Inflation Surges and Monetary Policy*

Carl E. Walsh†

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Abstract

Similarities between the 1960s and 70s raise concerns that central banks are repeating mistakes that led to the Great Inflation. Two explanations for this earlier period of inflation, that it was due to shocks and special factors or that it was the result of political pressures on monetary policy, seem particularly relevant today. Major central banks such as the Federal Reserve and the ECB have been slow to react to the surge in inflation due to COVID-19 and the war in Ukraine. I investigate the consequences of policy delay and the impact of a more aggressive reaction, conditional on policy being delayed. In assessing the persistence of inflation shocks and in dealing with uncertainty about inflation dynamics, policymakers seem to be ignoring lessons from the literature on monetary policy in the face of model uncertainty.

Keywords: inflation, monetary policy, COVID-19

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†Distinguished Professor Economics Emeritus, Department of Economics, University of California, Santa Cruz (email: walshc@ucsc.edu). The views expressed in this paper are those of the author and do not necessarily reflect the official views of the Bank of Japan. I thank Mai Hakamada, Andy Levin, and Shunichi Yoneyama for helpful discussions.

1 Introduction

At last year's conference of the Bank of Japan's Institute for Monetary and Economic Studies, inflation scarcely gained a mention; today, it is the critical issue facing many central banks. From a longer-term perspective, of course, inflation is not a new issue. But for more than a decade, and even longer in Japan, central banks have been wrestling with how to deal with inflation that is too low. Suddenly, concerns about the limits to monetary policy due to the effective lower bound (ELB) on nominal rates and the need for makeup strategies to deal with extended periods of below target inflation seem much less relevant. The primary challenge has shifted to one of containing a surge in inflation.

The disruptions associated with COVID-19 produced a sharp recession; GDP growth rates for the U.S., Japan, UK and the Euro Area all turned sharply negative during the first quarter of 2020. Both monetary and fiscal policies were employed to address the adverse economic impact of COVID-19. These policies stimulated economic demand, but they did so at a time when the shift in demand from services to goods, combined with supply chain disruptions and the withdrawal of workers from the labor force, reduced aggregate supply, leading to a surge in inflation. This has been further exacerbated by energy price increases this year associated with Russia's invasion of Ukraine, and forecasts for global economic growth have been downgraded.

Figure 1 shows inflation in the U.S., Japan, UK, and Euro Area since January 2019, as measured by the all-items CPI in the top panel and core CPI in the bottom panel.[1] CPI inflation fell essentially to zero in all four economies in the first half of 2020 as a result of COVID-19. As demand rebounded and supply constraints and disruptions created an imbalance between demand and supply, inflation rose, exceeding 2 percent in the U.S. by early 2021 and in the UK and Euro Area by the middle of 2021. Not surprisingly, price increases showed up particularly in flexible commodity prices, and, except for Japan, headline inflation has returned to levels not seen in the major industrialized economies since the Great Inflation period.

Only in Japan has inflation been below the BOJ's 2 percent target, and core inflation (bottom panel) has, until March 2022, been negative. Both measures have been affected by temporary factors such as the decline in mobile phone charges. The BOJ's April

[1]Data from OECD Main Economic Indicators, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/.: All items Consumer Price index for U.S., Japan, UK, and Euro Area: USACPIALLMINMEI, JPNCPIALLMINMEI, GBRCPIALLMINMEI, CP0000EZ19M086NEST. Core CPI index for U.S., Japan, UK, and Euro Area: USACPICORMINMEI, JPNCPICORMINMEI, CPHPLA01EZM661N, GBRCPICORMINMEI.

Outlook for Economic Activity and Prices (2022) reports estimates of inflation adjusted for these factors and on an adjusted basis, CPI inflation reached 2.1 percent for the first quarter of 2022, while core CPI inflation was 0.7 percent. Thus, the Japanese economy, unlike the other three economies, has not yet experienced sustained rates of inflation in excess of the BOJ's target.

Inflation is now the pressing issue for policymakers in the U.S., UK, and Euro Area. However, the central banks of all three economies were slow to react to rising inflation. The Bank of England began raising its policy rate in November 2021, but the Fed only did so in March 2022, and the ECB has still not changed its policy rate, though it appears set to do so in July.

Of course, what matters is not the policy rate but real interest rates. The solid blue line in the top panel of figure 2 is the U.S. 1-year nominal Treasury rate minus the corresponding 1-year expected inflation rate; the dashed blue line is the 2-year nominal rate minus the 2-year expected inflation rate. Expectations are from the Cleveland Federal Reserve Bank and are based on financial market date.[2] All measures suggest that in 2021 real interest rates reached their lowest levels in the past 20 years. All series began to rise in late 2021 in anticipation of eventual Fed tightening. However, they remain extremely low. The bottom panel, shows two measures of one-year real rate measured as the 1-year Treasury rate minus measures of inflation expectations that are based household survey data, the Michigan survey and the NY Fed household survey. Household surveys tend to show higher expected inflation than measures obtained from financial market participants. However, as figure 3 shows, household have been much more accurate in predicting the path of core inflation than have expectations derived from financial markets.

Central banks learned during the global financial crisis that balance sheet policies could substitute for interest rate cuts at the ELB. As discussed by Athanasios Orphanides (2021) at last year's conference, this lesson was applied during 2020 when COVID-19 hit. Policy tightening in the face of rising inflation could therefore have been implemented without raising policy rates by shrinking the size of the balance sheet – quantitative tightening. However, the Fed and the ECB continued to increase the size of their balance sheets throughout 2021, with the Fed only slowing purchases in November. The ECB it announced plans to reduce its balance sheet in 2022Q3.

[2]Date in the top panel are from the St. Louis FRB FRED and show DSG1 - EXPINF1YR and DSG2 - EXPINF2YR. The bottom panel shows DSG1 - MICH and DSG1 minus the one-year expected inflation rate from the FRBNY household survey. MICH is the from the Univ. of Michigan, Survey of Consumer Finances: data from the FRBNY is from their Suvey of Consumer Expectations, available at https://www.newyorkfed.org/microeconomics/sce#/.

The current environment, with its high inflation and slowing growth – a return of stagflation – brings many reminders of the 1960s and 70s, and with them, concern that we may be headed to a new era of high inflation. Figure 4 shows U.S. inflation and unemployment from 1960 until 1985. Inflation is measured by both the PCE price index and core PCE (PCE less food and energy); the unemployment rate gap is measured by civilian unemployment less the CBO's estimate of the natural rate of unemployment. The two large oil price shocks in the 1970s created surges in inflation that are clearly visible in the figure. Even though core PCE excludes food and energy prices, both measures paint a very similar picture. The red line shows a linear trend estimated using PCE inflation between 1960 and 1981 as inflation drifted upwards from around 2 percent to almost 10 percent.

The major policy mistake during this period was not the volatility of inflation caused by oil shocks. It was allowing inflation to have a decades long upward trend. The challenge now is to prevent transitory surges in inflation from increasing trend inflation. Key lessons were learned from the Great Inflation experience. These include the importance of an independent central bank, one with a clear commitment to low inflation, combined with transparency about its inflation goals and a communications strategy that explains policy in terms consistent with its goals – in other words, an independent and accountable central bank. And unlike the post-financial crisis decade of zero nominal interest rates during which many central banks found themselves in an unfamiliar environment (Japan being the exception here), central bankers should have been well-schooled in how to deal with a resurgence of inflation.

