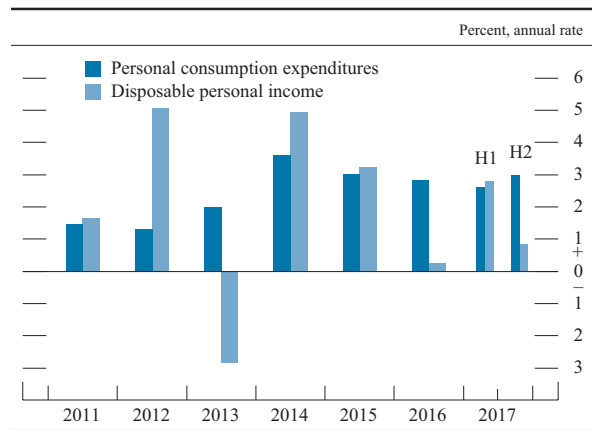
Supported by ongoing improvement in the labor market, real consumer spending rose at a solid annual rate of 3 percent in the second half of 2017, a somewhat faster pace than in the first half. Real disposable personal income—that is, income after taxes and adjusted for price changes—increased at a modest average rate of 1 percent in 2016 and 2017, as real wages changed little over this period (figure 13). With spending growth estimated to have outpaced income growth, the personal saving rate has declined considerably since the end of 2015 (figure 14).

Consumer spending has also been supported by further increases in household net wealth. Broad measures of U.S. equity prices rose robustly last year, though markets have been volatile in recent weeks; house prices have also continued to climb, strengthening the wealth of homeowners (figure 15). As a result of the increases in home and equity prices, aggregate household net worth rose appreciably in 2017. In fact, at the end of the third quarter of 2017, household net worth was 6.7 times the value of disposable income, the highest-ever reading for that ratio, which dates back to 1947 (figure 16).

**. . . borrowing conditions for consumers remain generally favorable . . .**

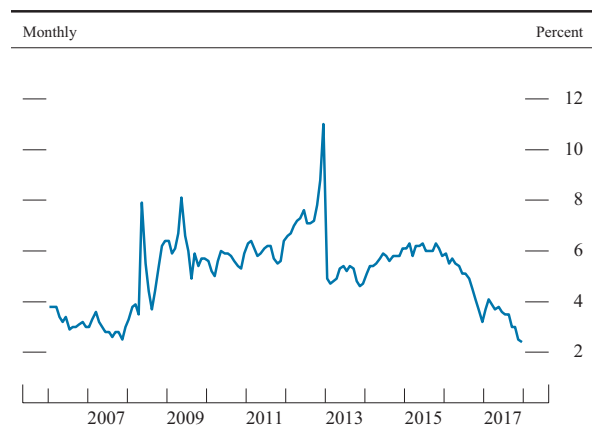
Consumer credit expanded in 2017 at about the same pace as in 2016 (figure 17). Financing conditions for most types of consumer loans are generally favorable. However, banks have continued to tighten standards on credit card and auto loans for borrowers with low credit scores, possibly in response to some upward drift in delinquency rates for those borrowers. Mortgage credit has remained readily available for households with solid credit profiles, but it was still difficult to access for households with low credit scores or harder-to-document incomes.

13. Change in real personal consumption expenditures and disposable personal income



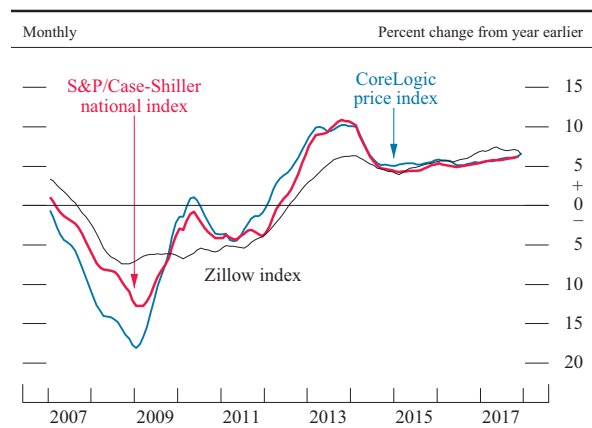
SOURCE: Bureau of Economic Analysis via Haver Analytics.

14. Personal saving rate



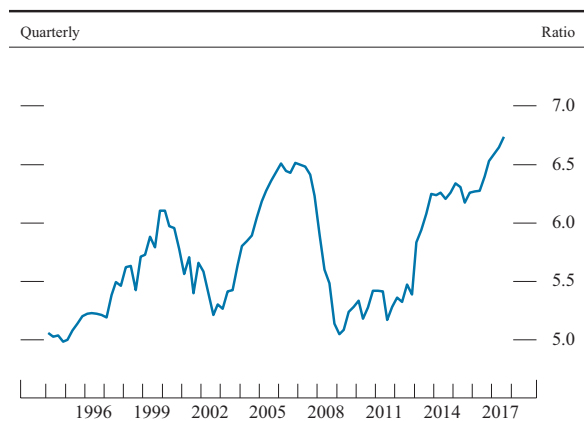
NOTE: Data are through December 2017. SOURCE: Bureau of Economic Analysis via Haver Analytics.

15. Prices of existing single-family houses



NOTE: The data for the S&P/Case-Shiller index extend through November 2017. The data for the Zillow index and the CoreLogic index extend through December 2017. SOURCE: CoreLogic Home Price Index; Zillow; S&P/Case-Shiller U.S. National Home Price Index. The S&P/Case-Shiller Index is a product of S&P Dow Jones Indices LLC and/or its affiliates. (For Dow Jones Indices licensing information, see the note on the Contents page.)

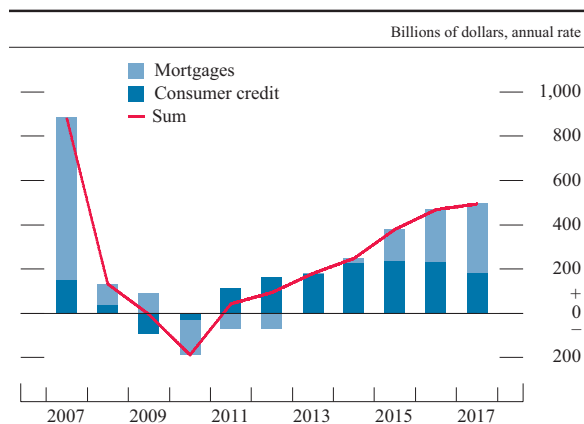
16. Wealth-to-income ratio



NOTE: The data extend through 2017:Q3. The series is the ratio of household net worth to disposable personal income.

SOURCE: For net worth, Federal Reserve Board, Statistical Release Z.1, “Financial Accounts of the United States”; for income, Bureau of Economic Analysis via Haver Analytics.

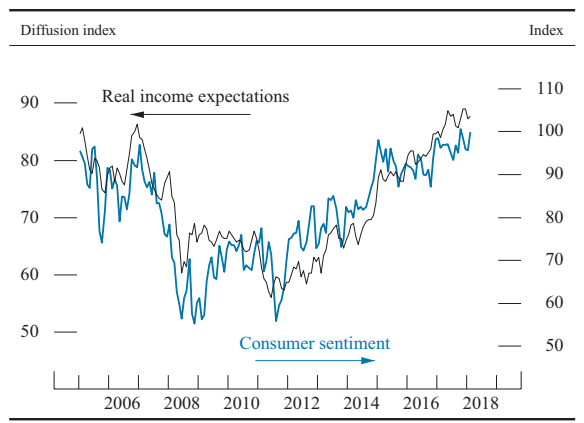
17. Changes in household debt



NOTE: The values for 2017 are the averages of the seasonally adjusted annualized quarterly flows through 2017:Q3.

SOURCE: Federal Reserve Board, Statistical Release Z.1, “Financial Accounts of the United States.”

18. Indexes of consumer sentiment and income expectations



NOTE: The data extend through February 2018; the February data are preliminary. The consumer sentiment data are monthly and are indexed to 100 in 1966. The real income expectations data are calculated as the net percentage of survey respondents expecting family income to go up more than prices during the next year or two plus 100 and are shown as a three-month moving average.

SOURCE: University of Michigan Surveys of Consumers.

Although household borrowing continued to increase last year, the household debt service burden—the ratio of required principal and interest payments on outstanding household debt to disposable income, measured for the household sector as a whole—remained low by historical standards.

... and consumer confidence is strong

Consumers have remained optimistic about their economic situation. As measured by the Michigan survey, consumer sentiment was solid throughout 2017, likely reflecting rising income, job gains, and low inflation (figure 18). Furthermore, the share of households expecting real income to rise over the next year or two has continued to strengthen and now exceeds its pre-recession level.

Activity in the housing sector has improved modestly

Real residential investment spending increased around 2 percent in 2017, about the same modest gain that was seen in 2016. Housing activity was soft in the spring and summer, possibly reflecting the rise in mortgage interest rates early in the year, and then picked up toward the end of the year. For the year as a whole, sales of new and existing homes gained, and single-family housing starts increased (figures 19 and 20). In contrast, multifamily housing starts continued to edge down from the solid pace seen in 2016. Going forward, lean inventories are likely to support further gains in homebuilding activity, as the months’ supply of homes for sale has remained near low levels.

Business investment has continued to rebound . . .

Real outlays for business investment—that is, private nonresidential fixed investment—rose at an annual rate of about 6 percent in the second half of 2017, a bit below the gain in the first half but still notably faster than the unusually weak pace recorded in 2016 (figure 21). Business spending on equipment and intangibles (such as research



and development) advanced at a solid pace in the second half of the year, and forward-looking indicators of business spending are generally favorable: Orders and shipments of capital goods have posted net gains in recent months, and indicators of business sentiment and activity remain very upbeat. That said, business outlays on structures turned down in the second half of 2017, as investment growth in drilling and mining structures retreated from a very rapid pace in the first half and investment in other nonresidential structures declined.

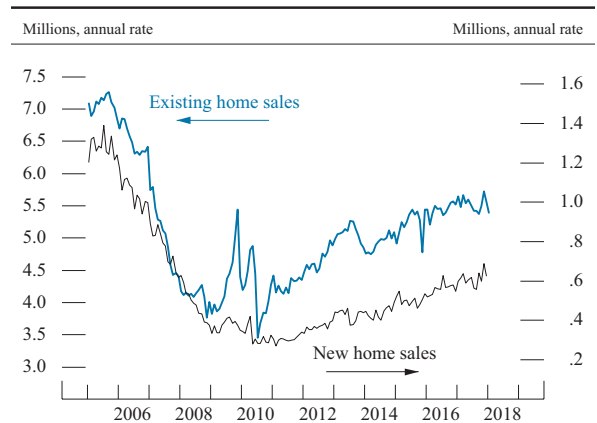
**... while corporate financing conditions have remained accommodative**

Aggregate flows of credit to large nonfinancial firms remained solid through the third quarter, supported in part by continued low interest rates (figure 22). The gross issuance of corporate bonds stayed robust during the second half of 2017, and yields on both investment-grade and high-yield corporate bonds remained low by historical standards (figure 23).

Despite solid growth in business investment, outstanding commercial and industrial (C&I) loans on banks' books continued to rise only modestly in the third quarter of 2017. Respondents to the Senior Loan Officer Opinion Survey on Bank Lending Practices, or SLOOS, reported that demand for C&I loans declined in the third quarter and was little changed in the fourth quarter even as lending standards and terms on such loans eased.<sup>8</sup> Respondents attributed this decline in demand in part to firms drawing on internally generated funds or using alternative sources of financing. Financing conditions for small businesses appear to have remained favorable, and although credit growth has remained sluggish, survey data suggest this sluggishness is largely due to continued weak demand for credit by small businesses.

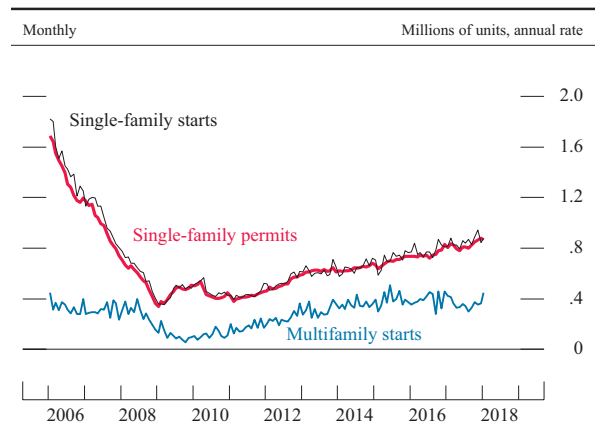
8. The SLOOS is available on the Board's website at <https://www.federalreserve.gov/data/sloos/sloos.htm>.

19. New and existing home sales



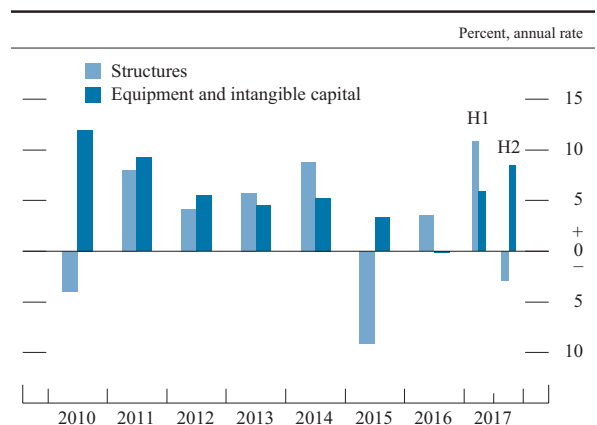
NOTE: Data are monthly. New home sales extend through December 2017 and include only single-family sales. Existing home sales includes single-family, condo, townhome, and co-op sales.  
SOURCE: For new home sales, U.S. Census Bureau; for existing home sales, National Association of Realtors; all via Haver Analytics.

20. Private housing starts and permits



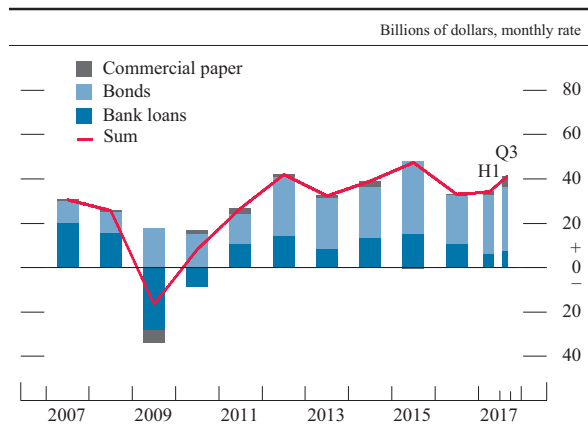
SOURCE: U.S. Census Bureau via Haver Analytics.

21. Change in real private nonresidential fixed investment



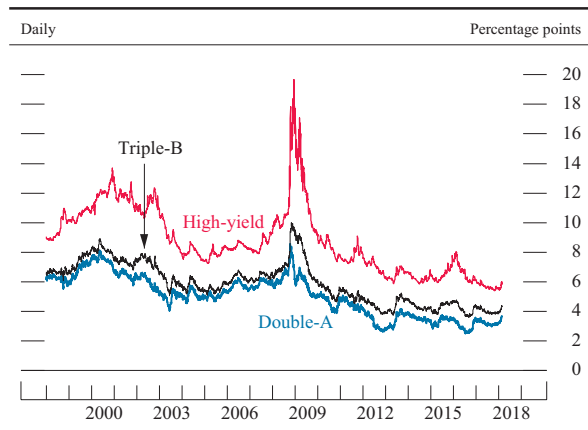
SOURCE: Bureau of Economic Analysis via Haver Analytics.

22. Selected components of net debt financing for nonfinancial businesses



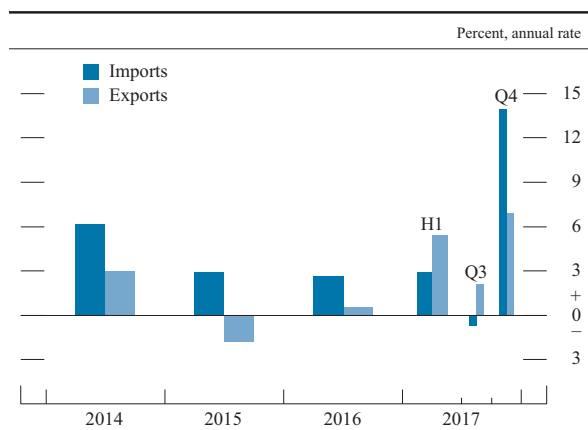
SOURCE: Federal Reserve Board, Statistical Release Z.1, “Financial Accounts of the United States.”

23. Corporate bond yields, by securities rating



NOTE: The yields shown are yields on 10-year bonds.  
SOURCE: ICE Bank of America Merrill Lynch Indices, used with permission.

24. Change in real imports and exports of goods and services



SOURCE: Bureau of Economic Analysis via Haver Analytics.

**Net exports subtracted from GDP growth in the fourth quarter after providing a modest addition during the rest of the year**

U.S. real exports expanded at a moderate pace in the second half of last year after having increased more rapidly in the first half, supported by solid foreign growth (figure 24). At the same time, real imports surged in the fourth quarter following a slight contraction in the third quarter. As a result, real net exports moved from modestly lifting U.S. real GDP growth during the first three quarters of 2017 to subtracting more than 1 percentage point in the fourth quarter. Although the nominal trade and current account deficits narrowed in the third quarter of 2017, the trade deficit widened in the fourth quarter (figure 25).

**Federal fiscal policy actions had a roughly neutral effect on economic growth in 2017 . . .**

Federal government purchases rose 1 percent in 2017, and policy actions had little effect on federal taxes or transfers (figure 26). Under currently enacted legislation, which includes the Tax Cuts and Jobs Act (TCJA) and the Bipartisan Budget Act, federal fiscal policy will likely provide a moderate boost to GDP growth this year.<sup>9</sup>

The federal unified deficit continued to widen in fiscal year 2017, reaching 3½ percent of nominal GDP. Although expenditures as a share of GDP were relatively stable at a little under 21 percent, receipts moved lower in 2017 to roughly 17 percent of GDP (figure 27). The ratio of federal debt held by the public to nominal GDP was 75¼ percent at the end of fiscal year 2017 and remains quite elevated relative to historical norms (figure 28).

9. The Joint Committee on Taxation estimates that the TCJA will reduce average annual tax revenue by a little more than 1 percent of GDP over the next few years. This revenue estimate does not account for the potential macroeconomic effects of the legislation.

### ... and the fiscal position of most state and local governments is stable

The fiscal position of most state and local governments is stable, although there is a range of experiences across these governments. Many state governments are experiencing lackluster revenue growth, as income tax collections have only edged up, on average, in recent quarters. In contrast, house price gains have continued to push up property tax revenues at the local level. Employment in the state and local government sector only inched up in 2017, while outlays for construction by these governments continued to decline on net (figure 29).

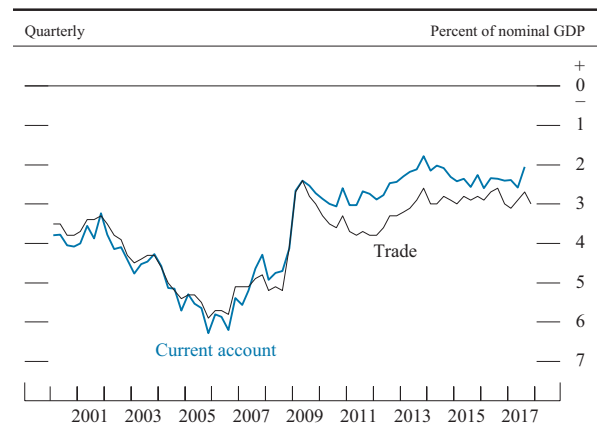
## Financial Developments

### The expected path of the federal funds rate has moved up

The path of the expected federal funds rate implied by market quotes on interest rate derivatives has moved up on net since the middle of last year amid an improving global growth outlook (figure 30). Part of the upward shift occurred around FOMC communications in the fall that were interpreted as implying a somewhat quicker pace of policy rate increases than had been previously anticipated. The expected policy path also moved higher around the time when the U.S. tax legislation was finalized.

