FOMC Fed Funds Rate Responses Distinguish Persistent Fluctuations from Other Fluctuations

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January 31, 2018

JEL Classification Codes: E52, C22, C32

Keywords: Taylor Rule, Great Inflation, Intermediate Target, Natural Rate, Persistence Dependence

Acknowledgement: The authors would like to thank, without implicating, Todd Clark, Ed Knotek, Jeff Fuhrer, Kurt Lunsford, Christian Mathes, Filippo Occhino, Giovanni Olivei, Ellis Tallman, and participants at the Cleveland Fed Brownbag. We have also benefitted from previous conversations with Marianne Baxter, Luca Benati, John Cochrane, Rob Engle, John Geweke, and Mark Watson.The views stated herein are those of the authors and are not necessarily those of the Federal Reserve Bank of Cleveland or of the Federal Reserve System.

Abstract

We ask whether the FOMC treats persistent fluctuations in the unemployment rate, or in the inflation rate, differently from transient fluctuations when it makes its fed funds rate decisions. We do this through the lens of estimated simple policy rules

which are extended to allow for (but not impose) such distinctions.

, but ones in which we allow the FOMC to respond differently to more persistent innovations than to more transitory innovations, in each of these two variables. Our estimation method uses real-time data in these rates – as did the FOMC – and requires no *a priori* assumptions on the nature of the processes generating either the data or the natural rate of unemployment. Also, unlike other approaches, our estimation method allows for possible feedback in the relationship. We find that, while its ability improved over time, the FOMC has always distinguished persistent movements in the unemployment rate from other movements; implicitly such movements were treated as an intermediate target, and the FOMC has responded to the implied unemployment gap. However, the FOMC behavior vis-a-vis inflation changed starting with Volcker: its response to the inflation rate became much stronger, and it focused more intensely on very persistent movements in this variable. Our results shed light on the "Great Inflation" experience of the 1970s, casting doubt that bad inflation forecasts or poor estimates of slack explain FOMC behavior over that time period.

1 Introduction

1.1 Background

Following its articulation in 1992 by John Taylor (Taylor 1993), a large literature has developed around the scrutiny of simple monetary policy rules. Taylor's rule took the form

$$i_t = \alpha + \beta u_t + \varphi \pi_t + e_t \tag{1}$$

where i_t is the federal funds rate, π_t is the annualized inflation rate from period $t-1$ to period t, u_t is a trendless measure of real activity (output gap or unemployment rate) in period t, and e_t is a stationary exogenous monetary shock. There are many variants of Equation (1). Theory often suggests forward-looking versions (e.g. Clarida, Gali and Gertler (2000)); real-time lags in data collection motivate the use of lagged inflation and real activity in a backward-looking monetary policy rule (e.g. McCallum (1997)), as we formulate it here; and interest rate smoothing considerations, as well as the statistical properties of i_t, motivate adding lags of i_t to the right-hand side of (1).[1] A number of studies have used variants of Equation (1) to examine and explain the "Great Inflation" of the 1970s (e.g., Athanasios 2002) or to examine FOMC behavior over time, generally finding that the central bank's policy changed markedly starting with Volcker (see, e.g. Judd and Rudebusch (1998) or Clarida, Gali and Gertler (2000); more recent studies reaching this conclusion include Debortoli and Lakdawala (2016) and Chen, Kirsanova and Leith (2017)).[2] Some studies extend the policy rule to include other variables such as bond yields (e.g., Fuhrer and Tootell 2008 or Roskelley 2017) or stock and house prices (e.g., Aastveit, Furlanetto and Loria 2017).

Despite the intensity of the research focus, econometric studies of simple monetary policy rules like (1) almost invariably impose strong restrictions on FOMC behavior that don't make sense –

[1] Consolo and Favero (2009) argues, in the forward-looking context, that the inertia is an artifact of a weak-instrument problem for expected inflation. (As will be evident below, our methods sidestep problems with instruments and identification in forward-looking policy rules (see, e.g., Jondeau, Bihan and Galles (2004)), though information from forecasts are incorporated gracefully.) Rudebusch (2002) disagrees with the interest rate smoothing interpretation; using evidence from the term structure, he shows that monetary policy inertia is more likely due to persistent shocks that the central bank faces.

[2] Using the the time-varying parameter framework, Cogley and Sargent (2005), Kim and Nelson (2006) and McCulloch (2007) come to a similar conclusion. Not all studies reach this conclusion; e.g., Sims (2001) and Sims and Zha (2006) find that there is less evidence for significant changes in the reaction coefficients ϕ if one allows for time-varying variance in the monetary policy shock.

an imposition that threatens the resulting inference, and may render conclusions about such things as the origins of the Great Inflation suspect. What are these restrictions?

First, the specification presumes that FOMC members would respond to extremely persistent movements in the unemployment rate – likely driven by supply-side factors – in the same way that they would respond to business-cycle-driven fluctuations in that variable. As this issue is well-known, a fairly common means of addressing it is to replace u_t in Equation (1) with an "unemployment gap" $(u_t - u_t^*)$, as (for example) in McCulloch (2007).[3] To take this approach, one needs an explicit estimate of u_t^*, the time-varying "long-run normal" level of unemployment. But the selection of any particular formulation for estimation of u_t^* may itself compromise inference. For instance, if one's estimate of u_t^* derives from a two-sided filter – such as an HP filter or a symmetric moving average filter – this will distort the coefficient estimate ϕ_u (see Ashley and Verbrugge, 2009). Further, estimates of u_t^* are inherently problematic in that they are estimated very imprecisely, are subject to large revisions, and typically hinge on untested (and perhaps untestable) auxiliary assumptions about the natural-rate data generating process (such as an explicit formulation of its persistence), any or all which may well be substantially incorrect. As might be expected, then, the u_t^* estimates can vary across concepts and methods widely (see Tasci and Verbrugge, 2014). Use of an output gap instead of an unemployment gap in Equation (1), also common, does not improve matters.

In any case, selection of a particular u_t^* measure implies an assumption that FOMC members were in broad agreement about that particular measure. At least during the 1970s, that seems unlikely. The natural rate of unemployment as a concept came into popular parlance following Friedman (1968), but it was not clear how to measure it.[4] Soon afterwards, the stagflation in the early 1970s was thought to indicate shortcomings in the concept, and prompted the introduction in 1975 of a related but distinct concept, the NIRU (Modigliani and Papademos, 1975), which was later re-termed the NAIRU.[5] Textual analyses of FOMC minutes and transcripts, such as

[3]See Orphanides (2008) and Knotek et al. (2016) for a more general discussion. Other notable studies, such as Ball and Tchaidze (2002) and Detmeister and Babb (2017), do not use an unemployment gap specification.

[4]Hetzel (2017), an author who writes extensively about the historical evolution of central banking, asserts that during the 1970s there was a "general belief that 4 percent unemployment represented full employment" (p.13). Having said this, as our results indicate, such a belief would not necessarily preclude a differential FOMC response to persistent unemployment rate fluctuations.

[5]See Espinosa-Vega and Russell (1997).

Chappelle, McGregor and Vermilyea (2004) or Weise (2012), indicate that the 1970s FOMC was concerned about high and rising unemployment and was grappling with the notion of what level was sustainable, but there was nothing like a settled concept or estimate guiding deliberations. Given this fact, a better approach would be to determine from the data whether and how the FOMC was actually responding to movements in the unemployment rate. Were they, for example, responding to more persistent movements in the unemployment rate in a way that was systematically different than their response to business cycle fluctuations in that variable? Did this aspect of their behavior change starting with the chairmanship of Volcker? In this study, we apply methods that let us credibly answer this question.