The surge in inflation and the slow response of central banks raises several questions. First, how costly is delay when fighting a surge in inflation? If policy is slow to react, should it then compensate by reacting more aggressively? COVID-19 and Russia's invasion of Ukraine have faced central banks with a very uncertain environment; what do we know about dealing with uncertainty and have central banks been behaving in ways consistent with that knowledge? Finally, is a repeat of the high inflation 1960s and 1970s a possibility?

To address these questions, the rest of the paper is organized as follows. The issue of whether the Fed is behind the curve is considered in section 2. The consequences of a delay in reacting to inflation surges are considered in section 3. Section 4 compares the current situation to the 1960s and 1970s with a focus on whether the lessons learned about policy in the face of uncertainty have been followed. Conclusions are in the final section.

2 Falling behind the curve

The inflationary impacts of COVID-19 shocks were initially expected to be temporary (e.g., lockdowns, disruptions to supply chains) or sources of relative prices shifts as opposed to causes of general inflation.[3] Prevailing expectations were that inflation would fall as the shocks passed. Statements by leading central bankers suggested that the temporary nature of the shocks implied that no significant change in monetary policy was needed. Most central bankers, economists, and commentators were, therefore, caught by surprise as inflation continued to surge in 2022.

Figure 5 shows the median inflation projections of FOMC members from December 2020 until March of this year. In December 2020, inflation for 2021 as measured by the PCE index was projected to be 1.8 percent (yoy) – it came in at 5.5 percent. Each set of projections since December 2020 reflected an upward revision to the inflation projection. Even as late as September 2021, however, the FOMC continued to project that inflation in 2022 would be close to its 2 percent target. Only in December was the rise in inflation recognized to be persistent, yet even then, 2022 inflation was projected to be just 2.6 percent. In March of this year, the projection for 2022 jumped from 2.6 percent to 4.3 percent. Already, this looks like it will be too low, with January through March seeing PCE inflation averaging 6.9 percent at an annual rate.

By April, the consensus was that central banks had been too slow in tackling inflation. New opinion pieces were appearing almost daily lamenting the fact that central banks were behind the curve. For example, in speaking with the Financial Times in April, Ottmar Issing, former Chief Economist of the ECB, was quoted as saying "It is obvious the ECB is late to react, while the Fed might be even more behind the curve."[4] And the Economist magazine for the last week of April carried a cover headline of "The Fed that failed."

2.1 Comparing to simple rules

One way to judge the Fed's policy response and assess whether it is behind the curve is to compare it to the recommendations of simple instrument rules.

To do this, I use two rules, both taken from the Fed's July 2021 *Monetary Policy Report* (see, for example, Federal Reserve Board of Governors 2021, p. 44).[5] The first

[3] As economies reopened during 2020, there were concerns that supply side impacts, such as those on labor force participation, would have long lasting effects.

[4] Martin Arnold, "Living in a fantasy: euro's founding father rebukes ECB over inflation response," April 11, 2022.

[5] These rules were dropped from the February 2022 Monetary Policy Report.

rule is the basic Taylor rule expressed in terms of the unemployment rate relative to its long-run value:

$$\text{TR: } i_t = r_t^{LR} + \pi_t + 0.5\left(\pi_t - \pi^{LR}\right) + \left(u_t^{LR} - u_t\right).$$

The second is the balanced-approach rule, a rule which doubles the weight on unemployment deviations:

$$\text{BA: } i_t = r_t^{LR} + \pi_t + 0.5\left(\pi_t - \pi^{LR}\right) + 2\left(u_t^{LR} - u_t\right).$$

I set the inflation target at 2 percent and for projections prior to March 2022, I assume a value for the long-run real rate of 0.5 percent. The long-run real rate was lowered to 2.4 percent in the March 2022 projections. These values were consistent with the FOMC member's projections for the longer-run value of the federal funds rate. The median projections of the FOMC's members for inflation and unemployment were used to see what the rules would imply for the funds rate.[6]

The December 2021 and March 2020 FOMC's projections for the funds rate are shown by the black solid (Dec 2021) and dashed (March 2020) lines in figure 6. These are the same in both the upper and lower panels. The FOMC projections of inflation and unemployment are used to calculate the funds rate implied by the Taylor rule (top panel) and the balanced-approach rule (bottom panel). The implicated funds rates for the rules are shown in red – solid using the Dec. 2021 inflation and unemployment rate projections, dashed using the March 2022 projections.

Based on the December 2021 projections, both rules imply the funds rate should be near 4 percent in 2022 and 2023. In December 2021, the FOMC was projecting a funds rate of just 0.9 percent for 2022 and 1.6 percent for 2023. At the March 2022 meeting, the FOMC projections for 2022 would imply a funds rate under the Taylor rule of almost 7 percent in 2022, falling to 4 percent in 2023. The balanced-approach rule paints a similar picture. In contrast, even as recently as March, the FOMC members were projecting that the funds rate would end 2022 at less than 2 percent.

Of course, one could reconcile the FOMC projections for the funds rate with the rules based on their projections for inflation and unemployment if FOMC members currently think the neutral real interest rate is much lower than the 50 basis point value I employed, or if the relative measure of labor market conditions points to much

[6] Simply plugging in realized inflation and unemployment into these rules would suggest the federal funds rate should have been near 8 percent by December 2021. Of course, if the FOMC had followed either of these rules, the paths of both inflation and unemployment would have been much different.

greater underutilization of the American work force than the unemployment rate and the CBO estimate of the natural rate suggest. Perhaps, but the neutral rate would need be close to -4 percent to reconcile the two, and the analysis of Domash and Summers (2022) suggests that U.S. labor markets are much tighter than traditional measures such as the unemployment rate indicate and are more like what one might expect with a 2 percent unemployment rate.

A final way to reconcile the difference would be to interpret the gap as the FOMC's assessment of the impact of running down the Fed's balance sheet – quantitative tightening. This would require imputing an extremely and implausibly large effect to quantitative tightening.[7]

3 Is it costly to delay?

Based on these simple rules, rules often employed as reasonable benchmarks for monetary policy, together with the FOMC's projections for inflation and unemployment, the Fed is far behind the curve in dealing with the surge in inflation. However, this conclusion may be premature. After all, since December the Fed has been talking about rate increases, and such forward guidance has the potential to be quite powerful. Perhaps the belief that central banks will eventually respond to inflation is sufficient to ensure the inflation surge is stabilized.

The Taylor Principle, imbedded in standard policy rules, requires that the policy rate increase more than one-for-one with inflation, but it does not require the full increase occur immediately. When private sector behavior is dependent on expectations of future developments, the literature on the power of forward guidance suggests, perhaps implausibly, that the credible promise of a future rate increase can serve almost as effectively in stabilizing the economy and controlling inflation as an actual increase today.

