ECON 375: Monetary Policy
Professor William English

By submitting this essay, I attest that it is my own work, completed in accordance with University regulations. —Ran Wang

Asymmetric Average Inflation Targeting: A Better Rule for Monetary Policy

by Ran Wang '23

1. Introduction

On August 27, 2020, the Federal Open Market Committee (FOMC) announced its new monetary policy framework in a revised Statement on Longer-Run Goals and Monetary Policy Strategy. The updates acknowledged the downward risks posed by "the proximity of interest rates to the effective lower bound (ELB)" and highlighted the absence of an unwanted rise in inflation despite a strong labor market (Powell, 2020). These key macroeconomic developments impart asymmetric elements to an average inflation targeting (AIT) framework (Clarida, 2020). This paper presents an explicit numerical rule to capture the new framework and argues that asymmetric AIT allows for a stronger and faster recovery from negative spending shocks than the Taylor (1993) rule, at the cost of a slight overshoot in inflation. More generally, simulating outcomes for other potential shocks, I find that the new framework delivers meaningful improvements in stabilizing the economy, with shorter lookback periods for the average inflation rate leading to smaller overshooting effects.

2. An asymmetric numerical rule for the new monetary policy framework

Taylor (1993) introduced an explicit formula for setting the federal funds rate (FFR):

$$i_t = r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5y_t, \quad (1)$$

where i_t denotes the nominal policy rate in period t, r^* denotes the natural level of interest, π_t denotes the inflation rate in period t, π^* denotes the desired inflation target, and y_t denotes the output gap in period t. This formula is known as the Taylor (1993) rule.

Although a benchmark for monetary policy, the Taylor (1993) rule fails to capture several aspects of the revised monetary policy strategy (FOMC, 2021). I will modify the Taylor (1993) rule to address these shortcomings and propose another explicit numerical rule which is more consistent with the new policy framework.

The statement introduces two major changes to help the Fed achieve its dual mandate. On the employment side, the historically strong pre-pandemic labor market did not induce excessive upward pressures on the price level, mitigating concerns of a significant rise in inflation at times of low unemployment. Therefore, the new framework emphasizes "shortfalls of employment from its maximum level" rather than "deviations of employment" (Powell, 2020).

Accordingly, in our numerical rule, the Fed does not raise the policy rate due to a low unemployment rate, or equivalently high output gap by Okun's Law, unless accompanied by undue inflationary pressures. Hence, I introduce an asymmetric formation for the output gap $\min\{y_t, 0\}$, upper bounded by zero when the output gap is positive, in lieu of y_t. In the case of an accompanying high inflation, the inflation terms $\pi_t + 0.5(\pi_t - \pi^*)$ still suggest a contractionary monetary policy.

The revised statement also changes the Fed's approach to price stability. The persistent undershoot of inflation from the Fed's 2 percent target has lowered inflation expectations and placed additional downward pressure on realized inflation (Powell, 2020). In an economy often constrained by the ELB, the Fed has less scope to cut the FFR to support the economy. Bernanke, Kiley, and Roberts (2019) and Arias et al. (2020) suggest that temporary AIT may provide moderate benefits in stabilization and help mitigate the challenges posed by the ELB. The Fed then "seeks to achieve inflation that averages 2 percent over time, and therefore judges that, following periods when inflation has been running persistently below 2 percent, appropriate monetary policy will likely aim to achieve inflation moderately above 2 percent for some time" (FOMC, 2020).

As a result, I propose adding another term, $\min\{(\bar{\pi})_T - \pi^*, 0\}$ (multiplied by some coefficient1), to the inflation terms in the rule $\pi_t + 0.5(\pi_t - \pi^*)$, where $(\bar{\pi})_T$ denotes the T-year average of inflation. The modification demonstrates that the Fed, to address the challenge posed by the ELB, would aim to overshoot after periods of persistent low inflation. This does not mean that the model fails to address high inflation: nominal interest rates will still react by more than one-for-one to increases in inflation, consistent with the Taylor principle (Woodford, 2001).