Second, but equally fundamentally, the specification insists that the FOMC responds to highly transient movements in the inflation rate in the identical way that they respond to persistent fluctuations. A crucial issue in inflation measurement is noise: in the short run, measured inflation is often subject to large transitory influences, which can affect an aggregate price index for long periods. Policymakers have argued – e.g. Mishkin (2007) – that the central bank should therefore not respond to transitory fluctuations in inflation. If the assumed policy rule does not take this differential response into account, Equation (1) will again be seriously misspecified. Some analysts have attempted to address this issue by making use of so-called "core" inflation measures in Equation (1). This expedient is valid, however, only if all movements in the core inflation measure are identically persistent, which is emphatically not the case; for example, see Bryan and Meyer (2002) and Dolmas and Wynne (2008).[6] Note that the issue we raise here is distinct from whether π_t should instead enter Equation (1) in terms of an "inflation gap," where this gap is the difference between π_t and an inflation target, π^*. As in the case of u_t, ideally one would want to let the data inform us as to how the FOMC was actually responding to movements in the inflation rate – e.g., whether it was ignoring transient movements in this variable, or focusing on the most persistent movements – and whether this behavior changed with the chairmanship of Volcker.

[6] Indeed, in March 2017, a large price drop in cellular communications resulted in a notable drop in the core PCE index. This caused a twelve-month drop in year-over-year core inflation. Yet FOMC communications make it clear that this transient movement was going to be ignored. Such analysis is not new; for example, the FOMC Greenbooks in early 1969 explicitly highlighted transitory inflation fluctuations deriving from Federal pay increases – clearly the FOMC regarded these as transitory.

1.2 The Approach and Broad Findings

In this paper, we relax the aforementioned restrictions implicit in (1), and allow the data to speak as to how the FOMC historically has responded to fluctuations with various persistence levels in the unemployment rate and in the inflation rate. Our approach delivers new insights into FOMC behavior and into how it changed starting with the chairmanship of Volcker.

We estimate the central bank's assumed monetary policy rule using a new method proposed by Ashley and Verbrugge (2009b).[7] This method allows us to test whether, and quantify how, the FOMC in fact distinguished between fluctuations with differing persistence levels. Essentially, we use a one-sided filtering technique to partition the real-time unemployment rate and inflation rate into components with differing levels of persistence. It is then straightforward to determine whether the FOMC responded (in real time) to the persistent part in the same manner that it responded to the less persistent part, or to the high-frequency part. The technique is briefly described as follows (for more details, refer to the Technical Appendix here, or to Ashley and Verbrugge 2009b).

We use moving windows to filter the real-time data at each time t, partitioning the time t observation into various frequency (or persistence) components. One-sided filtering is necessary for two reasons: first, two-sided filtering cannot be conducted in real-time; and second, two-sided filtering results in distorted coefficient estimates and destroys the ability to make causal statements (except in limited cases).[8] The precision of the partitioning is substantially enhanced by extending the data in each window with forecasts or "projections" (see also Mise, Kim and Newbold (2005) or Clark and Kozicki (2005)). Thus for example, to partition the unemployment rate at time t, we apply the Ashley-Verbrugge filter to a rolling window of 96 observations ending in t, augmented with a set of 1- through 24-month forecasts, starting at time $t+1$. The Ashley-Verbrugge filter is then applied to this 120 month window, and the time-t decomposition is saved. (The inflation rate is partitioned in the same manner, except in that case, a 42-month window is augmented by

[7] The Technical Appendix describes the latest version of this method.

[8] Two-sided filters (such as the HP filter) applied to both the explanatory and dependent variables, as in classical RBC studies or in recent New Keynesian DSGE modeling, distort relationships amongst variables which are contemporaneously cross-correlated or in a feedback relationship, because two-sided filtering inherently mixes up future and past values of the time series; see Ashley and Verbrugge 2009b for a more detailed exposition of this point. For the same reason, and because such calculations are incompatible with the use of real-time data, two-sided cross-spectral estimates or filtering with wavelets should similarly be eschewed for this kind of analysis.

18 months of forecasts. We argue below why distinct window lengths for the two variables are appropriate.) Figures 1 and 2 display the resulting components of each of these two variables, in each case partitioning the data by persistence level into three persistence components.

Obviously, we are not arguing that the FOMC made use of techniques from the future in order to guide their decisionmaking.[9] Instead, what we are asking is whether the FOMC, using the tools it had on hand at various points in time (such as forecasts, judgment, various trend estimates, or detailed studies of particular unemployment rate or inflation movements), has in fact made this type of distinction in its decisionmaking. Indeed, one may note that our method uses real-time information to assist in identifying persistent versus transient movements, in roughly the same manner that an informed observer might do using judgment.[10] In particular, we are using new tools to better understand and describe the behavior of the central bank, allowing the data to inform us as to the manner in which the central bank has actually responded to fluctuations in these macroeconomic variables.

While the original Taylor-type monetary policy response function is attractive in its simplicity, our extension of it broadens its generality and descriptive power, yielding novel results. By allowing the data a chance to tell us if the FOMC treated apparently persistent fluctuations differently fluctuations that appeared to be more transient, we obtain a clearer picture of how the FOMC's actual behavior has evolved over time – e.g., how it differs for the Martin-Burns-Miller (MBM) period (roughly, March 1960 to August 1979) versus the Volcker-Greenspan-Bernanke (VGB) period (here taken to run from September 1979 to August 2008).

Our results are surprising along some dimensions, but accord well with intuition and some other accounts. There are three major conclusions. First, estimates of (1) as it stands imply that the FOMC was unresponsive to unemployment rate fluctuations in the VGB period; as we

[9] While economists were already making use of the conventional tools of spectral analysis by the early 1970s, given the early cogent critique of Granger (1969) and the relative paucity of that sort of research, it is safe to say that such methods were not at the forefront of FOMC decisionmaking in the 1970s – and indeed, still aren't.

[10] This appears to be consistent with the viewpoint of Meyer, Venkatu and Zaman (2013), who state: "By specifying the inflation threshold in terms of its forecasted values, the FOMC will still be able to 'look through' transitory price changes, like they did, for example, when energy prices spiked in 2008. At that time, the year-over-year growth rate in the Consumer Price Index (CPI) jumped up above 5.0 percent but subsequently plummeted below zero a year later when the bottom fell out on energy prices. At the time, the Committee maintained the federal funds rate target at 2.0 percent, choosing not to react to the energy price spike."

explain below, this result underscores the necessity of allowing a distinction between persistent movements in the unemployment rate versus other fluctuations. Second, by allowing the data to inform us about FOMC responses to persistent fluctuations versus higher-frequency fluctuations, our striking finding is that the FOMC did *not* seem to be struggling with mismeasurement of u_t^* in the 1970s, as some analysts have argued. Instead, the FOMC has *always* ignored extremely persistent fluctuations in the unemployment rate – which one might largely identify with natural rate fluctuations, although an "intermediate target" interpretation is possible, as we outline below – a response that stands in sharp contrast to its strong response to business-cycle fluctuations of the unemployment rate. This suggests that some previous work, which has focused on particular estimates of an output gap (rather than on an unemployment gap), may have come to erroneous conclusions about FOMC behavior in the 1970s. Our third major finding is that, in contrast to its continuity in response to the unemployment rate over both periods, the FOMC response to inflation movements changed in not just one, but two ways, starting in the VGB period. First, the VGB FOMC became more aggressive in its response to inflation – something other authors have noted (e.g., Clarida, Gali and Gertler 2000). But second, it also became much more focused on fighting the *persistent* fluctuations in inflation, and ignoring more transient movements.[11]

