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Financial Markets and Monetary Policy: Is There a Hall of Mirrors Problem?

Remarks by

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Thank you to the conference organizers for inviting me here to discuss what former Chair Bernanke has famously referred to as a "hall of mirrors" problem: a situation in which a central bank's reaction function and financial market prices interact in economically suboptimal and potentially destabilizing ways.[1] In my remarks today, I will lay out the way I think about the interplay between financial markets and monetary policy, with a focus on how I myself seek to integrate noisy but often correlated signals about the economy that I glean from models, surveys, and financial markets.[2]

Three Observations

I begin with three unobjectionable observations. First, because of Friedman's long and variable lags, monetary policy should be—and, at the Fed, is—forward looking. Policy decisions made today will have no effect on today's inflation or unemployment rates, so good policy needs to assess where the economic fundamentals are going tomorrow to calibrate appropriate policy today. Of course, financial markets are also forward looking. An asset's value today depends upon its expected future cash flows discounted by a rate that reflects the expected path of the policy rate plus an appropriate risk premium. Thus, central banks and financial markets are looking at the same data on macro fundamentals to make inferences about the future path of the economy, and, of course, any decisions on the policy path made by the central bank will influence asset prices through the discount factor. So optimal monetary policy will (almost) always be

[1] See Ben S. Bernanke (2004), "What Policymakers Can Learn from Asset Prices," speech delivered at the Investment Analysts Society of Chicago, Chicago, April 15, https://www.federalreserve.gov/boarddocs/speeches/2004/20040415/default.htm.

[2] The views expressed are my own and not necessarily those of other Federal Reserve Board members or Federal Open Market Committee participants. I thank Dan Covitz and Eric Engstrom for their assistance in preparing these remarks.

correlated with asset prices. Correlation is not evidence of causation, and the hall of mirrors problem at its essence is about inferring causation from correlation.

Second, because key variables that are crucial inputs for conducting monetary policy—such as r*, u*, and expected inflation, to name just three—are both unobserved and time varying, responsible monetary policy requires informed views about how these variables evolve over time as well as a humility and an appreciation for the uncertainties surrounding baseline views, however well informed they might be.

Third, when trying to make an inference about unobserved variables like r* or expected inflation, it is generally a good idea to seek data from multiple signals correlated with the variable of interest, so long as the signals themselves are not perfectly correlated with one another. Think of this third unobjectionable observation as a sort of "model averaging" or "triangulation" principle of robust inference in a noisy and complex environment.[3]

Data Dependence

As I have written before, monetary policy needs to be—and, at the Fed, is— "data dependent" in two distinct ways.[4] Policy should be data dependent in the sense that incoming data indicate the *position* of the economy relative to the ultimate objectives of price stability and maximum employment. This information on where the economy is relative to the goals of monetary policy is an important input into standard interest rate

[3] See Bruce Hansen (2007), "Least Squares Model Averaging," *Econometrica*, vol. 75 (July), pp. 1175–89. On triangulation, see Robert Bogdan and Sari Knopp Biklen (2006), *Qualitative Research in Education: An Introduction to Theory and Methods*, 5th ed. (Boston: Pearson Allyn & Bacon).

[4] See Richard H. Clarida (2018), "Data Dependence and U.S. Monetary Policy," speech delivered at the Clearing House and the Bank Policy Institute Annual Conference, New York, November 27, https://www.federalreserve.gov/newsevents/speech/clarida20181127a.htm.

feedback rules, such as those introduced by John Taylor in 1993 and ones that continue today to inform monetary policy decisions at the Fed and at other central banks.[5]

Monetary policy, however, also needs to be data dependent in the second sense—that incoming data contain signals—that can enable the central bank to *update* its *estimates* of r* and u* in order to obtain its best estimate of the *destination* to which the economy is heading. As I mentioned a moment ago, a challenge for policymakers is that key variables that are essential inputs to monetary policy—such as u*, r*, and expected inflation—cannot be observed directly and must be inferred from observed data. And as is indicated in the Summary of Economic Projections, Federal Open Market Committee (FOMC) participants have, over the past seven years, repeatedly revised down their estimates of both u* and r* as unemployment fell and as real interest rates remained well below previous estimates of neutral without the rise in inflation those earlier estimates would have predicted. I would argue that these revisions to u* and r* indicate that the FOMC has been data dependent in this second sense and that these updated assessments of u* and r* have had an important influence on the path for the policy rate actually implemented in recent years. Indeed, had the Fed not been data dependent in this second sense and remained closed to the possibility that the economy had changed and historical estimates of r* and u* needed to be revised, that stubbornness would have represented a material policy mistake.

In addition to u* and r*, an important input into any monetary policy assessment is the state of inflation expectations. One of the robust messages from the DSGE (dynamic stochastic general equilibrium) literature on optimal monetary policy is that,

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[5] See John B. Taylor (1993), "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, vol. 39 (December), pp. 195–214.

away from the effective lower bound, optimal monetary policy will not eliminate all inflation volatility—there are always shocks—but will, under rational expectations (RE), deliver average, and under RE, expected, inflation equal to the target. Since the late 1990s, inflation expectations appear to have been stable and well anchored in the neighborhood of our 2 percent goal. However, like r* and u*, inflation expectations are not directly observable and so must be inferred from data. But which data?