Incorporating the ELB constraint, as the Fed has never implemented negative policy rates (Figure 1), my proposal of the new numerical rule is:

$$i_t = \max\{r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5\min\{(\bar{\pi})_T - \pi^*, 0\} + 0.5\min\{y_t, 0\}, ELB\}\,. \quad (2)$$

3. Simulations of potential shocks

Before running simulations of different potential shocks, I set the values of $r^* = 0.5$ percent, consistent with the Laubach-Williams (2003) estimation (Figure 2); $\pi^* = 2$ percent, in line with the revised statement (FOMC, 2020); and $ELB = 0.125$ percent, with reference to the Monetary Policy Report (FOMC, 2021). I will first relax the ELB constraint to better reflect the efficacy of the asymmetric terms. The results with the ELB will be displayed later.

The inflation lookback period T ("memory") is also undetermined. Following Bernanke, Kiley, and Roberts (2019), I conduct two different AIT models with 1-year and 3-year memory respectively, together with the Taylor (1993) rule as control, to study the selection of T.

I combine different rules for monetary policy with the spreadsheet model from class:

(3)

1 The Fed does not explicitly give a number for this coefficient and chooses to conduct "a flexible form of average inflation targeting" (Powell, 2020). In this paper, I choose the coefficient to be 0.5 with reference to the rule Professor English showed in Lecture 7.

$$IS: y_t = 0.5y_{t-1} + 0.5y_{t+1} - 0.1(i_t - \pi_t - r^*);$$

$$PC: \pi_t = 0.5\pi^* + 0.2\pi_{t-1} + 0.3\pi_{t+1} + 0.2y_t.$$

We will consider negative and positive spending shocks and inflation shocks. Due to the asymmetric nature of our numerical rules, positive and negative shocks with the same magnitude may lead to different paths, so both simulations are necessary.

We start with a negative spending shock of -1 percentage point in period 1, -0.75 in period 2, -0.5 in period 3, and -0.25 in period 4. Figure 3 presents the path simulations without the ELB constraint. Both asymmetric AIT rules show faster recoveries and less negative peak effects on the output gap and inflation than the Taylor (1993) rule, suggesting that the asymmetric AIT rules better support the economy in face of a recession. In addition, comparing the overshoots after recovery, the asymmetric AIT with 1-year memory stabilizes inflation better than that with 3-year memory. We arrive at similar conclusions when we include the ELB constraint (Figure 4).

With a positive spending shock of the same magnitude, I create the paths shown in Figure 5. The two asymmetric AIT rules coincide and generate a greater boost in the output gap at the cost of inflation reaching 4 percent at the peak. I offer two possible interpretations to this high inflation. First, the Fed may believe that the current Phillips curve is flatter than our model assumes because of the muted responsiveness of inflation. Under this assumption, the peak inflation would be lower. Alternatively, the Monetary Policy Report explicitly states that "if an undue increase in inflation were to arise, policymakers would have the tools to address such an increase" (FOMC, 2021). As discussed in the Appendix, we adjust our rule by setting an inflationary threshold and releasing the upper bound of zero for the output gap term when inflation goes higher. Figure 6 indicates that the adjusted model does a fair job compared to

Taylor (1993) rule in controlling the inflation peak. The path of the FFR, however, shows an abrupt surge and a plummet, undermining the credibility of such a rule. I suggest flexible adjustment of policy rates at times of high inflation based on our proposed rule.

For the negative inflation shock, I choose a series of shocks with -2 percentage points in period 1, -1.5 in period 2, -1 in period 3, and -0.5 in period 4. In Figure 7, the two asymmetric AIT rules boost the output gap more than double the amount the Taylor (1993) rule does. An overshoot in inflation comes along with the boost and the effect is larger for asymmetric AIT with 3-year memory, but an inflation rate of 2.5 percent is fair and in fact strengthens the Fed's capability of cutting the FFR. Once again, including the ELB gives similar results (Figure 8).

Unsurprisingly, all three rules coincide under positive inflation shock as they give the same expression under positive inflation deviations and negative output gaps (Figure 9).

4. Path simulations under uncertainty about the level of potential output

In addition to potential immediate shocks, we consider uncertainty in the real world. If the Fed anticipates potentially bad future outcomes, it may take preemptive actions to mitigate possible future disruptions to the economy, even when the economy seems robust at the moment.

I test a negative spending shock in the future of -1 percentage point in periods 7 and 8. As shown in Figure 10, the asymmetric AIT models exhibit faster recoveries and less negative peak effects on the output gap and inflation and the one with 1-year memory shows smaller overshooting effects, similar to what we have got with immediate negative spending shocks.