Our results thus shed some light on the origins of the Great Inflation. They imply that the "ideas" hypothesis – that FOMC errors in the 1970s were due to erroneous beliefs about the structure of the economy, including an unrealistically low estimate of the natural rate of unemployment (e.g., Orphanides 2002, Romer and Romer 2002, Romer 2005) – cannot fully explain FOMC policy during that time period. Our findings point in this direction because we show that FOMC behavior with respect to the fed funds rate response to the unemployment rate has remained rather stable: irrespective of any belief it may have had about the natural rate of unemployment, it has always ignored the most persistent unemployment rate fluctuations. Implicitly, the FOMC has always implicitly formed an unemployment gap in the same manner, with the lowest-frequency fluctuations

[11] While the coefficient estimates themselves are consistent with a differential-inflation-persistence-response interpretation in the MBM period, formal statistical tests fail to reject the null hypothesis that the FOMC responded to all inflation fluctuations in the same way during this period. We interpret this as indicating that the FOMC during the VGB period became either more focused or more accurate at identifying persistent inflation fluctuations. Broadly speaking, this accords with the analysis of Goodfriend and King (2013); in discussing this paper, Svensson (2013) states "...that a major explanation for the Great Inflation could be a small weight on inflation stabilization and drifting inflation target does not seem so far-fetched." (p. 213)

serving the role of an intermediate target (in the words of Fuhrer).[12] So what can explain the high inflation of that period? On the face of it, our results suggest that a change in policy preferences – possibly driven by political pressures (see, e.g., Chappell, Havrilesky and McGregor (1993), Meltzer (2009), Weise (2012), or Levin and Taylor (2013)) – is a far more likely explanation. What about the conjecture that FOMC behavior in the 1970s resulted from inaccurate inflation forecasts (see, e.g., Orphanides 2002, Levin and Taylor 2013 or Fuhrer and Olivei 2017)? This mechanism could certainly operate in conjunction. However, our results indicate that the actual behavior of the FOMC in the 1970s is more consistent with its using real-time CPI inflation data, where identification of the persistent part of inflation fluctuations uses information from simple-but-reliable inflation forecasts.

2 Empirical Results

2.1 Data Description and Plan of This Section

We use real-time data on the civilian unemployment rate (u_t) and the 12-month growth rate in the (real-time) Consumer Price Index inflation rate (π_t),[13] taken from St. Louis Federal Reserve Bank ALFRED data set. (In our investigation of the experience 1970s, for comparison purposes we also make use of real-time quarterly GNP deflator data, and inflation forecasts deriving from FOMC Greenbooks, both available from the Real-Time Data Research Center at the Federal Reserve Bank of Philadelphia.) For our projections of the unemployment rate, a case where univariate models can be slow to detect turning points in the data, we also make use of the Survey of Professional Forecasters projections of this variable, also available from the Federal Reserve Bank of Philadelphia. As the backward-looking filtering employed here uses up a good deal of sample data as a 'start-up' period, our regressions begin in January 1965. Our sample period ends in August 2008, just prior to the point when the sample variation in i_t becomes minimal. The data we are analyzing

[12] Jeffrey Fuhrer suggested this language in his discussion of Fuhrer and Olivei (2017) during the Boston Fed's annual central banking conference in October 2017.

[13] Specifically, we use the inflation rate defined as the 12-month growth rate in percentage terms – i.e., $100ln(CPI_t/CPI_{t-12})$ – where CPI_t is the non-seasonally adjusted Consumer Price Index for urban wage earners and clerical workers until February 1978 and the non-seasonally adjusted Consumer Price Index for all urban consumers thereafter. The value for CPI_{t-12} in π_t is that which was available when CPI_t was released.

correspond closely to those which were available to the FOMC at the time it set the federal funds rate (i_t).[14]

Our treatment of the federal funds rate, and the information available for the FOMC during its meeting each month, warrants some discussion. Over most of our sample, the federal funds rate experienced notable day-to-day changes, and was also subject to end-of-month effects as banks addressed regulatory constraints. Our goal is to estimate the FOMC reaction function, which models the FOMC fed funds rate decision in their meeting, in reaction to or based upon the information that the FOMC had available when it made the decision. However, FOMC meeting dates – and conference phone conversations at which decisions could also be taken – did not occur on the same day each month.[15] Hence, each month we estimate the monthly fed funds rate by taking a trimmed-mean estimate of the fed funds rate over the six business days following an FOMC meeting, trimming the highest and lowest daily rates of that period, and taking the average over the remaining four observations. If there was no meeting that month, we implicitly assume an FOMC meeting on the 20th day of the month, at which the rate was left unchanged. For the monthly unemployment rate and inflation rate series, we then utilized the information that was actually available immediately prior to the FOMC deliberations that month. Most commonly, the FOMC had available the unemployment rate from the previous month, and the CPI inflation rate from two months prior. However, for meetings that occured late in the month, CPI inflation data from the previous month were often available. (We describe below a robustness exercise which used GNP deflator information aligned to the same meeting dates.)

Following Clarida, Gali, and Gertler (2000), we primarily consider two sub-sample periods. The first of these is January 1965 to August 1979, which roughly corresponds to the Martin-Burns-Miller period and is here denoted 'MBM'. The second sub-sample runs from September 1979 to August 2008; it covers Volcker's, Greenspan's and part of Bernanke's tenures; it is here denoted 'VGB'. Most of the VGB period is also referred to as the 'Great Moderation' – see McConnell and Perez-Quiros (2000) and Kim and Nelson (1999) – as it is characterized by low variance in most

[14] Source: http://research.stlouisfed.org/fred2/. See Orphanides (2001) for evidence that estimated monetary policy rules are likely not robust to the vintage of the data.

[15] In fact, occasionally, there were two or meetings in a single month. In those cases, we selected one of the meetings, preferentially the meeting or conference call at which a rate change took place. Earlier in the sample, when Greenbook forecast information was more variable, we also gave consideration to meetings at which richer forecast information was included in the Greenbook.

macroeconomic variables. Since the onset of the Great Recession, of course, most macroeconomic variables have become more volatile.

