

The Fed and Financial Markets: Suggestions to Improve an Unhealthy Relationship

Mickey D. Levy

Hoover Institution

Strategies For Monetary Policy:

A Policy Conference

May 3, 2019

The Fed and Financial Markets: Suggestions to Improve an Unhealthy Relationship

Mickey D. Levy*

The Fed's relationship with financial markets has become increasingly unhealthy. It's natural for the Fed to look to financial markets as an input to its monetary policy and for financial markets to respond to the Fed's policies and forward guidance. But the Fed's excessive fine-tuning of the economy and financial markets — much of which is unnecessary to achieve its longer-run dual mandate — has created an environment of gamesmanship and “tilts” that have added financial market volatility and harmed economic performance.

This unhealthy relationship has been accentuated by the expanded scope of the Fed's objectives and the broader set of tools it uses to achieve its goals, which have added unnecessary complexities to its operating procedures and communications. Markets are not going to stop responding to what the Fed does and says. The Fed needs to retrain markets, but can do so only by breaking some of its bad habits: it must readdress its strategy for achieving its mandated goals, and how and what it communicates.

The Fed's broadened scope of objectives and policy tools. During the Volcker-Greenspan regimes, the Fed made it clear that stable low inflation and well-anchored inflationary expectations were the best contributions monetary policy could make to achieve its dual mandate. That overriding message was clear and the markets understood it. Interest rates were the Fed's nearly exclusive policy tool. Certainly, during the Great Moderation the Fed occasionally deviated from its primary objective—in 1987, in response to the weakening US dollar; in the early 1990s to the mild recession and slow recovery; and in the 1990s Greenspan clearly responded to the stock market—but the Fed did not persistently fine-tune financial markets.

Since then, the Fed's reaction function has evolved, particularly since the 2008-2009 financial crisis. Subject to its 2 percent inflation target, besides maximizing employment, the Fed now focuses on managing short-term fluctuations in the economy, expectations and fluctuations in

financial markets, and maintaining financial stability. As long as inflation is within the Fed's 2 percent target and inflationary expectations are well anchored, the Fed perceives the flexibility to pursue other objectives. Financial markets are well aware of the Fed's discretionary approach to these broader objectives, and responds accordingly, which heightens market volatility.

Many of these Fed objectives have not been well defined, or the Fed interprets and adjusts them for a variety of reasons. The Fed's biggest source of discretion is interpreting its objective of maximum employment, which the Fed acknowledges in its official Statement on Goals and Monetary Policy Strategy as uncertain, subject to revision and requires assessing a range of indicators. The Fed earlier linked its interest rate policy to an unemployment rate goal (the Evans Rule) and has constantly reinterpreted its goal as its perception of the Phillips Curve has changed and Okun's Law has fallen apart. It has heightened the labor force participation rate as a focus. It alters its historic estimates of potential growth to improve the statistical fit of its prior forecasts of inflation. International uncertainties have occasionally received significant attention (such as the Fed's accentuated dovish tilts in response to China-related uncertainties in late 2018-early 2019). Financial markets try to anticipate changes in Fed interpretations and focuses.

The Fed has heightened the importance of maintaining financial stability, but has not clearly defined its parameters or how it fits in with the Fed's dual mandate or established a strategy for achieving it. While history suggests that successfully achieving its dual mandate would significantly reduce the probability of financial instability, the Fed's tendency has been toward fine-tuning financial markets in an attempt to smooth volatility. This may have the adverse impact of adding to volatility in markets and aggregate demand, and distorting economic behavior by constraining the natural fluctuations in interest rates and stock markets that influence economic behavior. In addition, the Fed has responded systematically to declines in the stock market (Cieslak and Vissing-Jorgensen 2018). This happened most recently in early 2016 and in late 2018. Market expectations and valuations reflect these tilts.

The Fed's "mandate creep" has involved "policy tool creep". The Fed's QEI in late-2008 was an emergency response to a serious crisis that helped to stabilize a serious situation. While this was an important inflection point in the conduct of monetary policy, the subsequent asset purchase programs--particularly QEIII that was implemented in late-2012 for the express objective of lowering the unemployment rate--reflected a clear shift in the Fed's reaction

function that ushered in much more activist Fed policy, an enlarged balance sheet and significantly larger role of forward guidance. Its large balance sheet is now used to accomplish a variety of objectives and is now part of the Fed's normal conduct of monetary policy. At the same time, the Fed has dramatically increased its reliance on communications, and its forward guidance is a critical tool in financial and economic fine-tuning.