Survey-based measures of the expected path of the policy rate have been generally little changed on net, suggesting that part of the rise in the market-implied path reflected higher term premiums. In the Federal Reserve Bank of New York’s Survey of Primary Dealers and Survey of Market Participants, which were conducted just before the January 2018 FOMC meeting, the median respondents expected three 25 basis point increases in the FOMC’s target range for the federal funds rate as the most likely outcome for this year, unchanged from what they had expected in surveys conducted before the June FOMC meeting. Market-based measures of uncertainty about

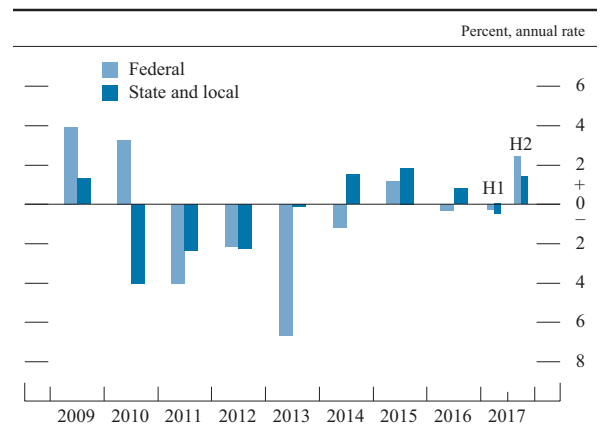
25. U.S. trade and current account balances



NOTE: GDP is gross domestic product. Current account data extend through 2017:Q3.

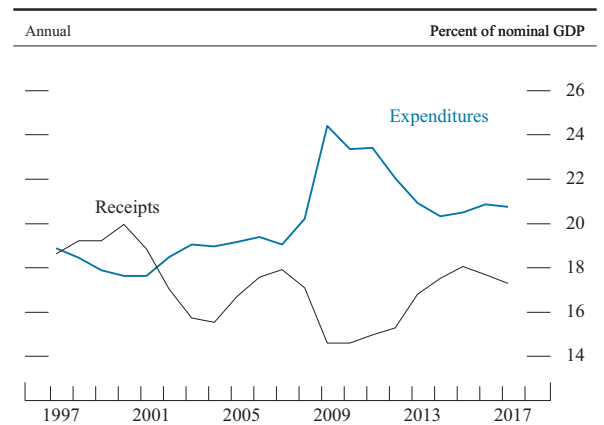
SOURCE: Bureau of Economic Analysis via Haver Analytics.

26. Change in real government expenditures on consumption and investment



SOURCE: Bureau of Economic Analysis via Haver Analytics.

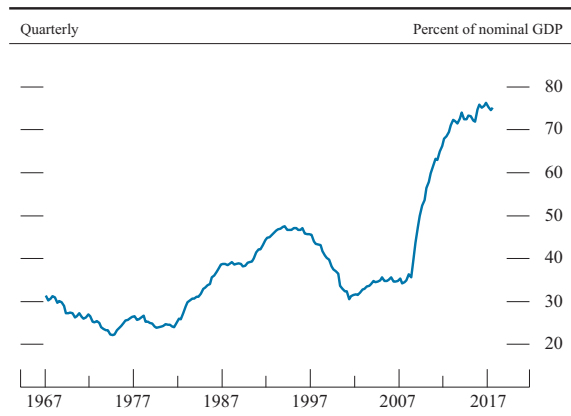
27. Federal receipts and expenditures



NOTE: The receipts and expenditures data are on a unified-budget basis and are for fiscal years (October through September); gross domestic product (GDP) data are for the four quarters ending in Q4.

SOURCE: Office of Management and Budget via Haver Analytics.

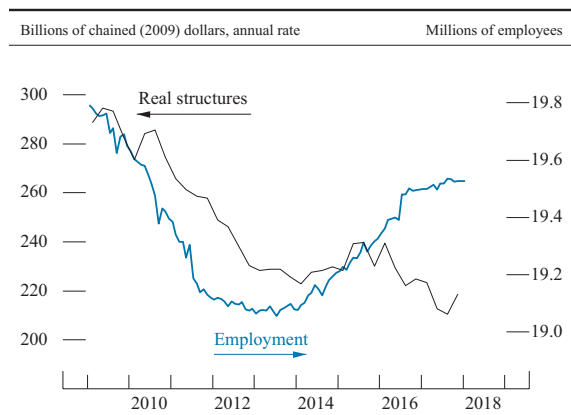
28. Federal government debt held by the public



NOTE: The data extend through 2017:Q3. The data for gross domestic product (GDP) are at an annual rate. Federal debt held by the public equals federal debt less Treasury securities held in federal employee defined benefit retirement accounts, evaluated at the end of the quarter.

SOURCE: For GDP, Bureau of Economic Analysis via Haver Analytics; for federal debt, Federal Reserve Board, Statistical Release Z.1, "Financial Accounts of the United States."

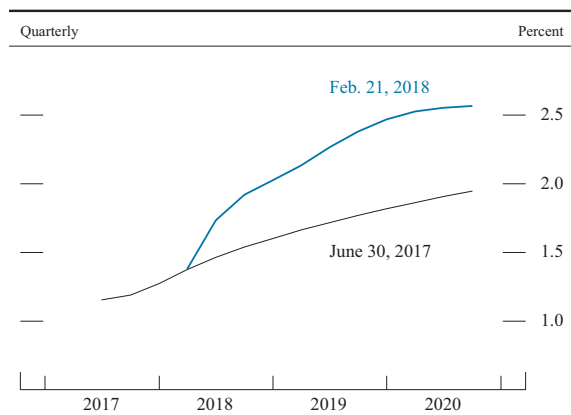
29. State and local employment and structures investment



NOTE: The employment data are monthly, and the structures data are quarterly.

SOURCE: For employment data, Bureau of Labor Statistics; for structures data, Bureau of Economic Analysis; all via Haver Analytics.

30. Market-implied federal funds rate



NOTE: The federal funds rate path is implied by quotes on overnight index swaps—a derivative contract tied to the effective federal funds rate. The implied path as of February 21, 2018, is compared with that as of June 30, 2017. The path is estimated with a spline approach, assuming a term premium of 0 basis points. The paths extend through 2020:Q4.

SOURCE: Bloomberg; Federal Reserve Board staff estimates.

the policy rate approximately one to two years ahead have, on balance, edged up from their levels in the middle of 2017.

**The nominal Treasury yield curve has shifted up**

The nominal Treasury yield curve has shifted up on net since the middle of 2017, owing to greater optimism about the global growth outlook and investors' perceptions of higher odds for the removal of monetary policy accommodation (figure 31). Yields on shorter-term nominal Treasury securities increased relatively more than those on longer-term nominal Treasury securities, thus resulting in some flattening of the yield curve. According to market participants, among the factors contributing to this outcome has been the Treasury Department's stated intention to increase its reliance on issuance of short-dated securities, as discussed in the two most recent releases of the Treasury's quarterly financing statement.

Consistent with the changes in Treasury yields, yields on 30-year agency mortgage-backed securities (MBS)—an important determinant of mortgage interest rates—increased but remain quite low by historical standards (figure 32).

**Broad equity price indexes have increased further . . .**

Broad U.S. equity indexes, despite some declines seen in recent weeks, have, on balance, increased further since June 2017, with most of the net gains occurring during the final quarter of last year (figure 33). Equity prices were reportedly supported in part by an increase in investors' confidence that changes to the federal tax law will boost corporate earnings. Stock prices generally increased across industries outside utilities and real estate, two sectors for which the increases in interest rates described earlier are likely to have weighed more heavily on stock prices; stock prices of banks rose more than the broader market. Implied volatility for the S&P 500 index, as calculated from options prices,

increased notably in early February, ending the period close to the median of its historical distribution.

**... while risk spreads on corporate bonds have continued to decrease**

Spreads on both high-yield and investment-grade corporate bond yields over comparable-maturity Treasury yields have decreased further since the middle of last year, with spreads for high-yield bonds moving closer to the bottom of their historical ranges. The narrowing of the spreads since the middle of 2017 appears to reflect both an anticipation that the losses from defaults on these bonds will be smaller and a lower compensation being charged for bearing the risk of such losses. (For a discussion of financial stability issues, see the box “Developments Related to Financial Stability.”)

**Markets for Treasury securities, mortgage-backed securities, municipal bonds, and short-term funding have functioned well**

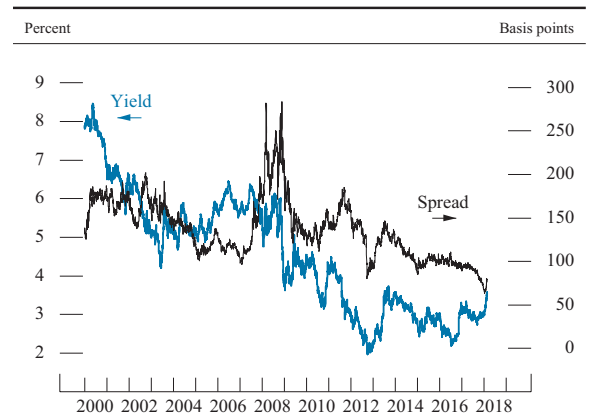
Available indicators of Treasury market functioning have generally remained stable over the second half of 2017 and early 2018, with a variety of liquidity metrics—including bid-ask spreads, bid sizes, and estimates of transaction costs—mostly unchanged over the period. Liquidity conditions in the agency MBS market have also been generally stable. In recent months, the functioning of Treasury and agency MBS markets has not been notably affected by the implementation of the Federal Reserve’s balance sheet normalization program and the resulting reduction in reinvestment of principal payments from the Federal Reserve’s securities holdings. In early February, amid financial market volatility, liquidity conditions in the Treasury market deteriorated but have recovered somewhat since. Credit conditions in municipal bond markets have also remained generally stable since June 2017. Over that period, yield spreads on 20-year general obligation municipal bonds over comparable-maturity Treasury securities have narrowed on balance. Nevertheless, significant financial strains were still evident for some issuers.

31. Yields on nominal Treasury securities



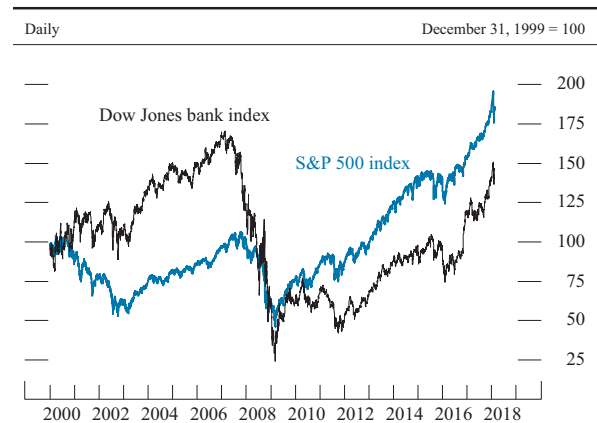
NOTE: The Treasury ceased publication of the 30-year constant maturity series on February 18, 2002, and resumed that series on February 9, 2006.  
SOURCE: Department of the Treasury.

32. Yield and spread on agency mortgage-backed securities



NOTE: The data are daily. Yield shown is for the Fannie Mae 30-year current coupon, the coupon rate at which new mortgage-backed securities would be priced at par, or face, value. Spread shown is to the average of the 5- and 10-year nominal Treasury yields. The data extend through February 16, 2018.  
SOURCE: Department of the Treasury; Barclays.

33. Equity prices



SOURCE: Standard & Poor’s Dow Jones Indices via Bloomberg. (For Dow Jones Indices licensing information, see the note on the Contents page.)

## Developments Related to Financial Stability

Overall vulnerabilities in the U.S. financial system remain moderate on balance.<sup>1</sup> Valuation pressures continue to be elevated across a range of asset classes, including equities and commercial real estate. Vulnerabilities from leverage in the financial sector appear low, reflecting in part capital and liquidity ratios of banks that have continued to improve from already strong positions. However, there are signs that nonbank financial leverage has been increasing in some areas—for example, in the provision of margin credit to equity investors such as hedge funds. Vulnerabilities from nonfinancial leverage are judged to be moderate. While household debt balances have been increasing modestly, the leverage of the business sector is elevated, particularly among speculative-grade firms. Vulnerabilities related to maturity and liquidity transformation remain low on net.

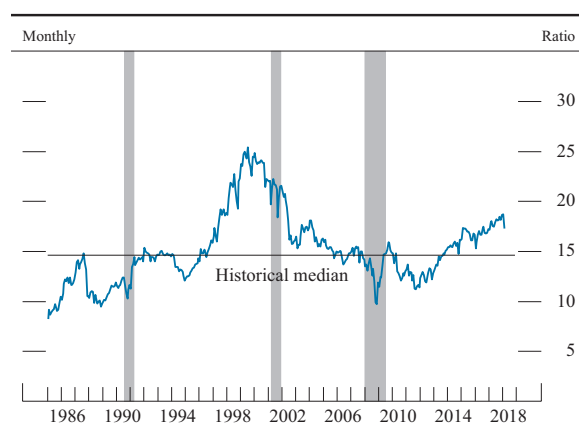
Over the second half of 2017, valuation pressures edged up from already elevated levels. In general, valuations are higher than would be expected based solely on the current level of longer-term Treasury yields. In part reflecting growing anticipation of the boost to future (after-tax) earnings from a corporate tax rate cut, price-to-earnings ratios for U.S. stocks rose through January and were close to their highest levels outside of the late 1990s (figure A); ratios dropped back somewhat in early February. In a sign of increasing valuation pressures in commercial real estate markets, net operating income relative to property values (referred to as capitalization rates) have been declining relative to Treasury yields of comparable maturity for multifamily and industrial properties. While these spreads narrowed further from already low levels, they are wider than in 2007. Even though the aggregate residential house price-to-rent ratio has been increasing faster than its long-run trend, it is only slightly elevated at present. In corporate credit markets, spreads of corporate bond yields over those of Treasury securities with comparable maturities fell, and the high-yield spread is now near the bottom of its historical distribution. Spreads on leveraged loans and collateralized loan obligations—which are a significant

funding source for the corporate sector—stayed compressed. In addition, nonprice terms eased on these types of loans, indicating weaker investor protection than at the peak of the previous credit cycle in 2007. Consistent with elevated risk appetite, virtual currencies experienced sharp price increases in 2017.

Vulnerabilities related to financial-sector leverage appear low. Leverage at insurance companies and at broker-dealers is on the low end of its historical range, and most indicators of leverage at other nonbank financial firms are stable. However, there is some evidence that dealers have eased price terms to hedge funds and real estate investment trusts, and that hedge funds have gradually increased their use of leverage, in particular margin credit for equity trades. Although such easing of price terms has taken place against the backdrop of building valuation pressures, the strong capital position of bank holding companies reduces the risk that sudden drops in asset prices could significantly affect bank-affiliated dealers. Risk-based regulatory capital ratios for most of the largest bank holding companies continued to increase from already high levels.

If interest rates were to increase unexpectedly, banks' strong capital position should help absorb the consequent losses on securities. About one-third of the losses that could be experienced by banks would affect held-to-maturity securities. While these losses

A. Forward price-to-earnings ratio of S&P 500 firms



NOTE: The February 2018 value is based on a mid-month estimate. The data depict the aggregate forward price-to-earnings ratio of S&P 500 firms. The historical median is based on data from 1985 to the present. Shaded bars indicate periods of recession as defined by the National Bureau of Economic Research. Data are based on 12-month-ahead expected earnings per share.

SOURCE: Staff estimates based on Thomson Reuters, IBES.

1. An overview of the framework for assessing financial stability in the United States is provided in Stanley Fischer (2017), "An Assessment of Financial Stability in the United States," speech delivered at the IMF Workshop on Financial Surveillance and Communication: Best Practices from Latin America, the Caribbean, and Advanced Economies, Washington, June 27, [www.federalreserve.gov/newsevents/speech/fischer20170627a.htm](http://www.federalreserve.gov/newsevents/speech/fischer20170627a.htm).

would not reduce regulatory capital, they could still have a variety of negative consequences—for example, by worsening banks’ funding terms. The large share of deposits in bank liabilities is also likely to soften the effect of an unexpected rise in interest rates on banks, because deposit rates tend to adjust with a delay and bank profitability would improve in the meantime.

Overall vulnerabilities arising from leverage in the nonfinancial sector continue to be moderate. Continuing its pattern in recent years, household debt has expanded about in line with nominal income, and the household credit-to-GDP gap remains sizable and negative (figure B). Leverage in the nonfinancial business sector remains high, with net issuance of risky debt climbing in recent months. However, the share of the lowest-quality debt in total issuance declined, and relatively low interest expenses mitigated some of the vulnerabilities associated with elevated leverage.

In part attributable to regulations introduced since the financial crisis, vulnerabilities associated with liquidity and maturity transformation—that is, the financing of illiquid or long-maturity assets with short-maturity debt—continue to be low. The reliance of global systemically important banks (G-SIBs) on short-term wholesale funding has risen only slightly from post-crisis lows, while their holdings of high-

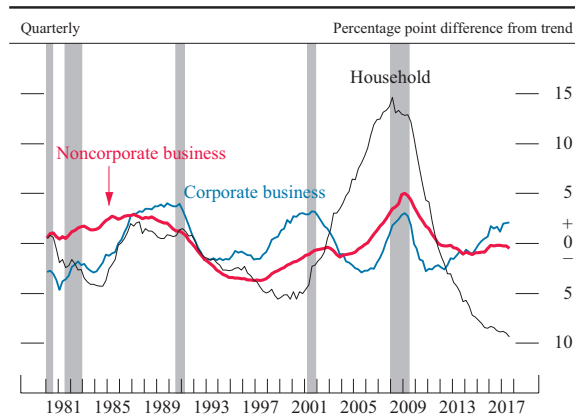
quality liquid assets stand at high levels and exceed those required by the Liquidity Coverage Ratio. The share of core deposits in total liabilities at G-SIBs also remains at historically high levels. More than one year after the money market fund reform, which reduced run risk as investors shifted from prime to government funds, the growth in alternative short-term investment vehicles has been limited. Regarding securitized products, although the issuance of asset-backed securities (ABS) was strong, overall issuance has remained well below pre-crisis levels for most asset classes, and securitizations appear to involve limited maturity or liquidity transformation. Nonetheless, ABS issuance was boosted by the securitization of assets that were rarely securitized in the past, such as aircraft leases and mobile phone contracts. In addition, certain nontraditional liabilities of life insurers, including funding-agreement-backed securities, have grown notably recently, although levels remain low relative to the broader market for securitizations.

Financial vulnerabilities in foreign economies are moderate overall. Advanced foreign economies, many of which have strong financial and real linkages to the United States, continue to struggle with elevated valuations, the disposal of legacy assets, and, in some cases, worrisome rises in mortgage debt. Some major emerging market economies harbor more pronounced vulnerabilities, reflecting one or more of the following: substantial corporate leverage, fiscal concerns, or excessive reliance on foreign funding.