Each monthly observation on u_t and π_t is here decomposed into frequency (persistence) components, as noted above and described in the Technical Appendix, using moving windows. In specifying the length of the moving windows used in decomposing the real-time unemployment rate, we note that the natural rate of unemployment is thought to be quite slowly-varying. For instance, Boivin (2006) uses a five-year moving average of the unemployment rate as a proxy for the natural rate. A shorter window – of length, say, 36 months – would risk including business cycle effects within the lowest-frequency unemployment rate component, and likely not properly distinguish very persistent supply-side pressures on the unemployment rate from less persistent business-cycle-related influences on the unemployment rate. Put differently, this short window length choice would impose the restriction that the central bank responds in much the same way to an unemployment rate fluctuation with a reversion period of 36 months as it does to a fluctuations with substantially larger reversion periods – e.g., of 5 years, or even 10 years. Hence, we conjectured that a ten-year window would likely result in a satisfactory decomposition for the unemployment rate.[16] As will be evident below, the outcome of the empirical analysis presented here will inform us as to whether or not a shorter window would have been adequate. In specifying the length of the moving windows used in decomposing the real-time inflation rate, in contrast, we considered that a central bank might very well react differently to a fluctuation in the real-time inflation rate which has persisted just 12 months – as compared to one which has persisted ca. 36 or 48 months – but that it seems unlikely *a priori* that it would attend to a 60-month-long fluctuation substantially differently than to one which has persisted substantially longer than this.[17] We thus judged that a moving 60-month window would suffice for the inflation rate.[18]

[16] An exercise – not reported here – that estimated the width of a moving average of the unemployment rate that best matched prominent estimates of the NAIRU resulted in a moving average of nine years.

[17] A (centered) 36-month moving average is often used as an estimate of trend inflation; see, for example, Cecchetti (1997) or Brischetto and Richards (2007); Giannone and Matheson (2007) and Higgins and Verbrugge (2015) argue for using even shorter moving averages.

[18] Our empirical results are not particularly sensitive to specifying somewhat shorter (or longer) moving windows for use in decomposing u_t and π_t. As noted in the Technical Appendix, this filtering provides a usefully accurate decomposition for the last sample observation in a moving window only if the sample observations in the window are augmented by a number of projected observations. We use 18 months of projections for the inflation rate partitioning, and 24 months of projections for the unemployment rate partitioning. These choices imply that roughly 80% of each window consists of sample data. Based on minimizing BIC as a selection criterion, the π_t projection forecasting model chosen for use here combines a random walk and an ARMA(6,2) process; the u_t forecasting model combines forecasts from the *Survey of*

FOMC Decisionmaking Distinguished Persistent Fluctuations

In previous versions of the paper, we have explored more disaggregated partitions of the data – e.g., splitting u_t and π_t each into ten components with differing persistence levels and estimating a distinct policy rule coefficient for each of these components. We also explored more parsimonious specifications in which the parameter variation across the ten components was constrained by a quadratic or cubic polynomial, as in Almon (1965). While the latter is a bit more satisfactory (and the former method still yields reasonable results), it is abundantly clear that a tripartite partition suffices, yielding the same economic inferences in a much more transparent manner. Accordingly, here we only quote results from a tripartite partition of each variable.

In particular, here we isolate the most persistent fluctuations that are resolvable given the length of the filtering window – thus the most persistent fluctuations in the unemployment rate consist of all fluctuations that take longer than 120 months to complete, while the most persistent fluctuations in the inflation rate consist of all fluctuations that take longer than 60 months to complete. We will denote these as the "extremely persistent" fluctuations.[19] Next, we split out the "transient" fluctuations of each variable, where these consist of all fluctuations that take 12 months or less to complete. We will be able to investigate whether the FOMC effectively ignored these fluctuations. The remaining component of u_t or π_t consists of "moderately persistent" fluctuations.

Professional Forecasters with an AR(2) process. As with the window lengths themselves, we find that our empirical results not sensitive to minor changes in the number of projections or the form of the projection forecasting model used, but it *is* necessary to use at least 12 projection months and some kind reasonable projection model for filling out each window. RATS code implementing this decomposition methodology is available from the authors. For non-RATS users, we also have available a ready-to-use Windows-based executable which implements the decomposition using simple AR(p) projection; in this case all that the user needs to do is specify the order p, the number of projections, and the window length – the program then produces the maximal number of frequency (persistence) components and the user can aggregate these components into frequency (or persistence) bands.

[19] As we explain below, the extremely persistent component will include all I(0) fluctuations, in addition to all fluctuations corresponding to reversion periods longer than the filtering window. Analysts may choose to include fluctuations with lesser persistence, although here we do not do so. In terms of the frequency domain analysis that underlies these decompositions, a 120-month reversion period corresponds to the sinusoidal frequencies proportional to 1/120; see the Technical Appendix for details.