To examine this issue, I subject a basic new Keynesian model to a positive and persistent inflation shock and examine the impulse responses when policy reacts with a delay. The core of the model is very standard, three equations in inflation, an output gap, and the policy rate given by equations (1) - (3). Partial indexation to lagged

[7] The gap between the Wu-Xia shadow rate and the fed funds rate is often interpreted as an estimate of the impact of the balance sheet. this gap was close to 2 percent in 2021 and then fell to zero in March 2022 when the funds rate was raised. See https://www.atlantafed.org/cqer/research/wu-xia-shadow-federal-funds-rate. Because the Fed's balance sheet had continued to increase, it is hard to attribute the slowing of the increase as sufficient tightening to close the roughly 3 percentage point gap between the March 2022 FOMC projection and the Taylor rule recommendation for 2022.

inflation introduces endogenous persistence into the inflation equation (1), while habits in consumption introduce endogenous persistence into the Euler equation (2). Policy inertial results in the lagged interest rate entering (3), where π_t^4 is 4-quarter inflation and $k \geq 0$ reflects the delay in the policy response. The time period is taken to be a quarter.

$$\pi_t = \left(\frac{1}{1+\chi\beta}\right)\left(\beta \mathrm{E}_t \pi_{t+1} + \chi\pi_{t-1} + \kappa x_t + v_t\right), \tag{1}$$

$$x_t = \left(\frac{1}{1+\eta}\right)\left[\mathrm{E}_t x_{t+1} + \eta x_{t-1} - \left(\frac{1-\eta}{\sigma}\right)\left(i_t - \mathrm{E}_t \pi_{t+1} - r_t^*\right)\right]. \tag{2}$$

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\left(r^* + \phi_\pi \pi_{t-k}^{(4)} - u_{t-k}\right). \tag{3}$$

I have added a fourth equation to link the output gap with unemployment – Okun's Law:

$$u_t = -0.5 x_t. \tag{4}$$

The coefficient of -0.5 in (4) is consistent with a basic Taylor rule as given in the table of instrument rules in *Monetary Policy Rules* in which the the coefficient of 0.5 on the output gap in the original Taylor (1993) rule is replaced by the unemployment rate gap with a coefficient of 1.

To allow for a temporary inflation shock without limiting it to an AR(1) process, I assume v_t follows an ARIMA(1,3) process, given by (5), where $e_{v,t}$ is a white-noise innovation to the inflation shock v_t:

$$v_t = 0.5 v_t + e_{v,t} + 1.2 e_{v,t-1} + 1.1 e_{v,t-2} + 0.5 e_{v,t-3}. \tag{5}$$

The parameters in the shock process are ad hoc, but they imply a positive innovation causes v_t to rise over the first 3 quarters and then decay.

Parameter values in the structural equations are $\beta = 0.995$, $\sigma = 1$, and $\kappa = 0.17$, which are taken from Galí (2015). I set $\rho_i = 0.85$, $\chi = 0.685$, and $\eta = 0.852$, based on the estimates of Dennis (2009). In the policy rule (3), $\phi_\pi = 1.5$, and I allow $k = \{0\ 1\ 2\ 3\ 4\}$. To represent a more aggressive response, I double ϕ_π from 1.5 to 3.0. I also reduce policy inertia to 0.5 as a second way of capturing a more aggressive response. Expectations are assumed to be based on full information and are rational (FIRE) in the standard sense of model consistent.

COVID-19 and the disruptions from the Russian invasion of Ukraine have, and will continue to have, complex impacts on both aggregate demand and supply in the global economy. To represent these as a shock to firms' marginal costs is too simple, but it

captures the chief issue facing central banks – what to do in the face of a surge in inflation that forces a trade-off between stabilizing inflation and stabilizing the real economy. My view is that on net, these other channels have acted to reduce aggregate supply relative to demand, reinforcing the need for interest rates to rise.[8] Thus, any costs associated with delaying in the face of an inflation shock would be even larger if the shock also, on net, increased aggregate excess demand.

3.1 Delay in a basic sticky price NK model

I start with the basic NK model without endogenous or policy inertia ($\chi = \eta = \rho_i = 0$). Figure 7 shows the results of a positive innovate to the inflation shock. The black line is for the no delay ($k = 0$) policy, while blue denotes a four quarter delay ($k = 4$). The solid blue and dashed blue lines differ based on the value of ϕ_π employed, with solid line based on $\phi_\pi = 1.5$ and the dashed line representing a stronger response to inflation (i.e., $\phi_\pi = 3.0$).

Comparing the solid black and blue lines reveals that the real interest rate (upper right panel) initially falls and takes longer to turn positive when $k = 4$. Delay results in a lower peak rise in unemployment (lower left panel), but unemployment also stays above its steady-state value longer and continues to fluctuate rather then converge smoothly back to steady state as is does when policy is not delayed. Delay actually reduces the rise in inflation (lower right panel) and returns inflation to its steady-state faster, though inflation does continue to cycle.

When policy reacts more strongly (i.e., $\phi_\pi = 3.0$), a standard trade-off arises — responding more strongly succeeds in reducing the rise in inflation at the cost of a higher peak rise in unemployment. An aggressive response after delaying does not contribute to a soft landing. Note that an aggressive response when policy is delayed generates long lasting fluctuations in the policy rate.

The intuition for why delay does not play a large role is based on the strong effect of forward-guidance policies at the ELB in NK models. Credible policy actions that will occur in the future have large effects on current output and inflation.

3.2 Endogenous persistence

The previous figure was based on purely forward-looking model with no endogenous persistence in either the inflation process (1) or the aggregate demand relationship (2)

[8] Oil price shocks act like a negative demand shock, particular for energy importers such as the Euro Area and Japan.

because $\chi = \eta = 0$. There was also no inertia in the policy rule, $\rho_i = 0$. I now set these parameters to their baseline values: $\chi = 0.685$, $\eta = 0.852$, and $\rho_i = 0.85$. With this calibration, results are shown in figure 8. As in the previous figure, the black line is for the policy that reacts immediately to the shock ($k = 0$); the solid blue line shows responses when policy delays four quarters before responding ($k = 4$). The response parameter in both cases is 1.5. The dashed lines are for $k = 4$ and a response coefficient of 3.0.

The primary thing to note is that the behavior of unemployment and inflation is very similar under all three policies. In terms of controlling inflation, delaying the monetary policy response reduces the peak rise in inflation, while it increases the peak rise in unemployment. Delay also postpones the recovery of unemployment. There is a trade-off between stabilizing inflation and stabilizing unemployment, but the differences are relatively small.

What the delay does create is much larger future fluctuations in the policy rate, unemployment and inflation. Responding more aggressively by doubling the coefficient on the rule to 3.0 results in large swings in the policy rate, while the near-term effect is to dampen the peak rise in inflation at the cost of a higher peak unemployment rate.

Responding more strongly to inflation is one definition of acting more aggressively. Another interpretation of calls for a more aggressive response is to react with less inertia. The rules in figure 8 all incorporate a high degree of inertia, reflected in the coefficient of 0.85 on the lagged policy rate; an aggressive response could mean reducing the inertia in the policy response. This is investigated in figure 9. The black and blue lines in the figure are repeated from the previous figure. The solid red line maintains the baseline response coefficient of 1.5 but reduces the parameter on the lagged policy rate from 0.85 to 0.5. The red dashed line corresponds to a policy with a response coefficient of 3.0 and inertia of 0.5.

There are two lessons. First, policies that dampen the peak rise in unemployment lead to the highest increases in inflation. Thus, the standard trade-off in the face of cost shocks applies. Second, combining aggressive moves when policy is behind the curve leads to prolonged fluctuations, particularly in the policy rate. Policy ends up oversteering, forced to swing the rudder from one direction to another, raising the issue of instrument instability.[9] In fact, the model becomes unstable if delay is too long (over 7 quarters) and policy is too aggressive.

To summarize, if inflation expectations are firmly anchored, a credible policy of

[9] The issue of instrument instability in the conduct of monetary policy was first investigated by Holbrook (1972) and Lane (1984).

delaying before reacting to a persistent positive inflation shock has only modest effects on the behavior of inflation and unemployment due to the power of forward guidance; credible promises of future action have large effects today. Since the Fed is behind the curve in reacting, it may be a relief to know that *if the public always knew they would eventually respond*, the delay may not be very costly. But given that a reaction was delayed, does it make sense to respond more aggressively? The impulse responses suggested that responding more to inflation does help stabilize inflation somewhat, but at the cost of more volatility in unemployment. It also leads to a significant increase in interest rate volatility.