Nevertheless, I admit that the spreadsheet model is oversimplified. The use of future output gap y_{t+1} instead of expected values in the IS curve assumes that the public foresee the future recession well and adjust their inflation expectations. This may explain the negative output gaps and the deviations in inflation in the first few periods of the simulation despite a cut in the FFR.

5. Conclusion

The Fed gains from the asymmetric AIT framework with a stronger and faster recovery from negative IS shocks than the Taylor (1993) rule, especially when the interest rate is stuck near the ELB. Overshooting in inflation is a by-product but, under a flat Phillips curve, its effect is not severe and creates more room for the Fed to cut the FFR. Though our results for positive shocks and uncertainty are flawed, we attribute these shortcomings to the simplicity of the model and encourage future explorations of flexibly adjusting rates during high inflation episodes and of more accurately modeling future output gaps. In all, the paper shows that the asymmetric rules are better able to stabilize the economy and takes a meaningful first step towards mathematically formalizing the Fed's average inflation targeting framework.

References

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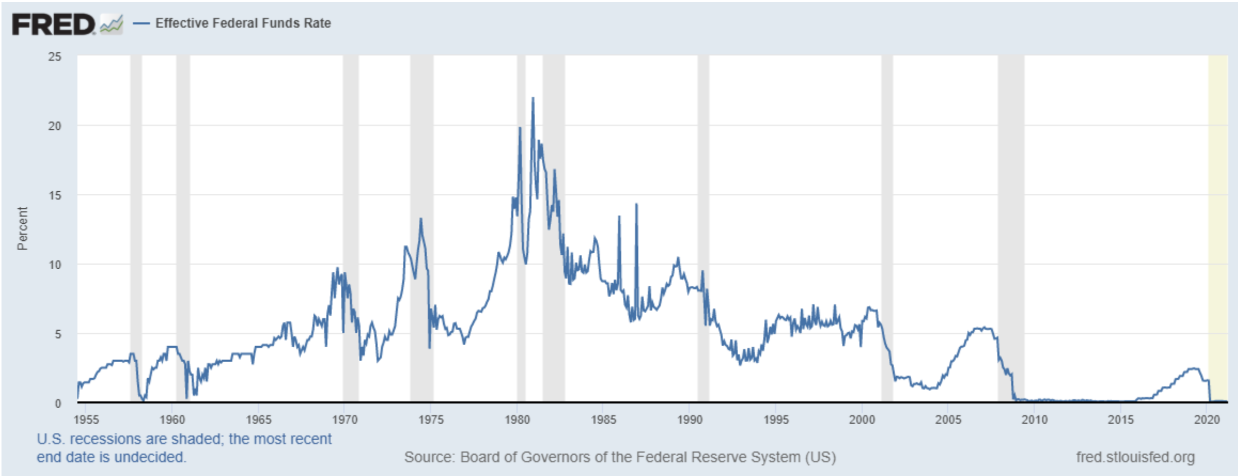
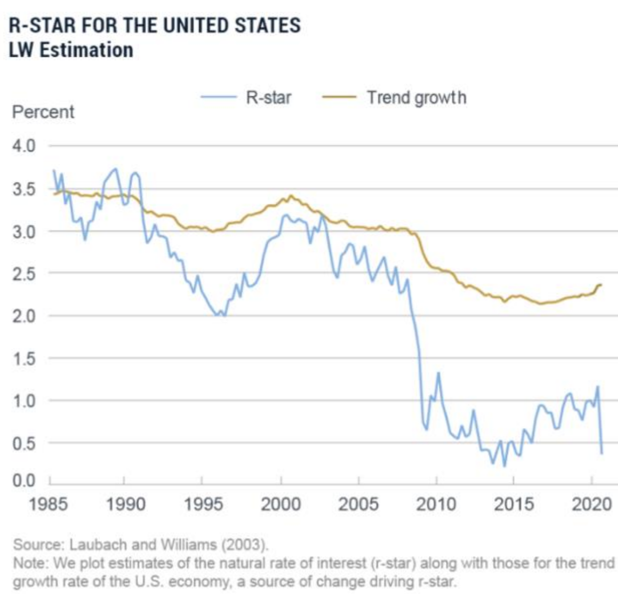
Figure 1. Effective Federal Funds Rate, 1954 – Present.