The countercyclical capital buffer (CCyB) is a macroprudential tool the Federal Reserve Board can use to increase the resilience of the financial system by raising capital requirements on internationally active banking organizations. The CCyB is activated when there is an elevated risk of above-normal future losses and when the banking organizations for which capital requirements would be raised by the buffer are exposed to or are contributing to this elevated risk—either directly or indirectly. The financial stability developments, assessments, and framework described and used here bear importantly on the Board’s setting of the CCyB.<sup>2</sup> In December 2017, the Board voted to affirm the CCyB at its level of 0 percent.

*(continued on next page)*

B. Private nonfinancial sector credit-to-GDP gap



NOTE: The data extend through 2017:Q3 and are smoothed using a Hodrick-Prescott filter. The shaded bars indicate periods of business recession as defined by the National Bureau of Economic Research. Gaps have been weighted by their share of overall credit. GDP is gross domestic product.

SOURCE: Federal Reserve Board, Statistical Release Z.1, “Financial Accounts of the United States”; Bureau of Economic Analysis via Haver Analytics, national income and product accounts, Table 1.1.5: Gross Domestic Product; Board staff calculations.

2. See Board of Governors of the Federal Reserve System (2016), “Regulatory Capital Rules: The Federal Reserve Board’s Framework for Implementing the U.S. Basel III Countercyclical Capital Buffer,” final policy statement (Docket No. R-1529), *Federal Register*, vol. 81 (September 16), pp. 63682–88.

## Developments Related to Financial Stability *(continued)*

Over the second half of 2017, the Federal Reserve Board has taken some key steps to reduce regulatory burden while promoting the financial stability of the United States. The Federal Reserve Board, Office of the Comptroller of the Currency, and Federal Deposit Insurance Corporation jointly proposed amendments to the banking agencies' commercial real estate appraisal regulations that raised the threshold price for mandating appraisals from \$250,000 to \$400,000, thereby reducing the number of required appraisals.<sup>3</sup> In addition, the federal banking agencies issued a proposal to simplify aspects of community banking organizations' regulatory capital rules, with the goal of reducing regulatory burden on smaller institutions while maintaining the safety and soundness of the banking system.<sup>4</sup>

The Board requested comment on a corporate governance proposal to enhance the effectiveness of financial firms' boards of directors. The proposal refocuses the Federal Reserve's supervisory expectations for the largest firms' boards of directors on their core responsibilities and would also reduce unnecessary burden for the boards of smaller institutions.<sup>5</sup> The Board

also adopted a final rule to improve the resolvability and resilience of G-SIBs and their subsidiaries to restrictions regarding the terms of their noncleared qualified financial contracts.<sup>6</sup> In addition, the Board proposed changes to its supervisory rating system for large financial institutions to better align with the post-crisis supervisory program for these firms; smaller institutions, including community banks, would continue to use the current rating system.<sup>7</sup> Finally, the Board requested comment on a package of proposals that would increase the transparency of its stress-testing program. In particular, the proposals would provide more information about the models used to estimate hypothetical losses in the stress tests while maintaining the Board's ability to test the resilience of the nation's largest and most complex banks.<sup>8</sup>

3. See Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System, and the Federal Deposit Insurance Corporation (2017), "Real Estate Appraisals," notice of proposed rulemaking and request for comment (Docket No. R-1568), *Federal Register*, vol. 82 (July 31), pp. 35478–93.

4. See Office of the Comptroller of the Currency, Board of Governors of the Federal Reserve System, and the Federal Deposit Insurance Corporation (2017), "Simplifications to the Capital Rule Pursuant to the Economic Growth and Regulatory Paperwork Reduction Act of 1996," notice of proposed rulemaking (Docket No. R-1576), *Federal Register*, vol. 82 (October 27), pp. 49984–50044.

5. See Board of Governors of the Federal Reserve System (2017), "Federal Reserve Board Invites Public Comment on

Two Proposals; Corporate Governance and Rating System for Large Financial Institutions," press release, August 3, <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20170803a.htm>.

6. See Board of Governors of the Federal Reserve System (2017), "Restrictions on Qualified Financial Contracts of Systemically Important U.S. Banking Organizations and the U.S. Operations of Systemically Important Foreign Banking Organizations; Revisions to the Definition of Qualifying Master Netting Agreement and Related Definitions," final rule (Docket No. R-1538), *Federal Register*, vol. 82 (September 12), pp. 42882–926.

7. See Board of Governors, "Federal Reserve Board Invites Public Comment on Two Proposals," in note 5.

8. See Board of Governors of the Federal Reserve System (2017), "Federal Reserve Board Requests Comment on Package of Proposals That Would Increase the Transparency of Its Stress Testing Program," press release, December 7, [www.federalreserve.gov/newsevents/pressreleases/bcreg20171207a.htm](http://www.federalreserve.gov/newsevents/pressreleases/bcreg20171207a.htm).



In particular, prices for Puerto Rico general obligation bonds fell notably after Hurricane Maria hit the island and its economic outlook deteriorated even further. However, these developments left little imprint in broader municipal bond markets. Conditions in domestic short-term funding markets have remained stable since the middle of last year.

**Bank credit continued to expand and bank profitability remained stable**

Aggregate credit provided by commercial banks continued to expand in the second half of 2017 at a pace similar to the one seen earlier in the year but more slowly than in 2016. Its pace was also slower than that of nominal GDP, thus leaving the ratio of total commercial bank credit to current-dollar GDP slightly lower than earlier in 2017 (figure 34). Measures of bank profitability were little changed at levels below their historical averages (figure 35).

**International Developments**

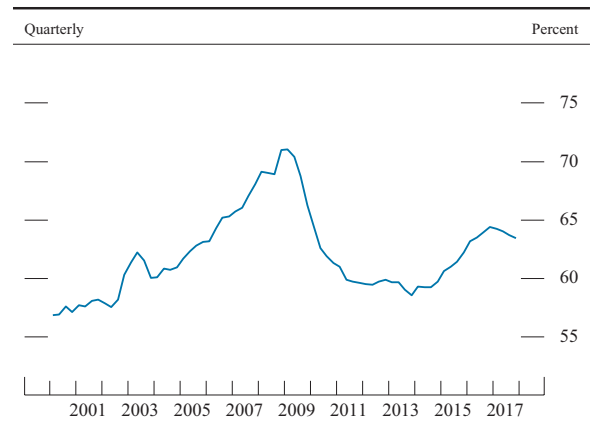
**Economic activity in most foreign economies continued at a healthy pace in the second half of 2017**

Foreign real GDP appears to have expanded notably in the second half of 2017, extending the period since mid-2016 when the pace of economic growth picked up broadly around the world.

**Growth in advanced foreign economies was solid, and unemployment fell to multidecade lows . . .**

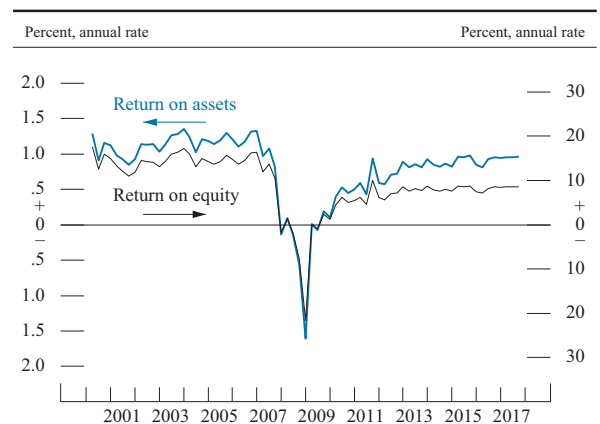
In the advanced foreign economies (AFEs), the economic recovery has continued to firm. Real GDP in the euro area and the United Kingdom expanded at a solid pace in the second half of the year (figure 36). Economic activity also continued to expand in Japan, though real GDP growth slowed sharply in the fourth quarter. In Canada, data through November indicate that economic growth moderated somewhat in the second half following a very rapid expansion earlier in the year. Unemployment declined further as

34. Ratio of total commercial bank credit to nominal gross domestic product



SOURCE: Federal Reserve Board, Statistical Release H.8, “Assets and Liabilities of Commercial Banks in the United States”; Bureau of Economic Analysis via Haver Analytics.

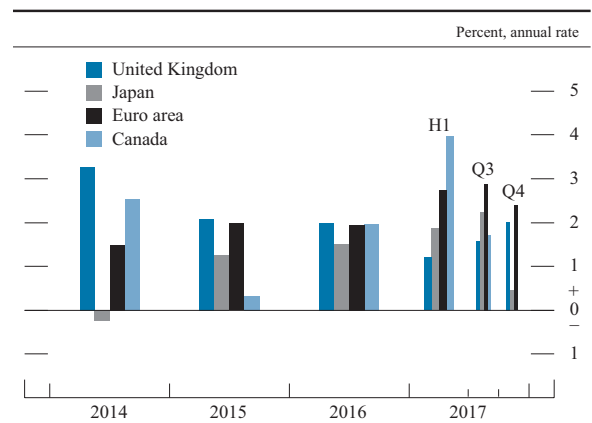
35. Profitability of bank holding companies



NOTE: The data are quarterly and are seasonally adjusted. The data extend through 2017:Q3.

SOURCE: Federal Reserve Board, Form FR Y-9C, Consolidated Financial Statements for Bank Holding Companies.

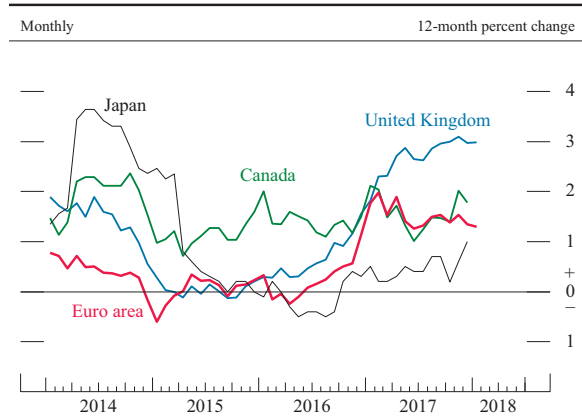
36. Real gross domestic product growth in selected advanced foreign economies



NOTE: The data for the United Kingdom and the euro area incorporate flash estimates for 2017:Q4. The data for Japan incorporate the preliminary estimate for 2017:Q4. The data for Canada extend through 2017:Q3.

SOURCE: For the United Kingdom, Office for National Statistics; for Japan, Cabinet Office, Government of Japan; for the euro area, Eurostat; for Canada, Statistics Canada; all via Haver Analytics.

37. Consumer price inflation in selected advanced foreign economies



NOTE: The data for the euro area incorporate the flash estimate for January 2018. The data for Canada and Japan extend through December 2017.  
 SOURCE: For the United Kingdom, Office for National Statistics; for Japan, Ministry of International Affairs and Communications; for the euro area, Statistical Office of the European Communities; for Canada, Statistics Canada; all via Haver Analytics.

well, reaching 40-year lows in Canada and the United Kingdom, while growth in labor compensation ticked up only modestly.

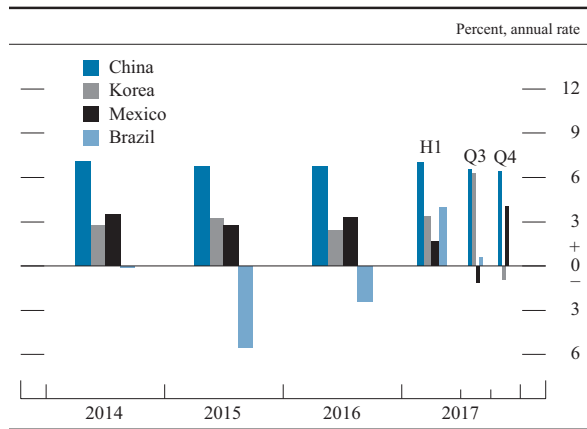
**... but inflation remained subdued ...**

Consumer price inflation rose somewhat in most AFEs, boosted by the rise in commodity prices (figure 37). However, headline and especially core inflation remained below the central banks’ targets in the euro area and Japan. In contrast, U.K. inflation rose further above the Bank of England’s (BOE) 2 percent target as the substantial sterling depreciation observed since the June 2016 Brexit referendum continued to provide some uplift to import prices. (For more discussion of inflation both in the United States and abroad, see the box “Low Inflation in the Advanced Economies” in the Domestic Developments section.)

**... leading AFE central banks to maintain accommodative monetary policies**

The Bank of Japan kept its policy rates at historically low levels, with the target for 10-year government bond yields around zero. In October, the European Central Bank extended its asset purchase program until September 2018, albeit at a reduced pace. The Bank of Canada and the BOE both raised their policy rates but also indicated that they intend to proceed gradually with further removal of policy accommodation.

38. Real gross domestic product growth in selected emerging market economies



NOTE: The data for China are seasonally adjusted by Board staff. The data for Korea, Mexico, and Brazil are seasonally adjusted by their respective government agencies. The data for Mexico incorporate the flash estimate for 2017:Q4. The data for Brazil extend through 2017:Q3.  
 SOURCE: For China, China National Bureau of Statistics; for Korea, Bank of Korea; for Mexico, Instituto Nacional de Estadística y Geografía; for Brazil, Instituto Brasileiro de Geografia e Estatística; all via Haver Analytics.

**In emerging Asia, growth remained solid...**

Economic growth in China remained relatively strong in the second half of 2017 even as the authorities enacted policies to limit production in heavily polluting industries, tighten financial regulations, and curb house price growth (figure 38). Most other emerging Asian economies registered very strong growth in the third quarter of 2017, fueled by solid external demand, but slowed in the fourth quarter.

**... while the largest Latin American economies continued to struggle**

In Mexico, real GDP declined in the third quarter as two major earthquakes and a hurricane significantly disrupted economic activity, but rebounded in the fourth quarter. Following a prolonged period of contraction, the Brazilian economy continues to recover, but only at a weak pace. Private investment has remained sluggish amid corporate deleveraging and continued uncertainty about government policies, although it turned positive in the third quarter for the first time in nearly four years.

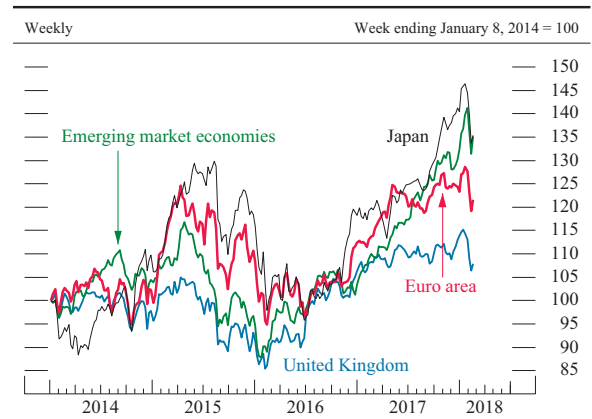
**Foreign equity prices rose further on net...**

Solid macroeconomic data and robust corporate earnings helped broad AFE and emerging market economies (EMEs) equity indexes extend their 2016 gains through the start of this year (figure 39). Declines since the end of January have erased some of these gains, and volatility in foreign stock markets increased. On balance, most AFE stock prices are higher, and EME equity markets significantly outperformed those of AFEs. Capital flows into emerging market mutual funds generally remained robust as higher commodity prices added to optimism about the economic outlook (figure 40).

**... and government bond yields increased**

Longer-term government bond yields in most AFEs were noticeably higher than their mid-2017 levels, reflecting strengthening growth and mounting prospects for the normalization of monetary policies (figure 41). In Canada, where the central bank has raised its policy interest rate 75 basis points since June, the rise in longer-term yields was particularly notable. On balance, spreads of dollar-denominated emerging market sovereign bonds over U.S. Treasury securities were stable around the levels observed in mid-2017 (as shown in figure 40).

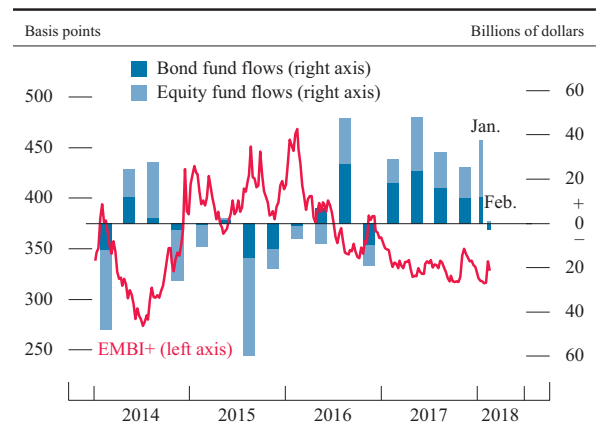
39. Equity indexes for selected foreign economies



NOTE: The data are weekly averages of daily data and extend through February 21, 2018.

SOURCE: For euro area, DJ Euro Stoxx Index; for Japan, TOPIX Stock Index; for United Kingdom, FTSE 100 Stock Index; for emerging market economies, MSCI Emerging Markets Local Currency Index; all via Bloomberg.

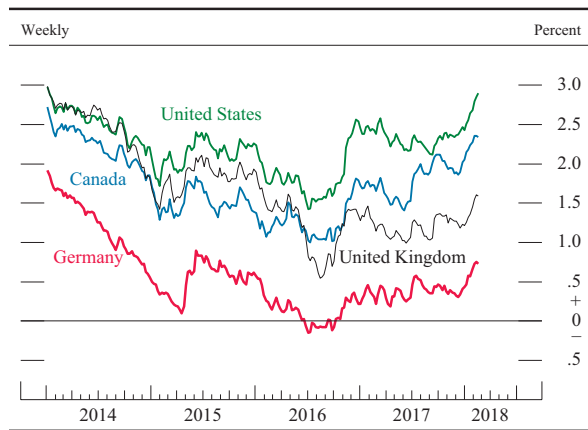
40. Emerging market mutual fund flows and spreads



NOTE: The bond and equity fund flow data are quarterly sums of weekly data from January 1, 2014, to December 31, 2017, and monthly sums of weekly data from January 1, 2018, to February 14, 2018. The fund flows data exclude funds located in China. The J.P. Morgan Emerging Markets Bond Index Plus (EMBI+) data are weekly averages of daily data and extend through February 20, 2018.

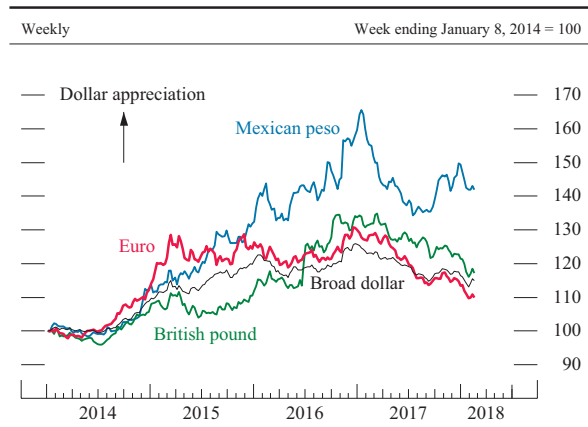
SOURCE: For bond and equity fund flows, EPER Global; for EMBI+, J.P. Morgan Emerging Markets Bond Index Plus via Bloomberg.

41. Nominal 10-year government bond yields in selected advanced economies



NOTE: The data are weekly averages of daily benchmark yields and extend through February 21, 2018.  
SOURCE: Bloomberg.

42. U.S. dollar exchange rate indexes



NOTE: The data, which are in foreign currency units per dollar, are weekly averages of daily data and extend through February 21, 2018. As indicated by the arrow, increases in the data represent U.S. dollar appreciation, and decreases represent U.S. dollar depreciation.  
SOURCE: Federal Reserve Board, Statistical Release H.10, "Foreign Exchange Rates."