The expanded uses of the balance sheet have heightened the Fed's involvement in financial markets and poses challenges. In promoting QEIII and forward guidance in 2012, Fed Chairman Bernanke argued that they would boost asset prices and encourage risk-taking, which would stimulate economic growth. In the years that followed, these unprecedented policies clearly contributed to higher asset prices (stocks, bonds and real estate) but had little perceptible impact on nominal GDP growth. If these policies had stimulated growth as the Fed (and its FRB/US model) had predicted, it would have moved quicker to normalize monetary policy.

Instead the sustained slow growth and sub-2 percent inflation provided the Fed the flexibility to maintain its unconventional accommodation, but there have been many bumps along the road. The Taper Tantrum in 2013—a surprise temporary 100 basis point rise in 10-year Treasury bond yields—stemmed from Bernanke's mention that under reasonable conditions the Fed would eventually taper QEIII. While bond yields actually receded during the actual tapering in 2014, the Fed's subsequent decision to raise interest rates before unwinding its balance sheet was driven by the Fed's fears of a negative market response to unwinding the balance sheet first. Fed Chairman Powell's strategy to "keep quiet" on the balance sheet unwind seemed to work until 2018Q4 when the stock market correction and year-end short-term funding pressures led the Fed to announce the outlines of a balance sheet strategy.

Significant uncertainty about how the balance sheet affects credit channels, financial markets and the economy has muddled the Fed's communications. The Fed has changed its story, materially reducing its assessment of the interest rate impacts of QEII and QEIII. The Fed's strategy has evolved toward arguing that maintaining large excess reserves in the banking system helps to manage financial stability and would serve as a buffer in crisis management. Meanwhile, despite uncertainties, financial markets respond to any forward guidance the Fed gives about the schedule of its balance sheet wind down and ultimate size, gleaning evidence on the Fed's hawkish or dovish tones.

Clearly, more research is needed on the balance sheet and also why the economy did not respond to the Fed's QEIII and forward guidance. Charles Plosser and others argue that the costs stemming from the unnecessary complexity and economic and political risks of maintaining an enlarged balance sheet are understated (Plosser 2019). Research shows that paying interest on excess reserves (IOER) and Fed regulations on commercial bank reserve requirements have affected the demand for bank reserves and bank lending (Ireland 2019). A better understanding of why the money multipliers collapsed (that is, why the surge in base money did not translate into faster growth of broad money and credit) and money velocity declined in response to the Fed's asset purchases is important for considering the proper monetary policy responses in the future--certainly more instructive than the Fed's blanket statement that without QEIII the economy would have faltered.

Markets understand that the Fed is purposely influencing markets, which accentuates the impact of Fed-speak. The Fed's stumble at its December 2018 FOMC meeting is a good example of the negative feedback loop in which the Fed's poor communications initiated a negative market reaction that elicited a subsequent Fed "calming" response. In March 2019, JP Morgan issued a report with the following title: "How much further can the Fed push markets?" (JP Morgan 2019). This brings up a host of questions: Why is the Fed pushing markets? Is it necessary to achieve its dual mandate? Might the Fed be undermining its credibility and desired longer-run impacts?

Extracting information from financial markets. The Fed emphasizes that its conduct of monetary policy is data dependent. John Williams, President of the Federal Reserve Bank of New York, recently elaborated: data dependence includes hard economic data, anecdotal evidence provided by business executives and information provided by financial markets (Williams 2019). But filtering information from stock market behavior is tricky: when is the stock market providing valuable information above that provided by hard economic data and forecasting tools, and when is it misleading? Historically, the stock market has not been a reliable predictor of the economy, and the Fed has "over reacted" to market moves, especially declines.

Why did the Fed respond so aggressively to the stock market correction in late-2018 after being so upbeat on the economy in September 2018 that it expressed the need to raise rates beyond

neutral? Although the economic data softened a bit and inflation and inflationary expectations receded, the biggest change was the Fed's dampened expectations in response to the stock market correction and quickly emerging concerns about recession. But the Fed's misguided communications accentuated the stock market correction, which clearly harmed year-end consumer spending. The Fed's subsequent aggressively dovish tilt lifted markets. It is uncertain the value of what the Fed had extracted from the stock market.

The Fed's forecasting track-record over the years has been mediocre—its errors in forecasting real GDP have been very large and of magnitudes similar to other forecasters (Reifschneider and Tulip, 2017). It seems unlikely that its forecasting errors would have been materially different if the Fed had not relied on insights from the stock market. The Fed should be more circumspect about its ability to extract reliable economic signals from the stock market. A more systematic pursuit of its dual mandate would lessen the Fed's intrusions into markets—and unnecessary market volatility.

