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Monetary Policy Without a Working Theory of Inflation

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Introduction

My appointment to the Board of Governors of the Federal Reserve in January 2009 came about principally because of my academic work in financial regulation and, to some extent, because of the experience I had as a White House economic policymaker during the Asian Financial Crisis. Although I had picked up some macroeconomics in that and other policymaking jobs over the years, and had worked on labor market issues both in and out of government, I was far from immersed in monetary policy theory or practice.

Needless to say, this relative unfamiliarity was a handicap in the early period of my service on the Fed, particularly since the extra hours I wanted to devote to background reading were at a premium, given the realities of an ongoing financial crisis and my new responsibilities in financial regulation and supervision. But the handicap turned out to be smaller than I might have thought. In part, this was because of then-Chairman Bernanke's generosity in providing what was in effect a monetary policy tutorial on Saturday mornings, when the two of us were usually at the Board. Another part was because the crisis and ensuing recession had called forth a range of "unconventional" policy responses that meant even monetary policy veterans were travelling through unknown policy regions.

In fact, by the time I left the Fed after more than eight years, I had come to believe that my lack of prior involvement in monetary policy had proven in one respect to be something of an *advantage* for my participation in FOMC deliberations. Coming fresh to a place where much of the discourse was accepted or assumed by the very smart economists on the FOMC and the Fed staff helped me to see where some of that received wisdom was not holding-up well in the circumstances we were facing. That perspective also led me to see how some well-worn tools or concepts in monetary policy that rely on unobservable variables had perhaps been less useful even before the onset of the financial crisis. The most important of these – which I will discuss at some length later – is the concept of inflation expectations, which has played a central role in mainstream monetary policy thinking and practice.

In this paper, I will explain two conclusions that I drew from my experience. One is a substantive monetary policy point, and the other is more of a sociological observation relevant to the monetary policy-making process. The substantive point is that we do not, at present, have a theory of inflation dynamics that works sufficiently well to be of use for the business of real-time monetary policy-making. The sociological point is that many (though certainly not all) good monetary policymakers who were formally trained as such have an almost instinctual attachment to some of those problematic concepts and hard-to-estimate variables.

To be clear up front: This is *not* an emperor-has-no-clothes story. My macroeconomist colleagues on the FOMC were hardly impervious to the problems with some of the models, correlations, curves, and laws that are the analytic equipment of monetary policy. Many were themselves asking questions and contributing significantly to efforts to develop new explanations for what we were seeing, rather than just

trying to force the data into pre-existing concepts.[1] Moreover, of course, much of that analytic equipment, as well as the technical expertise that lies behind it, is both sound and essential for formulating intelligent monetary policy. But at times, the macroeconomists seemed to display an almost paradoxical coincidence of intellectual doubt and continued affirmation of the utility of some unobservables.

In the last section of the paper, I will suggest some implications of my two observations. As to substance -- my own sense is that many of the concepts invoked in monetary policy, at least in the present state of knowledge, are more directional indicators in assessing the economy than guides to individual policy decisions. Going forward, monetary policy decisions will need to be made with as much, if not more, emphasis on the constellation of observable indicators with which the FOMC is confronted. As to process – I think my experience argues for a conscious effort to assure some diversity of experience and intellectual background on the FOMC. But it also argues for macroeconomists continuing to play a decidedly leading role.

Focus on the Unobservables

The dual mandate in the Federal Reserve Act instructs the FOMC to seek "maximum employment" and "stable prices."[2] In both popular parlance and Fedspeak, those goals are today generally understood to mean a low unemployment rate and an inflation rate near the Fed's stated 2% target. These two metrics are observable, though the question of whether a historically low unemployment rate is equivalent to "maximum" employment introduces some complications. Thus, with the important qualification that fiscal policy has a big impact on the potential for a well-run monetary policy to simultaneously achieve low unemployment and inflation of about 2%, these observables provide a basis for evaluating how the Fed is performing is statutory role.

Most of the time, however, those observable metrics are not themselves the most important considerations in setting monetary policy. This is because monetary policy decisions are rightly made based on what those metrics are expected to be in the future. To take an obvious example, if a large negative demand shock has just appeared, the fact that unemployment and inflation are currently at desirable levels tells the FOMC very little about what it should do. Since much of the impact of a change in monetary policy operates with a lag, the FOMC must predict, absent a policy change, the levels of employment and inflation that would be observed somewhere between a few months and a few quarters from the time of each of its meetings. Then it must predict how that outcome would change were the

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1. Indeed, one of the most thorough, recent critiques of central bank analysis of inflation was co-authored by a former senior staff advisor to the Board of Governors. Jon Faust and Eric M. Leeper, "The Myth of Normal: The Bumpy Story of Inflation and Monetary Policy," in Federal Reserve Bank of Kansas City, *Economic Symposium Proceedings 2015*, at 263-340, https://www.kansascityfed.org/~/media/files/publicat/sympos/2015/2015faust_leeper.pdf?la=en.

2. Section 2A of the Federal Reserve Act, codified at 12 U.S.C. 225a. In fact, Section 2A contains a third goal – that of "moderate long-term interest rates." Traditionally, the Fed has not interpreted this as the third element of a tri-mandate.

FOMC to increase or reduce the federal funds rate (or, in today's world, change the size or composition of the Fed's balance sheet).

Here is where the unobservables come in. The predictions that FOMC members make about the near (or nearish) future rest substantially on a range of data that is impractical to measure directly and on a range of parameters that cannot be observed at all. The former type of unobservable, which includes data on variables such as productivity growth and the savings rate, is derived from measures that *are* observable. Labor productivity, for example, is calculated from data series on the amount of labor input (hours worked) and total output of goods and services. The personal savings rate is calculated by subtracting observed personal spending and taxes from observed personal income.