If a more aggressive response is interpreted to mean a less inertial policy reaction, then the volatility of the policy interest rate increases significantly when ρ_i is reduced. Inflation is marginally less volatility, while unemployment becomes more volatile. However, when economic behavior is characterized by both forward-looking and inertial behavior, delay can result in instrument instability.[10]

3.3 Anchored Expectations

The results so far have been based on a model that assume long-run inflation expectations are anchored, focusing only on the impact of policy delay on short-run dynamics. A failure to respond to a persistent rise in inflation may cause long-term expectations to become unanchored. If the private sector began to expect higher inflation, these expectations feed through into price and wage setting decisions, resulting in an upward drift of inflation such as occurred during the 1970s. This, in turn, would also lead to an expansionary fall in real interest rates further contributing to a rise in inflation if monetary policy fails to react sufficiently (i.e., if it violated the Taylor Principle).

Figure 10 shows several survey-based measures of household inflation expectations in the U.S. (top panel) and Japan (bottom panel).[11] All have shown increases in recent months, though longer-term expectations have shown smaller increases. Expectations based on financial market data, not shown, have remained much more anchored in the U.S. and remain closer to the Fed's 2 percent target. In Japan, firm inflation expectations are also much lower than those of households. However, for understanding the possible implications for actual inflation, Coibion, Gorodnichenko and Kamdar (2018), in their review of empirical evidence on the Phillips Curve, conclude that "...

[10] When $\phi_\pi = 3.0$, the model becomes unstable when $k > 7$.

[11] Inflation expectations for Japan are the average of bias-adjusted responses of inflation expectations in the Bank of Japan's Opinion Survey. Biases are adjusted using the method of Nishiguchi, Nakajima, and Imakubo (2014).

household expectations appear to play a special role in making the Phillips curve stable and inflation predictable." (p. 1475). As figure 3, showed, household expectations have tracked the actual path of inflation over the past year than have expectations from financial markets. Thus, the rise in household inflation expectations is particularly worrisome.

The prior impulse response functions assumed rational expectations. At last year's conference Evans (2021) discussed a form of behavioral expectations due to Bianchi, Fischer, and Melosi (2021) which, in turn, built on the work of Bianchi and Melosi (2017). Applied to expected future inflation, the assumption was that

$$\tilde{\mathrm{E}}_t \pi_{t+1} = 0.86\pi_{t-1} - 0.11u_t, \tag{6}$$

where the operator $\tilde{\mathrm{E}}_t$ denotes the time t behavioral expectation of future inflation. Replacing $\mathrm{E}_t\pi_{t+1}$ with $\tilde{\mathrm{E}}_t\pi_{t+1}$ in the model given by (1) - (5) produces the results shown in figure 11.[12] The maximum delay shown is $k = 3$ as the model becomes unstable for longer delays. Greater inflation inertia also generates instability, so results are only shown for $\rho_i = \{0\ 0.5\}$. Comparing results with figure 9 illustrates how expectations matter. With inflation expectations given by (6), the consequences of delay are larger, generating large fluctuations in both unemployment and inflation. Delaying too long in reacting to a surge in inflation can generate explosive fluctuations in inflation.

Anchored expectations are not something central banks can take for granted. Nor is it safe to assume that temporary shocks have temporary effects on inflation if monetary policy fails to react. Modern inflation theory tells us that in the absence of a policy response, a return to target inflation after temporary shocks have passed is only one possible equilibrium; others are also possible in which inflation remains high well after the shock has fully dissipated. And outside of the world of full information and rational expectations, we lack any empirically grounded theory of expectations that ensures inflation expectations will be consistent with the central bank's policy.[13]

What does anchor inflation expectations? They are anchored by faith in the central bank's commitment to a clear and transparent inflation target, and that faith is validated when policy actions are consistent with achieving the target. Talk may be

[12] For this simple exercise, I continue to assume expectations of future output in (2) are rational on the grounds that the Euler equation relates to household's expectations of their own future income, for which they may have more accurate information than they do about future aggregate inflation.

[13] As Carvalho, Eusepi, Moench and Preston (2022) put it, theories "provide little guidance on how market participants form these expectations, or how policy ensures expectations to be consistent with central bank objectives. Indeed, most models simply assume long-term expectations are consistent with the policy strategy of the central bank."

crucial when inflation is below target and the ELB is a constraint, but when inflation is above target, action is needed to validate the public's faith that inflation will be controlled.

Importantly, one cannot divorce the future path of inflation expectations from an assumption about monetary policy. Whether inflation is anchored or not comes down to the credibility of the central bank. Thus, as Ricardo Reis (2021) puts it (p. 40): "One lesson from the 1967-73 experience is that policymakers should keep a close eye on measures of the expected inflation anchor, and not give in to the temptation to dismiss them as temporary noise or as vague psychological factors. A more general lesson ... is that policy can play a role in where the anchor ends up."

That is why statements by central bankers over the past year that gave the impression inflation would fall once shocks had passed, without making any explicit link to the monetary policy actions needed to ensure the rise in inflation is temporary, were troubling.

The 1970s illustrated the dangers of treating inflation as if it were exogenous to monetary policy. A somewhat surreal exchange from the transcript of the FOMC meeting on September 9, 1978 is quite revealing. Lawrence K. Roos, President of the St. Louis Federal Reserve Bank, expressed exasperation as inflation rose towards 8 percent, saying

> "I'm really not trying to be critical, but is our monetary policy responsibility such that we should maybe discuss whether we're satisfied to see the economy drift into an 8 percent inflation rate? And if not, are there things that we can do to affect this? ... Are we in any way the masters of what happens, or are we merely observers on the sidelines? I'm lost."

Fed Chair G. William Miller then drew upon the U.S. Constitution's 5th Amendment protection against self-incrimination in responding "I take the fifth."

I am confident that no central banker today would fail to connect inflation developments with monetary policy. Still, some discussions have come close to implicitly downplaying the role of policy in anchoring expectations.[14]

[14] For example, at last year's conference, Federal Reserve Bank of Chicago President Charles Evans devoted his panel remarks to inflation (the only presentation last year to focus on inflation). Yet monetary policy was never mentioned in his discussion of inflation expectations.

4 The return of the 1970s

Is it possible that this year's surge in inflation will lead to a prolonged period of high inflation? In considering this possible, it is useful to review the four primary but not necessarily mutually exclusive explanations for the Great Inflation: 1) Shocks and special factors (Blinder and Rudd (2013)); 2) the belief in a static Phillips curve trade off (Romer and Romer (2002)); 3) imperfect information leading to an overestimate of potential output (Orphanides (2003), Primiceri (2006)); and 4) an inherent bias towards inflation due to political pressures and an inability of central banks to credibly commit to low inflation (Kydland and Prescott (1977), Barro and Gordon (1983).

There are aspects of each of these four explanations that seem very relevant today. I want to focus, however, on the first and the last ones on this list.

4.1 Shocks and special factors

Blinder and Rudd (2013) have argued that sharp increases in inflation during the 1970s were due to supply shocks and special factors that included oil embargoes, crop failures, corn blight and the disappearance of Peruvian anchovies. Inflation fell sharply once these factors passed.