The Fed's communications: suggestions for improvement. While the Fed has elevated its reliance on communications and forward guidance, its efforts to be transparent have been prone to misinterpretation and the source of undesired volatility. The Fed's official Longer-Run Strategy Statement emphasizes that while inflation over the longer-run is primarily determined by monetary policy, “the maximum level of employment is largely determined by nonmonetary factors that affect the structure and dynamics of the labor market.” Despite this caution, an inordinate amount of the Fed's focus and communications are on current economic conditions that are beyond its control and have little to do with its dual mandate (Levy 2019).

Fed members provide constant public commentary on economic conditions and appear frequently on TV to assess the just-released monthly Employment Report and other high-frequency government data. The Fed's official Policy Statement following each FOMC meeting begins with its description of economic conditions and typically (but not always) includes a risk assessment of near-term economic conditions. Small word changes are closely scrutinized for insights for what they may imply for future policy rates. The Fed's quarterly updated economic projections are closely followed as critical forward guidance.

All too frequently, financial market participants wonder or presume that the Fed knows something the markets do not. Following the Fed's further downward growth revisions and explicitly dovish Policy Statement at its recent March 2019 FOMC meeting, I received an email from an institutional investor: "Why did the FOMC choose to stop early? Is the US economy really that bad?" In reality, the Fed has one important piece of "inside" information: what it is inclined to do with monetary policy. In light of intense market scrutiny, the Fed should be as systematic as possible with its forward guidance about future policies and remember that its economic commentary influences decisions by businesses and households.

One simple recommendation is that FOMC members should cease making public comments immediately following government data releases. Such commentary gives the wrong impression of the Fed's role and mandate. Let private economists, financial market participants and the media discuss high frequency data, and how much of the "miss" relative to consensus expectations is due to seasonal adjustments or statistical noise. Being data dependent does not mean responding publicly to high frequency data. In public speeches and statements, FOMC members should relate their comments on the economy to the Fed's dual mandate, and carefully distinguish between short-term fluctuations that are beyond the control of monetary policy and intermediate-term trends that the Fed may influence. Its public comments on the stock market should be limited to all but extreme valuations; casual assessments of whether the stock market is too high or too low should be avoided.

The Fed's Policy Statements: Recommended Changes. The Fed's official Policy Statement following FOMC meetings should be modified in at least three ways. First, every Policy Statement should begin with an assessment of monetary policy and whether it is consistent with achieving the Fed's statutory mandate, rather than the Fed's assessments of the economy and its subsectors. Reordering of the current format would reinforce the Fed's primary focus on its statutory mandate and policy stance, and properly put current economic conditions as a supporting and not the lead role.

Secondly, the Fed should explicitly convey in every Policy Statement separate balance of risk assessments on inflation and on employment and/or the economy. Focusing the risk assessment on the economy, or temporarily dropping the risk assessment and replacing it with nuanced language on inflation and inflationary expectations only add confusion. Changes in these risk

assessments must be carefully aligned with changes in the Fed’s forecasts. Such modifications may have helped to avoid the Fed’s communications missteps in December 2018 when the Policy Statement, SEP forecasts and Chairman Powell’s press conference created confusion while the subsequently released minutes of the FOMC meeting painted a far different picture on the Fed’s balance of risks.

Third, the Policy Statement must include the Fed’s strategy on its balance sheet and unwind policy. The Fed’s balance sheet strategy cannot simply be ignored or put into an addendum. Even though the Fed has emphasized that interest rates are its primary policy tool, the enlarged balance sheet is nevertheless an important tool, particularly if the Fed were to face the zero lower bound on interest rates.

The Fed’s Quarterly Forecast Updates: Suggestions for Revamping. The Fed’s quarterly Summary of Economic Projections (SEPs) draw too much attention to single point estimates and convey sense of certainty and are prone to misinterpretation. They should be redesigned with three goals in mind: 1) in addition to the Fed’s baseline forecast they should include estimates of forecast uncertainties and appropriate paths of monetary policy associated with them, 2) they should provide a framework for the Fed to analyze and consider monetary policy under different situations and contingency planning, and 3) the forecasts of the appropriate Fed funds rate should not commit the Fed to a policy path.