It is often the case that a variable calculated from multiple observed statistics is more likely to be incorrect, since an inaccuracy in *any* of the observed data series will lead to an error in that variable (though there is the serendipitous possibility that errors in several observed series will offset each other, producing a more accurate derivative variable). An inaccuracy can be either a simple reporting problem (e.g., the current tax payments of individuals were not properly recorded) or a more nettlesome measurement problem (e.g., the well-known debate as to whether output statistics used to calculate productivity growth are being properly adjusted to take account of product improvements). The latter kind of problem can be quite consequential for one's thinking about monetary policy.

Another problem with unobservables such as productivity and savings rates is that the reported derived values often bounce around a good bit from quarter to quarter. This circumstance is pretty intuitive, since one can easily imagine the behavior of firms and households that affect both unobservables varying a lot in relatively short timespans. Hence, trends for these variables may be harder to identify in the short term than in other data series. But, considering the need to make monetary policy decisions eight times a year, and the absence of a concrete alternative to the productivity number calculated by BLS, I think most FOMC members resign themselves to incorporating the BLS number into their own decision-making processes. This is with full awareness that the next quarter's numbers may look considerably different, even when the path of the economy appears unchanged. This is not always the case, however. Former Chairman Alan Greenspan's insight about productivity trends in the 1990s – to which I shall return later – is an instructive counterexample.

The second group of unobservables is composed of parameters that are not data at all, but are instead conceptual constructs. From this group of unobservables, I am going to focus on the following concepts that are effectively incorporated into three of the four "longer-term" projections that each FOMC participant makes quarterly, and that are now reported in the Summary of Economic Projections (SEP) that accompanies the FOMC statement in March, June, September, and December: (1) potential GDP growth, (2) the "natural rate" of unemployment, and (3) the "neutral" or "equilibrium" real rate of interest, conventionally denominated as r*. I should note that the definitions of these concepts that I am about to provide are not "official" Fed definitions. Fed staff tend to adopt consistent definitions of these and other concepts in their own work, but as explained below, the terms of the SEP call upon these concepts without ever quite defining them.

Potential GDP growth, sometimes referred to as "trend" growth, denotes the pace of growth that the economy would achieve if it were operating at full employment with a stable inflation rate.[3] The difference between potential output and actual output is the "output gap." In recessions, when output decelerates significantly, a "negative" output gap grows, indicating the difference between the amount of goods and services the economy has actually produced versus what it would have produced if potential output had been achieved grows.

The "natural rate" of unemployment is generally considered to be the rate which would prevail in the absence of cyclical fluctuations in aggregate demand. The natural rate incorporates the frictional unemployment of workers moving among jobs, as well as the structural unemployment associated with such factors as skill or experience mismatches between willing workers and the needs of potential employers.[4] Monetary policy-makers will, of course, assess the natural rate in the context of their goal of stable, near-target inflation.

To those outside of the monetary policy world, the neutral real rate of interest is a concept even less familiar than the first two. As its name implies, the neutral "real" rate of interest (i.e., net of inflation) is the value of the interest rate targeted by monetary policy that will provide neither stimulus to, nor restraint on, the economy. Theoretically, in the absence of any exogenous shocks, keeping policy at the neutral rate should allow an economy operating at trend to maintain that pace and leave inflation at target.

To reiterate, these are concepts, not simply data that is hard or costly to observe directly. There is a large economic literature on how to estimate the natural rate and the potential GDP growth rate, and a growing literature on how to calculate r*. But these concepts can be made into concrete values only through estimation and judgment. Long-term versions of these variables depend to a greater or lesser extent on fundamentals such as demographics, structural fiscal policy, and productivity growth. Medium- and shorter-term versions of these variables are also affected by developments that, while not of indefinite duration, can have a significant effect over a time horizon relevant for monetary policy. For example, fluctuations in the relative success of job-matching efforts during periods when the economy is changing rapidly can affect the natural rate over shorter periods. Looking (far enough) backward, economists can do a pretty good job of determining what these variables have been, as they are able to distinguish trends from noise more readily. But looking forward, and particularly over the several quarters to the several

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3. Sometimes this concept is discussed as if it were a prediction of longer-term actual growth, and sometimes as a more formal, often counterfactual estimate of the level of output that would prevail in the absence of price rigidities. But since longer-run predictions presumably hypothesize central banks pursuing sound monetary policies, these two definitions tend to converge in macroeconomic models. *See* Susanto Basu and John G. Fernald, What Do We Know (And Not Know) About Potential Output?, Federal Reserve Bank of St. Louis Economic Review, July/August 2009, 91(4), pp. 187-213.

4. The natural rate is connected, though not necessarily identical, to the concept of the non-accelerating-inflation-rate-of-unemployment (NAIRU), which is the unemployment rate consistent with maintaining stable inflation at any given period. Since "cyclical fluctuations" in aggregate demand are often, if not always, present, some economists argue that the NAIRU is more useful for practical monetary policy-making. When analysts estimate a shorter-term natural rate, the differences from the NAIRU are perhaps more technical than consequential.

years relevant for monetary policy-making, sound estimation and judgment are sometimes hard to differentiate from guesswork in attempting to see through transitory developments.[5]

Technically, the SEP does not ask FOMC participants for the natural rate, potential GDP growth, or the neutral rate of interest. Instead, it instructs them to indicate the level to which the rate of unemployment, GDP growth, and the federal funds rate would "converge under appropriate monetary policy and in the absence of further shocks to the economy." The fourth longer-term variable is the inflation rate, but that is not really a variable at all, because all members of the FOMC are expected to, and do, project that inflation over the longer term will be at the target rate of 2%.[6] Since appropriate monetary policy is presumed to maintain inflation around this target rate, and since the absence of further shocks is roughly comparable to the absence of cyclical fluctuations in aggregate demand, the SEP longer-term GDP and unemployment projections are closely related to the potential output and natural rate concepts. Indeed, one sometimes hears FOMC participants, in referring to their longer-term GDP growth or unemployment rate projections, saying that they have marked up (or down) their projection of the natural rate or trend growth rate, respectively. Each participant's estimate of r* can be calculated by simply subtracting the 2% inflation target from the value given by the participant for the longer-term federal funds rate.