This explanation seems very consistent with the thinking of the Fed and the ECB last year. Policymakers frequently mentioned special factors – beginning with statements that the rise in inflation will subside once the base effects of the prices decline of 2020 dropped out of the year-over-year calculations – to explain why inflation would be temporary. Bad shocks happen – structural shifts, labor force participation, work-from-home, supply chain disruptions, semi-conductor shortages, and shifts away from reliance on far-flung supply chain networks during 2021, compounded by oil price spikes and disruptions caused by Russia's invasion of Ukraine in 2022. Because each of these could be viewed as temporary, the argument was that inflation will fall once the shocks passed and there was little need for policy to respond.

In discussing the sources of the inflation of the 1970s, Reis (2021) argued that an important factor explaining why oil shocks had a lasting effect on inflation was that "internal forecasts (by the Fed) that all shocks had temporary effects led to a belief that inflation expectations remained anchored." The Fed underestimated the persistence of "temporary" shocks in the 1970s, and, unfortunately, this also seems to be the case now. As figure 5 shows, the FOMC in December 2021 was projecting that inflation would decelerate from 5.3 percent in 2021 to 2.3 percent in 2022. Given that realized

PCE inflation for the first three months of 2022 has average 6.29 percent, inflation will need to sharply decline over the remaining months to an average of 3.64 percent to achieve the FOMC's projection of 4.3 percent inflation for 2022.[15]

4.1.1 Uncertainty about exogenous shocks

The persistence of exogenous shocks such as COVID-19 and the war in Ukraine is clearly important for forecasting the path of inflation and calibrating the appropriate monetary policy response. However, policymakers face a great deal of uncertainty when it comes to assessing whether any shock will be temporary or persistent. Fortunately, work carried out in the early 2000s investigated the issue of monetary policy under uncertainty.[16] In particular, this research offers guidance on setting policy when the persistence of exogenous shocks is uncertain, guidance that policymakers today seem to be ignoring.

Before getting to those insights, however, it is worth pointing out that simple rules such as the Taylor rule (or any of the others in the Fed's *Monetary Policy Report*) do not depend at all on knowing how persistent a shock is. Each rule implies the central bank should react the same way to actual inflation and unemployment, regardless of whether the shock itself is purely transitory or very persistent. Yet it is generally accepted that the Taylor rule delivers reasonable guidance for monetary policy except, of course at the effective lower bond for the nominal interest rate.[17] The Taylor rule is not optimal, but it is robust.

One can consider deviating from the original coefficients in the Taylor rule and optimize these based on a chosen objective function. It turns out that if one optimally sets the response coefficients to stabilize a quadratic function of inflation and unemployment, one does better by overestimating the persistence of inflation shocks when deriving the optimal coefficients.[18] This is due to the fact that the costs of inflation and real fluctuations become larger the more persistent the shock is.

A key insight, therefore, is that policymakers should overestimate the persistence of inflation shocks, just the opposite of what they were doing in 2021. Rather than

[15] PCE inflation has averaged (1/3)*(6.01+6.27+6.59) = 6.29 percent during January - March 2022. To hit the yoy projection for 2022 of 4.3 percent, PCE inflation would need to average (4/3)*(4.3 - (1/4)*6.29) = 3.64 percent for April through December.

[16] I discuss some of this research in Walsh (2003).

[17] Marc Giannoni and Michael Woodford (2003a, 2003b) showed how, if the central bank cares about interest rate volatility, optimal interest rate rules do not depend on the persistence of shocks (ignoring the ELB).

[18] See Walsh (2003).

treat an inflation shock as temporary, it would have been better if policymakers had acted as if the shock was likely to be persistent.

Further insight into policy and model uncertainty comes from work by Lars Hansen and Tom Sargent (2002) on robust control in which policymakers act as if there is an evil agent that is trying to make their policy look as bad as possible. Optimal policy then protects the economy from the worst the evil agent can deliver. As a practical application of this approach, I showed in Walsh (2004) that the robust control approach implies monetary policymakers should act as if the evil agent will hit the economy with an adverse inflation shock just when the economy is facing an expected slowdown and inflation is above target. Of course, in the robust control framework, the evil agent doesn't real exist, but this scenario does fit the case of the war in Ukraine which occurred when policymakers were already worried about a growth slowdown and an inflation surge.

Acting as if there is an evil agent helps ensure that policy is prepared for the worst-case scenario. More generally, a policymaker seeking robustness should systematically overestimate the persistence of any inflation shock. During the past year, central bank policymakers seem to have done just the opposite.

4.1.2 Model uncertainty

Uncertainty about the persistence of shocks is not the only source of uncertainty faced by policymakers. I mentioned earlier that the results on policy delay were obtained from just a single model. It would be useful to do a full analysis of the robustness of the results to gain more insight into the consequences of delay when policymakers face uncertainty about the true (best?) model of the economy, but a useful starting point for such an analysis is provided by the work of Andrew Levin and John Williams (2003). They showed that one can protect against model uncertainty by basing policy on a more backward-looking model than the policymaker truly believes characterizes the economy.[19] Thus, a desire for robustness in the face of model uncertainty suggests policymakers should overestimate the degree of *endogenous* persistence in the economy.

The model Levin and Williams used to illustrate this point was a completely backward-looking model estimated using U.S. data by Glenn Rudebusch and Lars Svensson (1999). What does such a model imply about policy delays and aggressive

[19] Levin and Williams compared how policy rules optimized for one model performed in an alternative model. They found that rules optimized for a forward-looking model performed poorly in the backward-looking model due to Rudesbusch and Svensson (1999), while the a optimized for the Rudebusch-Svensson model also delivered reasonable results in the forward-looking model.

responses? The answer is shown in figure 12.

Impulse responses are shown for delays of zero and 3; the model becomes unstable when the policy delay is any longer and policy is too aggressive (i.e., when $\phi_\pi = 3.0$). Nor can the model be solved when the inertia in the policy rule is as high as the baseline value of 0.85. Large and potentially explosive fluctuations arise when policy is delayed, particularly when attempts to compensate for delay are made by responding more strongly to inflation. Because the Rudebusch-Svensson model is backward-looking, the delay in reacting combine with a gradual policy response ($k = 3$ and $\rho_i = 0.5$) leads to a fall in the real interest rate and unemployment actually declines, exacerbating the rise in inflation.

I take the Levin and Williams result as a cautionary tale – give potential policies a test in models with significant endogenous inertia and make sure that delay and aggression are not going to generate instability.

I have touched on uncertainty about the persistence of inflation shocks and the degree of backward-looking aspects in the model. There is also a great deal of uncertainty about the appropriate structural model of inflation.[20] Prior to the recent inflation surge, there were arguments that the Phillips curve was very flat and that policymakers could push unemployment lower without needing to worry about any effect on inflation. In testimony before the U.S. House Committee on Financial Services in July 2019, Federal Reserve Chairman Powell had this exchange with Representative Ms. Ocasio-Cortez (D-NY): Ocasio-Cortez "And I have been seeing lately that economists are increasingly worried that the idea of a Phillips curve that links unemployment and inflation is no longer describing what is happening in today's economy. Have you been considering on that? What are your thoughts on that?" Chair Power: "Yes. Very much so. We spend a great deal of time on that. The connection between slack in the economy or the level of unemployment and inflation was very strong if you go back 50 years. And it has gotten weaker and weaker and weaker to the point where it is a faint heartbeat that you can hear now. It is still there. You can see it at the State level data and things like that."[21]

Uncertainty about the slope of the Phillips curve is a form of parameter uncertainty, and the classic conclusion of Brainard (1967) was to exercise caution in the face of parameter uncertainty. As is well-known, Brainard's result is model specific and does

[20] For example, see Rudd (2021) for a very critical assessment of the new Keynesian Phillips curve.