The current SEPs have the benefit of incorporating the forecasts of all FOMC members, including the inputs of the Bank Presidents that reflect their diverse opinions and anecdotal evidence from the districts. However, the SEPs are limited and prone to misinterpretation. The Fed’s central tendency and range of forecasts in the SEPs are simply the bands of the baseline (“best”) forecasts of the FOMC members (the central tendency throws out the three highest and three lowest forecasts), and do not reflect forecast uncertainties, as they are often perceived. Since 2010, real GDP growth in the year following the FOMC’s December forecasts has been outside of the Fed’s forecast central tendency in seven out of nine years and outside the range in six years (Levy, 2018). The median FOMC member forecast of the Fed funds rate forecast at year end—the so-called median “dot”—is too frequently perceived to be a binding commitment. It is noteworthy that in recent years, the futures market has provided more accurate forecasts of the Fed funds rate than the FOMC’s median dot.

The FOMC's forecasts may have other problems. Member forecasts may be based on different assumptions about what they consider "appropriate monetary policy", so their individual forecasts may not be comparable and combining them may be biased. The Fed's inflation forecasts may be constrained by its 2 percent target. The Fed knows that its forecasts provide important forward guidance, and this may affect what they forecast. Moreover, the Fed Governors may be constrained because their forecasts tend not to stray too far from the senior Fed staff FRB/US model forecasts.

The Fed is aware of these challenges and would like to emphasize the conditionality of monetary policy. Federal Reserve Bank of Cleveland President Loretta Mester has identified key issues in uncertainties and recommended changes, including providing estimates of confidence bands around the SEP projections (Mester, 2016). Fed researchers David Reifschneider and Peter Tulip analyzed forecasting uncertainties and found that the Fed's median forecasts of real GDP plus or minus the 20-year moving average of the root mean squared errors (RMSE) computed from a blend of real GDP forecasts by the Fed and other government and private sector forecasters captured approximately 70 percent of actual outcomes (Reifschneider and Tulip, 2017).

Reflecting these observations, the Fed now shows charts of those calculated 70 percent confidence intervals around the FOMC's median forecasts, but they are not included in the SEPs, so they do not get much attention. Instead, they and other measures of uncertainty and balances of risks are included in the back of the FOMC meeting minutes released with a three week lag.

The optimal solution would be a more systematic approach in which the Fed would publish a single forecast based on a model that is consistent with achieving its dual mandate that would measure how the appropriate Fed funds rate path would vary under different economic and inflation outcomes. However, the Fed has concluded that agreement on a single forecast methodology would be too difficult.

With this constraint, the SEPs should be revamped to incorporate estimates of reasonable uncertainties and the Fed estimates of policies that would be appropriate under alternative economic and inflation outcomes. Rather than ask each FOMC member to calculate a confidence interval around their baseline intermediate-term forecasts, each member would be

provided by the Fed Board staff a calculated 70 percent confidence interval (using the Reifschneider-Tulip methodology), so that before every quarterly FOMC meeting, each FOMC member would submit 1) forecasts for GDP, the unemployment rate and inflation and the high and low bands based on the calculated 70 percent confidence intervals, and 2) three forecasts of the Fed funds rate: one rate appropriate for their baseline economic and inflation forecast and one each for their high and low bands of the confidence intervals. Since the longer-run equilibrium forecasts of the variables like r^* and potential real GDP are unobservable, confidence intervals cannot be calculated. Accordingly, each FOMC member would submit a baseline and a “reasonable range” of that variable that he/she estimates may be consistent with achieving the Fed’s dual mandate. The Fed’s senior staff would also be required to provide its baseline estimates and confidence intervals and three Fed funds rate paths for the intermediate-term, along with a baseline and reasonable range for longer-run forecasts.

In addition, the SEPs should include a separate forecast of nominal GDP. This would not be redundant and would serve a valuable purpose. Monetary policy influences nominal spending and production, not real GDP which is derived from nominal GDP and quality-adjusted inflation. The quality-adjustment calculations conducted by the Bureau of Economic Analysis involve judgment and assumption. Projections of real GDP and PCE inflation do not add up to nominal GDP, in part because the PCE index does not include business capital investment or government consumption or investment. Another possible change would be the length of the forecasting period. While the Fed’s longer-run forecasts are very instructive, cutting the projection period back to two years from three would eliminate the unnecessary extrapolation into the third year that is beyond the Fed’s thinking on monetary policy.