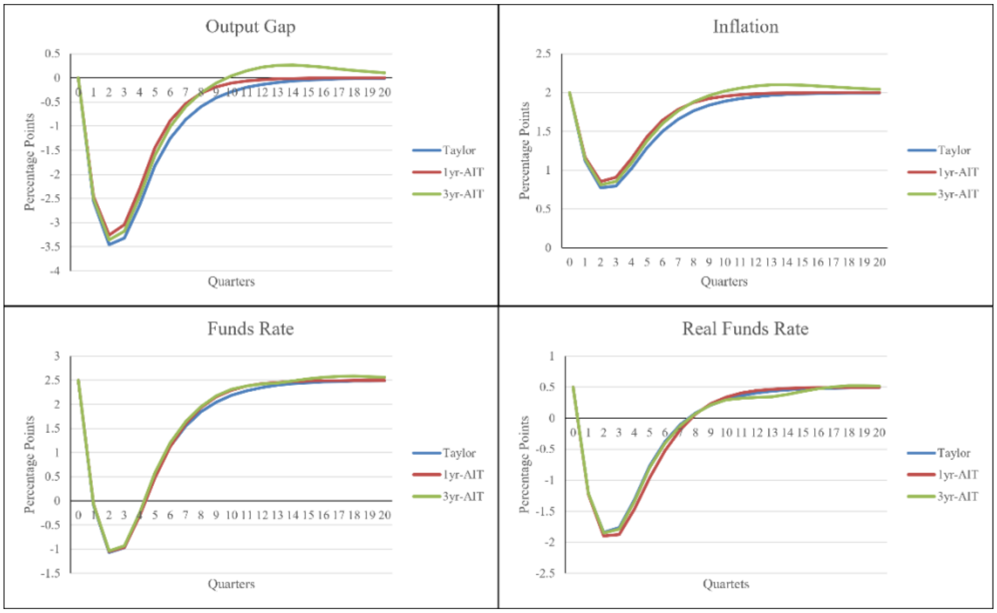
Source: FRED and the Federal Reserve.

Figure 2. LW-Estimates of R-Star (the natural rate of interest), 1985 – Present.



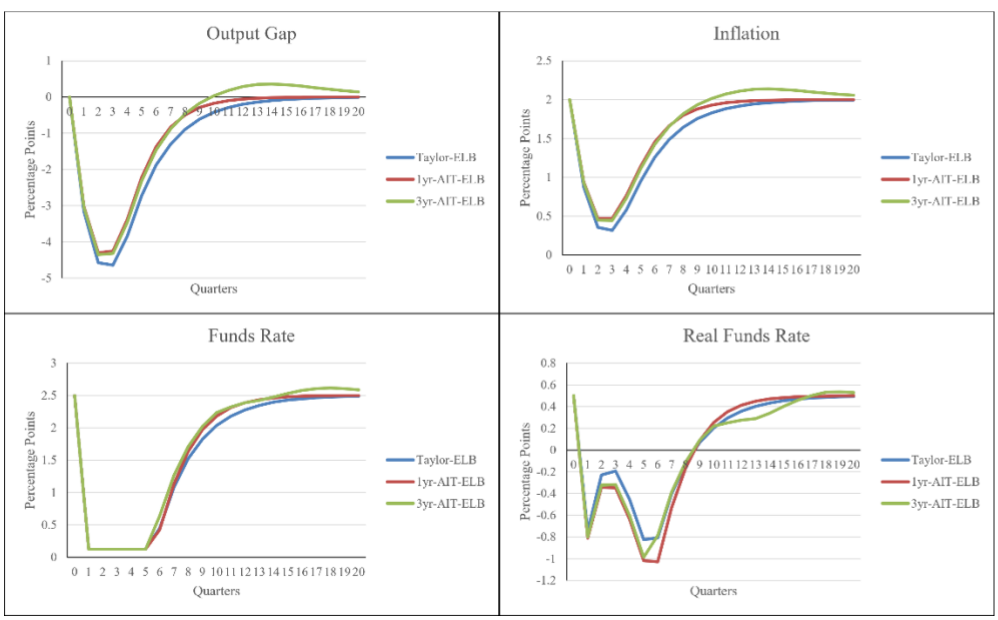
Source: Laubach and Williams (2003) and New York Fed.

Figure 3. Path simulations to a negative spending shock without the ELB constraint.