Early in my tenure at the Fed, I was perplexed by the requirement that I project these longer-run values. The task of estimating the natural rate and potential growth seemed to be one that especially required formal economic training (in 2009 the SEP did not yet include a long-run federal funds rate projection.). So I spent a fair amount of time, on my own and with the help of the Fed staff, digging into the two concepts and the factors that were thought to influence the levels of these two variables. To be honest, though, I never quite understood how I could sensibly project what the post-crisis, post-recession state of the U.S. economy would look like. And, as a result, I never felt that my projections of those longer-run values were very useful, and I certainly did not place too much weight on them in thinking about specific monetary policy decisions.

What became clear in the intervening years is that I was not the only one who faced a challenge in making projections of this sort. A look at the progression of those longer-run projections by the FOMC since the 2009-2010 period reveals how substantially they have changed. The median longer-run

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5. For an interesting exercise in trying to measure the natural real rate of interest, see Thomas Laubach and John C. Williams, Measuring the Natural Rate of Interest Redux, Hutchins Center on Fiscal and Monetary Policy at Brookings Working Paper #15, November 2, 2015, https://www.brookings.edu/wp-content/uploads/2016/07/WP15-Laubach-Williams-natural-interest-rate-redux.pdf.

6. There is no inherent reason why this need be so, of course. A member of the FOMC *could* predict inflation in the longer term above or below 2%. But this prediction would sit a bit uneasily with the FOMC commitment to the 2% target. And, as I learned when I once penciled in a number other than 2% in the first version of one of my SEP submissions (before the formal FOMC adoption of the 2% target), the result of such a deviation was a visit from the staff of the Monetary Affairs Division, who explained the awkwardness that such a reported submission would have for FOMC communications and for the (then) Chairman. Because, as explained in the next, I had little confidence in the ability of anyone on the FOMC to predict where any of the key variables would be in the medium- to longer-term, and because I didn't want to complicate further an already challenging communication task for the Chairman, I changed my actual submitted number to 2%.

unemployment rate has dropped more than a percentage point from the 5.5% projected in late 2010. The median longer-run GDP growth rate has declined almost a percentage point from the 2.7% projected in late 2010, a much more dramatic change in relative terms. As to r*, the median projection of the longer-run federal funds rate has come down from 4% five years ago to 2.75% today (which translates into more than a 60% reduction in the imputed r* -- from 2% to 0.75%).

Of course, the changes in all three values reflect a striking shift in expectations for the post-crisis, post-recession U.S. economy. There has been a parallel shift in consensus views of the natural rate and potential growth from non-official-sector economists. One can hardly blame the FOMC or any of its members for not being able in 2010 to see through all that has become apparent since (and, doubtless, some additional surprises yet to come). On the contrary, I remember numerous discussions with my former colleagues trying to puzzle out how much *would* be changing in a durable, rather than temporary fashion. Moreover, the publication of these longer-term projections may be useful to outside economists and the public in understanding FOMC policy. For example, if an analyst understood that what she regarded as the excessively hawkish intentions of the FOMC, as revealed the famed "dot plot," were due to a misreading of the rate to which unemployment could fall without sparking undesirable inflation, she might conclude (and advise others) that the Fed will end up increasing rates less that it currently predicts.

I also don't believe that what now appears to be the substantial overestimations of potential growth, the natural rate of unemployment, and the neutral rate of interest had much of an impact on the actual course of monetary policy four or five years ago. In particular, there was a substantial gap between the actual rate of unemployment and what all but the most hawkish members of the Committee believed to be the natural rate. Hence, no removal of accommodation would have been indicated even for those who supposed there to be a strong inverse relationship between the rate of unemployment and inflation.

But this last qualifier does suggest a proposition that to me became stronger as the recovery continued and the economy began to approach, and eventually overtake, the now much reduced estimates of the natural rate. Recall that these variables are conceptualized as parameters rather than data. The concepts themselves necessarily involve hypotheses about the relationship of economic variables to one another – most importantly, for monetary policy purposes, the relationship of employment and output to inflation. That is, these concepts are frequently explained, or even assumed, to define an upper bound to growth and a lower bound to unemployment beyond which inflationary pressures are somewhere between likely and sure to take hold.

Over time it seemed to me that many economists in (and outside) the Committee were implicitly assuming a stronger correlation between declining unemployment and rising inflation – that is, a somewhat more robust version of the Phillips Curve – than the quite attenuated relationship that has prevailed for more than twenty years, as documented by considerable economic scholarship.[7] The

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7. The original Phillips Curve, developed in the late 1950s by London School of Economics professor William Phillips, correlated unemployment with *wage inflation,* not overall price inflation. In the 1960s U.S. economists adapted the curve to establish the trade-off between unemployment and price inflation that I still remember being taught in my undergraduate macroeconomics course. This version of the curve had a fairly steep slope. In recent years the correlation originally posited by Phillips between wage inflation and unemployment has borne up better – though by no means perfectly – than the price inflation/unemployment correlation.

flattening of the Phillips Curve has occurred not just in the United States, but also in nearly every mature economy.[8] Nearly everyone shares the intuition about the directional relationship between inflation and unemployment that is embedded in the Phillips Curve, which continues to have a positive coefficient slope, but one that is apparently much smaller than it was in the 1970s. But that intuition is not very much help in making policy decisions on a meeting-by-meeting basis.

These points are of course well understood among FOMC participants and staff.[9] And, these points became more and more apparent as the economy approached, and in the view of some surpassed, the natural rate of unemployment. Yet, inflation continued its nearly uninterrupted run below target for almost a decade. Some economists hold onto a belief that the Phillips Curve may now be substantially non-linear, and that there may accordingly be a large jump in inflation associated with very low levels of unemployment. But there's not much in the empirical record to sustain this belief.

So I was faced with an interesting situation. On the one hand, many of my colleagues – and, for that matter, many outside economists doing their own forecasts -- had a full understanding of the difficulties in accurately constructing "longer-run" variables and of the relative unhelpfulness of traditional constructs, such as the Phillips Curve, in predicting inflation. On the other hand, they often seemed to downplay those difficulties and shortcomings when approaching policy decisions. I don't have a fully satisfying explanation for this apparent cognitive dissonance, but I do have three thoughts.