Incorporating a calculated 70 percent confidence interval around baseline economic and inflation forecasts and having FOMC members align their appropriate Fed funds rate forecasts to the upper and lower bands would be a fruitful task. It would encourage the Fed to consider policy responses to a reasonably large band of actual outcomes, and lean against the natural tendency to focus on the baseline forecasts. Also, it would help the Fed clarify its balances of risks assessment at every FOMC meeting and align them with any change in forecasts.

The new SEPs published at the conclusion of each quarterly FOMC meeting would include: 1) the summary table of the medians of the FOMC members’ baseline forecasts and the calculated

70 percent confidence intervals over the intermediate-term projection and the medians of their longer-run baseline and reasonable ranges (a prototype with hypotheticals is shown in Table 1); the median estimates of confidence intervals for the intermediate-term forecasts would replace the current “Central tendency” and “Range” forecasts, 2) the Fed’s senior staff forecasts, including forecasts of the Fed funds rate, 3) a chart of the median forecasts of the appropriate path of the Fed funds rate for the baseline and upper and lower bands of estimated confidence intervals on the economy and inflation; these would replace the current “dot plot” (Chart 1), 4) separate charts of the FOMC’s median estimated forecasts and confidence intervals (and longer-run ranges) for nominal and real GDP, the unemployment rate and PCE inflation. In addition, the SEPs would include some of the FOMC’s balance of risk bar charts that are now in the back of the minutes of each meeting.

Replacing the current confusing dot plot with the median Fed member estimate of the appropriate policy rate for the alternative economic and inflation forecasts would be a step forward. If the Fed considers this too controversial and chooses to continue to include the dot plot, it should be shown against the backdrop of the shaded area bounded by the calculated 70 percent confidence intervals (Chart 2).

One further modification is important: the SEPs should include an addendum on the appropriate size of the balance sheet under the FOMC’s median forecast and confidence intervals. It is short-sighted and incomplete to only include the Fed’s estimates of an appropriate path of the Fed funds rate. Presumably, under normal conditions and forecasts, the Fed’s balance sheet strategy would remain unchanged. However, including its balance sheet strategy would definitely be important if the Fed were to face the zero lower bound on rates. Fed Chairman Powell has changed from characterizing the Fed’s balance sheet as being on “auto pilot” to being “in play” under certain circumstances. More policy transparency would be appropriate.

Concluding Remarks. The Fed must take the lead to break its negative self-reinforcing relationship with financial markets by taking steps to rein in its activist fine-tuning of the economy and financial markets and focus on a strategy for achieving its dual mandate. For starters, the Fed needs to curtail its excessive focus on the real economy and retrain markets to understand that short-term economic fluctuations occur naturally and are beyond the Fed’s control. It must strike a symmetrical stance on the stock market and not respond to corrections.

Revamping the SEPs by introducing uncertainties and highlighting the conditionality of monetary policy would be consistent with concerns expressed by Fed Chair Powell and Governor John Williams and others (Powell, 2018; Williams, 2018). This has been advocated by Andrew Levin (2014) who urges the Fed to conduct scenario analyses of its monetary policy alternatives—that is, “stress tests” for monetary policy, which would force more accountability and enhance the Fed’s transparency.

Market participants may initially balk at the width of the 70 percent confidence intervals, which may be seemingly large compared to the current central tendency forecasts. However, they would soon find them useful in mapping the Fed’s conditional policy rate forecasts with alternative reasonable economic and inflation outcomes. Markets are adaptable and would not miss the Fed’s dot plot.

References

Cieslak, Anna and Vissing-Jorgensen, Annette, “The Economics of the Fed’s Put”, working paper, September 2018.

Calomiris, Charles and Mamaysky, Harry, “Monetary Policy and Exchange Rate Returns: Time-Varying Risk Regimes”, Working Paper, Columbia University Business School, 2019.

Ireland, Peter, “Monetary Policy Implementation: Making Better and More Consistent Use of the Federal Reserve’s Balance Sheet”, Shadow Open Market Committee, March 2019.

JP Morgan, “How Much Further Can the Fed Push Markets?”, March 2019.

Levin, Andrew, “The Design and Communication of Systematic Monetary Strategies”, Hoover Institution conference on “Frameworks for Central Banking in the Next Century”, May 2014.

Levy, Mickey, “The Fed’s Communications: Suggestions for Improvement”, Shadow Open Market Committee, March 2019.

Mester, Loretta, “Acknowledging Uncertainty”, speech delivered at the Shadow Open Market Committee, New York, New York, October 2016.