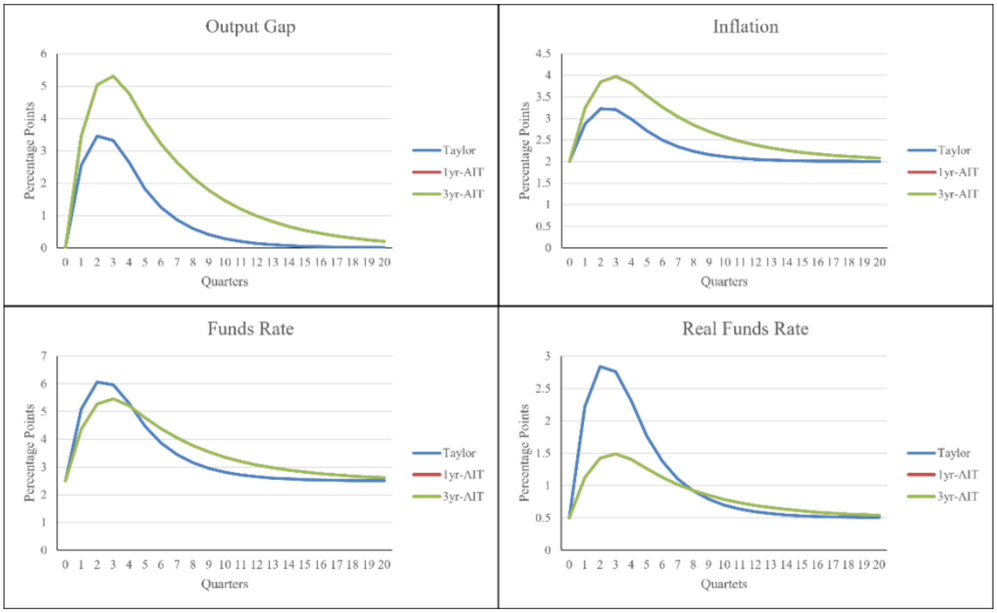
Source: Authors' calculations.

Figure 4. Path simulations to a negative spending shock with the ELB constraint.



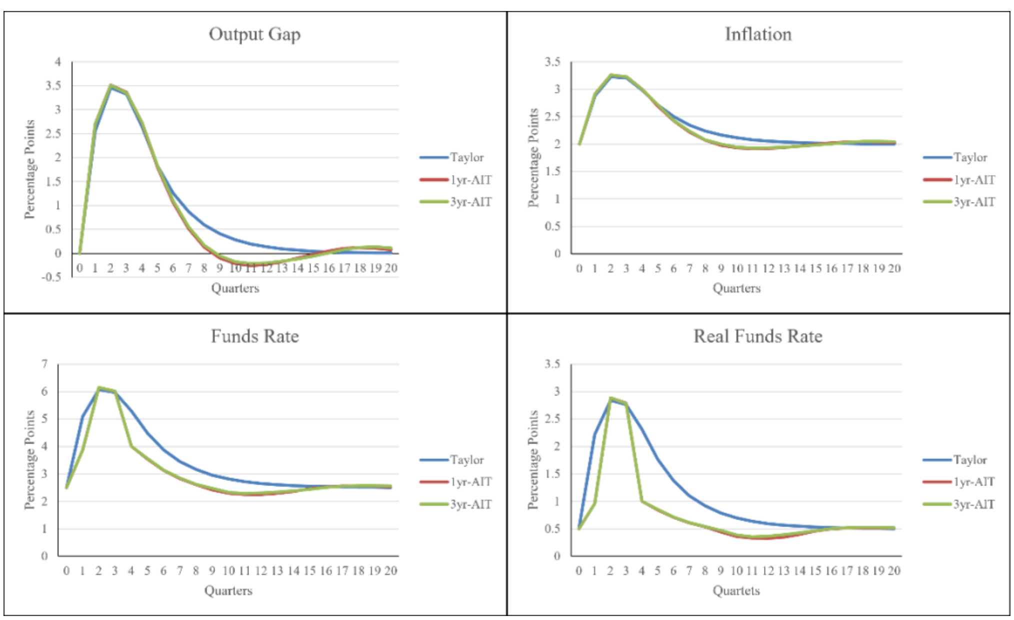
Source: Authors' calculations.

Figure 5. Path simulations to a positive spending shock.



Note: The "1-yr AIT" coincides with the "3-yr AIT".
Source: Authors' calculations.