Financial Data and Monetary Policy

Let me now discuss in more detail how I use a form of model averaging to combine financial market data with data from surveys and econometric models to inform my thinking about the evolution of two key inputs to monetary policy: r* and long-run expected inflation. To be sure, financial market signals are noisy, and day-to-day movements in asset prices are unlikely to tell us much about the cyclical or structural position of the economy, let alone r* and expected inflation. However, persistent shifts in financial market conditions can be informative. Signals derived from financial market data, when combined with signals revealed from surveys of households and firms along with the filtered estimates from econometric models, can together provide valuable and reasonably robust foundations for real-time inference about the direction of travel in r* and expected inflation.

For example, a "straight read" of interest rate futures prices provides one source of high-frequency information about the destination for the federal funds rate expected by market participants. The destination for the federal funds rate implied by a straight read of futures prices is in turn the sum of the market-implied r* plus market-implied expected inflation. But these signals from interest rate futures are only a pure measure of the

expected policy rate path under the assumption of a zero risk premium. For this reason, it is useful to compare policy rate paths derived from market prices with the path obtained from surveys of market participants, which, while subject to measurement error, should not be contaminated with a term premium. Market- and survey-based estimates of the policy rate path are often highly correlated. But when there is a divergence between the path or destination for the policy rate implied by the surveys and a straight read of interest rate derivatives prices, I place at least as much weight on the survey evidence—for example, derived from the surveys of primary dealers and market participants conducted by the Federal Reserve Bank of New York—as I do on the estimates obtained from market prices. Finally, as another reality check, I, of course, always consult the latest estimate of r* produced by the Laubach and Williams (2003) unobservable components state-space model, which, I should point out, includes no information on asset prices other than the short-term nominal interest rate itself.[6]

Quotes from the Treasury Inflation-Protected Securities (TIPS) market can provide valuable information about both r* and expected inflation. TIPS market data, together with nominal Treasury yields, can be used to construct measures of "breakeven inflation" or inflation compensation that provide a noisy signal of market expectations of future inflation. But, again, a straight read of breakeven inflation based on TIPS curve forward real rates needs to be augmented with a model to filter out the liquidity and risk premium components that place a wedge between inflation compensation and expected inflation.

[6] See Thomas Laubach and John Williams (2003), "Measuring the Natural Rate of Interest," *Review of Economics and Statistics*, vol. 85 (November), pp. 1063–70.

It is again useful to compare estimates of expected inflation derived from breakeven inflation data with estimates of expected inflation obtained from surveys—for example, the expected inflation over the next 5 to 10 years from the University of Michigan Surveys of Consumers. Market- and survey-based estimates of expected inflation are correlated, but, again, when there is a divergence between the two, I place at least as much weight on the survey evidence as on the market-derived estimates. Again, here I also consult time-series models of underlying inflation, such as Stock and Watson (2007) and Cecchetti and others (2017), presented at the U.S. Monetary Policy Forum in 2017.[7] At the Fed, the staff have estimated a state-space model decomposition of the common factor that drives a number of different measures of inflation expectations. State-space econometrics is one formal way to do model averaging. As I look at all of this evidence from market signals, surveys, and econometric models, I judge that inflation expectations reside at the low end of the range I consider consistent with our price-stability goal of 2 percent personal consumption expenditure inflation in the long run.

In both of the examples I have just discussed, the medium-frequency evolution of market-based, survey-based, and model-based estimates of r* and expected inflation have, over time, tended to move broadly together. When high-frequency market signals diverge from the survey- and model-based estimates, the potential benefit from increasing the weight on a signal derived from a forward-looking asset price versus backward

[7] See James H. Stock and and Mark W. Watson (2007), "Why Has U.S. Inflation Become Harder to Forecast?" *Journal of Money, Credit and Banking*, vol. 39 (s1, February), pp. 3–33; and Stephen G. Cecchetti, Michael E. Feroli, Peter Hooper, Anil K Kashyap, and Kermit L. Schoenholtz (2017), *Deflating Inflation Expectations: The Implications of Inflation's Simple Dynamics*, report prepared for the 2017 U.S. Monetary Policy Forum, sponsored by the Initiative on Global Markets at the University of Chicago Booth School of Business, held in New York, March 3, https://research.chicagobooth.edu/%7E/media/806fc2ded9644b5da99518d2b07cc637.pdf.

estimates from models and slowly evolving surveys must be balanced against the cost of treating the noise in the asset price as a signal. There is no unique way to do this, and judgment is required.

In conclusion, while my colleagues and I are attuned to the potential for a hall of mirrors problem, in my experience this affliction is one the Federal Reserve guards against and does not suffer from. My colleagues and I do look at developments in asset markets, but never in isolation and always in the context of balancing asset market signals with complementary signals from surveys and econometric models. It is fair to say that when signals from all three sources line up in the same direction—as, for example, has been the case with market-, survey-, and model-based estimates of r*—the effect of those combined signals, at least on my thinking about the policy path, is more material than when the signals provide conflicting interpretations.

Thank you for your attention. I look forward to hearing from the other panelists and to our discussion.