Powell, Jerome H., “Monetary Policy in a Changing Economy”, Federal Reserve Bank of Kansas City Jackson Hole Symposium, August 24, 2018.

Plosser, Charles, “Balance Sheet: Exposures, Risks, and Financial Difficulties”, Shadow Open Market Committee, March 2019.

Reifschneider, David and Tulip, Peter, “Gauging the Uncertainty of the Economic Outlook Using Historical Forecasting Errors: The Federal Reserve’s Approach”, Federal Reserve Board Finance and Economics Discussion Series, 2017-020.

Williams, John C., “Normal! Monetary Policy in Words and Deeds”, speech delivered at Columbia University, School of International and Public Affairs, New York City, September 28, 2018.

Table 1: Hypothetical Summary Table - Economic projections of Federal Reserve Board members and Federal Reserve Bank presidents under their individual assessments of projected appropriate monetary policy, March 2019*

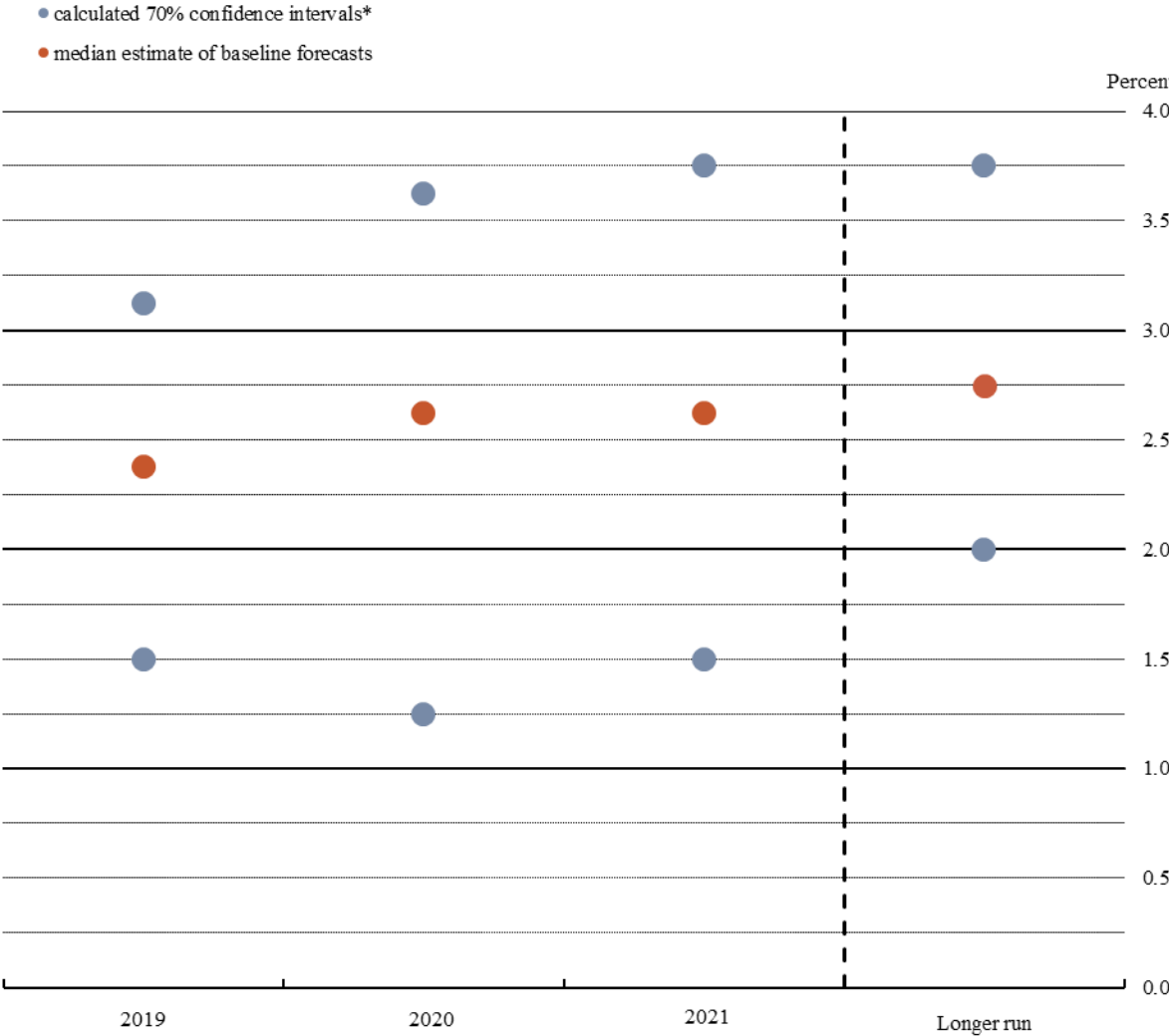
Percent												
Variable	Median ¹ and 70 Percent Confident Intervals Around Forecasts ²									Median and Range ³		
	2019			2020			2021			Longer run		
Change in nominal GDP	<i>a</i>	--	<i>b</i>	<i>a</i>	--	<i>b</i>	<i>a</i>	--	<i>b</i>	<i>c</i>	--	<i>d</i>