[21] U.S. House Committee on Financial Services in July 10, 2019,
https://www.govinfo.gov/content/pkg/CHRG-116hhrg39738/pdf/CHRG-116hhrg39738.pdf.
Powell went on to say the Phillips curve could still be seen in state level data. See Hooper, Mishkin, and Sufi (2019).

not generalize. Ferrero, Pietrunti, and Tiseno (2019) reexamine monetary policy under uncertainty in a NK model and find that uncertainty about the slope of NKPC calls for a more aggressive response if the cost shock is sufficiently persistent. This result implies that when the policymaker underestimates the degree of persistence, as occurred in 2021, it will react too cautiously to exogenous shocks to inflation.

Uncertainty about the endogenous inertia that characterizes inflation dynamics is also important. Ulf Söderström (2002) showed that this type of uncertainty calls for a more aggressive policy response, a sharp contrast to Brainard's conclusion that caution is called for in the face of uncertainty. A useful analogy is to consider the best way to respond to wildfires. An initial fire may burn itself out if fuel is scarce and weather conditions are calm. But weather conditions might change and if winds pick up, the fire may rapidly spread. If it continues to spread, reaching areas with more plentiful fuel, a fire can begin creating its own weather, further intensifying the fire. The best strategy is to attempt aggressively to control even small fires to prevent them from spreading. Similarly, a rise in inflation may trigger rising inflation expectations that, if left unaddressed, lead to increases in wages and result in a wage-price spiral. A cautious approach – waiting to see if inflation persists – can put policymakers into the position the Fed finds itself today.

The literature on policy in the face of uncertainty assumed policy reacted immediately to shocks to inflation. Unfortunately, the results of section 3 suggested that an aggressive response can generate instrument instability if the response is delayed too long.

4.1.3 Lessons on uncertainty

I conclude that the literature on model uncertainty offers the following lessons: 1) base policy on the assumption that temporary shocks are likely to turn out to be persistent; 2) policymakers should act as if they expect new inflation shocks just when they are already facing the need to slow the economy down to deal with a surge in inflation; and 3) use models that overestimate endogenous persistence in designing policy.

In the current environment, all three of these lessons seem to have been ignored. Of course, aggressively countering slight flare-ups of inflation need not require much actual policy action. If the public is firmly convinced that the central bank will quickly respond to inflation, expectations will remain anchored and will help stabilize actual inflation.

4.2 Political bias

A second explanation for the 1960s and 70s inflation that also seems particularly relevant now, at least in the U.S., points to an inflationary biases due to political pressures on central banks, combined with discretionary policymaking. An inability to credibly commit to low inflation in an environment of systematic political pressures to exploit the short-run trade-off between inflation and unemployment led the public to expect higher inflation. The best the central bank could do was deliver it.

As applied to the 1960s and 70s, the outline of the story is as follows. In 1962, the first Economic Report of the Kennedy Administration set an interim goal of 4 percent for unemployment, a value well below current estimates of the natural rate of unemployment for that period.[22] Political pressures to achieve an unsustainably low unemployment, combined with a static view of the trade-offs offered by the Phillips curve, helped explain the rising inflation trend in the U.S. during the 60s and 70s.[23]

Today, there is vocal political support in the U.S. for ensuring an "inclusive" economic recovery and the lifting of interest rates by the Fed in December 2015 when the unemployment rate was 5 percent (and the natural rate was estimated to be 4.7 percent) is viewed as a mistake. In response, the FOMC's "Statement on Longer-Run Goals and Monetary Policy Strategy" was revised in August 2021 to define the employment goal as "a broad-based and inclusive goal that is not directly measurable and changes over time owing largely to nonmonetary factors... Consequently, it would not be appropriate to specify a fixed goal for employment; rather the Committee's policy decisions must be informed by assessments of the shortfalls of employment from its maximum level, recognizing that such assessments are necessarily uncertain and subject to revision."

Making policy decisions "informed" by employment shortfalls from a goal "that is not directly measurable" has the potential to impart an asymmetric, inflationary bias in policy (Blinder (1998), Ruge-Murcia (2003)). Thus, in 2021, even with the unemployment rate at record lows and other measures of labor utilization also high, the Fed seemed reluctant to focus on dealing with rising inflation. In addition, the

[22] In the first quarter of 1961, the unemployment was 6.8 percent while the (current) CBO estimate of the non-cyclical rate of unemployment for the quarter is 5.9 percent. Of course, the concept of the natural rate only came to prominance later due to Friedman (1968). Another similarity with the 1960s is that both then and now fiscal policy was expansionary.

[23] This story incorporates elements of three of the four standard explanations: the wrong theory (a static Phillips curve), imperfect information (an underestimate of the natural rate of unemployment); and political pressures together will the inability to commit. Another similarity between the 1960s and recent years is the Fed's apparent faith in fine tuning as reflected in its belief that it can engineer a soft landing, reducing inflation without causing unemployment to rise.

Fed's 2019 review of its policy framework meant it no longer even has a clearly defined inflation target.

The desire for central banks to do more – to not hold back a strong recovery – clashes with the view expressed in 1955 by then Federal Reserve Chairman William McChesney Martin (1955) who compared the job of the Federal Reserve to that of a "...chaperone who has ordered the punch bowl removed just when the party was really warming up." (p. 12)[24]

An inability to credibly commit to low inflation policies, combined with an incentive to seek short-term reductions in unemployment were central components of many theories of inflation developed in the 1980s. Work based on these theories were particularly influential in supporting the idea of independent central banks headed by inflation adverse central bankers – a Rogoff (1985) conservative central banker – or constrained by explicit inflation targets – Bernanke (2005). This idea was central to the consensus that emerged from the inflation experiences of the 1970s. The consensus about monetary policy that was articulated by Bernanke (2005) and Goodfriend (2007) seems to be eroding, suggesting a further risk to the inflation outlook.

The movement away from a consensus around monetary policy is reflected in the views of economist. Since 1976, a sample of members of the American Economic Association (AEA) have been surveyed periodically about their views on important macroeconomic and microeconomic questions. Recent results from this survey are reported in Geide-Stevenson and La Parra Perez (2021).[25] For each of the economic proposition on the survey, respondents were asked whether they agreed (A), agreed with provision (A+P), or disagreed (D).

The top panel of figure 13 reports the results from the 2000, 2011 and 2021 surveys for two propositions: "The Federal Reserve should focus on a low rate of inflation rather than other goals such as employment, economic growth, or asset bubbles" (top panel), and "Management of business cycles should be left to Fed, not to fiscal policy" (bottom panel). For both propositions, there is a declining share of economists agreeing or agreeing with provisions, while the share disagreeing has grown.[26] The first of these propositions is central to the rationale for central banks to adopt inflation targeting. The fraction of AEA members surveyed who disagreed with this proposition has risen from 28.4 percent in 2000 to 61.6 percent in 2021. The fraction agreeing without

[24] See https://fraser.stlouisfed.org/blog/2016/03/martins-punch-bowl-metaphor/.

[25] The 2021 survey was the first conducted online, and yielded 1436 responses once non-US resident and duplicate responses were eliminated. Details on the characteristics of the respondents are discussed in Geide-Stevenson and Perez (2021).

[26] These the propositions were added to the survey in 2000.

provisions has fallen over this period from 42 percent to 18 percent, while the share agreeing with provisions has fallen from 72 percent to 32 percent..

