Data Dependence and U.S. Monetary Policy

Remarks by

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I am delighted to be speaking at this annual conference of the Clearing House and the Bank Policy Institute. Today I will discuss recent economic developments and the economic outlook before going on to outline my thinking about the connections between data dependence and monetary policy. I will close with some observations on the implications for U.S. monetary policy that flow from this perspective.[1]

Recent Economic Developments and the Economic Outlook

U.S. economic fundamentals are robust, as indicated by strong growth in gross domestic product (GDP) and a job market that has been surprising on the upside for nearly two years. Smoothing across the first three quarters of this year, real, or inflation-adjusted, GDP growth is averaging an annual rate of 3.3 percent. Private-sector forecasts for the full year--that is, on a fourth-quarter-over-fourth-quarter basis--suggest that growth is likely to equal, or perhaps slightly exceed, 3 percent. If this occurs, GDP growth in 2018 will be the fastest recorded so far during the current expansion, which in July entered its 10th year. If, as I expect, the economic expansion continues in 2019, this will become the longest U.S. expansion in recorded history.

Likewise, the labor market remains healthy. Average monthly job gains continue to outpace the increase needed to provide jobs for new entrants to the labor force over the longer run, with payrolls rising by 250,000 in October. And, at 3.7 percent, the unemployment rate is the lowest it has been since 1969. In addition, after remaining stubbornly sluggish throughout much of the expansion, nominal wage growth is picking

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up, with various measures now running in the neighborhood of 3 percent on an annual

basis.

The inflation data in the year to date for the price index for personal consumption

expenditures (PCE) have been running at or close to our 2 percent objective, including on

a core basis--that is, excluding volatile food and energy prices. While my base case is for

this pattern to continue, it is important to monitor measures of inflation expectations to

confirm that households and businesses expect price stability to be maintained. The

median of expected inflation 5-to-10 years in the future from the University of Michigan

Surveys of Consumers is within--but I believe at the lower end of--the range consistent

with price stability. Likewise, inflation readings from the TIPS (Treasury Inflation-

Protected Securities) market indicate to me that financial markets expect consumer price

index (CPI) inflation of about 2 percent to be maintained. That said, historically, PCE

inflation has averaged about 0.3 percent less than CPI inflation, and if this were to

continue, the readings from the TIPS market would indicate that expected PCE inflation

is running at somewhat less than 2 percent.

What might explain why inflation is running at or close to the Federal Reserve's

long-run objective of 2 percent, and not well above it, when growth is strong and the

labor market robust? According to the Bureau of Labor Statistics, productivity growth in

the business sector, as measured by output per hour, is averaging 2 percent at an

annualized rate this year, while aggregate hours worked in the business sector have risen

at an average annual rate of 1.8 percent through the third quarter. This decomposition--in

which the growth in output is broken down into measures of aggregate supply, the growth

of aggregate hours and the growth of output per hour--suggests that the growth rates of

productivity and hours worked in 2018 each have been exceeding their respective longer-run rates as estimated by the Congressional Budget Office.[2] In other words, while growth in aggregate demand in 2018 has been above the expected long-run growth rate in aggregate supply, it has not been exceeding this year's growth in *actual* aggregate supply.

Ultimately, hours growth will likely converge to a slower pace because of demographic factors. But how rapidly this happens will depend in part on the behavior of labor force participation. And recent years' developments suggest there may still be some further room for participation in the job market--especially in the prime-age group of 25-to-54-year-olds--to rise. Labor participation by prime-age women has increased around 2 percentage points in the past three years and is now at its highest level in a decade. That said, it is still 1-1/2 percentage points below the peak level reached in 2000. Labor force participation among 25- to 54-year-old men has risen by roughly 1 percentage point in the past several years. But it is still 2 percentage points below levels seen a decade ago, and it is 3 percentage points below the levels that prevailed in the late 1990s.