December projection	<i>a</i>	--	<i>b</i>	<i>a</i>	--	<i>b</i>	<i>a</i>	--	<i>b</i>	<i>c</i>	--	<i>d</i>
Change in real GDP	<i>a</i>	2.1	<i>b</i>	<i>a</i>	1.9	<i>b</i>	<i>a</i>	1.8	<i>b</i>	<i>c</i>	1.9	<i>d</i>
December projection	<i>a</i>	2.3	<i>b</i>	<i>a</i>	2.0	<i>b</i>	<i>a</i>	1.8	<i>b</i>	<i>c</i>	1.9	<i>d</i>
Unemployment rate	<i>a</i>	3.7	<i>b</i>	<i>a</i>	3.8	<i>b</i>	<i>a</i>	3.9	<i>b</i>	<i>c</i>	4.3	<i>d</i>
December projection	<i>a</i>	3.5	<i>b</i>	<i>a</i>	3.6	<i>b</i>	<i>a</i>	3.8	<i>b</i>	<i>c</i>	4.4	<i>d</i>
PCE inflation	<i>a</i>	1.8	<i>b</i>	<i>a</i>	2.0	<i>b</i>	<i>a</i>	2.0	<i>b</i>	<i>c</i>	2.0	<i>d</i>
December projection	<i>a</i>	1.9	<i>b</i>	<i>a</i>	2.1	<i>b</i>	<i>a</i>	2.1	<i>b</i>	<i>c</i>	2.0	<i>d</i>
Core PCE inflation ⁴	<i>a</i>	2.0	<i>b</i>	<i>a</i>	2.0	<i>b</i>	<i>a</i>	2.0	<i>b</i>			
December projection	<i>a</i>	2.0	<i>b</i>	<i>a</i>	2.0	<i>b</i>	<i>a</i>	2.0	<i>b</i>			
Memo: Projected appropriate policy path												
Federal funds rate	<i>a</i>	2.4	<i>b</i>	<i>a</i>	2.6	<i>b</i>	<i>a</i>	2.6	<i>b</i>	<i>c</i>	2.8	<i>d</i>
December projection	<i>a</i>	2.9	<i>b</i>	<i>a</i>	3.1	<i>b</i>	<i>a</i>	3.1	<i>b</i>	<i>c</i>	2.8	<i>d</i>