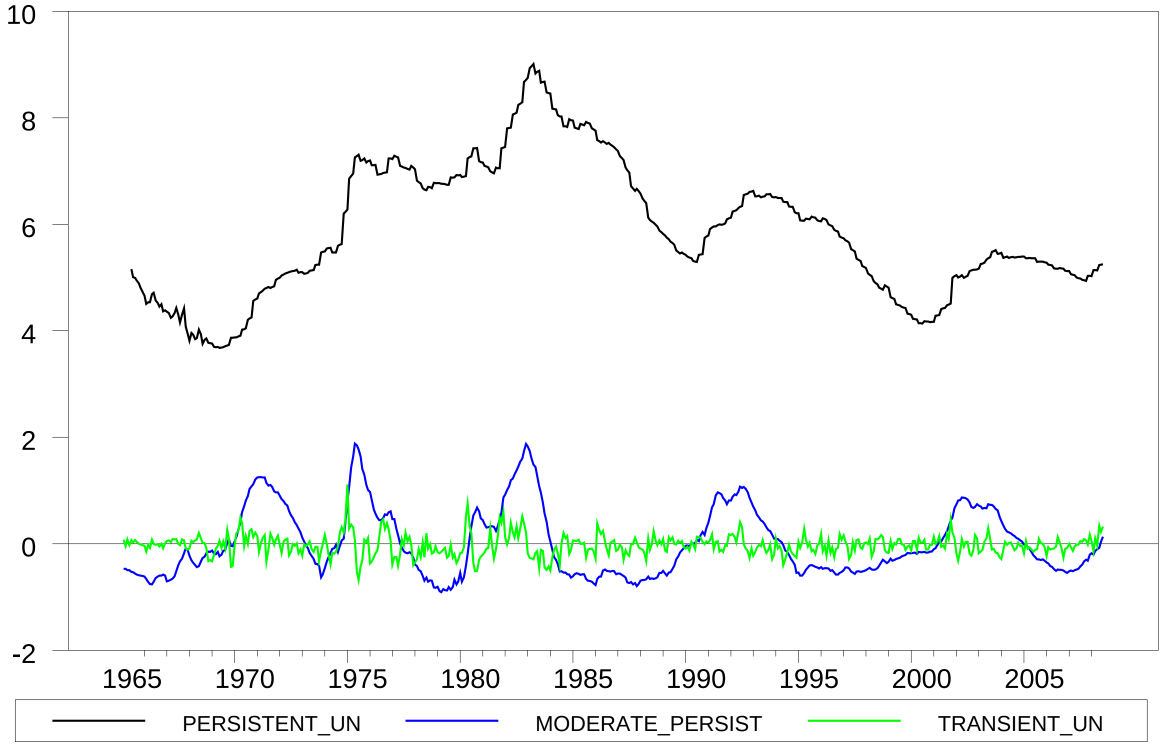

Figure 1: Components of u_t By Persistence

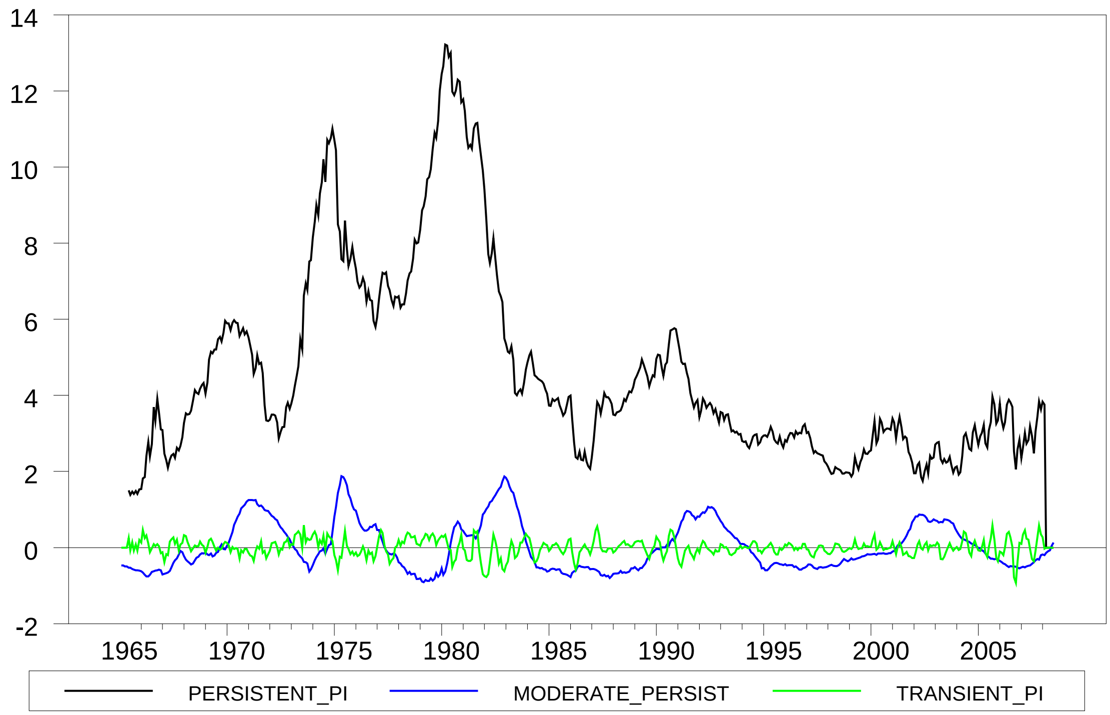

Figure 2: Components of π_t By Persistence

Time plots of "extremely persistent" components ("persistent_un" or "persistent_pi"), "moderately persistent" components ("moderate_persist"), and "transient" components ("transient_un" or "transient_pi) are displayed in Figure 1 for the u_t components and in Figure 2 for the π_t components.

A few words of explanation may be in order, related both to the apparent lack of smoothness in the more persistent components that might have been expected, and also to the apparent correlation of these components. Decompositions by frequency must be performed on trendless data, and accordingly, frequency-domain filters typically detrend the sample data prior to performing the decomposition, and add the trend back afterwards. Our procedure is no different, except that we apply such a decomposition on each sample window. Accordingly, included in the most persistent component of u_t (or π_t) at time τ is the trend estimate of this variable pertaining to time τ (i.e., the trend is estimated for the time-τ window, and the time-τ portion of that trend is added to the persistent component at τ). By virtue of our windowing procedure, the extremely persistent component will incorporate a nonlinear adaptive trend; this component will thus include all zero-frequency movements, but also all frequency components whose period exceeds the width of the window. (See the Technical Appendix for a figure demonstrating how the lower frequency movements of the data are estimated by our procedure.). In this paper, we do not include any other components in this series.

Owing to the one-sided nature of the filtering, each of the three estimated components will typically contain an innovation at every time period τ, irrespective of the ostensible persistence level of that component. Why? Between time $\tau-1$ and time τ, there is an innovation in the variable; the history of the variable may have changed (since we are conducting decompositions on real-time data); the oldest data point in the window is dropped; and there is a new forecast. Two things change. First, there is a change in the estimated trend. Second, the additional data and updated forecast provide better information about the extent to which innovations at time $\tau-1, \tau-2$, etc., were part of highly persistent movements. Now consider how the time-τ change in the variable will be decomposed into various persistence components. Without information about the variable at time $\tau+1, \tau+2$, etc., it is impossible to parse the time-τ change into its persistence components without error. (Indeed, these facts are a chief motivation for performing decompositions in a two-sided manner; but as we have indicated, that option is contraindicated for studies of this nature.) Most likely, a given innovation might be partially attributed to an extremely persistent movement, and partially attributed to a less persistent movement. This suggests that real-time decompositions of this sort inevitably give rise to at least a modest level of correlation between components.[20]

In Section 2.2 the usual simple monetary policy rule model discussed as Equation (1) in Section 1.1 is generalized. First, we take account of persistence in i_t by including lags of i_t in the equation. This generalization is econometrically necessary, so as to yield model errors free from serial correlation; and it is economically interesting, in that such dynamics correspond to the FOMC acting so as to smooth the time path of the federal funds rate. Second, the model is further extended to allow for our estimated FOMC reaction functions to differentiate between highly persistent fluctuations

[20] The apparent correlations that are evident in Figures 1 and 2 are fairly modest. Correlations are typically in the 0.1 range. However, the most persistent part of each series has a correlation with the moderately persistent part on the order of 0.2 (u_t) to 0.35 (π_t). These estimates are biased upwards; see Ashley and Verbrugge (2009a) for details.

in each variable, moderately persistent fluctuations in each variable, and transient fluctuations in each variable.

2.2 Specification and Results

2.2.1 Specification

Our empirical specification was guided by prior work and by theoretical considerations, in conjunction with a desire to allow the data to speak as clearly as possible. First, the federal funds rate is highly persistent. Empirical estimates of central bank policy functions from around the world generally indicate the presence of substantial inertia (see, e.g., Goodhart 1999 or Coibion and Gorodnichenko 2012), consistent with partial adjustment of the interest rate toward its target. (In their study of the U.S. Great Inflation episode in the 1970s, Humpage and Mukherjee (2015) find that inertia was deliberate.) Incorporating such inertia is also found to improve outcomes in many theoretical models (see, e.g., Woodford 2003, Taylor and Williams 2011). In the U.S. at least, there is some evidence for "double inertia "(see Carlstrom and Fuerst, 2014): two lags of the federal funds rate are necessary to yield serially uncorrelated fitting errors. Ignoring such persistence is likely to lead to severe parameter estimate distortions (see Ashley and Verbrugge, 2009a); these distortions are avoided here by the inclusion of lags in i_t.