First, it's important to note that to this point, at least, the FOMC's approach to removing accommodation has been an appropriately careful one. This approach has reflected a recognition that very unusual economic circumstances may have persisted well after the Great Recession technically ended, and that the combined effects of the crisis and recession may have accelerated secular changes in the economy that were already underway. Members of the FOMC often referred to these forces as "headwinds." A good deal of the credit for the success of this approach to date rests with the leadership provided by Chair Yellen. Toward the end of this paper, I shall have a little more to say about policy-making going forward.

Second, there has been a considerable analytic effort to redeem the obvious shortcomings of Phillips Curve and similar traditional analyses. Some of these efforts, such as incorporating supply shocks and exchange rates effects into the models used by the Fed, are somewhat incremental, but have clearly been helpful in avoiding policy mistakes. Another, arguably more far-reaching change has been the increased emphasis on what I regard as the most significant unobservable of all --- the concept of inflation expectations. I will turn to that issue shortly.

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8. Olivier Blanchard, Eugenio Cerutti, and Lawrence Summers, Inflation and Activity: Two Explanations and Their Monetary Policy Implications, in *Inflation and Unemployment in Europe: Conference Proceedings*, European Central Bank, ECB Forum on Central Banking, pp. 25-46, http://www.ecb.europa.eu/pub/pdf/other/ecbforumoncentralbanking2015en.pdf.

9. Indeed, a senior economist on the Fed staff has written a widely-read assessment of the Phillips Curve and related points on inflation. Michael Kiley, Low Inflation in the United States: A Summary of Recent Research, Board of Governors of the Federal Reserve System, FEDS Notes, Nov. 23, 2015, https://www.federalreserve.gov/econresdata/notes/feds-notes/2015/low-inflation-in-the-united-states-a-summary-of-recent-research-20151123.html.

Third, I began to wonder over time whether the continued, almost instinctual attachment to past correlations between inflation and unobservable constructs, such as the natural rate and potential growth, was in part an effort to cope with the cognitive dissonance to which I alluded earlier. Unless inflation expectations can save the day, the relative unhelpfulness of these past correlations leaves the FOMC without a working theory of inflation. This, I think, is highly disconcerting for a profession that it is very attached to modelling and, by the way, makes the very reasonable point that having to identify the model that one is explicitly or implicitly using forces a more direct specification of the assumptions and presumed causal relationships that one believes are at work in the economy. In the absence of another theory that can explain the behavior of inflation, and thereby guide policymaking, I suspect that a lot of economists are reluctant to fully let go of an approach that uses the natural rate and that assumes some robustness of the Phillips Curve. It has seemed to me that some can at times be resistant to dissonant information, dismissing pieces of data as anomalous or transitory, so as to keep arguing – or at least assuming – for a Phillips Curve-inspired policy. This is more likely to happen when, as I think is the case, the basic relationship implied by the model continues to seem correct, but the coefficient is either weak or in doubt.

Inflation Expectations

Inflation expectations are a third, and arguably unique, kind of unobservable. Like the first kind, they are a form of data that is hard to observe directly. As the term implies, they are generally described simply as the expectations of the public as to where inflation will be at some point in the future. But unlike the first kind of unobservable or, for that matter, the second, they are not simply a factor or parameter that helps determine the path within which the economy is likely to head with a given monetary policy. Instead, they are believed to exert a direct effect upon the inflation rate in the economy and, most importantly for present purposes, to be significantly within the control of the central bank.

The presumed role of inflation expectations has become crucial to central bank thinking about inflation dynamics: “Well-anchored inflation expectations” is a phrase that echoes through the halls and the Board room at the Federal Reserve. I came to appreciate the concept, and all the work by economic researchers and policymakers that lay behind it. But a lot of that research reflects just how many gaps there are in the theory of inflation expectations. There are, if anything, even more gaps in understanding the practicalities of how to use inflation expectations as a key determinant of real-time monetary policy decisions.

While expectations had long played a part in monetary policy theory and practice, the steadily increasing emphasis on inflation expectations has occurred in no small part from, first, the breakdown of the presumed unemployment/inflation trade-off in the stagflation of the 1970s and, next, the flattening of the Phillips Curve in the subsequent period. Together, these developments suggested that changes in resource utilization mattered less than what they used to in affecting the near to medium-term inflation rate. The other side of this story was that the medium-term trend of inflation seemed to be moving around less than during the high inflationary period of the later 1960s through the early 1980s. That is,

economic shocks of all sorts seemed to be affecting actual inflation less than before. The trend had become better "anchored."

There were numerous possible explanations for this shift in the dynamic of inflation – which occurred not just in the U.S. economy, but in other mature economies as well. The one that seemed to fit best with what economic studies could observe was that the expectations of the public as to what inflation would be in the future had firmed up considerably, though they were still subject to some fluctuation. This finding, in turn, suggested that if economic actors were basing their economic decisions at least in part on the inflation rate they expected, then a better anchored set of expectations should lead to behavior consistent with inflation around that level. If a business didn't anticipate that inflation would accelerate, for example, it would take that expectation into account in setting its prices going forward. A shock to the economy might have a temporary effect on inflation, but once the shock had diminished or the economy had adjusted to it, its impact on inflation would fade.

But why did the public shift towards a stronger expectation that future inflation would remain closer to the central bank's target? Again, there were numerous possible explanations, but the one that became dominant was that credit lay with the central bank itself. The resolve of the Federal Reserve and other central banks in combatting inflation in the very late 1970s and into the 1980s was presumed to have convinced the public that – unlike the earlier period – central banks were now firmly on task, and that they would do what it took to keep inflation relatively close to their stated (or implicit) target.