### The dollar depreciated on net

The broad dollar index—a measure of the trade-weighted value of the dollar against foreign currencies—fell roughly 5 percent in the first half of 2017. Notwithstanding some appreciation in early February, the currency has depreciated further since the end of June, partially reversing substantial appreciation realized over the period from 2014 to 2016 (figure 42). The weakness in the dollar mostly reflects a broad-based improvement in the outlook for foreign economic growth. Brexit-related headlines weighed on the British pound at times during the second half of 2017, but progress regarding the terms of the U.K. separation from the European Union boosted the currency later in the year. In contrast, the dollar appreciated against the Mexican peso, on net, amid uncertainty around North American Free Trade Agreement negotiations.

## PART 2

### MONETARY POLICY

#### The Federal Open Market Committee raised the federal funds rate target range in December

For more than two years, the Federal Open Market Committee (FOMC) has been gradually increasing its target range for the federal funds rate as the labor market strengthened and headwinds in the aftermath of the recession continued to abate. After having raised the target range for the federal funds rate twice in the first half of 2017, the Committee raised it again in December, bringing the target range to 1¼ to 1½ percent (figure 43).<sup>10</sup> As on previous occasions, the decision to increase the federal funds rate in December reflected realized and expected labor market conditions and inflation relative to the FOMC’s objectives. Information available at that time indicated that economic activity had been rising at a solid rate and the labor market had continued to strengthen. In addition, although inflation had continued to run below the FOMC’s 2 percent longer-run objective,

the Committee expected that it would stabilize around that target over the medium term. At its most recent meeting, which concluded on January 31, the Committee kept the target range for the federal funds rate unchanged.<sup>11</sup>

#### Monetary policy continues to support economic growth

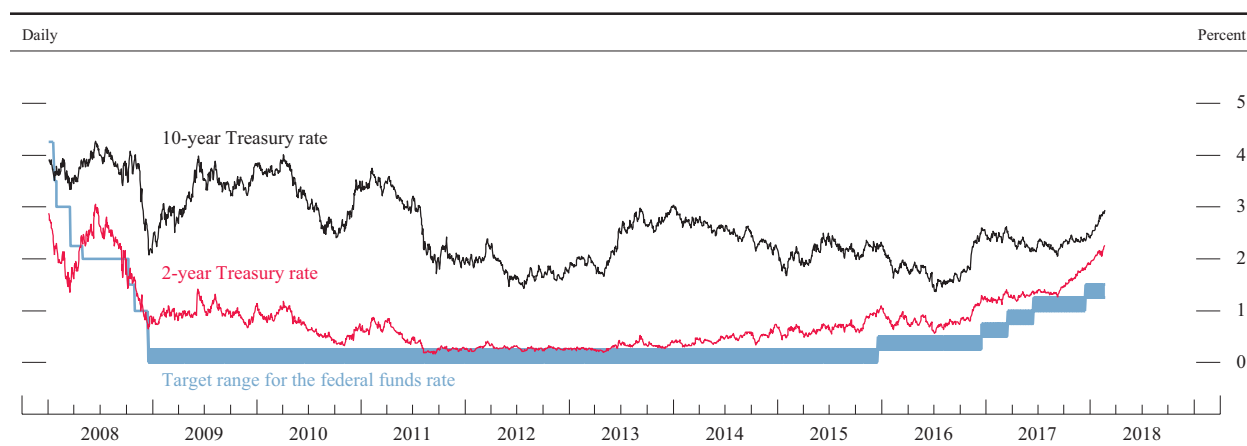
Even with the gradual increases in the federal funds rate to date, the Committee judges that the stance of monetary policy remains accommodative, thereby supporting strong labor market conditions and a sustained return to 2 percent inflation. The federal funds rate remains somewhat below most estimates of its neutral rate—that is, the level of the federal funds rate that is neither expansionary nor contractionary.

In evaluating the stance of monetary policy, policymakers routinely consult prescriptions from a variety of policy rules, which can serve as useful benchmarks. However, the

10. See Board of Governors of the Federal Reserve System (2017), “Federal Reserve Issues FOMC Statement,” press release, December 13, <https://www.federalreserve.gov/newsevents/pressreleases/monetary20171213a.htm>.

11. See Board of Governors of the Federal Reserve System (2018), “Federal Reserve Issues FOMC Statement,” press release, January 31, <https://www.federalreserve.gov/newsevents/pressreleases/monetary20180131a.htm>.

43. Selected interest rates



NOTE: The 2-year and 10-year Treasury rates are the constant-maturity yields based on the most actively traded securities.  
SOURCE: Department of the Treasury; Federal Reserve Board.

use and interpretation of such prescriptions require careful judgments about the choice and measurement of the inputs to these rules as well as the implications of the many considerations these rules do not take into account (see the box “Monetary Policy Rules and Their Role in the Federal Reserve’s Policy Process”).

### **Future changes in the federal funds rate will depend on the economic outlook as informed by incoming data**

The Committee has continued to emphasize that, in determining the timing and size of future adjustments to the target range for the federal funds rate, it will assess realized and expected economic conditions relative to its objectives of maximum employment and 2 percent inflation. This assessment will take into account a wide range of information, including measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial and international developments. The FOMC has emphasized that it will carefully monitor actual and expected inflation developments relative to its symmetric inflation goal, as inflation has been running persistently below the 2 percent longer-run objective.

The Committee expects that the ongoing strength in the economy will warrant further gradual increases in the federal funds rate, and that the federal funds rate will likely remain, for some time, below the levels that the Committee expects to prevail in the longer run. Consistent with this outlook, in the most recent Summary of Economic Projections, which was compiled at the time of the December FOMC meeting, the median of participants’ assessments for the appropriate level of the midpoint of the target range for the federal funds rate at year-end rises gradually over the period from 2018 to 2020, remaining below the median projection for its longer-run level through the end of 2019.<sup>12</sup>

12. See the December Summary of Economic Projections, which appeared as an addendum to the

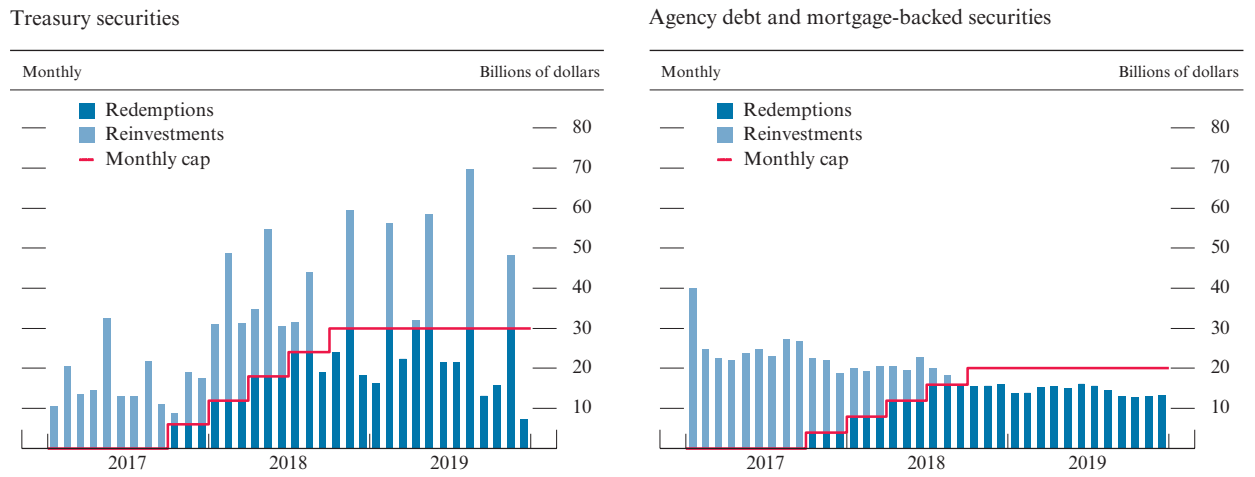
### **The size of the Federal Reserve’s balance sheet has begun to decrease**

The Committee had communicated for some time that it intended to reduce the size of the Federal Reserve’s balance sheet once normalization of the level of the federal funds rate was well under way. At its meeting in September, the FOMC decided to initiate the balance sheet normalization program described in the June 2017 Addendum to the Policy Normalization Principles and Plans. This program is gradually and predictably reducing the Federal Reserve’s securities holdings by decreasing the reinvestment of the principal payments it receives from securities held in the System Open Market Account (SOMA). Since October, such payments have been reinvested only to the extent that they exceeded gradually rising caps (figure 44).

In the fourth quarter, the Open Market Desk at the Federal Reserve Bank of New York, as directed by the Committee, reinvested principal payments from the Federal Reserve’s holdings of Treasury securities maturing during each calendar month in excess of \$6 billion. The Desk also reinvested in agency mortgage-backed securities (MBS) the amount of principal payments from the Federal Reserve’s holdings of agency debt and agency MBS received during each calendar month in excess of \$4 billion. Since January, payments of principal from maturing Treasury securities and from the Federal Reserve’s holdings of agency debt and agency MBS have been reinvested to the extent that they have exceeded \$12 billion and \$8 billion, respectively. The Committee has indicated that the cap for Treasury securities will continue to increase in steps of \$6 billion at three-month intervals until it reaches \$30 billion per month, and that the cap for agency debt and agency MBS will continue to increase in steps of \$4 billion at three-month intervals until it reaches \$20 billion per month. These caps will remain in place until the Committee judges that the Federal Reserve is holding no more securities

minutes of the December 12–13, 2017, meeting of the FOMC and is presented in Part 3 of this report.

44. Principal payments on SOMA securities



NOTE: Reinvestment and redemption amounts of agency mortgage-backed securities are projections starting in January 2018. The data extend through December 2019.  
 SOURCE: Federal Reserve Bank of New York; Federal Reserve Board staff calculations.

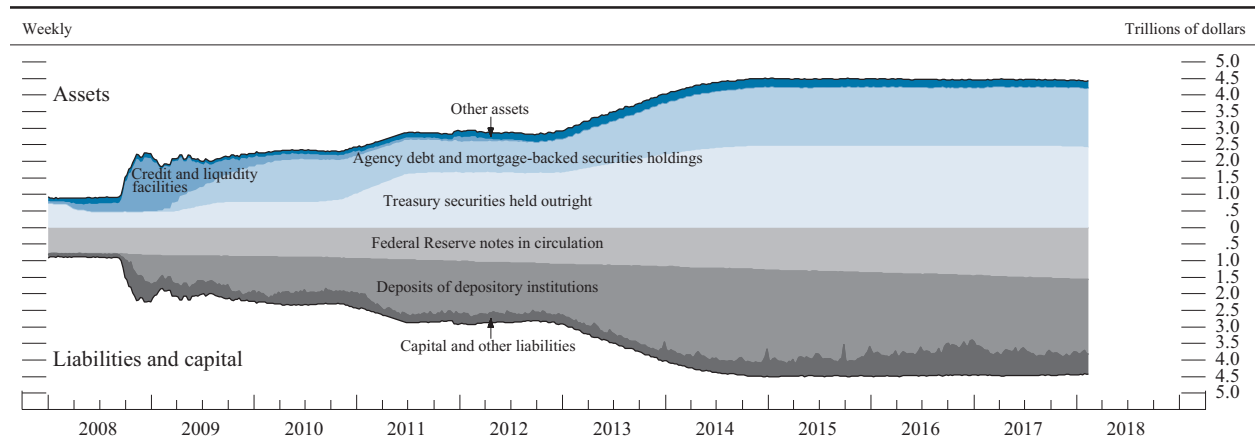
than necessary to implement monetary policy efficiently and effectively.

The initiation of the balance sheet normalization program was widely anticipated and therefore did not elicit a notable reaction in financial markets. Subsequently, the implementation of the program has proceeded smoothly without materially affecting Treasury and MBS markets. With the caps having been set thus far at relatively low levels, the reduction in SOMA securities has represented

a small fraction of the SOMA securities holdings. Consequently, the Federal Reserve’s total assets have declined somewhat to about \$4.4 trillion, with holdings of Treasury securities at approximately \$2.4 trillion and holdings of agency debt and agency MBS at approximately \$1.8 trillion (figure 45).

Interest income on the SOMA portfolio has continued to support substantial remittances to the U.S. Treasury. Preliminary financial statement results indicate that the Federal

45. Federal Reserve assets and liabilities



NOTE: “Credit and liquidity facilities” consists of primary, secondary, and seasonal credit; term auction credit; central bank liquidity swaps; support for Maiden Lane, Bear Stearns, and AIG; and other credit facilities, including the Primary Dealer Credit Facility, the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, the Commercial Paper Funding Facility, and the Term Asset-Backed Securities Loan Facility. “Other assets” includes unamortized premiums and discounts on securities held outright. “Capital and other liabilities” includes reverse repurchase agreements, the U.S. Treasury General Account, and the U.S. Treasury Supplementary Financing Account. The data extend through February 14, 2018.  
 SOURCE: Federal Reserve Board, Statistical Release H.4.1, “Factors Affecting Reserve Balances.”

Reserve remitted about \$80.2 billion of its estimated 2017 net income to the Treasury.

### **The Federal Reserve's implementation of monetary policy has continued smoothly**

In December 2017, the Federal Reserve raised the effective federal funds rate by increasing the interest rate paid on reserve balances along with the interest rate offered on overnight reverse repurchase agreements (ON RRP). Specifically, the Federal Reserve increased the interest rate paid on required and excess reserve balances to 1½ percent and the ON RRP offering rate to 1¼ percent. In addition, the Board of Governors approved an increase in the discount rate (the so-called primary credit rate) to 2 percent. Yields on a broad set of money market instruments moved higher in response to the FOMC's policy action in December. The effective federal funds rate rose in line with the increase in the FOMC's target

range and generally traded near the middle of the new target range amid orderly trading conditions in money markets. Usage of the ON RRP facility has declined on net since the middle of 2017, reflecting relatively attractive yields on alternative investments.

Although the normalization of the monetary policy stance has proceeded smoothly, the Federal Reserve has continued to test the operational readiness of other policy tools as part of prudent planning. Two operations of the Term Deposit Facility were conducted in the second half of 2017; seven-day deposits were offered at both operations with a floating rate of 1 basis point over the interest rate on excess reserves. In addition, the Desk conducted several small-value exercises solely for the purpose of maintaining operational readiness.



# Monetary Policy Rules and Their Role in the Federal Reserve's Policy Process

## What are monetary policy rules?

Monetary policy rules are formulas that prescribe the setting of a policy rate, such as the federal funds rate, that should prevail in relation to the values of a small number of other variables—typically including the gap between actual and target inflation along with an estimate of resource slack in the economy. Policy rules can provide helpful guidance for policymakers. Indeed, since 2004, prescriptions from policy rules have been part of the information regularly reported to the Federal Open Market Committee (FOMC) ahead of its meetings.<sup>1</sup> However, interpretation of the prescriptions of policy rules requires careful judgment about the measurement of the inputs to the rules and the implications of the many considerations the rules do not take into account.

Policy rules can incorporate key principles of good monetary policy. One key principle is that monetary policy should respond in a predictable way to changes in economic conditions. A second key principle is that monetary policy should be accommodative when inflation is below the desired level and employment is below its maximum sustainable level; conversely, monetary policy should be restrictive when the opposite holds. A third key principle is that, to stabilize inflation, the policy rate should be adjusted by more than one-for-one in response to persistent increases or decreases in inflation.

Economists have analyzed many monetary policy rules, including the well-known Taylor (1993) rule as well as other rules that will be discussed later: the “balanced approach” rule, the “adjusted Taylor (1993)” rule, the “price level” rule, and the “first difference” rule (figure A).<sup>2</sup> These policy rules generally embody

the three key principles of good monetary policy noted earlier. Each rule takes into account estimates of how far away the economy is from achieving the Federal Reserve's dual-mandate goals of maximum employment and price stability. Specifically, most of the rules include the difference between the rate of unemployment that is sustainable in the longer run ( $u^{LR}$ ) and the current unemployment rate (the unemployment gap); the first-difference rule includes the change in the unemployment gap rather than its level.<sup>3</sup> In addition, most of the rules include the difference between inflation and its longer-run objective (2 percent as measured by the annual change in the price index for personal consumption expenditures (PCE), in the case of the Federal Reserve), while the price-level rule includes the gap between the level of prices today and the level of prices that would be observed if inflation had been constant at 2 percent from a specified starting year.

The Taylor (1993), balanced-approach, adjusted Taylor (1993), and price-level rules provide prescriptions for the *level* of the federal funds rate and require an estimate of the neutral real interest rate in the longer run ( $r^{LR}$ )—that is, the level of the real federal

*(continued on next page)*

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Monetary Policy Rules,” in John B. Taylor, ed., *Monetary Policy Rules* (Chicago: University of Chicago Press), pp. 319–41. The adjusted Taylor (1993) rule was studied in David Reifschneider and John C. Williams (2000), “Three Lessons for Monetary Policy in a Low-Inflation Era,” *Journal of Money, Credit, and Banking*, vol. 32 (November), pp. 936–66. A price-level rule was discussed in Robert E. Hall (1984), “Monetary Strategy with an Elastic Price Standard,” in *Price Stability and Public Policy*, proceedings of a symposium sponsored by the Federal Reserve Bank of Kansas City, held in Jackson Hole, Wyo., August 2–3 (Kansas City: Federal Reserve Bank of Kansas City), pp. 137–59, <https://www.kansascityfed.org/publicat/sympos/1984/s84.pdf>. Finally, the first-difference rule was introduced by Athanasios Orphanides (2003), “Historical Monetary Policy Analysis and the Taylor Rule,” *Journal of Monetary Economics*, vol. 50 (July), pp. 983–1022. A comprehensive review of policy rules is in John B. Taylor and John C. Williams (2011), “Simple and Robust Rules for Monetary Policy,” in Benjamin M. Friedman and Michael Woodford, eds., *Handbook of Monetary Economics*, vol. 3B (Amsterdam: North-Holland), pp. 829–59. The same volume of the *Handbook of Monetary Economics* also discusses approaches other than policy rules for deriving policy rate prescriptions.

3. The Taylor (1993) rule represented slack in resource utilization using an output gap (the difference between the current level of real gross domestic product (GDP) and what GDP would be if the economy was operating at maximum employment). The rules in figure A represent slack in resource utilization using the unemployment gap instead, because that gap better captures the FOMC's statutory goal to promote maximum employment. Movements in these alternative

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1. Prescriptions from monetary policy rules are included in the Board staff's Tealbook (previously the Bluebook); the precise set of rules presented has changed from time to time. The transcripts and briefing materials for FOMC meetings through 2012 are available on the Board's website at [https://www.federalreserve.gov/monetarypolicy/fomc\\_historical.htm](https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm). In the materials from 2012, the policy rule prescriptions are contained in the Monetary Policy Strategies section of Tealbook B. The briefing materials that FOMC policymakers review regularly also include the Board staff's baseline forecast for the economy and model simulations of a variety of alternative scenarios intended to provide a sense of the effects of other plausible developments that were not included in the staff's baseline forecast.

2. The Taylor (1993) rule was first suggested in John B. Taylor (1993), “Discretion versus Policy Rules in Practice,” *Carnegie-Rochester Conference Series on Public Policy*, vol. 39 (December), pp. 195–214. The balanced-approach rule was analyzed in John B. Taylor (1999), “A Historical Analysis of

## Monetary Policy Rules and Their Role *(continued)*

### A. Monetary policy rules

Taylor (1993) rule	$R_t^{T93} = r_t^{LR} + \pi_t + 0.5(\pi_t - \pi^{LR}) + (u_t^{LR} - u_t)$
Balanced-approach rule	$R_t^{BA} = r_t^{LR} + \pi_t + 0.5(\pi_t - \pi^{LR}) + 2(u_t^{LR} - u_t)$
Taylor (1993) rule, adjusted	$R_t^{T93adj} = \text{maximum} \{R_t^{T93} - Z_t, 0\}$
Price-level rule	$R_t^{PL} = \text{maximum} \{r_t^{LR} + \pi_t + (u_t^{LR} - u_t) + 0.5(PLgap_t), 0\}$
First-difference rule	$R_t^{FD} = R_{t-1} + 0.5(\pi_t - \pi^{LR}) + (u_t^{LR} - u_t) - (u_{t-4}^{LR} - u_{t-4})$

NOTE:  $R_t^{T93}$ ,  $R_t^{BA}$ ,  $R_t^{T93adj}$ ,  $R_t^{PL}$ , and  $R_t^{FD}$  represent the values of the nominal federal funds rate prescribed by the Taylor (1993), balanced-approach, adjusted Taylor (1993), price-level, and first-difference rules, respectively.