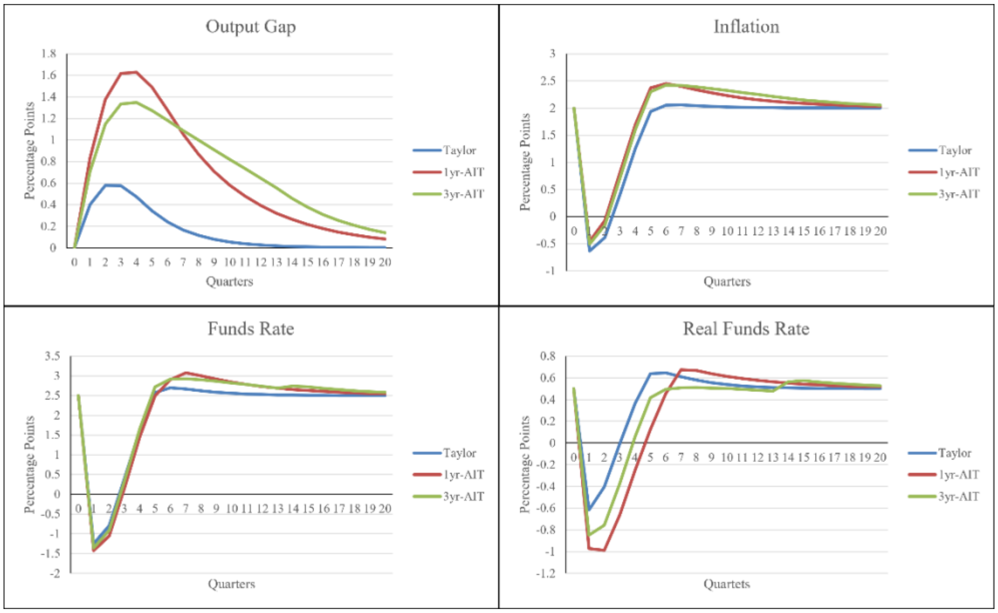
Figure 6. Path simulations to a positive spending shock (adjusted with inflationary threshold).



Note: The "1-yr AIT" coincides with the "3-yr AIT".

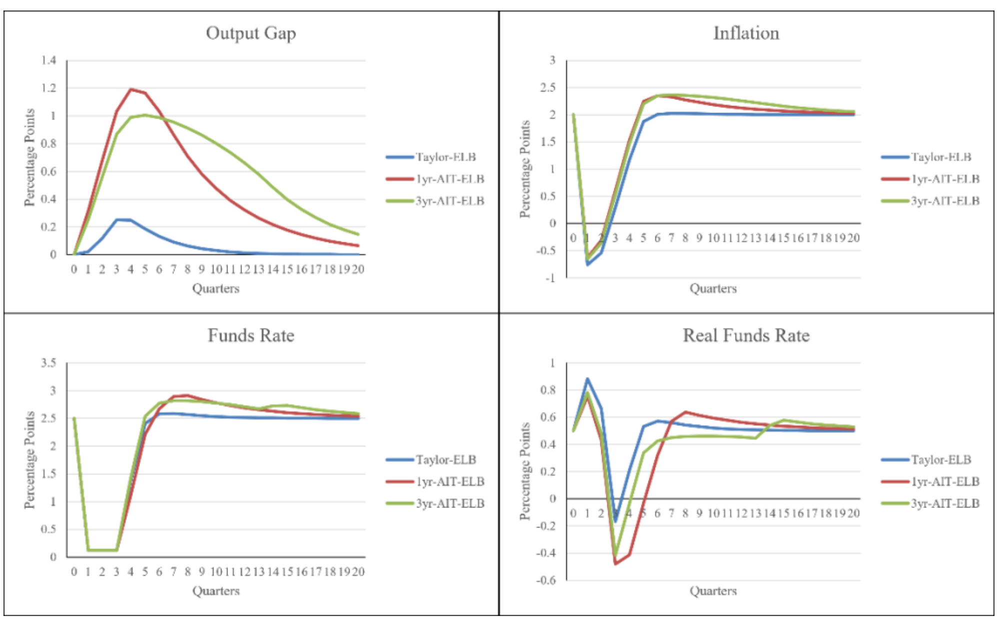
Source: Authors’ calculations.

Figure 7. Path simulations to a negative inflation shock without the ELB constraint.