Second, as discussed in the introduction, it is common to see an estimate of a "natural rate of unemployment" and/or an inflation target in a central bank policy reaction function specification. Such inclusions are inherently awkward because these quantities are time-varying (albeit slowly so), but their time variation cannot be identified without making strong (and untestable) assumptions about their time-evolution. Such variables are not included in our base model specification here because the estimation methodology we use will allow for the coefficients on u_t and π_t to differ for slowly-varying ("highly persistent") fluctuations in these variables. Thus, our base model specification is given by:

$$i_t = \delta_1 i_{t-1} + \delta_2 i_{t-2} + (1 - \delta_1 - \delta_2)(\alpha + \beta u_t + \varphi \pi_t) + e_t. \tag{2}$$

As is standard in the literature, lagged values of π_t and u_t are not included. Because of the parameters δ_1 and δ_2, equation (2) is estimated via non-linear least squares. The term $(\alpha+\beta u_t+\varphi\pi_t)$ is often interpreted as a target interest rate, with the central bank eliminating a fraction $(1-\delta_1-\delta_2)$ of the gap between the current target and the current federal funds rate each month.[21][22]

To investigate whether the FOMC reaction function differentiated between highly persistent movements of each variable, moderately persistent movements of each variable, and higher-frequency movements of each variable, we re-specify Equation (2) to allow for the possibility that the coefficients on π_t and u_t depend on the persistence levels of the fluctuations in these variates. This yields the model:

$$i_t = \delta_1 i_{t-1} + \delta_2 i_{t-2} + (1-\delta_1-\delta_2)\left(\alpha + \sum_{k=1}^{3}\beta_k u_t^k + \sum_{j=1}^{3}\varphi_j \pi_t^j\right) + \epsilon_t. \tag{3}$$

In Equation (3), u_t^1 is the "highly persistent" component of u_t; u_t^2 is the "moderately persistent" component of of u_t; and u_t^3 is the "transient" component of of u_t, as described in Section 2.1 above. This model specification allows us to estimate distinct policy-response coefficients (β_1, β_2, and β_3) for these components of unemployment rate fluctuations, as perceived by the FOMC based upon the real-time data available to it at the time a decision was made.The variables $\left(\pi_t^1, \pi_t^2, \text{and } \pi_t^3\right)$ and coefficients (φ_1, φ_2, and φ_3) are analogously defined, corresponding to the "highly persistent," "moderately persistent," and "transient" components of inflation rate data, as perceived by the

[21] Several of the terms in Equation (2) are extremely persistent. While the presence of lagged interest rate terms ensures that all of the coefficients will be estimated consistently, Ashley and Verbrugge (2009a) have shown that a degree of finite-sample bias can be expected with persistent regressors. Our sample lengths here – of $T = 176$ in the MBM period and $T = 348$ in the VGB period – are not small, but we note that their simulation results warn that these biases are not necessarily completely negligible when there is substantial regressor persistence, even with several hundred observations. It is worth pointing out that unit root hypotheses are all strongly rejected in each of the MBM and VGB subperiods when these periods are considered separately. This is in keeping with what one might expect, given the arguments in Clarida, Gali and Gertler (1999) to the effect that stationarity for these variables is implied by theoretical models in which simple monetary policy functions play a role. Partitioning the sample also, to some degree, alleviates the problem of time-varying variance mentioned in Sims and Zha (2001, 2006), but we use Eicker-White standard error estimates throughout nonetheless.

[22] Implicitly, (2) imposes a fixed equilibrium or natural real interest rate over time. This assumption is almost certainly a poor description of reality over the last decade, but is arguably innocuous up until that time. Prior to the 1980s, estimates often did not reject rough constancy of the realized real interest rate (see, e.g., Carlson 1977) and such constancy was routinely assumed in academic work during that period (see, e.g., Fama 1975) and even later. During the VGB period, it is possible that the FOMC may have been cognizant of a time-varying natural rate of interest. As robustness checks, during the VGB period we included in (2) the real-time r_t^* estimate of Fuhrer and Olivei (2017) or the one-sided r_t^* estimate of Laubach and Williams (2003, 2015). (Unfortunately, such estimates – regardless of method – "are very imprecise and subject to considerable real time mismeasurement" (LW 2003, Clark and Kozicki 2003).) Our results were qualitatively unchanged.

FOMC based upon the real-time data available at the time a decision was made.

2.2.2 Results

The first two columns of Table 1 display NLS estimates of δ_1, δ_2, β, and φ separately over the MBM and VGB subperiods, corresponding to Equation (2). As noted above, the inclusion of two lags in i_t in this model suffices to yield serially uncorrelated model fitting errors. Eicker-White standard errors are quoted for all coefficient estimates, here and below, to account, at least asymptotically, for any heteroskedasticity in ϵ_t.[23] The coefficients δ_1 and δ_2 can be taken to quantify 'interest rate smoothing' behavior by the FOMC, so it is noteworthy that the null hypothesis that both of these coefficients are zero can be always be rejected with $P < 0.0005$.[24]

Equation (2) imposes an assumption that the FOMC did not distinguish the most persistent movements in u_t and π_t from other fluctuations. Our results indicate that, during the VGB period, this is a profound misspecification. While β and φ enter with conventional signs and statistical significance during the MBM period, during the VGB period the estimates would appear to indicate that the FOMC ignored fluctuations in u_t, and the hypothesis that $\varphi = 0$ cannot be rejected at the 5.9% level of significance. Taking coefficient estimates at face value indicates that the FOMC's response to inflation rate fluctuations was notably smaller in the MBM than in the VGB period: on average the FOMC increased the federal funds rate by only 0.63% for every 1% increase in the inflation rate in MGM period, whereas in the VGB period the estimated response is 1.63%.

[23] Possible parameter estimation distortion due to three outlying observations in the fitting errors – for July 1973, May 1980, and Feb 1981 – was addressed using dummy variables to shift the intercept. The estimated coefficients on these dummy variables were always highly significant – and (negative, negative, positive) in signs, respectively – but their exclusion did not substantively affect the inference results reported below. Consequently, the listing of these coefficient estimates – and the model intercept term (α) – is, for simplicity, suppressed in the results tables here.

[24] Fed funds rate dynamics were significantly more volatile prior to 1983 than afterwards. What might explain these changes? One potential explanation is regime shifts. First, the Federal Reserve formally adopted monetary targets in 1970. However, by the mid-1970s the fed funds rate had essentially become the operational target. Then, in October 1979, ostensibly to control high inflation, the Federal Reserve switched to targeting monetary aggregates. During this period, there were several episodes during which large fluctuations in the federal funds rate prompted no FOMC response (see Gilbert, 1994). Finally, in October 1982, the Federal Reserve effectively began targeting the fed funds rate again (although arguably this may not have always been the chief focus of attention; for instance, during a conference call on January 9, 1991, Richard Sternlight, who was manager of the trading desk at the Federal Reserve Bank of New York, remarked, "Somewhat by default we might place more guidance on, of all things, the federal funds rate..."). Regime switches often lead to uncertainty, experimentation, and apparent policy reversals, and the associated diminishment of any beneficial effects arising from stable expectations.

The FOMC's short-run response to a 1% increase in the unemployment rate is only economically meaningful during the MBM period, and even then it is of only modest economic significance (-0.84%).[25]

But these results are artifactual. Allowing for (but not imposing an assumption that) the FOMC could distinguish the most persistent movements in u_t and π_t from other fluctuations yields interestingly different results. Indeed, the imposition that the FOMC did not distinguish fluctuations by persistence level leads to seriously misleading conclusions as to the FOMC's past behavior.