$R_t$  denotes the actual nominal federal funds rate for quarter  $t$ ,  $\pi_t$  is four-quarter price inflation for quarter  $t$ ,  $u_t$  is the unemployment rate in quarter  $t$ , and  $r_t^{LR}$  is the level of the neutral real federal funds rate in the longer run that, on average, is expected to be consistent with sustaining maximum employment and inflation at its 2 percent longer-run objective,  $\pi^{LR}$ . In addition,  $u_t^{LR}$  is the rate of unemployment in the longer run.  $Z_t$  is the cumulative sum of past deviations of the federal funds rate from the prescriptions of the Taylor (1993) rule when that rule prescribes setting the federal funds rate below zero.  $PLgap_t$  is the percent deviation of the actual level of prices from a price level that rises 2 percent per year from its level in a specified starting period.

The Taylor (1993) rule and other policy rules are generally written in terms of the deviation of real output from its full capacity level. In these equations, the output gap has been replaced with the gap between the rate of unemployment in the longer run and its actual level (using a relationship known as Okun's law) in order to represent the rules in terms of the FOMC's statutory goals. Historically, movements in the output and unemployment gaps have been highly correlated. Footnote 2 provides references for the policy rules.

funds rate that is expected to be consistent in the longer run with sustained maximum employment and stable inflation.<sup>4</sup> In contrast, the first-difference rule prescribes how the level of the federal funds rate at a given time should be altered from its previous level—that is, it indicates how the existing rate should be increased or decreased in a particular period.

The adjusted Taylor (1993) rule recognizes that the federal funds rate cannot be reduced materially below zero, and that following the prescriptions of the Taylor (1993) rule after a period when interest rates have been constrained may not provide enough policy accommodation. To make up for the cumulative shortfall in accommodation ( $Z_t$ ), the adjusted rule prescribes only a gradual return of the policy rate to the (positive) levels prescribed by the unadjusted Taylor (1993) rule as the economy recovers.

In four of the rules, the interest rate responds to deviations of inflation from its longer-run value of 2 percent; in the price-level rule, however, the interest rate responds to the price-level gap ( $PLgap_t$ ). This gap measures how far the price level is from where it would have been had it been increasing at 2 percent each year.<sup>5</sup> The price-level rule thereby takes account of deviations of inflation from the longer-run objective in earlier periods as well in the current period. Thus, if inflation has been running persistently above the central bank's objective, the price-level rule would prescribe a higher policy interest rate than rules that use the current inflation gap. Likewise, if inflation has been running persistently below the central bank's objective, a price-level rule would prescribe setting the policy rate lower than rules that use the current inflation gap. The purpose of this dependence on previous inflation

measures of resource utilization are highly correlated. For more information, see the note below figure A.

4. Taylor-type rules—including John Taylor's original rule—have often been estimated assuming that the value of the neutral real interest rate in the longer run,  $r^{LR}$ , is equal to 2 percent, which roughly corresponds to the average historical value of the real federal funds rate before the financial crisis.

5. Estimation of the price-level rule requires selecting a starting year for the price level from which to cumulate the 2 percent annual inflation. For the U.S. economy, 1998 is used as the starting year; around that time, the underlying trend of inflation and longer-term inflation expectations stabilized at a level consistent with PCE price inflation being close to 2 percent.

behavior is to bring the price level back into line with where it would be if it had been running at a constant 2 percent per year. Like the adjusted Taylor (1993) rule, the price-level rule recognizes that the federal funds rate cannot be reduced materially below zero. If inflation runs below the 2 percent objective during periods when the rule prescribes setting the federal funds rate well below zero, the price-level rule will make up for past inflation shortfalls as the economy recovers.

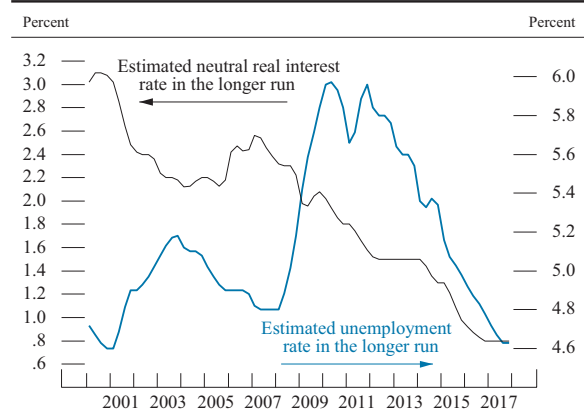
The adjusted Taylor (1993) and price-level rules may prescribe more appropriate policy settings than the other rules following a period when the policy rate falls below zero. However, all of the rules shown are highly simplified and do not capture the substantial complexity of the U.S. economy. Furthermore, both the level of the neutral real interest rate in the longer run and the level of the unemployment rate that is sustainable in the longer run are difficult to estimate precisely, and estimates made in real time may differ substantially from estimates made later on, after the relevant economic data have been revised and additional data have become available.<sup>6</sup> For example, since 2000, respondents to the Blue Chip survey have markedly reduced their projections of the longer-run level of the real short-term interest rate (figure B). Survey respondents have also made considerable changes over time to their estimates of the rate of unemployment in the longer run, with consequences for the unemployment gap. Revisions of this magnitude to the neutral real interest rate and the rate of unemployment in the longer run can have important implications for the federal funds rate prescribed by monetary policy rules. Policy rules must be adjusted to take into account these changes in the projected values of longer-run rates as they occur over time.

### Accounting for risks to the economic outlook

Monetary policy rules do not take account of broader risk considerations. In the years following the financial crisis, with the federal funds rate still close to zero, the FOMC has recognized that it would have limited scope to respond to an unexpected weakening

6. The first-difference rule shown in figure A reduces the need for good estimates of longer-run rates because it does not require an estimate of the neutral real interest rate in the longer run. However, this rule has its own shortcomings. For example, research suggests that this sort of rule will result in greater volatility in employment and inflation relative to what would be obtained under the Taylor (1993) and balanced-approach rules unless the estimates of the neutral real federal funds rate in the longer run and the rate of unemployment in the longer run are sufficiently far from their true values.

### B. Real-time estimates of the neutral real interest rate and the unemployment rate in the longer run



NOTE: The data are biannual and have been interpolated to yield quarterly values. The estimated neutral real interest rate in the longer run equals the three-month Treasury bill rate projected in the long run deflated by the long-run projected annual change in the price index for gross domestic product.

SOURCE: Wolters Kluwer, Blue Chip Economic Indicators.

in the economy by lowering short-term interest rates. This asymmetric risk has, in recent years, provided a sound rationale for following a more gradual path of rate increases than that prescribed by policy rules.<sup>7</sup> In these circumstances, increasing the policy rate quickly in order to have room to cut rates during an economic downturn could be counterproductive because it would make the downturn more likely to happen.

Estimates of the neutral real interest rate in the longer run (such as those in figure B), taken together with the FOMC's inflation objective of 2 percent, suggest that the neutral level of the federal funds rate that can be expected to prevail in the longer run is currently around 3 percent, well below the average federal funds rate of 6 percent from 1960 to 2007. With the neutral federal funds rate so low, there is a likelihood that the policy interest rate will hit its lower limit of zero more frequently than in the past. Historically, the FOMC has cut the federal funds rate by 5 percentage points, on average, during downturns in the economy—cutting the policy rate by this much starting from a neutral level of 3 percent would not be feasible. Under these circumstances, the prescriptions from many policy rules would lead to poor economic performance, with inflation averaging below the

*(continued on next page)*

7. Asymmetric risk need not always provide a rationale for a more gradual path; if the risks were strongly tilted toward substantial and persistent overheating and too-high inflation, the asymmetric risk could argue for higher rates than prescribed by simple rules.

## Monetary Policy Rules and Their Role *(continued)*

Committee's 2 percent objective.<sup>8</sup> Rules that try to offset the cumulative shortfall of accommodation posed by the zero bound on interest rates, such as the adjusted Taylor (1993) rule, or make up the cumulative shortfall in the level of prices, such as the price-level rule, are intended to help achieve average inflation at or near 2 percent over time.<sup>9</sup>

Different monetary policy rules often offer quite different prescriptions for the federal funds rate, and there is no unambiguous metric for favoring one rule over another. While monetary policy rules often agree about the direction (up or down) in which policymakers should move the federal funds rate, they frequently disagree about the appropriate level of that rate. Historical prescriptions from policy rules differ from one another and also differ from the Committee's target for the federal funds rate, as shown in figure C. (These prescriptions are calculated using both the actual data

and the estimates of the neutral real interest rate in the longer run and of the rate of unemployment in the longer run—data and estimates that were available to FOMC policymakers at the time.) Moreover, the rules sometimes prescribe setting short-term interest rates well below zero—a setting that is not feasible. With the exception of the adjusted Taylor (1993) and price-level rules, which impose a lower limit of zero, all of the rules shown in figure C called for the federal funds rate to turn negative in 2009 and to stay below zero for several years thereafter. Thus, these rules indicated that the Federal Reserve should provide more monetary stimulus than could be achieved by setting the federal funds rate at zero. Almost all of the policy rules have called for rising values of the federal funds rate in recent years, but the pace of tightening that the rules prescribe has varied widely. Prescriptions from these rules for the level of the federal funds rate in the fourth quarter of 2017 ranged from 0 basis points (price-level rule) to 3.0 percent (balanced-approach rule).<sup>10</sup>

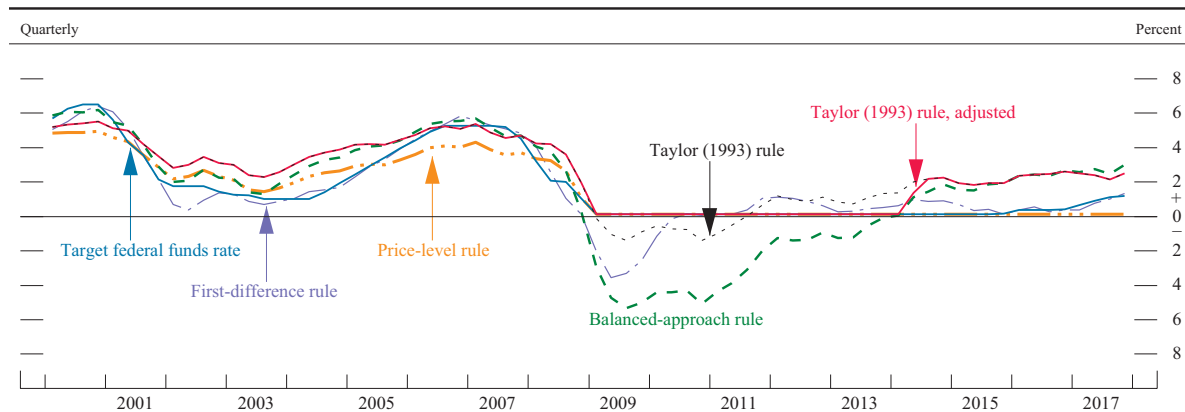
8. For further discussion of these issues, see Michael T. Kiley and John M. Roberts (2017), "Monetary Policy in a Low Interest Rate World," *Brookings Papers on Economic Activity*, Spring, pp. 317–72, <https://www.brookings.edu/wp-content/uploads/2017/08/kileytextsp17bpea.pdf>.

9. Economists have found that a "makeup" policy can be the best response in theory when the policy interest rate is constrained at zero. See Ben S. Bernanke (2017), "Monetary Policy in a New Era," paper presented at "Rethinking Macroeconomic Policy," a conference held at the Peterson Institute for International Economics, Washington, October 12–13, [https://www.brookings.edu/wp-content/uploads/2017/10/bernanke\\_rethinking\\_macro\\_final.pdf](https://www.brookings.edu/wp-content/uploads/2017/10/bernanke_rethinking_macro_final.pdf); and Michael Woodford (1999), "Commentary: How Should Monetary Policy Be Conducted in an Era of Price Stability?"

in *New Challenges for Monetary Policy*, proceedings of a symposium sponsored by the Federal Reserve Bank of Kansas City, held in Jackson Hole, Wyo., August 26–28 (Kansas City: Federal Reserve Bank of Kansas City), pp. 277–316, <https://www.kansascityfed.org/publications/research/escp/symposiums/escp-1999>.

10. As noted earlier, the price-level rule makes up for the cumulative shortfall in the price level when inflation runs below 2 percent. Because inflation has been below 2 percent in recent years, the price-level rule calls for the federal funds rate to remain at zero.

### C. Historical federal funds rate prescriptions from simple policy rules



NOTE: The rules use real-time historical values of inflation, the federal funds rate, and the unemployment rate. Inflation is measured as the four-quarter percent change in the price index for personal consumption expenditures excluding food and energy. Quarterly projections of long-run values for the federal funds rate and the unemployment rate are derived through interpolations of biannual projections from Blue Chip Economic Indicators. The long-run value for inflation is taken as 2 percent. The target value of the price level is the average level of the price index for personal consumption expenditures excluding food and energy in 1998, extrapolated at 2 percent per year.

SOURCE: Federal Reserve Bank of Philadelphia; Wolters Kluwer, Blue Chip Economic Indicators; Federal Reserve Board staff estimates.

## PART 3

### SUMMARY OF ECONOMIC PROJECTIONS

*The following material appeared as an addendum to the minutes of the December 12–13, 2017, meeting of the Federal Open Market Committee.*

In conjunction with the Federal Open Market Committee (FOMC) meeting held on December 12–13, 2017, meeting participants submitted their projections of the most likely outcomes for real gross domestic product (GDP) growth, the unemployment rate, and inflation for each year from 2017 to 2020 and over the longer run.<sup>13</sup> Each participant’s projection was based on information available at the time of the meeting, together with his or her assessment of appropriate monetary policy—including a path for the federal funds rate and its longer-run value—and assumptions about other factors likely to affect economic outcomes. The longer-run projections represent each participant’s assessment of the value to which each variable would be expected to converge, over time, under appropriate monetary policy and in the absence of further shocks to the economy.<sup>14</sup> “Appropriate monetary policy” is defined as the future path of policy that each participant deems most likely to foster outcomes for economic activity and inflation that best satisfy his or her individual interpretation of the statutory mandate to promote maximum employment and price stability.

All participants who submitted longer-run projections expected that, under appropriate

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13. Four members of the Board of Governors were in office at the time of the December 2017 meeting, the same number as in September 2017. However, since the September meeting, one member, Stanley Fischer, resigned from the Board and another, Randal K. Quarles, joined. The incoming president of the Federal Reserve Bank of Richmond is scheduled to assume office on January 1, 2018; First Vice President Mark L. Mullinix submitted economic projections at this meeting as he did in September.

14. One participant did not submit longer-run projections for real output growth, the unemployment rate, or the federal funds rate.

monetary policy, growth in real GDP in 2018 would be somewhat stronger than their individual estimates of its longer-run rate. All participants projected that real GDP growth would moderate in 2019, and nearly all predicted that it would ease further in 2020; a solid majority of participants thought that growth in real GDP would be at or close to their individual estimates of the economy’s longer-run growth rate by 2020. All participants who submitted longer-run projections expected that the unemployment rate would run below their estimates of its longer-run normal level through 2020. Participants generally projected that inflation, as measured by the four-quarter percentage change in the price index for personal consumption expenditures (PCE), would step up toward the Committee’s 2 percent objective in 2018 and be at or close to that objective by 2019. Most participants indicated that prospective changes in federal tax policy were a factor that led them to boost their projections of real GDP growth over the next couple of years; some participants, however, noted that they had already incorporated at least some effects of future tax cuts in their September projections. Several also noted the possibility that changes to tax policy could raise the level of potential GDP in the longer run.<sup>15</sup> Table 1 and figure 1 provide summary statistics for the projections.

As shown in figure 2, participants generally expected that the evolution of the economy relative to their objectives of maximum employment and 2 percent inflation would

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15. Participants completed their submissions for the Summary of Economic Projections before the reconciliation of the House and Senate tax bills in the Congress.

Table 1. Economic projections of Federal Reserve Board members and Federal Reserve Bank presidents, under their individual assessments of projected appropriate monetary policy, December 2017

Percent

Variable	Median <sup>1</sup>					Central tendency <sup>2</sup>					Range <sup>3</sup>				
	2017	2018	2019	2020	Longer run	2017	2018	2019	2020	Longer run	2017	2018	2019	2020	Longer run
Change in real GDP . . . . .	2.5	2.5	2.1	2.0	1.8	2.4–2.5	2.2–2.6	1.9–2.3	1.7–2.0	1.8–1.9	2.4–2.6	2.2–2.8	1.7–2.4	1.1–2.2	1.7–2.2
September projection . . . . .	2.4	2.1	2.0	1.8	1.8	2.2–2.5	2.0–2.3	1.7–2.1	1.6–2.0	1.8–2.0	2.2–2.7	1.7–2.6	1.4–2.3	1.4–2.0	1.5–2.2
Unemployment rate . . . . .	4.1	3.9	3.9	4.0	4.6	4.1	3.7–4.0	3.6–4.0	3.6–4.2	4.4–4.7	4.1	3.6–4.0	3.5–4.2	3.5–4.5	4.3–5.0
September projection . . . . .	4.3	4.1	4.1	4.2	4.6	4.2–4.3	4.0–4.2	3.9–4.4	4.0–4.5	4.5–4.8	4.2–4.5	3.9–4.5	3.8–4.5	3.8–4.8	4.4–5.0
PCE inflation . . . . .	1.7	1.9	2.0	2.0	2.0	1.6–1.7	1.7–1.9	2.0	2.0–2.1	2.0	1.5–1.7	1.7–2.1	1.8–2.3	1.9–2.2	2.0
September projection . . . . .	1.6	1.9	2.0	2.0	2.0	1.5–1.6	1.8–2.0	2.0	2.0–2.1	2.0	1.5–1.7	1.7–2.0	1.8–2.2	1.9–2.2	2.0
Core PCE inflation <sup>4</sup> . . . . .	1.5	1.9	2.0	2.0		1.5	1.7–1.9	2.0	2.0–2.1		1.4–1.5	1.7–2.0	1.8–2.3	1.9–2.3	
September projection . . . . .	1.5	1.9	2.0	2.0		1.5–1.6	1.8–2.0	2.0	2.0–2.1		1.4–1.7	1.7–2.0	1.8–2.2	1.9–2.2	
Memo: Projected appropriate policy path															
Federal funds rate . . . . .	1.4	2.1	2.7	3.1	2.8	1.4	1.9–2.4	2.4–3.1	2.6–3.1	2.8–3.0	1.1–1.4	1.1–2.6	1.4–3.6	1.4–4.1	2.3–3.0
September projection . . . . .	1.4	2.1	2.7	2.9	2.8	1.1–1.4	1.9–2.4	2.4–3.1	2.5–3.5	2.5–3.0	1.1–1.6	1.1–2.6	1.1–3.4	1.1–3.9	2.3–3.5

NOTE: Projections of change in real gross domestic product (GDP) and projections for both measures of inflation are percent changes from the fourth quarter of the previous year to the fourth quarter of the year indicated. PCE inflation and core PCE inflation are the percentage rates of change in, respectively, the price index for personal consumption expenditures (PCE) and the price index for PCE excluding food and energy. Projections for the unemployment rate are for the average civilian unemployment rate in the fourth quarter of the year indicated. Each participant's projections are based on his or her assessment of appropriate monetary policy. Longer-run projections represent each participant's assessment of the rate to which each variable would be expected to converge under appropriate monetary policy and in the absence of further shocks to the economy. The projections for the federal funds rate are the value of the midpoint of the projected appropriate target range for the federal funds rate or the projected appropriate target level for the federal funds rate at the end of the specified calendar year or over the longer run. The September projections were made in conjunction with the meeting of the Federal Open Market Committee on September 19–20, 2017. One participant did not submit longer-run projections for the change in real GDP, the unemployment rate, or the federal funds rate in conjunction with the September 19–20, 2017, meeting, and one participant did not submit such projections in conjunction with the December 12–13, 2017, meeting.