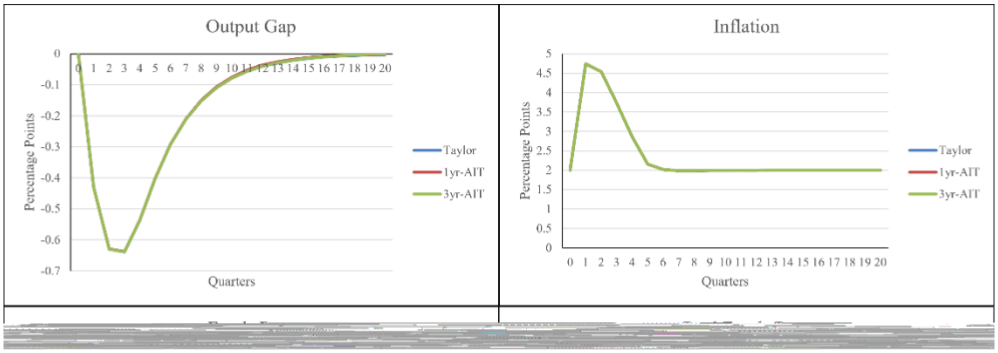
Source: Authors’ calculations.

Figure 8. Path simulations to a negative inflation shock with the ELB constraint.



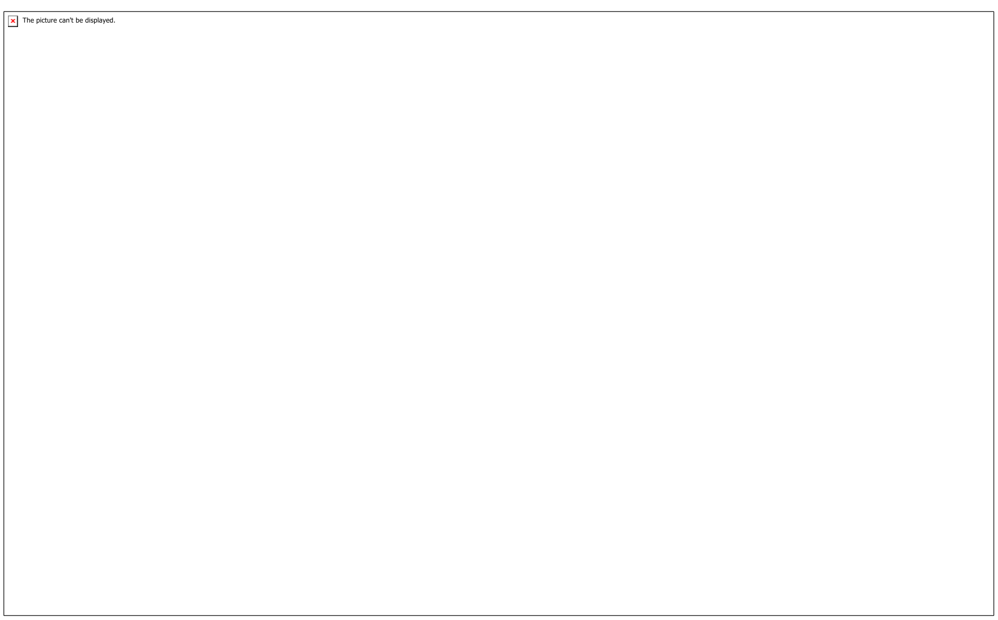
Source: Authors’ calculations.

Figure 9. Path simulations to a positive inflation shock.



Note: All three paths coincide.
Source: Authors' calculations.

Figure 10. Path simulations to a future negative spending shock without the ELB constraint.



Source: Authors' calculations.

Appendix: Rule Adjusted with an Inflationary Threshold (Positive Spending Shocks)

Define a new output gap term in the rule with an inflationary threshold:

$$\tilde{y}_t = \begin{cases} \min\{y_t, 0\}, & \pi < thresh \\ y_t, & \pi \geq thresh \end{cases} \tag{4}$$

For the value of the threshold, it might largely depend on the Fed's tolerance to upshoot in inflation. I would choose $thresh = 3$ percent here. The adjusted rule is then:

$$i_t = \max\{r^* + \pi_t + 0.5(\pi_t - \pi^*) + 0.5\min\{(\bar{\pi})_T - \pi^*, 0\} + 0.5\tilde{y}_t, ELB\}. \tag{5}$$

I substitute the new rule in the spreadsheet model and get results in Figure 6 under the selected positive spending shock.