This conclusion, while admittedly containing a bit of self-congratulation when reached by central bankers, was certainly logical, though it has not been verified empirically (something that doubtless would be very hard to do). But one can see how important the conclusion is for a contemporary central bank's understanding of its mission. It gives the central bank a tool to help control inflation by emphasizing, and where necessary acting upon, its commitment to stabilize inflation around target. To be effective, the central bank must ensure that those all-important inflation expectations do not become "unanchored," presumably to prevent the public from losing faith in that commitment.

Economists had incorporated expectations into their models of the Phillips Curve, producing numerous "expectations-augmented" Phillips Curves, some of which seemed to fit experience better than the original Phillips Curve. There has been, I should note in passing, both substantial variation in these Phillips Curves and some significant disagreement among their respective proponents.[10] But the details of that important, complicated history are less important for present purposes than the fact that the expectations-augmented models most looked at by the Fed (and many others) still broke down during the Great Recession. Unlike in the mid-1970s, when double-digit unemployment was associated with a significant decline in the inflation rate, the 10% unemployment reached in 2009 was associated with only a modest decrease. This outcome was at odds with the so-called "accelerationist" Phillips Curve, which posited that inflation should fall if unemployment was above the natural rate (which everyone agreed it was in 2009). It was also at odds with the intuitions not only of most macroeconomists, but of most of us

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10. For a comprehensive review of the competing strands of the economic literature since the mid-1970s, see Robert J. Gordon, The History of the Phillips Curve: Consensus and Bifurcation," *Economica*, 78(1), pp. 10-50 (2011),

non-macroeconomists who had paid reasonably close attention to economic policy over the last few decades.

One key explanation offered for the relative stability of inflation, in the Fed and elsewhere, was precisely that inflation expectations had become *really* well-anchored in the period since the end of the high inflationary period twenty years previously. The persistence of inflation at quite stable levels, as well as the growing credibility of the Federal Reserve that it would maintain that state of the world, were together assumed to convince households and businesses that deflation would not take hold – presumably, because of actions by the Fed itself.

In my pre-Fed academic work on sovereign debt crises, I had the occasion to delve into some of the inflation-targeting literature, which had given me some exposure to inflation expectations concepts. But I had not been nearly conversant enough with the concept to see how important the presumed explanatory power of inflation expectations had become. And, as we meet today, there is certainly a plausible case for that account of why we avoided more downward pressure on inflation. Yet even if that account is valid, and if well-anchored inflation expectations really were central to maintaining price stability, that fact alone doesn't tell us what effect they may have in the future. Most importantly, in the near term, how much confidence should we have in the belief of some monetary policymakers that well-anchored expectations will help pull inflation up to 2% after all these years in which inflation has come in under target? Over my time at the Fed, I came to worry that inflation expectations are bearing an awful lot of weight in monetary policy these days, considering the range and depth of unanswered questions about them. I am going to discuss three.

First, in keeping with my theme of unobservables, is the question of how to measure inflation expectations, which are obviously not directly discernable. The Fed looks at quite a few different measures of expectations: During my time on the Board, most emphasis was given to the Survey of Professional Forecasters, the Michigan survey of consumer expectations, and several market-based indicators derived from the pricing of financial instruments.[11] Note that while there are measures for the expectations of professional economists, consumers, and financial market traders, there are no well-established measures for the expectations of those who set prices charged by non-financial firms.[12] The practical difficulties of surveying what is almost surely a collective function in any sizeable business probably loom large here. But the absence of a well-established metric of this sort in the Fed's trove of data does seem to be a notable limitation on the practical usefulness of expectations, even apart from theoretical problems.

Each of the measures that were highlighted in staff briefings carries its own problems. The economists who respond to the survey of professional forecasters obviously do not themselves constitute a significant source of economic activity. So, the import of this series for the direct impact of inflation expectations can lie only in its possible effects on market actors' own expectations (though, as with the

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11. The staff also followed the Blue Chip survey, the Federal Reserve Bank of New York's consumer survey, and the Primary Dealers Survey.

12. The Federal Reserve Bank of Atlanta now conducts a one-year-ahead survey of business inflation expectations, but it has not been running for very long.

forecasts themselves, it provides a useful point of comparison for the Fed). Consumer surveys have the well-known problems of surveys generally, including whether responses to the surveys reveal the beliefs that motivate the questions. There is also the problem that the use of medians in the results of these surveys can mask significant cross-sectional dispersions of expectations.[13] While the market-based indicators are obviously precise and very much measurable as they are defined, it is well-recognized that the price of even a financial instrument premised on future inflation, such as Treasury Inflation-Protected Securities (TIPS), is influenced by the liquidity of each particular issue and the inflation risk premium, as well as by anticipated inflation compensation.

Second, what is the mechanism by which inflation expectations affect actual prices? We can all agree, I think, that any market actor's expectations about inflation could influence that actor's behavior in setting or accepting a price, wage, or investment return. But there are obviously lots of other influences, and I never saw a strong account that was intuitively appealing – much less empirically verified – as to how the actual transmission mechanism operated. In looking around the Internet at outlines or slides from college macroeconomics courses, I was struck that the illustration to which teachers seemed to gravitate was collective bargaining. In that context, it is at least moderately intuitive that union and industry negotiators would incorporate their expectations into their bargaining positions for multi-year wage agreements, although – again – how important that factor is remains unclear. But in an economy where only about 10% of the workforce (and less than 7% of the private workforce) is unionized, even the arguable plausibility of this account doesn't take you too far.

On this same point, some staff at the Fed mentioned to me their impression that a theory giving a prominent role to expectations doesn't line up too well with how many businesses describe their own method for establishing and changing prices. In the most non-systematic of ways, I tried out that notion on a number of non-financial business people and found it to indeed be the case. The accounts I heard differed somewhat, as one would expect, but "what the market would bear" always seemed to come out well on top of inflation expectations, which I sometimes had to introduce into the conversation.[14] Again, one can see the relationship between expectations of what the market will bear and inflation expectations, but it is a complicated one that does not give the kind of clean account that would be desirable in seeking to understand how expectations affect actual inflation.