1. For each period, the median is the middle projection when the projections are arranged from lowest to highest. When the number of projections is even, the median is the average of the two middle projections.
2. The central tendency excludes the three highest and three lowest projections for each variable in each year.
3. The range for a variable in a given year includes all participants' projections, from lowest to highest, for that variable in that year.
4. Longer-run projections for core PCE inflation are not collected.

likely warrant further gradual increases in the federal funds rate. Compared with the projections they submitted in September, some participants raised their federal funds rate projections for 2018 and 2019, while several others lowered their projections, leaving the median projection for the federal funds rate in those years unchanged; the median projection for 2020 was slightly higher, and the median projection for the longer-run normal level of the federal funds rate was unchanged. Nearly all participants saw it as likely to be appropriate for the federal funds rate to rise above their estimates of its longer-run normal level at some point during the forecast period. Participants generally noted several sources of uncertainty about the future course of the federal funds rate, including the details of potential changes in tax policy, how those changes would affect the economy, and the range of factors influencing inflation over the medium term.

In general, participants viewed the uncertainty attached to their economic projections

as broadly similar to the average of the past 20 years, and all participants saw the uncertainty associated with their projections for real GDP growth, the unemployment rate, and inflation as essentially unchanged from September. As in September, most participants judged the risks around their projections for economic growth, the unemployment rate, and inflation as broadly balanced.

### *The Outlook for Economic Activity*

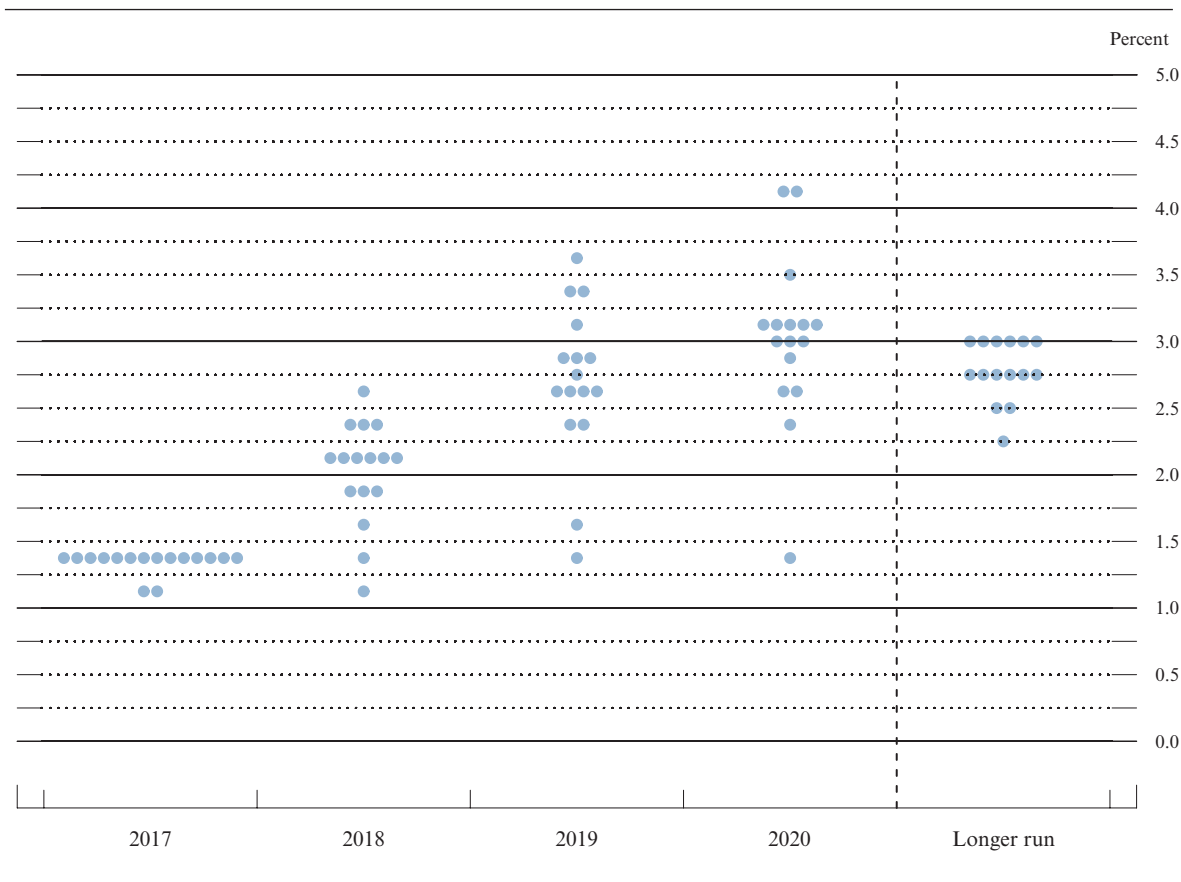
The median of participants' projections for the growth rate of real GDP for 2018, conditional on their individual assessments of appropriate monetary policy, was 2.5 percent, the same as for 2017. The median projections for GDP growth in 2019 and 2020 were slightly lower, at 2.1 and 2.0 percent, respectively. Compared with the Summary of Economic Projections (SEP) from September, the median of the projections for real GDP growth for 2018 was notably higher, while the medians for real GDP growth for 2019 and 2020 were modestly higher. The median of projections for the

Figure 1. Medians, central tendencies, and ranges of economic projections, 2017–20 and over the longer run



NOTE: Definitions of variables and other explanations are in the notes to table 1. The data for the actual values of the variables are annual.

Figure 2. FOMC participants' assessments of appropriate monetary policy: Midpoint of target range or target level for the federal funds rate



NOTE: Each shaded circle indicates the value (rounded to the nearest 1/8 percentage point) of an individual participant's judgment of the midpoint of the appropriate target range for the federal funds rate or the appropriate target level for the federal funds rate at the end of the specified calendar year or over the longer run. One participant did not submit longer-run projections for the federal funds rate.

longer-run normal rate of real GDP growth remained at 1.8 percent. Most participants pointed to changes in tax policy as likely to provide some boost to real GDP growth over the forecast period; in September, fewer than half of the participants incorporated prospective tax policy changes in their projections. Several participants indicated that they had marked up their estimates of the magnitude of tax cuts, relative to their assumptions in September.

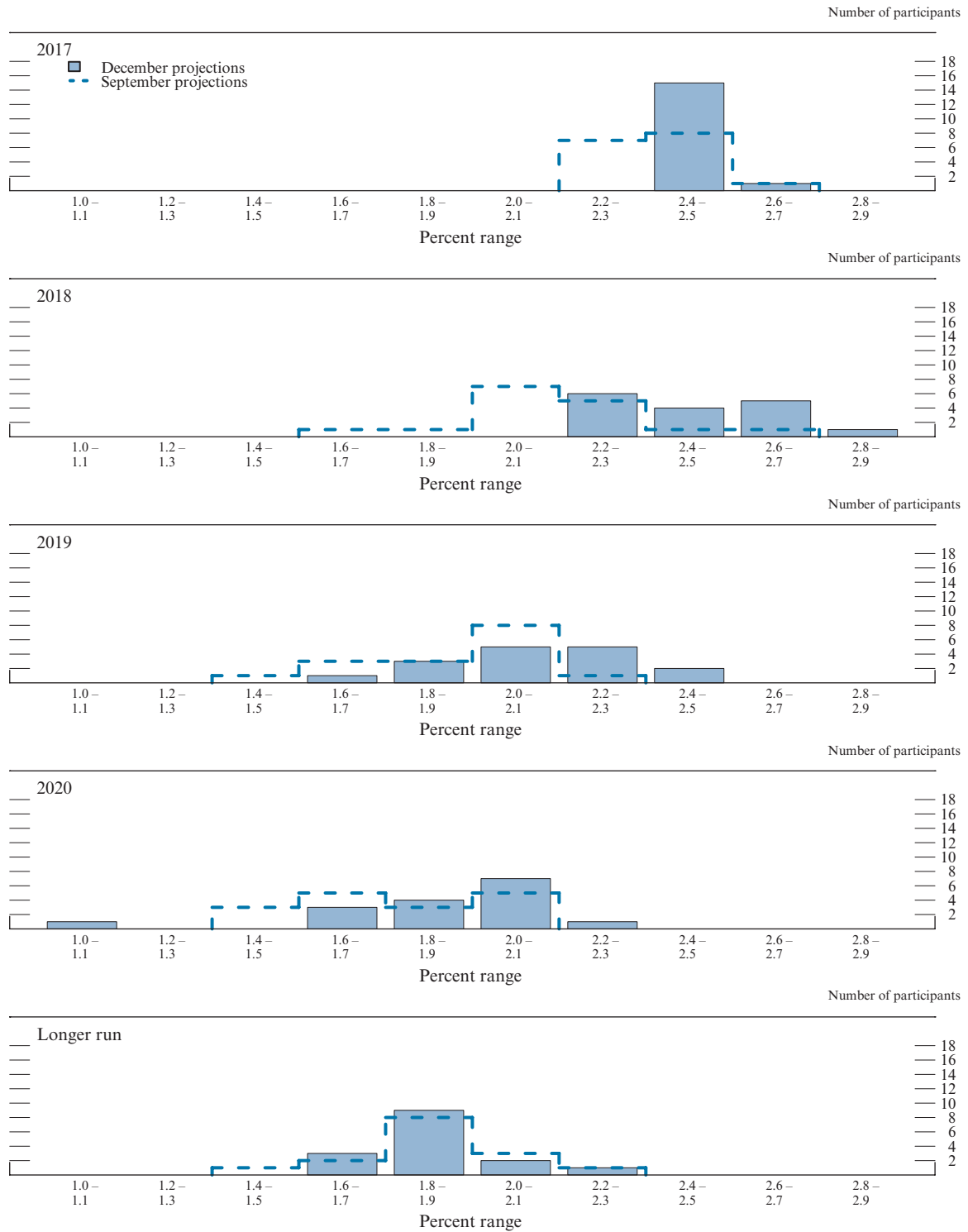
The medians of projections for the unemployment rate in the fourth quarter of both 2018 and 2019 were 3.9 percent, 0.2 percentage point below the medians from September and about  $\frac{3}{4}$  percentage point below the median assessment of its longer-run normal level. The median projection for

the unemployment rate ticked up slightly to 4.0 percent in 2020.

Figures 3.A and 3.B show the distributions of participants' projections for real GDP growth and the unemployment rate from 2017 to 2020 and in the longer run. The distribution of individual projections for real GDP growth for 2018 shifted up, with more than half of the participants now expecting real GDP growth of 2.5 percent or more and none seeing it below 2.2 percent. The distribution of projected real GDP growth in 2019 and 2020 also shifted up, albeit only slightly. The distribution for the longer-run normal rate of GDP growth was little changed from September. The distributions of individual projections for the unemployment rate in 2018 and 2019 shifted down relative to those

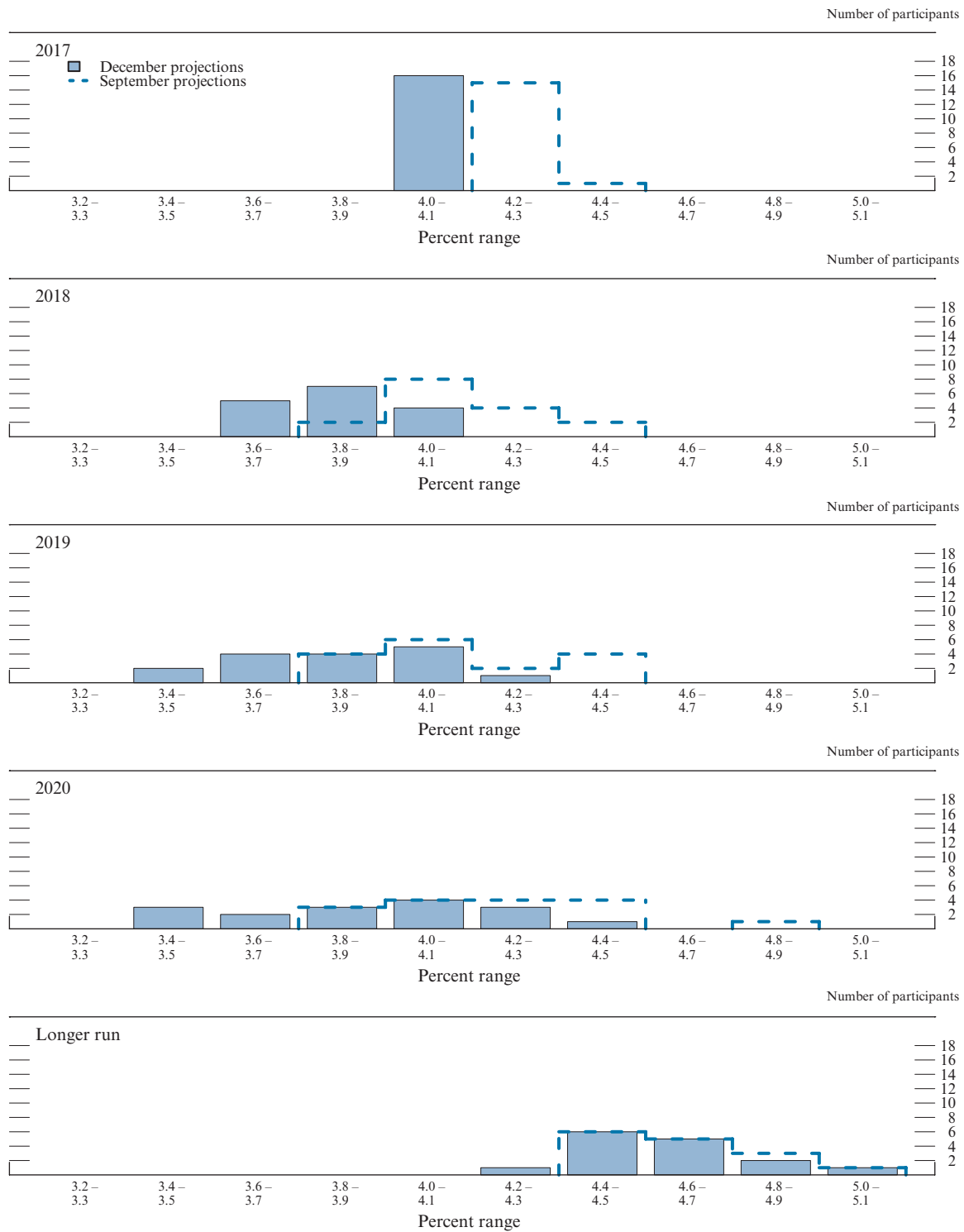


Figure 3.A. Distribution of participants' projections for the change in real GDP, 2017–20 and over the longer run



NOTE: Definitions of variables and other explanations are in the notes to table 1.

Figure 3.B. Distribution of participants' projections for the unemployment rate, 2017–20 and over the longer run



NOTE: Definitions of variables and other explanations are in the notes to table 1.

in September, broadly consistent with the changes in the distributions for real GDP growth.

### *The Outlook for Inflation*

The median of projections for headline PCE price inflation was 1.9 percent in 2018 and 2 percent in 2019 and 2020, the same as in the September SEP. Most participants anticipated that inflation would continue to run a bit below 2 percent in 2018, and only one participant expected inflation above 2 percent that year. A majority of participants projected that inflation would be equal to the Committee's objective in 2019 and 2020. Several participants projected that inflation would slightly exceed 2 percent in 2019 or 2020. The medians of projections for core PCE price inflation over the 2018–20 period were the same as those for headline inflation.

Figures 3.C and 3.D provide information on the distributions of participants' views about the outlook for inflation. On the whole, the distributions of projections for headline PCE price inflation and core PCE price inflation beyond 2017 were little changed from September.

### *Appropriate Monetary Policy*

Figure 3.E provides the distribution of participants' judgments regarding the appropriate target—or midpoint of the target range—for the federal funds rate at the end of each year from 2017 to 2020 and in the longer run. Overall, the distributions differed in only small ways from those reported in the September SEP. There was a moderate reduction in the dispersion of the distribution for 2020 and for the longer run; some of the lower-end projections for those horizons from the September SEP were revised up in the current projections.

The median projection of the year-end federal funds rate continued to rise gradually over the 2018–20 period. The median projection for the end of 2018 was 2.13 percent; the medians of

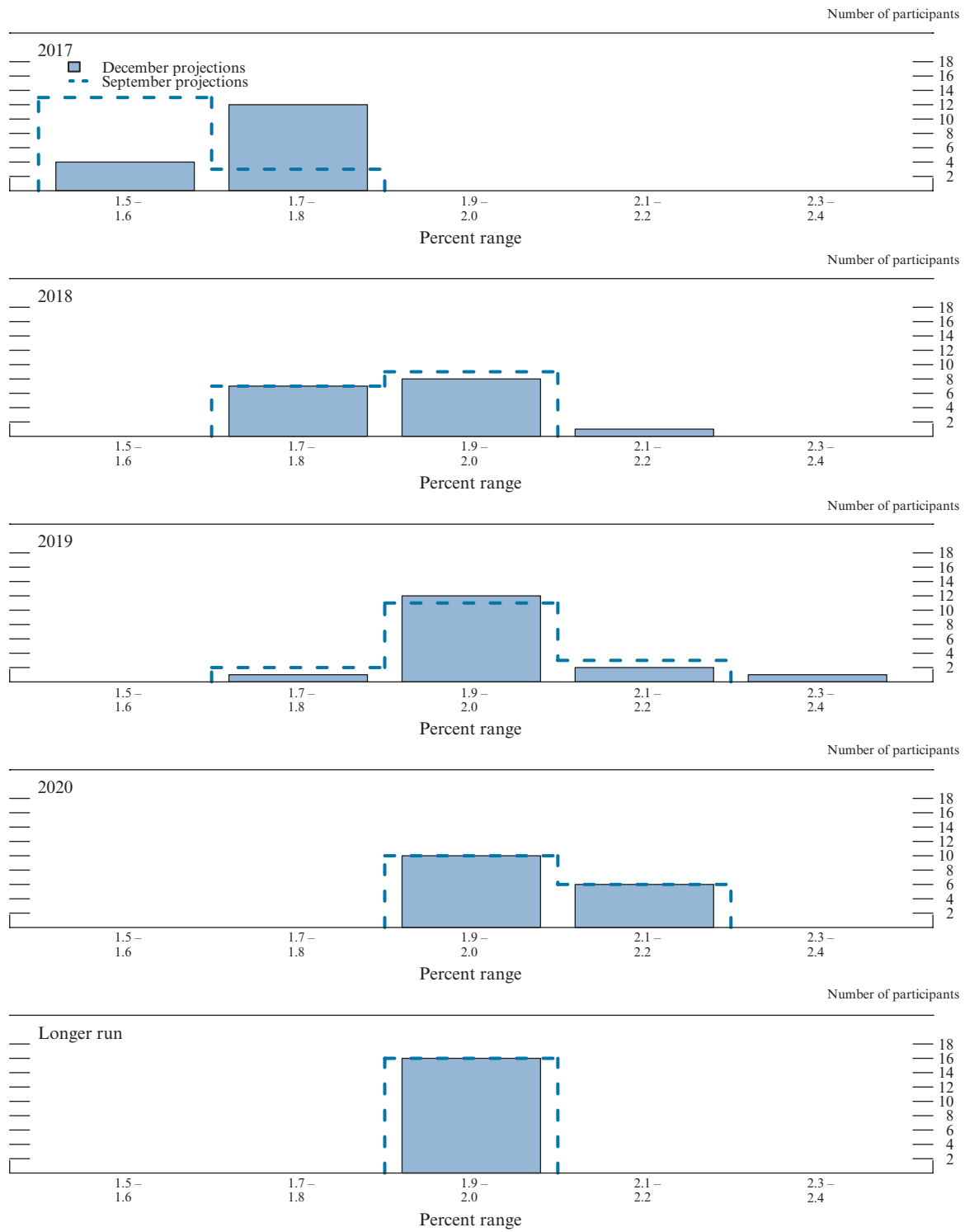
the projections were 2.69 percent at the end of 2019 and 3.07 percent at the end of 2020. Nearly all participants projected that it would likely be appropriate for the federal funds rate to rise above their individual estimates of the longer-run normal rate at some point over the forecast period. Compared with their projections prepared for the September SEP, a few participants raised their projections for the federal funds rate in the longer run and one lowered it; the median was unchanged at 2.75 percent.