The changing views on the respective roles of the Fed and fiscal authorities in managing business cycles is not surprising, given the active use of fiscal policy in response to the global financial crisis in 2008-09 and during COVID-19 in 2020-2021. In 2000, 28.5 percent disagreed with the proposition that the Fed, not fiscal policies, manage business cycles; by 2021, this fraction had risen to 66.6 percent.

5 Summary and conclusions

Central banks have fallen behind the curve in addressing the recent surge in inflation. The implications of standard monetary policy models suggest, however, that the costs of delay are relatively small. An aggressive response combined with delay can, however, produce volatility in the return to steady state. The standard model, though, is based on firmly anchored inflation expectations and a shared belief by all that monetary policy will eventually respond strongly to inflation. If agents are backward-looking or base actions on expectations that differ from rational expectations, delay plus aggressive responses can lead to instability.

The Fed has underestimated the persistence of inflation shocks and inflation inertia. In doing so, it has forgotten the relevant theory for dealing with inflation surges in a world of model uncertainty. That theory suggests that policymakers should systematically overestimate the degree of persistence of inflation shocks, not underestimate persistence in the hope shocks will quickly fade away.

The Fed may also have overestimated the maximum sustainable level of employment in a desire for a more inclusive recovery. It has established an asymmetric, unmeasurable objective that opens it to political pressures and imparts an inherent inflationary bias to policy. Even among economists, there is declining support for monetary policy to focus on maintaining low and stable inflation.

A policy framework that put increased emphasis on an unmeasurable goal that incorporated a bias towards expansion, combined with overconfidence in the public's belief inflation would remain anchored at 2 percent even as household inflation expectations moved above 4 percent over a year ago, are all uncomfortable remainders of the environment that led to the Great Inflation.

The pessimistic view, therefore, must be that all the pieces are in place for a repeat of the 1970s.

Let me conclude, though, by giving the optimistic view. Since December, the

FOMC has consistently signaled that interest rates will rise. The credibility of the Fed's 2 percent inflation target still seems sufficient to keep long-term inflation expectations anchored. While slow to address the rise in inflation, the power of forward guidance, combined with near rational expectations and the basic forward-looking nature of households and firms may mean that the late start to addressing the surge in inflation will end up mattering little. Most importantly, there seems to be a recognition that maintaining the inflation anchor requires action on the part of the central bank and that the trend rate of inflation is ultimately determined by monetary policy.

Only time will tell whether the advanced economies now facing surging inflation will see inflation quickly return to target. If not, a costly recession is likely to be necessary to re-establish a low-inflation environment. Ironically, the costs of such a recession will fall disproportionately on those the Fed had hope would benefit from pursuing a more inclusive expansion.

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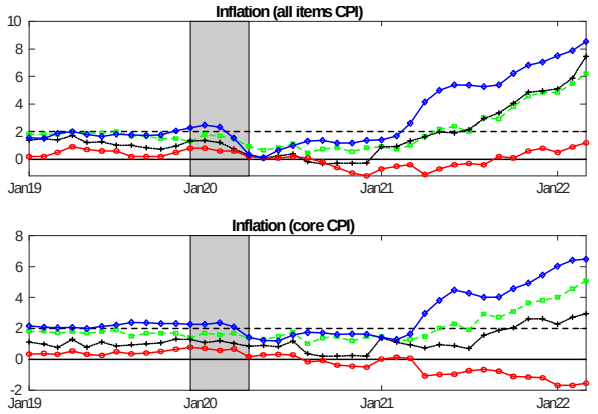

Figure 1: CPI inflation (% yoy): US (blue), Japan (red) Euro Area (black), UK (green). top panel: all items, bottom panel: less food and energy.

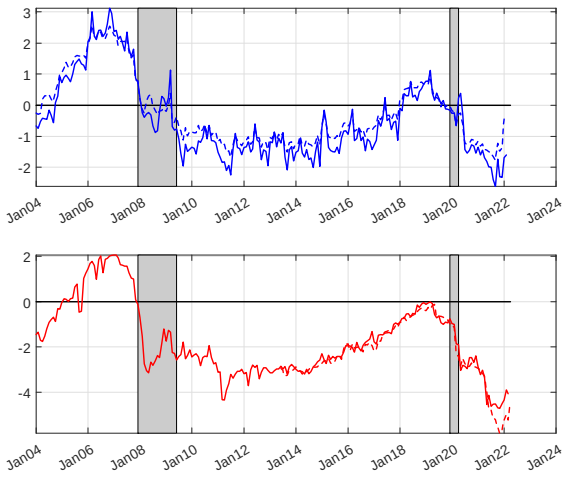

Figure 2: Top panel: 1 yr (solid) and 2 yr (dash) uses inflation expectations from the FRB Cleveland based on financial market data and surveys of Blue Chip and Professional Forecasts. Bottom panel: 1 yr based on household expectations (Univ. of Michigan, Survey of Consumer Finances (solid), and NY Fed Suvey of Consumer Expectations (dash).

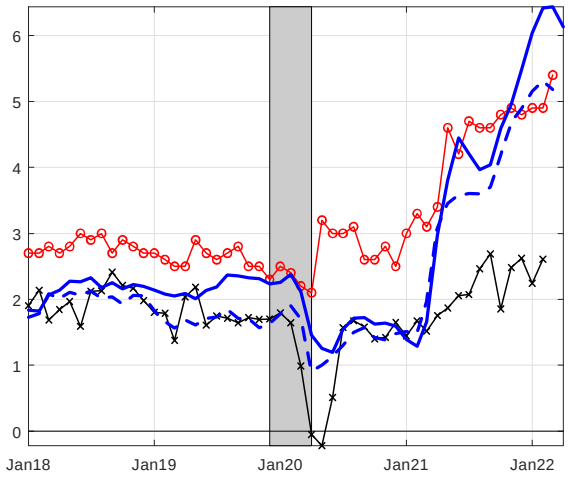

Figure 3: U.S. core CPI inflation (blue), core PCE inflation (blue dash), U. of Michigan expected inflation (red), and 1-year expected inflation from FRB Cleveland, FRED: EXPINF1YR (black).

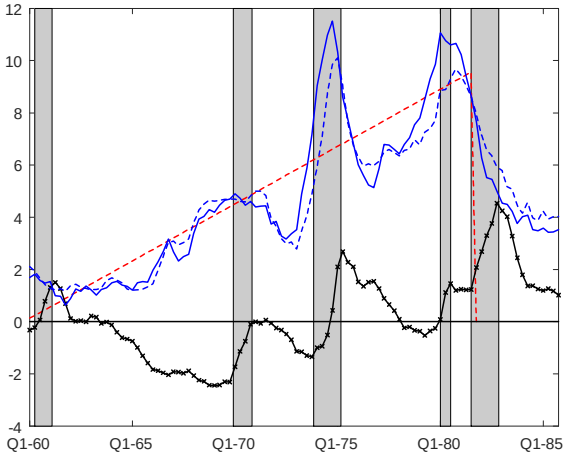

Figure 4: Year over year inflation as measured by the PCE (blue, solid line) and core PCE (blue dotted line), together with the unemployment rate minus the CBO measure of the natural rate of unemployment (black dashed line). Red dashed line is 1960Q1-1981Q4 trend of PCE inflation. Shaded area are recesions based on NBER business cycle dates.