Third, how and why do expectations change? Most central bankers would agree, I think, that while expectations became quite well anchored in the two decades following the high inflationary period of the 1970s and early 1980s, they are not immoveable. What does it take to make them shift? More importantly, assuming we could get comfortable that there was some consistency in the surrogates used

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13. See Gregory Mankiw, Ricardo Reis, and Justin Wolfers, Disagreement About Inflation Expectations, *NBER Macroeconomics Annual 2003,* at pp. 209-248.

14. Saten Kumar and his co-authors conducted a survey of firm managers in New Zealand and found little evidence that their inflation expectations were anchored, that they were aware of the policies of the Reserve Bank of New Zealand, or even that they were aware actual recent inflation dynamics. Saten Kumar, Olivier Coibion, Hassan Afrouzi, Yuriy Gorodnichenko, "Inflation Targeting Does Not Anchor Inflation Expectations: Evidence from Firms in New Zealand," *Brookings Papers on Economic Activity*, Fall 2015, pp. 151-208, https://www.brookings.edu/wp-content/uploads/2015/09/KumarTextFall15BPEA.pdf.

for measuring expectations, how *big* a change in those metrics would be needed for it to be significant in affecting future inflation? That is, what does it take to shift expectations enough that they become "unanchored," and thereby have greater supposed influence on behavior and, eventually, inflation? The theory would suggest that the answer lies somewhere at the nexus of actual inflation experience and the credibility of the Fed with respect to future policy. Even at a theoretical level, though, there's not much of a detailed response.

For several years, the consumer and market measures have been hovering around the low ends of historical ranges. Is remaining at this low end for an extended period enough to have an effect going forward? For the last several years, some economists – including Narayana Kotcherlakota, former President of the Minneapolis Fed – have been warning that the Fed's failure to reach its target, except for a few fleeting moments, in what is now nine years may be having an effect. That is, the presumed direction of causation may be backwards: Lagged inflation may be affecting expectations as much or more than current expectations are affecting future inflation. Others disagree. But just as there's nothing approaching a consensus narrative on how expectations affect actual behavior that in turn affects prices, there is nothing approaching a consensus on what leads to the "unanchoring" of expectations that have previously been established.

In sum, the concept of inflation expectations is quite undertheorized and hard to pin down empirically.[15] It "works" as an explanation for why we did not experience deflation in the face of the worst economic downturn since the Great Depression. But there are alternative explanations that also "work," at least in part: One is downward nominal wage rigidity. Another is that much of the unemployment in the wake of the Great Recession was longer-term, which historically has placed less downward pressure on wages than high short-term unemployment rates.[16]

A lot of academic and policy economists have spent a lot of time trying to answer these questions, and they have produced the beginnings of some answers. There have been careful studies trying to match particular hypotheses and measures of expectations with actual inflation experience.[17] For example, one recent paper concludes that – for all the shortcomings of survey measures – consumer expectations

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15. Strictly speaking, there *are* theories, but in the absence of empirical support they look more like conjecture. For a review of some of these ideas, see Olivier Coibion, Yuriy Gorodnichenko & Rupal Kamdar, "The Formation of Expectations, Inflation and the Phillips Curve," NBER Working Paper 23304, March 2017, http://www.nber.org/papers/w23304.

16. My own intuition is that the nominal wage rigidity hypothesis had more explanatory value than the long-term/short-term hypothesis. But the latter continues to be productively debated and may well be either validated or undermined in a way useful to policymakers. For an argument combining the expectations and short-term unemployment hypotheses, see Laurence Ball and Sandeep Mazumder, A Phillips Curve with Anchored Expectations and Short-Term Unemployment, IMF Working Paper WP/15/39, February 2015, https://www.imf.org/en/Publications/WP/Issues/2016/12/31/A-Phillips-Curve-with-Anchored-Expectations-and-Short-Term-Unemployment-42735.

17. For a recent review of some of this work, see Jeremy Nalewaik, "Inflation Expectations and the Stabilization of Inflation: Alternative Hypotheses," Finance and Economic Discussion Series 2016-035, Board of Governors of the Federal Reserve System, April 21, 2016, https://www.federalreserve.gov/econresdata/feds/2016/files/2016035pap.pdf.

"provide the best fit" for predicting inflation in recent years.[18] Another paper, after trying to remove the inflation risk premium from TIPS prices, concluded that the remaining, "pure" expectations component was correlated reasonably well with inflation.[19] As promising as some of this work may be, a lot remains unknown or uncertain. Indeed, other work continues to raise questions. To take just one example, a recent staff paper from the Federal Reserve Board calls into question just how aware consumers are of inflation developments.[20]

The theory has still not been elaborated to explain convincingly both the mechanism by which expectations affect behavior and what it takes to change expectations. Until it has, and until there is at least some empirical support for the elaborated theory, I will continue to be uneasy with placing too much confidence in the efficacy of inflation expectations in making monetary policy. Thus I have been hesitant to rely on "well-anchored inflation expectations" to help pull inflation back up to 2%, as some have argued will be the case. We just don't know enough to accept or reject that proposition. And, although we do not currently face a high risk of rapidly increasing inflation, in different circumstances we will have to be hesitant to rely too much on well-anchored expectations from keeping inflation from rising well above its target.

Policy Implications

The problems with inflation expectations theory and practice feed back into the longstanding problems in making successive iterations of the Phillips Curve work prospectively. The Phillips Curve, which embodies the core assumption of a trade-off between unemployment and inflation, has had to be more or less continually revised in light of new economic developments. As Jim Stock and Mark Watson noted in 2010, the history of Phillips Curve "inflation forecasting… is one of apparently stable relationships falling apart upon publication."[21] On the basis of an exhaustive review of the econometric literature on the New Keynesian Phillips Curve, Jim and other co-authors have concluded in more recent work that research in this area over the last twenty years has reached its limit. They also suggest that new identification

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18. Coibion et al., op. cit.