In discussing their projections, many participants once again expressed the view that the appropriate trajectory of the federal funds rate over the next few years would likely involve gradual increases. This view was predicated on several factors, including a judgment that the neutral real interest rate was currently low and would move up only slowly, as well as the balancing of risks associated with, among other things, the possibility that inflation pressures could build if the economy expands well beyond its long-run sustainable level, and the possibility that the forces depressing inflation could prove to be more persistent than currently anticipated. As always, the actual path of the federal funds rate will depend on evolving economic conditions and their implications for the economic outlook.

### *Uncertainty and Risks*

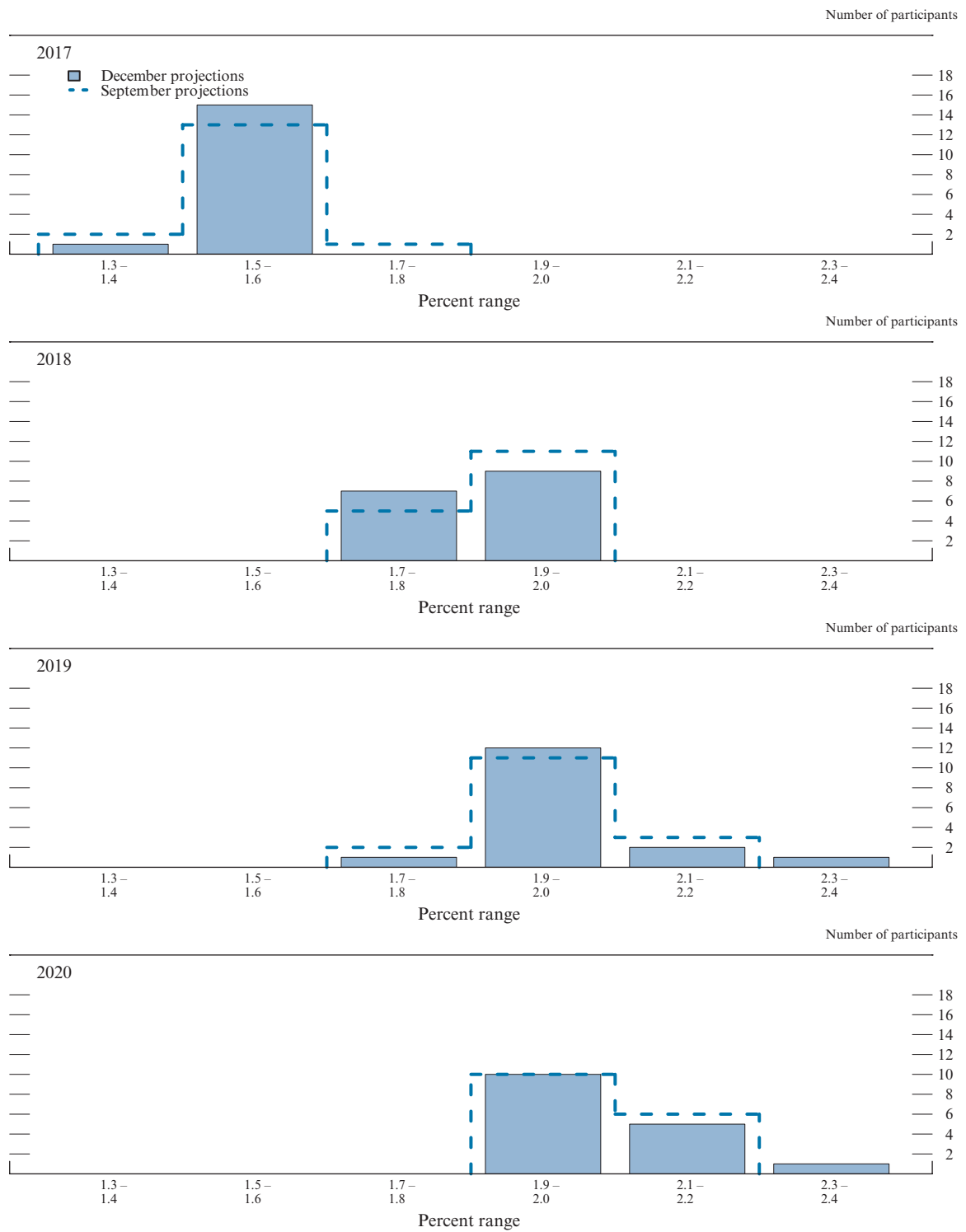
In assessing the path for the federal funds rate that, in their view, is likely to be appropriate, FOMC participants take account of the range of possible economic outcomes, the likelihood of those outcomes, and the potential benefits and costs should they occur. As a reference, table 2 provides a measure of forecast uncertainty, based on the forecast errors of various private and government forecasts over the past 20 years, for real GDP growth, the unemployment rate, and total consumer price inflation. That measure is incorporated graphically in the top panels of figures 4.A, 4.B, and 4.C, which display “fan charts” plotting the median SEP

Figure 3.C. Distribution of participants' projections for PCE inflation, 2017–20 and over the longer run



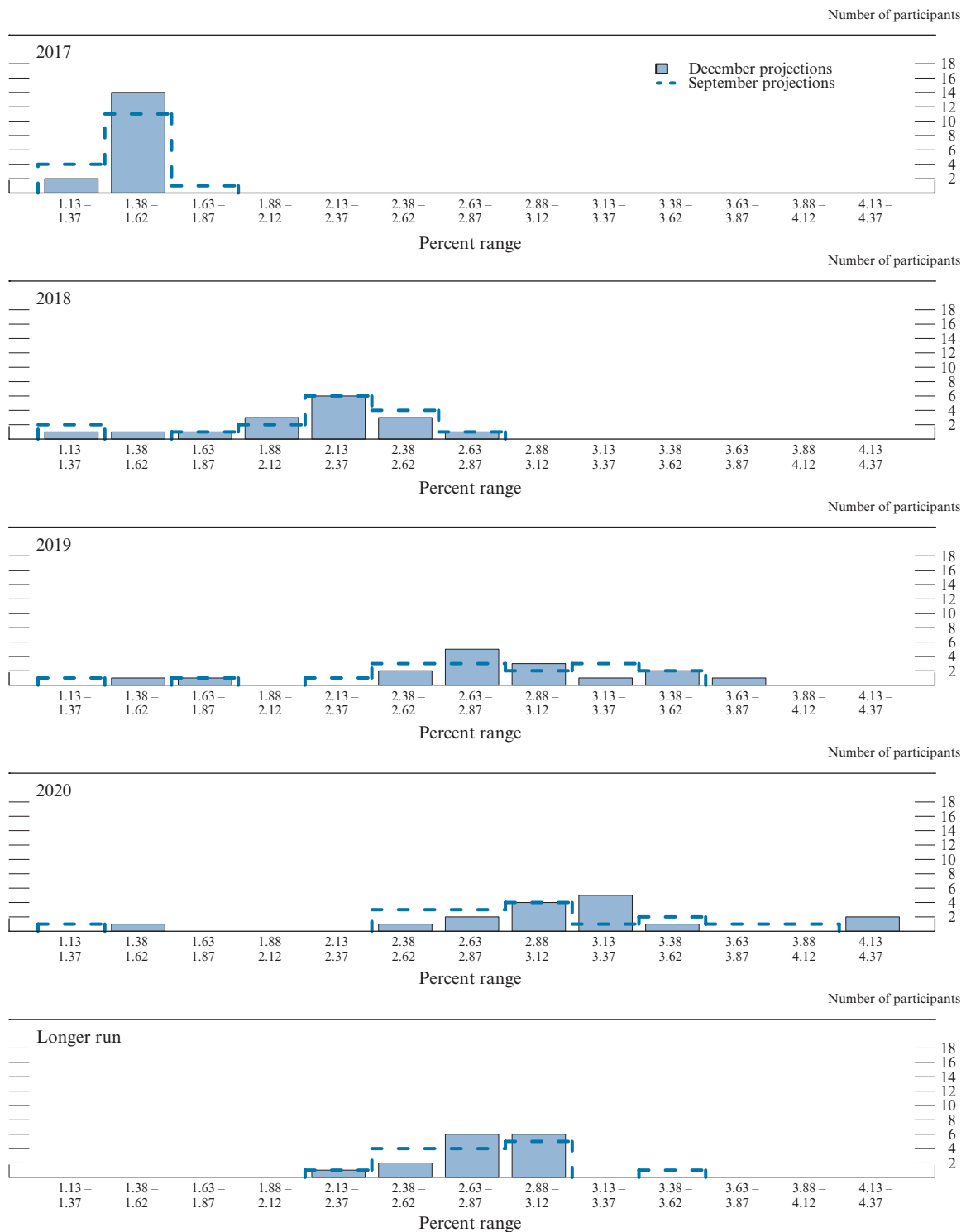
NOTE: Definitions of variables and other explanations are in the notes to table 1.

Figure 3.D. Distribution of participants' projections for core PCE inflation, 2017–20



NOTE: Definitions of variables and other explanations are in the notes to table 1.

Figure 3.E. Distribution of participants' judgments of the midpoint of the appropriate target range for the federal funds rate or the appropriate target level for the federal funds rate, 2017–20 and over the longer run



NOTE: Definitions of variables and other explanations are in the notes to table 1.

projections for the three variables surrounded by symmetric confidence intervals derived from the forecast errors presented in table 2. If the degree of uncertainty attending these projections is similar to the typical magnitude of past forecast errors and the risks around the projections are broadly balanced, future outcomes of these variables would have about a 70 percent probability of occurring within these confidence intervals. For all three variables, this measure of projection uncertainty is substantial and generally increases as the forecast horizon lengthens.

Participants' assessments of the level of uncertainty surrounding their economic projections are shown in the bottom-left panels of figures 4.A, 4.B, and 4.C. Nearly all participants viewed the degree of uncertainty attached to their economic projections about GDP growth, the unemployment rate, and inflation as broadly similar to the average of the past 20 years, a view that was essentially unchanged from September.<sup>16</sup> About half of the participants who commented on this topic suggested that uncertainties about the details of the pending tax legislation had raised their assessment of uncertainty for GDP growth, albeit not by enough to tip their assessments into the higher-than-average category.

Because the fan charts are constructed to be symmetric around the median projection, they do not reflect any asymmetries in the balance of risks that participants may see in their economic projections. Accordingly, participants' assessments of the balance of risks to their economic projections are shown in the bottom-right panels of figures 4.A, 4.B, and 4.C. As in September, most participants judged the risks to their projections of real GDP growth, the unemployment rate, headline inflation and core inflation as broadly balanced—in other words, as broadly

16. At the end of this summary, the box “Forecast Uncertainty” discusses the sources and interpretation of uncertainty in the economic forecasts and explains the approach used to assess the uncertainty and risks attending the participants' projections.

Table 2. Average historical projection error ranges  
Percentage points

Variable	2017	2018	2019	2020
Change in real GDP <sup>1</sup> . . . . .	±0.8	±1.7	±2.1	±2.2
Unemployment rate <sup>1</sup> . . . . .	±0.1	±0.8	±1.5	±1.9
Total consumer prices <sup>2</sup> . . . . .	±0.2	±1.0	±1.1	±1.0
Short-term interest rates <sup>3</sup> . . . . .	±0.1	±1.4	±1.9	±2.4

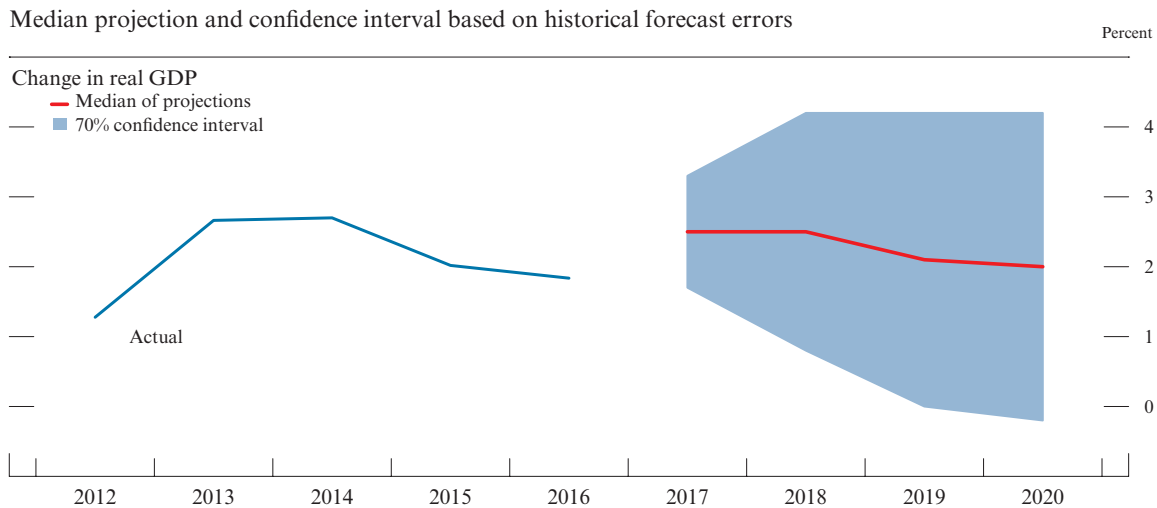
Note: Error ranges shown are measured as plus or minus the root mean squared error of projections for 1997 through 2016 that were released in the winter by various private and government forecasters. As described in the box “Forecast Uncertainty,” under certain assumptions, there is about a 70 percent probability that actual outcomes for real GDP, unemployment, consumer prices, and the federal funds rate will be in ranges implied by the average size of projection errors made in the past. For more information, see David Reifschneider and Peter Tulip (2017), “Gauging the Uncertainty of the Economic Outlook Using Historical Forecasting Errors: The Federal Reserve’s Approach,” Finance and Economics Discussion Series 2017-020 (Washington: Board of Governors of the Federal Reserve System, February), [www.federalreserve.gov/econresdata/feds/2017/files/2017020pap.pdf](http://www.federalreserve.gov/econresdata/feds/2017/files/2017020pap.pdf).

1. Definitions of variables are in the general note to table 1.
2. Measure is the overall consumer price index, the price measure that has been most widely used in government and private economic forecasts. Projections are percent changes on a fourth quarter to fourth quarter basis.
3. For Federal Reserve staff forecasts, measure is the federal funds rate. For other forecasts, measure is the rate on 3-month Treasury bills. Projection errors are calculated using average levels, in percent, in the fourth quarter.

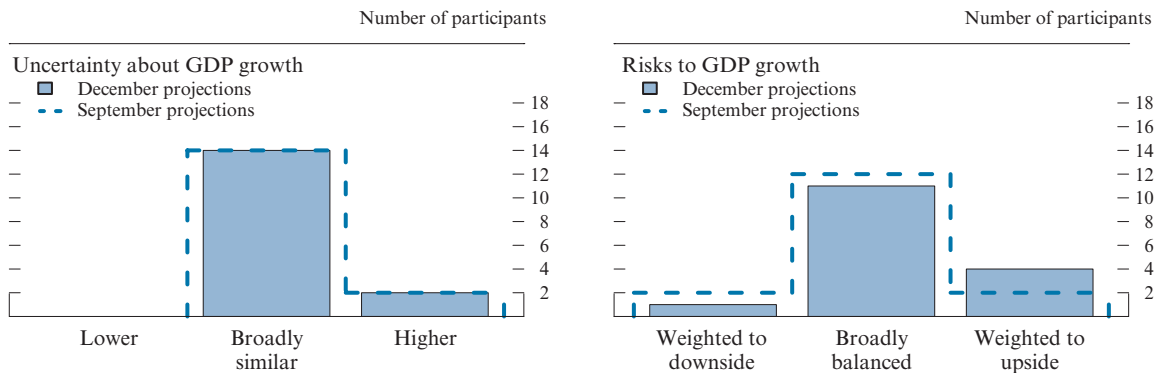
consistent with a symmetric fan chart. The balance of risks to the economic outlook shifted slightly in the direction of strength, with two more participants seeing upside risks to growth in real GDP than in September and one more seeing risks to the unemployment rate as weighted to the downside. In addition, one more participant than before saw risks to inflation as weighted to the upside.

Participants' assessments of the future path of the federal funds rate consistent with appropriate policy are also subject to considerable uncertainty. Because the Committee adjusts the federal funds rate in response to actual and prospective developments over time in real GDP growth, unemployment, and inflation, uncertainty surrounding the projected path for the funds rate importantly reflects the uncertainties about the path for those key economic variables. Figure 5 provides a graphical representation of this uncertainty, plotting the median SEP projection for the federal funds rate surrounded by confidence intervals derived from the results presented in table 2. As with the macroeconomic variables, forecast uncertainty is substantial and increases for longer horizons.