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 December projections were made in conjunction with the meeting of the Federal Open Market Committee on December 18–19, 2018. 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 December 18–19, 2018, and one participant did not submit such projections in conjunction with the March 19-20, 2019 meeting.

*Forecasts are hypothetical and for illustration purposes only.

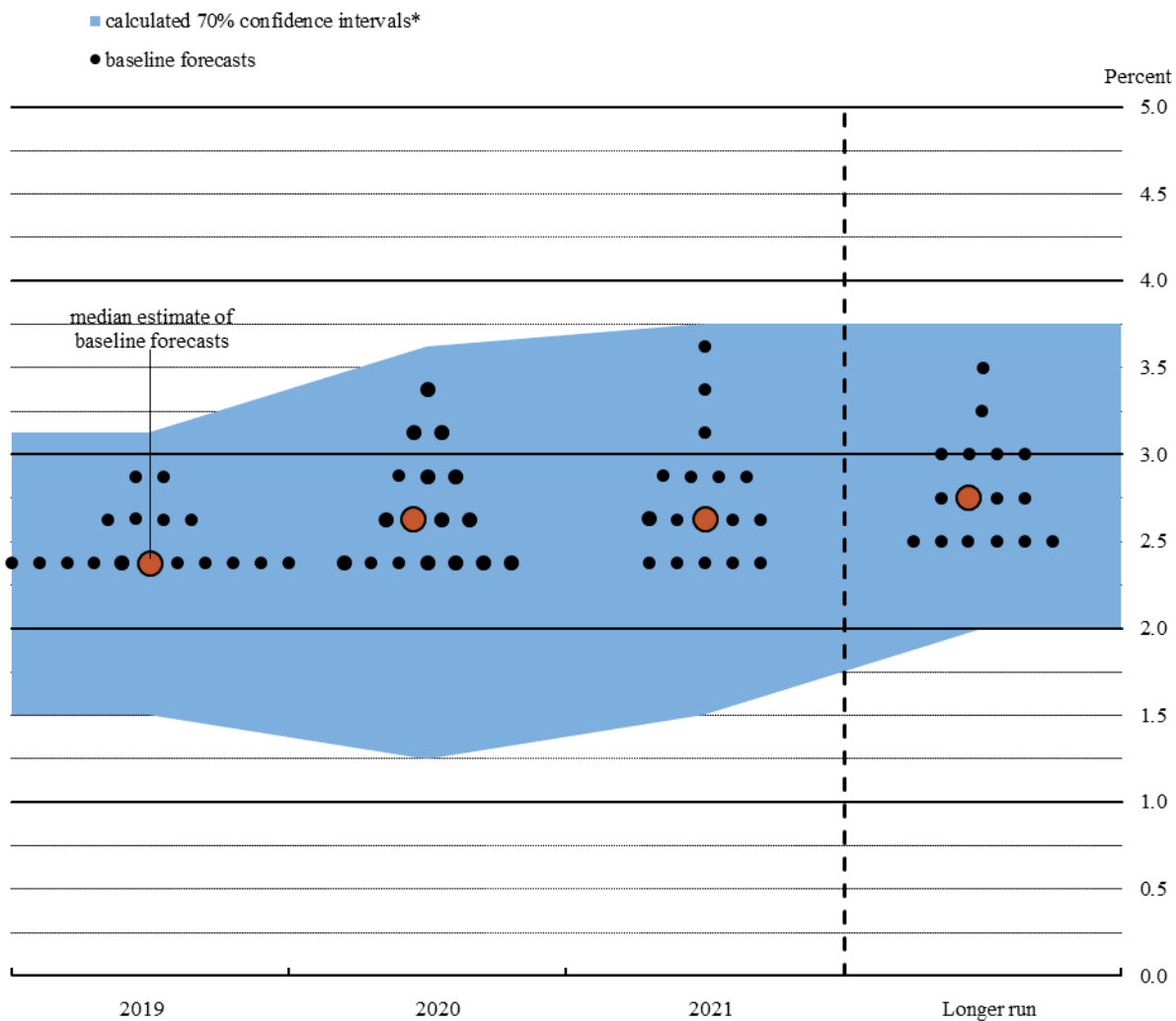
1. For each period, the median is the middle projection when individuals' baseline projections are arranged from lowest to highest. When the number of projections is even, the median is the average of the two middle projections.
2. For each period, "a" and "b" reflect the median economic, inflation or interest rate forecast minus and plus, respectively, the 20-year moving average of the root mean squared errors (RMSE) computed from a blend of each variable's respective forecasts by the Fed and other government and private sector forecasters.
3. A "reasonable range" of the respective variable that may be consistent with achieving the Fed's dual mandate. "c" and "d" are the medians of the lower and upper ends, respectively, of members' estimated ranges.
4. Longer-run projections for core PCE inflation are not collected.

Chart 1: Hypothetical Dot Plot - FOMC participants' assessments of appropriate monetary policy: Median estimate of baseline forecasts and calculated 70% confidence intervals around baseline forecasts⁺



⁺Forecasts are hypothetical and for illustration purposes only.
 *For the longer run forecasts, the shaded blue circles are the medians of the lower and upper ends, respectively, of Fed members' estimated ranges of the Fed funds rate judged to be consistent with achieving the Fed's dual mandate.
 Note: Each shaded orange circle indicates the median value of individual participants' baseline 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. Shaded blue circles reflect the median baseline forecast minus and plus, respectively, the 20-year moving average of the root mean squared errors (RMSE) computed from a blend of forecasts for short-term interest rates by the Fed and other government and private sector forecasters.

Chart 2: Optional Hypothetical Dot Plot - FOMC participants' assessments of appropriate monetary policy: Baseline forecasts of each participant and calculated 70% confidence intervals around baseline forecasts[†]



[†]Forecasts are hypothetical and for illustration purposes only.

*For the longer run forecasts, the shaded blue area represents the medians of the Fed members' estimated ranges of the Fed funds rate judged to be consistent with achieving the Fed's dual mandate.