19. Michael Abrahams, Tobias Adrian, Richard K. Crump, and Emanuel Moench, "Decomposing Real and Nominal Yield Curves," Federal Reserve Bank of New York Staff Reports, no. 570 September 2012; revised February 2015, https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr570.pdf.

20. See Claudia Sahm and Jason Sockin, "'Limited Attention' and Inflation Expectations of Households," Board of Governors of the Federal Reserve, FEDS Notes, October 19, 2016, https://www.federalreserve.gov/econresdata/notes/feds-notes/2016/limited-attention-and-inflation-expectations-of-households-20161019.html.

21. James Stock and Mark Watson, "Modelling Inflation After the Crisis," National Bureau of Economic Research Working Paper 16488, October 2010, at p. 31, http://www.nber.org/papers/w16488.

approaches and datasets will be needed to develop an empirical consensus on the role of expectations in the inflation process that will be useful for policymaking.[22]

That last phrase – "useful for policymaking" – is key. After eight years at the Fed (actually, well before that) my conclusion was that there is no well-elaborated and empirically grounded theory that explains contemporary inflation dynamics in a way useful to real-time policymaking. In retrospect, this is not such a surprising realization. Forecasting is notoriously difficult, with the difficulty increasing exponentially as one's forecasting horizon lengthens. These difficulties are only compounded when the characteristics of the economy are changing significantly, or at least when we are recognizing some changes that may have been amplified and accelerated by the financial crisis and Great Recession.

In preparing to write this paper, I looked back at the file of materials that I had accumulated on inflation expectations, among which was a speech Ben Bernanke gave in 2007. In it, he explained his rejection (my word, not his) of the rational expectations model of inflation expectations in part because "the structure of the economy is constantly evolving in ways that are imperfectly understood by both the public and policymakers."[23] Ten years later, that statement is if anything, truer. Any number of pre-crisis regularities and correlations broke down in the intervening period, and it is still probably too early to say which may again look convincing and which have ceased to hold indefinitely.

So what implications for policy do I draw from my experience with the unobservables, and more specifically, the absence of a working theory of inflation dynamics that is useful for real-time policymaking? Let me offer three.

First, I think we need to be paying more attention to the observables. In recent times, that has meant placing greater emphasis on actual, observed inflation, as well as a broad array of (observable) economic factors that may be determining inflation in this specific context. It's reasonably clear now that it would have been a mistake a few years ago to begin a steady series of interest rate increases based on the assumption that the then prevailing unemployment rate was near the natural rate. Attention to the relative lack of movement in actual inflation and the variety of indicators suggesting there was considerably more slack in labor markets – such as elevated levels of involuntary part-time unemployment – argued instead for more caution in the timing and subsequent pace of interest rate increases. With the risks of a *rapid* acceleration of inflation seemingly quite small, with interest rates still relatively close to the zero lower bound, and with observed inflation still not rising closer to target, erring a bit on the side of caution in the pace of rate increases continues to be the right policy.

I recognize that this approach of somewhat downplaying the unobservables may leave some economists feeling uneasy – their own experience of becoming unanchored. For it is the unobservables that are important in economic modelling associated with quantitative forecasting. As I mentioned earlier, my years at the Fed led me to an even greater appreciation of the rigor and explicitness about

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22. Sophocles Mavroeidis, Mikkel Plagborg-Moller, and James H. Stock, Empirical Evidence on Inflation Expectations in the New Keynesian Phillips Curve, *Journal of Economic Literature*, 52(1), pp. 124-188 (2014).

23. Ben Bernanke, Inflation Expectations and Inflation Forecasting, at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts, July 10, 2007, https://www.federalreserve.gov/newsevents/speech/bernanke20070710a.htm.

assumptions that formal, or even informal, modelling brings to analysis. I found it useful to have the results from several models as a point of reference in thinking about my own policy position, because – when I found myself disagreeing with them -- they forced me to be clear with myself (and hopefully others) as to what important factors were missing. In fact, my concern was frequently not the intuition behind the models, but the precision in the models' output. The problem lies more in the coefficients than the concept. The direction of the economic variables predicted by the model is often convincing, but the idea that we know pretty accurately how much and how quickly a change in one variable (unemployment) will affect another (inflation) is not. Hence the limitations on the utility of the models for deciding when to change the target rate.

In practical terms, I think this all argues for using concepts like the Phillips Curve and inflation expectations as directional guidance, but relying more on observed indicators in deciding on monetary policy in real-time. There has been a bit of a tendency to explain away the persistence of sub-target inflation by pointing to a series of supposedly one-off factors that are holding inflation down and assuming that the continuation of a strong labor market should be pulling inflation back to target. Another explanation, of course, is that the presumed relationship between unemployment and inflation – while directionally accurate -- is sufficiently attenuated that other factors affecting inflation are playing a more important role. Accordingly, paying more attention to those other (observable) factors seems indicated.

This pragmatic approach should not be understood as simple reliance on one's gut feeling, much less on ideology. Far from it. It suggests instead a careful analysis of the myriad of factors that may be holding back (or pumping up) inflation within the broader, but less determinate, relationship defined by an inflation-augmented Phillips Curve. Considering all these uncertainties, it also seems to me that one should be placing more emphasis on actual, observed inflation rates, as opposed to expectations of where those rates are headed based on Phillips Curve-type assumptions. It is likely and probably unavoidable that, in the absence of reliably precise coefficients, policymakers will to some extent act on their predispositions. All we can ask is that they remain data sensitive, open to adjusting their views, and straightforward about their reasoning.

Interestingly, some work using models to try to provide more guidance for policy-making when uncertainty about the observables is high comes to a congruent conclusion. In a Hutchins Center paper, James Hamilton and his co-authors conclude from simulations using the FRB/US model that the substantial uncertainty around r* and the unemployment gap may argue for waiting longer to raise rates, but *once actual inflation is observed to be rising,* argue for raising rates more quickly.