Figure 4.A. Uncertainty and risks in projections of GDP growth



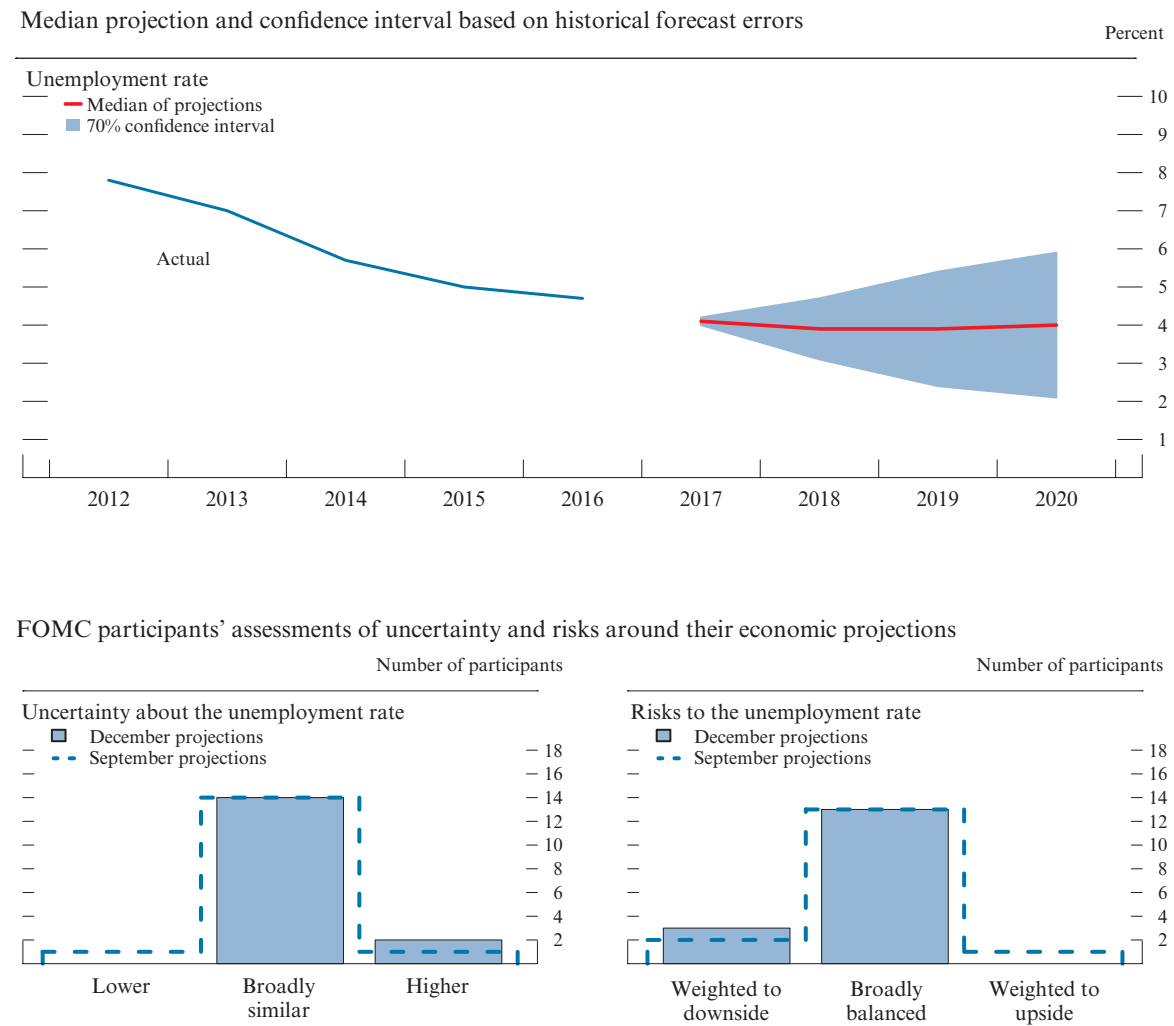
FOMC participants' assessments of uncertainty and risks around their economic projections



NOTE: The blue and red lines in the top panel show actual values and median projected values, respectively, of the percent change in real gross domestic product (GDP) from the fourth quarter of the previous year to the fourth quarter of the year indicated. The confidence interval around the median projected values is assumed to be symmetric and is based on root mean squared errors of various private and government forecasts made over the previous 20 years; more information about these data is available in table 2. Because current conditions may differ from those that prevailed, on average, over the previous 20 years, the width and shape of the confidence interval estimated on the basis of the historical forecast errors may not reflect FOMC participants' current assessments of the uncertainty and risks around their projections; these current assessments are summarized in the lower panels. Generally speaking, participants who judge the uncertainty about their projections as "broadly similar" to the average levels of the past 20 years would view the width of the confidence interval shown in the historical fan chart as largely consistent with their assessments of the uncertainty about their projections. Likewise, participants who judge the risks to their projections as "broadly balanced" would view the confidence interval around their projections as approximately symmetric. For definitions of uncertainty and risks in economic projections, see the box "Forecast Uncertainty."

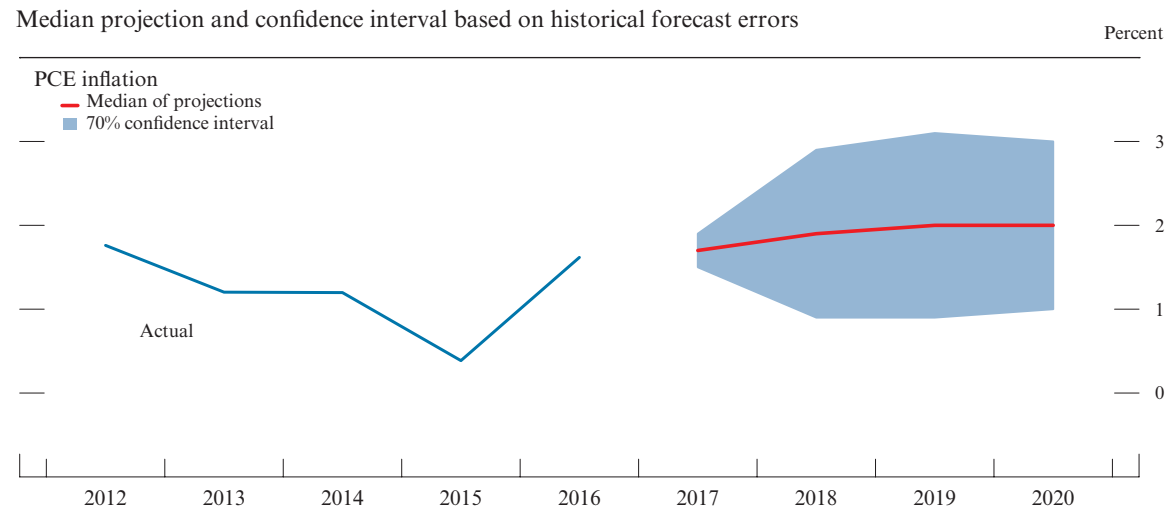


Figure 4.B. Uncertainty and risks in projections of the unemployment rate

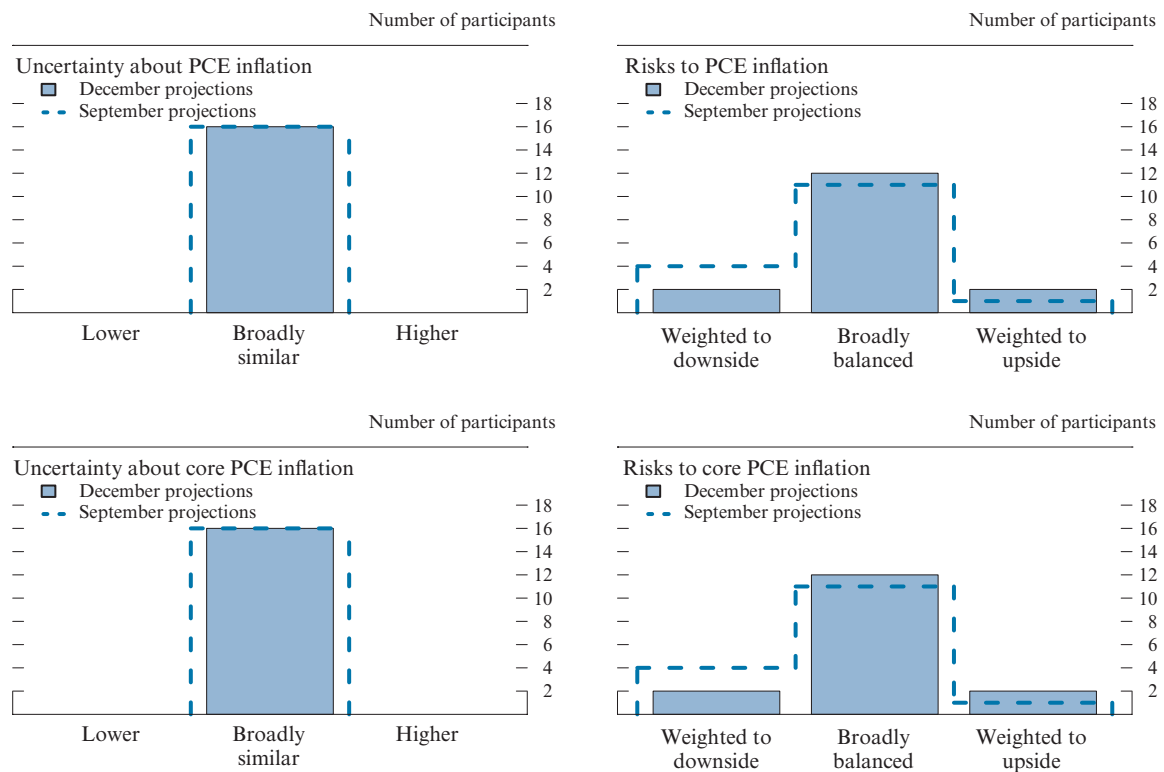


NOTE: The blue and red lines in the top panel show actual values and median projected values, respectively, of the average civilian unemployment rate in the fourth quarter of the year indicated. The confidence interval around the median projected values is assumed to be symmetric and is based on root mean squared errors of various private and government forecasts made over the previous 20 years; more information about these data is available in table 2. Because current conditions may differ from those that prevailed, on average, over the previous 20 years, the width and shape of the confidence interval estimated on the basis of the historical forecast errors may not reflect FOMC participants' current assessments of the uncertainty and risks around their projections; these current assessments are summarized in the lower panels. Generally speaking, participants who judge the uncertainty about their projections as “broadly similar” to the average levels of the past 20 years would view the width of the confidence interval shown in the historical fan chart as largely consistent with their assessments of the uncertainty about their projections. Likewise, participants who judge the risks to their projections as “broadly balanced” would view the confidence interval around their projections as approximately symmetric. For definitions of uncertainty and risks in economic projections, see the box “Forecast Uncertainty.”

Figure 4.C. Uncertainty and risks in projections of PCE inflation

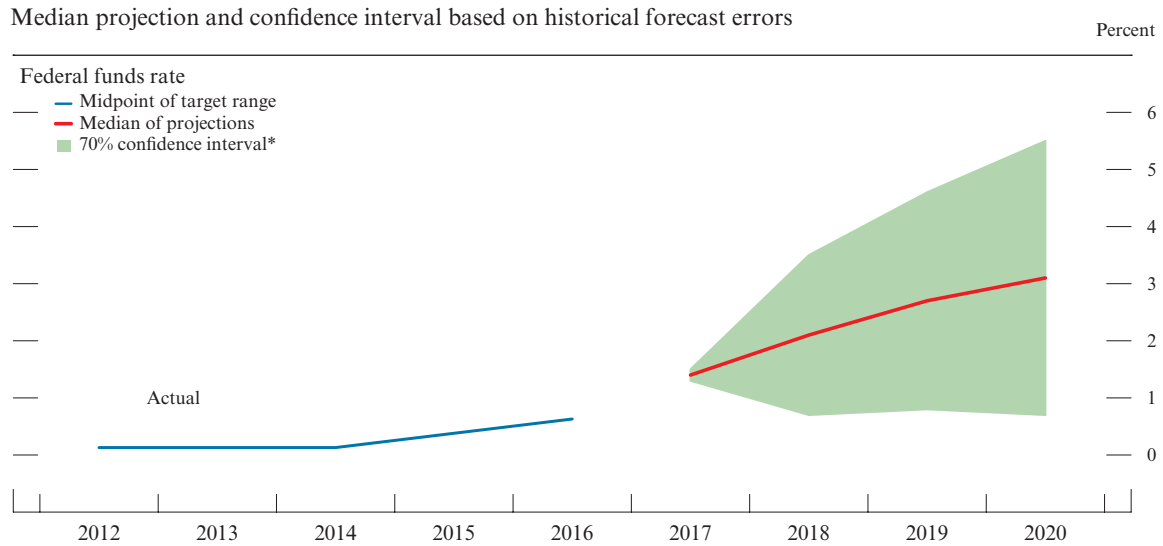


FOMC participants' assessments of uncertainty and risks around their economic projections



NOTE: The blue and red lines in the top panel show actual values and median projected values, respectively, of the percent change in the price index for personal consumption expenditures (PCE) from the fourth quarter of the previous year to the fourth quarter of the year indicated. The confidence interval around the median projected values is assumed to be symmetric and is based on root mean squared errors of various private and government forecasts made over the previous 20 years; more information about these data is available in table 2. Because current conditions may differ from those that prevailed, on average, over the previous 20 years, the width and shape of the confidence interval estimated on the basis of the historical forecast errors may not reflect FOMC participants' current assessments of the uncertainty and risks around their projections; these current assessments are summarized in the lower panels. Generally speaking, participants who judge the uncertainty about their projections as "broadly similar" to the average levels of the past 20 years would view the width of the confidence interval shown in the historical fan chart as largely consistent with their assessments of the uncertainty about their projections. Likewise, participants who judge the risks to their projections as "broadly balanced" would view the confidence interval around their projections as approximately symmetric. For definitions of uncertainty and risks in economic projections, see the box "Forecast Uncertainty."

Figure 5. Uncertainty in projections of the federal funds rate



NOTE: The blue and red lines are based on actual values and median projected values, respectively, of the Committee’s target for the federal funds rate at the end of the year indicated. The actual values are the midpoint of the target range; the median projected values are based on either the midpoint of the target range or the target level. The confidence interval around the median projected values is based on root mean squared errors of various private and government forecasts made over the previous 20 years. The confidence interval is not strictly consistent with the projections for the federal funds rate, primarily because these projections are not forecasts of the likeliest outcomes for the federal funds rate, but rather projections of participants’ individual assessments of appropriate monetary policy. Still, historical forecast errors provide a broad sense of the uncertainty around the future path of the federal funds rate generated by the uncertainty about the macroeconomic variables as well as additional adjustments to monetary policy that may be appropriate to offset the effects of shocks to the economy.

The confidence interval is assumed to be symmetric except when it is truncated at zero—the bottom of the lowest target range for the federal funds rate that has been adopted in the past by the Committee. This truncation would not be intended to indicate the likelihood of the use of negative interest rates to provide additional monetary policy accommodation if doing so was judged appropriate. In such situations, the Committee could also employ other tools, including forward guidance and large-scale asset purchases, to provide additional accommodation. Because current conditions may differ from those that prevailed, on average, over the previous 20 years, the width and shape of the confidence interval estimated on the basis of the historical forecast errors may not reflect FOMC participants’ current assessments of the uncertainty and risks around their projections.

\* The confidence interval is derived from forecasts of the average level of short-term interest rates in the fourth quarter of the year indicated; more information about these data is available in table 2. The shaded area encompasses less than a 70 percent confidence interval if the confidence interval has been truncated at zero.

## Forecast Uncertainty

The economic projections provided by the members of the Board of Governors and the presidents of the Federal Reserve Banks inform discussions of monetary policy among policymakers and can aid public understanding of the basis for policy actions. Considerable uncertainty attends these projections, however. The economic and statistical models and relationships used to help produce economic forecasts are necessarily imperfect descriptions of the real world, and the future path of the economy can be affected by myriad unforeseen developments and events. Thus, in setting the stance of monetary policy, participants consider not only what appears to be the most likely economic outcome as embodied in their projections, but also the range of alternative possibilities, the likelihood of their occurring, and the potential costs to the economy should they occur.

Table 2 summarizes the average historical accuracy of a range of forecasts, including those reported in past *Monetary Policy Reports* and those prepared by the Federal Reserve Board's staff in advance of meetings of the Federal Open Market Committee (FOMC). The projection error ranges shown in the table illustrate the considerable uncertainty associated with economic forecasts. For example, suppose a participant projects that real gross domestic product (GDP) and total consumer prices will rise steadily at annual rates of, respectively, 3 percent and 2 percent. If the uncertainty attending those projections is similar to that experienced in the past and the risks around the projections are broadly balanced, the numbers reported in table 2 would imply a probability of about 70 percent that actual GDP would expand within a range of 2.2 to 3.8 percent in the current year, 1.3 to 4.7 percent in the second year, 0.9 to 5.1 percent in the third year, and 0.8 to 5.2 percent in the fourth year. The corresponding 70 percent confidence intervals for overall inflation would be 1.8 to 2.2 percent in the current year, 1.0 to 3.0 percent in the second year, 0.9 to 3.1 percent in the third year, and 1.0 to 3.0 percent in the fourth year. Figures 4.A through 4.C illustrate these confidence bounds in "fan charts" that are symmetric and centered on the medians of FOMC participants' projections for GDP growth, the unemployment rate, and inflation. However, in some instances, the risks around the projections may not be symmetric. In particular, the unemployment rate cannot be negative; furthermore, the risks around a particular projection might be tilted to either the upside or the downside, in which case the corresponding fan chart would be asymmetrically positioned around the median projection.

Because current conditions may differ from those that prevailed, on average, over history, participants provide judgments as to whether the uncertainty attached to their projections of each economic variable is greater than, smaller than, or broadly similar to typical levels of forecast uncertainty seen in the past 20 years, as presented in table 2 and reflected in the widths of the confidence intervals shown in the top panels of figures 4.A through 4.C. Participants' current assessments of the

uncertainty surrounding their projections are summarized in the bottom-left panels of those figures. Participants also provide judgments as to whether the risks to their projections are weighted to the upside, are weighted to the downside, or are broadly balanced. That is, while the symmetric historical fan charts shown in the top panels of figures 4.A through 4.C imply that the risks to participants' projections are balanced, participants may judge that there is a greater risk that a given variable will be above rather than below their projections. These judgments are summarized in the lower-right panels of figures 4.A through 4.C.

As with real activity and inflation, the outlook for the future path of the federal funds rate is subject to considerable uncertainty. This uncertainty arises primarily because each participant's assessment of the appropriate stance of monetary policy depends importantly on the evolution of real activity and inflation over time. If economic conditions evolve in an unexpected manner, then assessments of the appropriate setting of the federal funds rate would change from that point forward. The final line in table 2 shows the error ranges for forecasts of short-term interest rates. They suggest that the historical confidence intervals associated with projections of the federal funds rate are quite wide. It should be noted, however, that these confidence intervals are not strictly consistent with the projections for the federal funds rate, as these projections are not forecasts of the most likely quarterly outcomes but rather are projections of participants' individual assessments of appropriate monetary policy and are on an end-of-year basis. However, the forecast errors should provide a sense of the uncertainty around the future path of the federal funds rate generated by the uncertainty about the macroeconomic variables as well as additional adjustments to monetary policy that would be appropriate to offset the effects of shocks to the economy.

If at some point in the future the confidence interval around the federal funds rate were to extend below zero, it would be truncated at zero for purposes of the fan chart shown in figure 5; zero is the bottom of the lowest target range for the federal funds rate that has been adopted by the Committee in the past. This approach to the construction of the federal funds rate fan chart would be merely a convention; it would not have any implications for possible future policy decisions regarding the use of negative interest rates to provide additional monetary policy accommodation if doing so were appropriate. In such situations, the Committee could also employ other tools, including forward guidance and asset purchases, to provide additional accommodation.

While figures 4.A through 4.C provide information on the uncertainty around the economic projections, figure 1 provides information on the range of views across FOMC participants. A comparison of figure 1 with figures 4.A through 4.C shows that the dispersion of the projections across participants is much smaller than the average forecast errors over the past 20 years.

## ABBREVIATIONS

AFE	advanced foreign economy
BOE	Bank of England
C&I	commercial and industrial
EME	emerging market economy
FOMC	Federal Open Market Committee; also, the Committee
GDP	gross domestic product
LFPR	labor force participation rate
MBS	mortgage-backed securities
Michigan survey	University of Michigan Surveys of Consumers
ON RRP	overnight reverse repurchase agreement
OPEC	Organization of the Petroleum Exporting Countries
PCE	personal consumption expenditures
SEP	Summary of Economic Projections
SLOOS	Senior Loan Officer Opinion Survey on Bank Lending Practices
SOMA	System Open Market Account
S&P	Standard & Poor's
TCJA	Tax Cuts and Jobs Act
TIPS	Treasury Inflation-Protected Securities