As for productivity growth, there is considerable uncertainty about how much of the rebound in productivity growth that we have seen in recent quarters is cyclical and how much is structural. I believe both factors are at work. The structural, or trend, component of productivity growth is a function of capital deepening through business investment as well as a multifactor component sometimes referred to as the "Solow residual." Initial estimates from the recent GDP release indicate that equipment and software investment in the third quarter moderated from the rapid pace recorded in the

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[2] See the Congressional Budget Office's August 2018 projections for the nonfarm business sector at https://www.cbo.gov/system/files/2018-08/51137-2018-08-potentialgdp.xlsx.

first half of the year. One data point does not make a trend, but an improvement in business investment will be important if the pickup in productivity growth that we have seen in recent quarters is to be sustained.

As for the economic outlook, in the most recent Summary of Economic Projections (SEP) released in September, participants had a median projection for real GDP growth of 3.1 percent in 2018 and 2-1/2 percent in 2019. The unemployment rate was expected to decline to 3-1/2 percent next year. And, for total PCE inflation, the median projection remains near 2 percent.

With a robust labor market and inflation at or close to our 2 percent inflation goal and based on the baseline economic outlook for 2019 I have just laid out, I believe monetary policy at this stage of the economic expansion should be aimed at sustaining growth and maximum employment at levels consistent with our inflation objective. At this stage of the interest rate cycle, I believe it will be especially important to monitor a wide range of data as we continually assess and calibrate whether the path for the policy rate is consistent with meeting our dual-mandate objectives on a sustained basis.

Data Dependence of Monetary Policy: What It Means and Why It Is Important

Economic research suggests that monetary policy should be "data dependent."[3] And, indeed, central banks around the world, including the Federal Reserve, often describe their policies in this way. I would now like to discuss how I think about two

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[3] The seminal reference is John B. Taylor (1993), "Discretion versus Policy Rules in Practice," Carnegie-Rochester *Conference Series on Public Policy,* vol. 39 (December), pp. 195-214. See also Richard Clarida, Jordi Galí, and Mark Gertler (1999), "The Science of Monetary Policy: A New Keynesian Perspective," *Journal of Economic Literature,* vol. 37 (December), pp. 1661-707; Richard Clarida, Jordi Galí, and Mark Gertler (2000), "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory," *Quarterly Journal of Economics,* vol. 115 (February), pp. 147-80; Michael Woodford (2003), *Interest and Prices: Foundations of a Theory of Monetary Policy* (Princeton, N.J.: Princeton University Press); and Lars E.O. Svensson (2015), "Forward Guidance," *International Journal of Central Banking,* vol. 11 (September), pp. 19-64.

distinct roles that data dependence should play in the formulation and communication of monetary policy.

It is important to state up-front that data dependence is not, in and of itself, a monetary policy strategy. A monetary policy *strategy* must find a way to combine incoming data *and* a model of the economy *with* a healthy dose of judgment--and humility!--to formulate, and then communicate, a path for the policy rate most consistent with our policy objectives. In the case of the Fed, those objectives are assigned to us by the Congress, and they are to achieve maximum employment and price stability. Importantly, because households and firms must make long-term saving and investment decisions and because these decisions--directly or indirectly--depend on the expected future path for the policy rate, the central bank should find a way to communicate and explain how incoming data are or are not changing the expected path for the policy rate consistent with best meeting its objectives.[4] Absent such communication, inefficient divergences between public expectations and central bank intentions for the policy rate path can emerge and persist in ways that are costly to the economy when reversed.

Within this general framework, let me now consider two distinct ways in which I think that the path for the federal funds rate should be data dependent. U.S. monetary policy has for some time and will, I believe, continue to be data dependent in the sense that incoming data reveal at the time of each Federal Open Market Committee (FOMC) meeting where *the economy is* at the time of each meeting relative to the goals of

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[4] For example, long-term bond yields can be written as the sum of the expected path of the policy rate plus a term premium. The exchange rate between two countries can be written as the sum of the policy rate path differential between two countries plus a risk premium. So even for households and firms that do not directly care about the policy rate path, they do care about long-term bond yields and exchange rates that reflect this path.