It's worth noting that Fed precedent for a somewhat skeptical approach to reliance on the unobservables, and on models more generally, can be found in the person of none other than Alan Greenspan. As recounted by Alan Blinder and Ricardo Reis in their retrospective on his policies, former Chairman Greenspan "jettisoned the [Fed's] vestigial attachment to the monetary aggregates in 1993" and later "refused to accept the Phillips curve canon with a 6 percent natural rate."[24] The latter example is

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24. Alan S. Blinder and Ricardo Reis, Understanding the Greenspan Standard, in *The Greenspan Era: Lessons for the Future*, Federal Reserve Bank of Kansas City Symposium Proceedings 2005, at pp. 11-96. The quote in the text is found at p. 16.

particularly noteworthy, since it is associated with Greenspan's famous conclusion --based on his well-known practice of examining a wide range of incoming data series -- that productivity increases were running higher than the reported figures.

I should add that I think the FOMC as a whole has been moving closer over the last year and half or so to the approach I have sketched out. The sizeable markdowns in r* and the longer-term expected unemployment rate doubtless reflect the reassessment of a range of factors affecting these variables. The behavior of inflation this year has, in particular, prompted this reconsideration. Indeed, Chair Yellen's speech last week was both an acknowledgement of the gaps in everyone's understanding of inflation dynamics and an example of analysis taking careful account of the configuration of economic factors currently affecting the inflation outlook (though expectations continue to play a role). Whether one agrees or disagrees with her conclusions, her transparency in explaining her thinking is laudable.

A *second* implication is that the use of monetary policy rules as the mandatory, or even presumptive, basis for monetary policy is ill-advised. One traditional argument against such a rule has been that there is often too much of importance going on in the economy to be captured by a parsimonious rule and thus produce good policy[25] -- a description that certainly applies to the period since the onset of the financial crisis. In addition, though, monetary policy rules include what I have described as my second type of unobservable – a conceptual construct that operates as a parameter for forecasting and policy-making. The Taylor Rule, for example, requires the specification of both r* and the GDP output gap.[26] Both require judgment on the part of anyone applying the "rule." And, as we have seen, most forecasters in and out of the Fed have significantly changed their estimates of both those variables in just a few years. Thus, even if the rule were in some abstract sense "right," and factors other than current inflation, the output gap, and r* were not significant enough to undercut the utility of the rule, material misspecifications of those variables could still lead to suboptimal policy.

Third, monetary policy will need to confront the likelihood that we may be in for an indefinite period in which no Phillips Curve or other model will be a workable guide to policy. Blinder and Reis draw attention to former Chairman Greenspan's view, which could be understood as saying that this is a permanent state: "The economic world . . . is best described by a structure whose parameters are continuously changing. . . . An ongoing challenge for the Federal Reserve . . . is to operate in a way that does not depend on a fixed economic structure based on historically average coefficients."[27] Even if one does not go so far, and believes that there may be periods in which such coefficients are useful predictors for a time, we are clearly not currently in such a period.

I should be clear that I think it very worthwhile for economists to continue working to try to establish useful coefficients, even if they turn out much of the time to do a better job of describing what *has*

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25. The Fed has recently provided a good statement of the reasons for limiting the use of monetary policy rules. Board of Governors of the Federal Reserve, Monetary Policy Report, July 2017, at pp. 36-39.

26. The Fed explains its use of monetary policy rules using the difference between the natural rate and observed unemployment because that measure of economic slack better aligns with its statutory dual mandate. Of course, estimation of the natural rate also requires the kind of judgment – and has also been characterized by recent significant errors.

27. Blinder & Reis, op. cit. at 17.

happened than what *will* happen. At the least, elucidation of the relationships that have prevailed in the recent past can help place present policymaking decisions in a richer context. But even if some have value beyond the purely heuristic, it seems unlikely that there will much permanence to any, at least in any strong quantitative sense.

All this poses a challenge for the Fed. Even as I and many others reject the use of monetary policy rules in a mandatory or strong sense, it is important to note that a good bit of the motivation for those rules is to provide some measure of monetary policy predictability to market actors and some basis for assessing the Fed's approach in using the substantial authority delegated to it by Congress. My suggestion that, even short of a rule, it is not feasible to rely on coefficient-driven approaches to monetary policy for the foreseeable future places the issues of predictability and accountability in even sharper relief. The importance of a coherent and cohesive communication strategy from the Fed to explain its reasoning and policies becomes even greater. But this is a subject for another paper.

Let me close with a few comments on the institutional implications of all this, specifically as it pertains to the optimal composition of the FOMC. It will come as no surprise that I find value in having a voice or two on the FOMC coming from an analytic tradition other than macroeconomics and monetary policy to provide an outside, critical perspective on the learning and accepted wisdom within monetary policy. Needless to say, that tradition need not be legal academia. Ph.D. economists with other specialties such as labor markets or international economics may bring a useful questioning perspective while having some of the technical training to make their inquiries concerning monetary policy tools even more pointed. And I have long thought that the FOMC is missing an important voice from non-financial business. Based on my conversations with some of the very perceptive CEOs who served as chairs or vice chairs of the regional Reserve Banks, I believe such a person would bring insight on issues such as pricing, investment planning, and hiring intentions that would complement the analysis produced by Fed staff.

Notwithstanding the desirability of ensuring some diversity of analytically critical voices on the FOMC, my strong view is that the weight of the Committee should remain with those long immersed in monetary policy (without becoming enthralled to models). These individuals will mostly have been formally trained as macroeconomists, though the group might include a few with different educational backgrounds who have worked in monetary policy long enough to have acquired and displayed a similar breadth of knowledge and some measure of econometric facility. Paradoxically, the absence of a working theory of inflation dynamics only reinforces my view, particularly when it comes to the leadership of the Fed. Were there something like a Phillips Curve providing reasonably good guidance on monetary policy decisions, one or more capable non-specialists would have a sound starting point for monetary policy. But, in current circumstances, it is more important than ever to have leaders of the Fed who can call upon a deep knowledge of the history and theoretical evolution of monetary policy in assessing contemporary economic conditions, and who have the competence to evaluate the continuing efforts to devise correlations and coefficients that might inform contemporary monetary policy decisions.

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