		Equation 2.2		Equation 2.3	
		MBM Period	VGB Period	MBM Period	VGB Period
	δ_1	$+1.46^{***}$ (0.09)	$+1.37^{***}$ (0.08)	$+1.33^{***}$ (0.09)	$+1.28^{***}$ (0.08)
	δ_2	-0.55^{***} (0.09)	-0.42^{***} (0.08)	-0.42^{***} (0.09)	-0.37^{***} (0.07)
	β_1	$\lceil$	$\lceil$	-0.46 (0.32)	$+0.38$ (0.35)
u_t	β_2	-0.84^{***} (0.26)	$+0.08$ (0.36)	-1.57^{***} (0.50)	-2.63^{***} (0.51)
	β_3	$\lfloor$	$\lfloor$	-6.58^{***} (2.67)	-5.14^{***} (2.05)
	φ_1	$\lceil$	$\lceil$	$+0.60^{***}$ (0.17)	$+1.63^{***}$ (0.30)
π_t	φ_1	$+0.63^{***}$ (0.16)	$+1.82^{***}$ (0.48)	$+0.09$ (0.60)	-0.28 (1.11)
	φ_1	$\lfloor$	$\lfloor$	$+1.16$ (1.82)	$+5.05^{***}$ (1.80)
F-test: $\beta_i = 0\ \forall i$				0.004	0.000
F-test: $\beta_i = \beta_j 0\ \forall i, j$				0.08	0.000
F-test: $\beta_2 = \beta_3$				0.76	0.24
F-test: $\varphi_i = 0\ \forall i$				0.001	0.000
F-test: $\varphi_i = \varphi_j\ \forall i, j$				0.66	0.013
F-test: $\varphi_2 = \varphi_3$				0.81	0.016

[25] In one re-estimates Equation (2) using a conventional unemployment rate gap, one finds – in keeping with most of the literature – evidence for a response to unemployment rate fluctuations in the VGB period. As is evident from those results, the apparent non-response to unemployment rate fluctuations in the VGB period is actually arising from the fact that the FOMC does not respond to extremely persistent movements in the unemployment rate, and these comprise a large part of the variance.

FOMC Decisionmaking Distinguished Persistent Fluctuations

Table 1

With respect to unemployment rate fluctuations, we note that during the MBM period, *just like in the VGB period*, the FOMC did not respond to – i.e., was ignoring – the most persistent unemployment rate fluctuations. (This conclusion follows from the standard error estimates on individual coefficients, as well as the test that $\beta_i = \beta_j \forall i, j$, which is rejected at the 8% level of significance. In Table 1, individual standard error estimates and tests of coefficient equality were bootstrapped, owing to the presence of the extremely persistent regressors u_t^1 and π_t^k.) And we note that during the VGB period, *even more than in the MBM period*, the FOMC aggressively responded to those unemployment rate fluctuations that are likely associated with business cycle effects. Implicitly, the FOMC has *always* ignored extremely persistent movements in u_t, and has focused on deviations from these movements. Our methods allow us to determine this without making use of ancillary assumptions, or the imposition of concepts that were arguably not guiding FOMC discussions during this period. The continuity of behavior vis-a-vis the unemployment rate that we estimate is evidence against the "views" explanation of the Great Inflation. Arguably, struggles with mismeasurement of u_t^* do *not* explain FOMC behavior in the 1970s, as some analysts have argued. Instead, as noted above, the FOMC has *always* ignored highly persistent fluctuations in the unemployment rate, a response that stands in sharp contrast to its strong response to business-cycle fluctuations of the unemployment rate. This ignoring-of-persistent-movements-in-u_t is consistent with its viewing such movements as being natural rate fluctuations; but this interpretation is not necessary, and one might equally interpret this behavior as treating the persistent part as an "intermediate target." Our results thus suggest that much previous work (which has often focused on (particular estimates of) an output gap rather than an unemployment gap) may have come to erroneous conclusions about FOMC behavior in the 1970s. We further note that, as is evident from Figure 1, the FOMC's implicit intermediate target for u_t is much more volatile that conventional "natural rate" estimates.

With respect to π_t fluctuations, we find that – in contrast to its continuity of response to the unemployment rate over both periods – the FOMC response to inflation movements changed in not just one, but two ways, starting in the VGB period. First, the VGB FOMC became more aggressive in its response to inflation – something other authors have noted (e.g., Clarida, Gali and Gertler 2000 or Conrad and Eife 2012). But second, it also became much more focused on fighting the *persistent* fluctuations in inflation, and ignoring more transient movements.[26] While the coefficient estimates themselves are consistent with a differential-inflation-persistence-response interpretation in the MBM period, formal statistical tests fail to reject the null hypothesis that the FOMC responded to all inflation fluctuations in the same way during this period. We interpret this as indicating that the FOMC during the VGB period became either more focused or more accurate at identifying persistent inflation fluctuations.

2.2.3 Comparisons and Robustness

One might ask, is our model significantly better than a conventional alternative? In particular, how do its predictions compare to those of an alternative model which uses a more conventional estimate of u_t^*, such as that of the CBO, and ignores the distinction betweeen persistent and transient movements in inflation? To answer this question, we used the Diebold/Mariano forecast comparison test to compare one-step-ahead forecast errors from two linear models over the VGB period, estimated over rolling ten-year windows.[27] To make the treatment of u_t comparable across models, we specified both models in "gap" form: in the CBO model, the unemployment gap was defined to be $\left(u_t - u_t^{*,CBO}\right)$, while in our model, the unemployment gap was defined to be $\left(u_t - u_t^{persistent}\right)$. In both models, this gap term was lagged one month. Regarding the treatment of π_t, the CBO model simply uses the real-time estimate of π_t, while our model uses the real-time estimate of $\pi_t^{persistent}$. In both models, this term was lagged two months. Then each model included a constant and one lag of the fed funds rate. Our model significantly outperformed the CBO model: the p-value of Diebold/Mariano test statistic was 0.000.

As we have noted above, our results are robust to a number of specification choices. One in

[26] On its face, φ_3 is estimated to be significantly negative, ostensibly indicating high-frequency accomodation of inflation rate fluctuations. However, this result appears to be spurious. Between October 1979 and October 1982, rather than targeting the fed funds rate, the FOMC was targeting nonborrowed reserves (as a means to control monetary aggregates, and hence inflation). During this period, the fed funds rate was highly variable, with reversals that roughly line up with high-frequency inflation shifts. This is consistent with the view that high-frequency shifts in inflation occurred along with (and perhaps causing) high-frequency shifts in money demand that, in turn, induced high-frequency shifts in the fed funds rate. When one allows a break in φ_3 after 1982, this coefficient is statistically different from zero only during the pre-1983 period.

[27] This is not a true real-time forecast comparison, since the CBO estimate is taken from the future. One might argue, however, that this biases the comparison against us.

particular may be noteworthy. It may be argued that during the VGB period, the FOMC was implicitly using a target-r^* concept. If we modify (3) to incorporate an r^* in the parenthetical expression, then use the real-time r^* estimate from Fuhrer and Olivei (2017),[28] or the one-sided r^*estimate from Laubach and Williams (2015), our results are nearly unchanged.

2.2.4 The Great Inflation

Our results shed some light on the origins of the Great Inflation. They imply that the "ideas" hypothesis – that FOMC errors in the 1970s were due to erroneous beliefs about the structure of the economy, including an unrealistically low estimate of the natural rate of unemployment (e.g., Orphanides 2002, Romer and Romer 2002, Romer 2005) – cannot fully explain FOMC policy during that time period. Our findings point in this direction because we show that FOMC behavior with respect to the fed funds rate response to the unemployment rate has remained rather stable: it has always ignored the most persistent fluctuations in u_t. So what can explain the high inflation of that period? On the face of it, our results suggest that a change in policy preferences – possibly driven by political pressures (see, e.g., Chappell, Havrilesky and McGregor (1993), Meltzer (2009), Weise (2012), or Levin and Taylort (2013)) – is a far more likely explanation.[29]

What about the conjecture that FOMC behavior in the 1970s resulted from inaccurate inflation forecasts (see, e.g., Orphanides 2002, Levin and Taylor 2013 or Fuhrer and Olivei 2017)? This mechanism could certainly operate in conjunction. To investigate this, in parallel to our treatment of the real-time monthly CPI inflation rate, we constructed monthly estimates of the persistent part of the quarterly GNP deflator. For this exercise, one-sided filtering was conducted for each month using a five-year window of quarterly data based upon 15 quarters of real-time data, augmented with the monthly real-time nowcasts and 4 quarterly forecasts in the Greenbook of that month. (Early in the sample, in order to obtain sufficient number of forecasts, we had to augment Greenbook forecasts. We did this using SPF forecasts when available, or using simple univariate forecasts which treated available Greenbook forecasts (or Greenbook + SPF forecasts) as additional data.) We find

[28] We thank these authors for sharing these data with us.