monetary policy. This information on where the economy is relative to the goals of monetary policy is an important input into the policy decision. If, for example, incoming data in the months ahead were to reveal that inflation and inflation expectations are running higher than projected at present and in ways that are inconsistent with our 2 percent objective, then I would be receptive to increasing the policy rate by more than I currently expect will be necessary. Data dependence in this sense is easy to understand, as it is of the type implied by a large family of policy rules *in which the parameters of the economy are known.*[5]

But what if key parameters that describe the long-run destination of the economy are unknown? This is indeed the relevant case that the FOMC and other monetary policymakers face *in practice.* The two most important unknown parameters needed to conduct--and communicate--monetary policy are the rate of unemployment consistent with maximum employment, u^*, and the riskless real rate of interest consistent with price stability, r^*. As a result, in the real world, monetary policy should, I believe, be data dependent in a second sense: that incoming data can reveal at each FOMC meeting signals that will enable it to *update* its *estimates* of r^* and u^* in order to obtain its best estimate of where *the economy is heading.*[6] And, indeed, as indicated by the SEP,

[5] See the Board of Governors of the Federal Reserve System (2018), *Monetary Policy Report* (Washington: Board of Governors, July), pp. 37-41, https://www.federalreserve.gov/monetarypolicy/files/20180713_mprfullreport.pdf, or the webpage "Monetary Policy Principles and Practice" available on the Federal Reserve Board's website at https://www.federalreserve.gov/monetarypolicy/monetary-policy-principles-and-practice.htm for a discussion of the policy rate paths implied by five different policy rules using parameter values typically assumed in the literature.

[6] If the economy can be described by a linear model in which the only two unknown parameters are r^* and u^* and the shocks that hit the economy are normal, Kalman filtering can be used to derive a closed form mathematical expression for how to update one's estimate of r^* and u^* as new macro data arrive. But, in practice, "the" model of the economy is neither known, nor linear, and the shocks that strike it are not normal. Thus, monetary policy in practice is, of necessity, as much or more an art than a science.

FOMC participants have, over the past nearly seven years, revised their estimates of both u^* and r^* substantially lower as unemployment fell and real interest rates remained well below prior estimates of neutral without the rise in inflation or inflation expectations those earlier estimates would have predicted. And these revisions to u^* and r^* almost certainly did have an important influence on the path for the policy rate that was actually realized in recent years.[7] I would expect to revise my estimates of r^* and u^* as appropriate if incoming data on future inflation and unemployment diverge materially and persistently from my baseline projections today.

Consequences for Monetary Policy

What does this mean for the conduct of monetary policy? As the economy has moved to a neighborhood consistent with the Fed's dual-mandate objectives, risks have become more symmetric and less skewed to the downside than when the current rate cycle began three years ago. Raising rates too quickly could unnecessarily shorten the economic expansion, while moving too slowly could result in rising inflation and inflation expectations down the road that could be costly to reverse, as well as potentially pose financial stability risks.

Although the real federal funds rate today is just below the range of longer-run estimates presented in the September SEP, it is much closer to the vicinity of r^* than it was when the FOMC started to remove accommodation in December 2015. How close is a matter of judgment, and there is a range of views on the FOMC. As I have already

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[7] That was my inference as one who was a Fed watcher until September 17, 2018. It has also been the inference of some private-sector forecasters as well as some other FOMC participants. For example, see Janet L. Yellen (2017), "The Economic Outlook and the Conduct of Monetary Policy," speech delivered at the Stanford Institute for Economic Policy Research, Stanford University, Stanford, Calif., January 19, https://www.federalreserve.gov/newsevents/speech/yellen20170119a.htm.

stressed, r^* and u^* are uncertain, and I believe we should continue to update our estimates of them as new data arrive. This process of learning about r^* and u^* as new data arrive supports the case for gradual policy normalization, as it will allow the Fed to accumulate more information from the data about the ultimate destination for the policy rate and the unemployment rate at a time when inflation is close to our 2 percent objective.