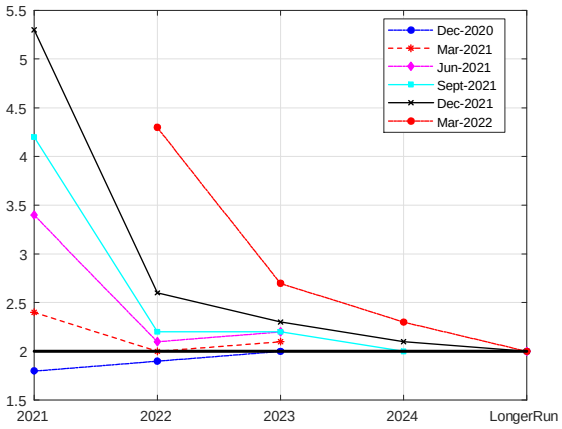

Figure 5: FOMC projections for 4-quarter PCE inflation at different meeting dates. Source: FOMC Summary of Economic Projections, various meeting minutes.

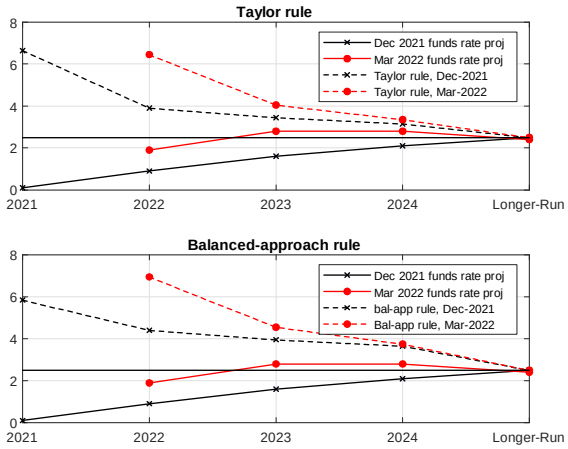

Figure 6: Policy rate implied by FOMC projections of inflation and unemployment. Black circles are policy rate projections from Dec. 2021

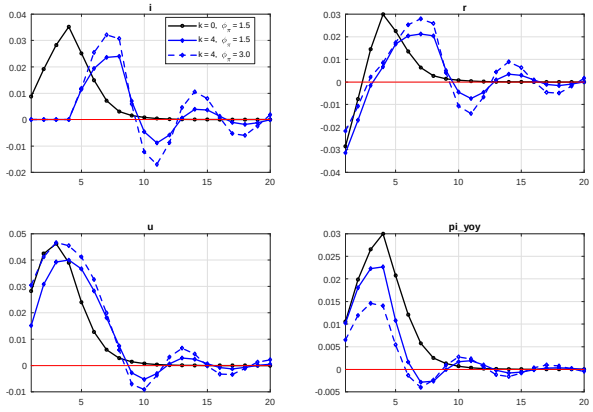

Figure 7: Response under to an inflation shock.

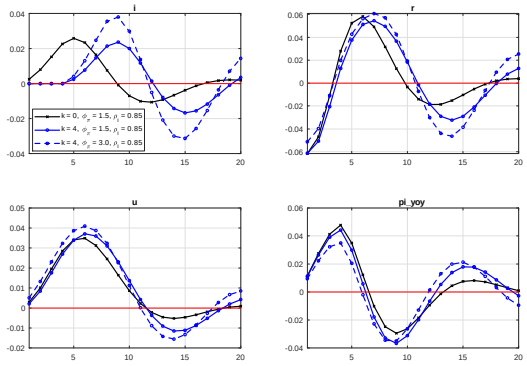

Figure 8: Response under to an inflation shock: different inflation responses

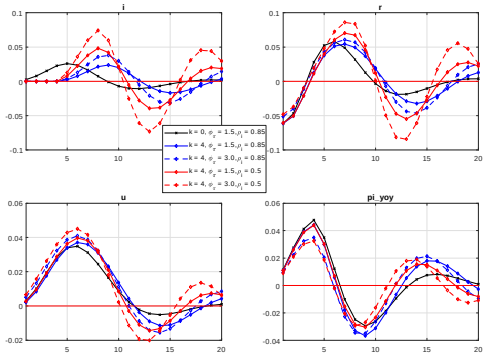

Figure 9: Response under to an inflation shock: different inflation responses and policy inertia

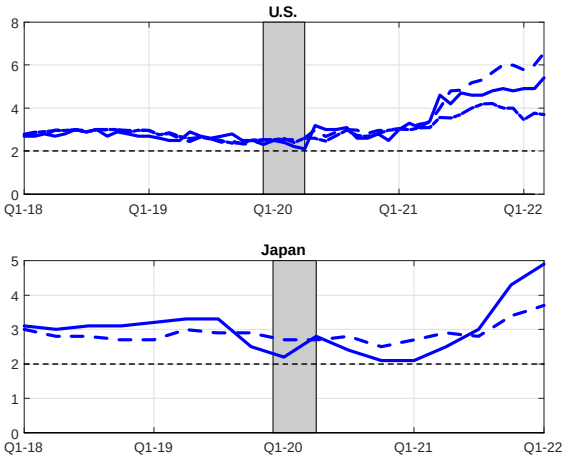

Figure 10: Top panel – US: Cleveland Fed 1 yr (black solid), Cleveland Fed 2 yr (black dashed), 5yr 5yr ahead (black dot dash), Michigan (red solid), NY Fed median 1-year (red dashed) and 3-yr (red dot dash). Bottom panel – Japan: Opinion Survey 1 yr (red solid) and 2 yr (red dash), Tankan 1 yr (black solid) and 3 yr (black dot dash).

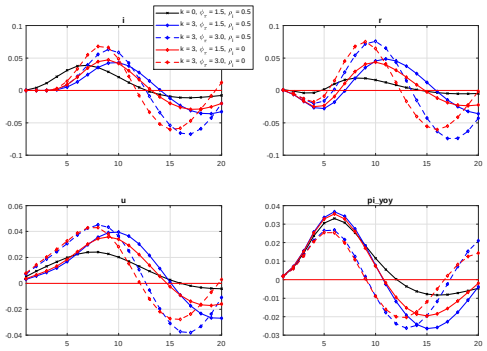

Figure 11: Response to an inflation shock with "behavioral" expectations of future inflation based on Bianchi, Fischer, and Melosi (2021).

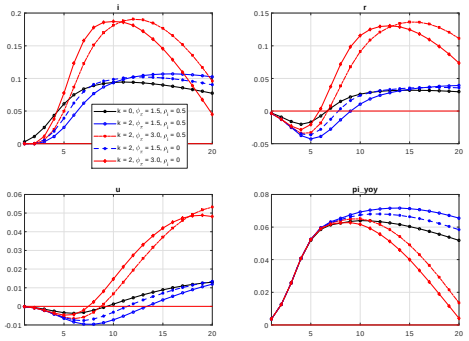

Figure 12: Response under to an inflation shock in the Rudebusch-Svensson model: delays greater than two quarters lead to instability

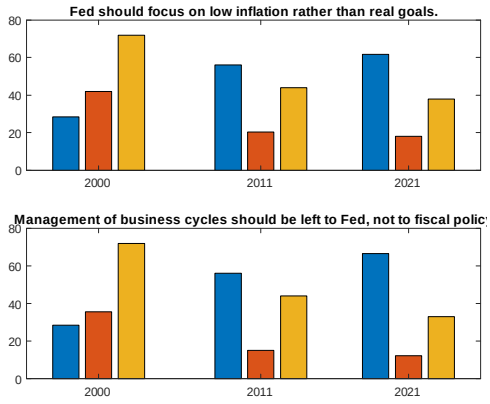

Figure 13: Propostion of respondents who agreed (A), agreed with provision (A+P), or disagreed (D) with each proposition. Source: Geide-Stevenson and La Perra Perez (2021).