[29] Many commentators (e.g., Sargent 1999, Hetzel 2018) note that the narrative evidence indicates that the FOMC largely held pessimistic beliefs about the "sacrifice ratio," i.e. that reducing inflation would require very high levels of unemployment. But as Levin and Taylor (2013) argue, such a belief should translate into a more *vigorous* response to incipient increases in inflation.

that, as one might have expected based upon previous research, the implied estimate of $\pi_t^{persistent}$ is systematically significantly lower than our baseline CPI-based estimate during a large portion of the 1970s. However, we conducted a second out-of-sample forecast comparison test to determine which model – our baseline CPI-based model, or the alternative GNP-deflator-with-Greenbook-forecasts – better predicted or described actual FOMC behavior. As before, we used the Diebold/Mariano forecast comparison test to compare two linear models over the MBM period, estimated over rolling ten-year windows. Both models treat u_t identically, with this variable entering in gap form as in $\left(u_t - u_t^{persistent}\right)$; in both models, this term was lagged one month. Regarding the treatment of π_t, the GNP deflator model uses the *current* real-time estimate of $\pi_t^{persistent}$, while our model uses our real-time estimate of $\pi_t^{persistent}$, lagged two months. Then each model included a constant and one lag of the fed funds rate. Despite our model's informational disadvantage – the GNP deflator model always uses all available inflation information, including CPI inflation and other inflation-relevant data, while our baseline model ignores other inflation-relevant data and is sometimes one month out of date relative to the GNP deflator data – our baseline model significantly outperformed the GNP deflator model: the p-value of Diebold/Mariano test statistic was 0.037. This indicates that the actual behavior of the FOMC in the 1970s is more consistent with its using real-time CPI inflation data (where identification of the persistent part of inflation fluctuations uses information from simple-but-reliable inflation forecasts). Evidently, poor inflation forecasts do not explain the Great Inflation.[30]

3 Conclusions

Using the lens of simple monetary policy reaction functions, we apply recently developed econometric tools to deepen our understanding of FOMC behavior and how it has (or has not) changed starting with the chairmanship of Volcker. Standard simply monetary policy rules like Equation (2) properly allow for persistence in the fed funds rate but arbitrarily impose an assumption that

[30] We have conducted several different investigations into the post-sample forecasting effectiveness of our models, comparing the ability of models incorporating frequency-partitioned explanatory variables relative to analogous models specified without frequency dependence; two of these were reported above. These results were encouraging, in that a disaggregated model is always somewhat superior on this metric, yielding credence to our modeling approach. We note, however, that the present study is about inference rather than forecasting, and we lay no claim here to having developed a new forecasting approach. For a study along those lines, see, e.g., Carlstrom and Zaman (2014).

the FOMC treated persistent fluctuations in the unemployment rate, and persistent fluctuations in the inflation rate, in the same way that they treated transient movements in those variables. In this paper, we relax that restriction and test it. Our results are surprising along some dimensions, but accord well with intuition and some other accounts. Our study reaches the following conclusions.

First, estimates of Equation (2) as it stands imply that the FOMC was unresponsive to unemployment rate fluctuations in the VGB period; as we explain below, this fundamentally misleading result underscores the necessity of allowing for a distinction between the response to persistent movement in the unemployment rate versus the response to a less persistent fluctuation. By extension, we would argue that there are likely many other macroeconomic relationships in which the relationship between two variables differs by persistence level. In such cases, restricting this relationship to be the same will quite likely to miss out on uncovering some interesting features in the data, and may well lead to over-simplified and distorted inferences.

Second, by allowing the data to inform us about FOMC responses to persistent fluctuations versus higher-frequency fluctuations, our striking finding is that mismeasurement of u_t^* (or the output gap) is *not* a convincing explanation of FOMC behavior in the 1970s, as some analysts have argued. Instead, whether or not such an equilibrium concept was understood formally, or simply incorporated in judgment (whether consciously or unconsciously), the FOMC has *always* ignored extremely persistent fluctuations in the unemployment rate (although it arguably got better at this starting with Volcker). We follow Fuhrer and term this extremely persistent value the FOMC's "intermediate target" for the unemployment rate. This lack-of-response to extremely persistent fluctuations stands in sharp contrast to the FOMC's strong response to *moderately* persistent fluctuations of the unemployment rate; presumably these fluctuations are more responsive to movements in the federal funds rate. Our finding of this continuity of behavior between the MBM and VGB periods suggests that much previous work, which has incorporated (particular estimates of) an output gap rather than an unemployment gap, may have come to erroneous conclusions about FOMC behavior in the 1970s.

Third, the FOMC response to inflation movements changed in not just one, but two ways, starting in the VGB period. First, the VGB FOMC became more aggressive in its response to inflation – something other authors have noted (e.g., Clarida, Gali and Gertler 2000). But second, it also became much more focused on fighting the most *persistent* fluctuations in inflation, and began ignoring more transient movements.[31]

Our results thus shed some light on the origins of the Great Inflation. They imply that the "ideas" hypothesis – that FOMC errors in the 1970s were due to erroneous beliefs about the structure of the economy, particularly an unrealistically low estimate of the natural rate of unemployment (e.g., Orphanides 2002, Romer and Romer 2002, Romer 2005) – cannot fully explain FOMC policy during that time period. They also imply that the "poor inflation forecasts" hypothesis also fails to explain FOMC behavior. Hence, taken together, our results suggest that a change in policy preferences – possibly driven by political pressures – is a far more likely explanation of the Great Inflation.

Economic theory often suggests that decision-makers distinguish between fluctuations with different degrees of persistence. The relatively straightforward technique used here illustrates how one can easily test this hypothesis – even in settings where (as here) feedback is likely, so that ordinary spectral analysis is inappropriate. This new empirical tool can lead to sharp new insights about the process generating such data, whereas ordinary time-series techniques (in either the time domain or the frequency domain) would fail to reliably uncover features of this nature in the data generating process.

The "persistence dependence" in empirical model coefficients directly addressed by the new econometric methodology used here is very clearly interpretable in intuitive economic terms. This methodology is therefore particularly well suited toward guiding the construction of deeper and richer structural model specifications for the economic processes underlying the data generating mechanism empirically uncovered.

[31] While the coefficient estimates themselves are consistent with a differential-inflation-persistence-response interpretation in the MBM period, formal statistical tests fail to reject the null hypothesis that the FOMC responded to all inflation fluctuations in the same way during this period. We interpret this as indicating that the FOMC during the VGB period became either more focused or more accurate at identifying persistent inflation fluctuations.

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