A Smorgasbord of Expectation Shocks

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Abstract

I study a smorgasbord of various expectation shocks in two kinds of macroeconomic models. I present impulse response results for exogenous, temporary expectation shocks lasting for one period only *or* 4 periods, permanent exogenous shocks (long run shock) and a series of multiple positive and negative, temporary exogenous shocks within a long period. As a baseline, I use a simple, aggregate demand and supply framework with adaptive expectations. Later, I extend my results by using modern New Keynesian models with various choices of parameters, allowing for a deeper analysis. The results indicate blah.. monetary policy rule explains the variation in results etc etc etc[1].

Keywords: Smorgasbord of Inflation Expectation Shocks. Temporary, Permanent and Sequence of Temporary Expectation Shocks. Monetary Policy and Inflation Expectations. AD and AS Model. Expectation Shocks in New Keynesian Models.
JEL Classification:

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[1] The replication code of this paper, using Python, R and Julia is available on my github page: https://github.com/sonanmemon

CONTENTS

1. Motivation

2. Aggregate Demand and Aggregate Supply Model

blah blah blah

2.1. Building Blocks

Output Equation/Demand for Goods and Services:

$$Y_t = \bar{Y} - \alpha(r_t - \varrho) + \epsilon_t,\ \alpha > 0 \tag{1}$$

Fisher Equation:

$$r_t = i_t - \mathbb{E}_t\{\pi_{t+1}\} \tag{2}$$

Philip's Curve:

$$\pi_t = i_t - \mathbb{E}_{t-1}\{\pi_t\} + \phi(Y_t - \bar{Y}) + v_t,\ \phi > 0 \tag{3}$$

Adaptive Expectations:

$$\mathbb{E}_t\{\pi_{t+1}\} = \pi_t + \eta_t,\ \forall t \tag{4}$$

Monetary Policy Rule:

$$i_t = \pi_t + \varrho + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y}),\ \theta_\pi, \theta_Y > 0 \tag{5}$$

2.2. Long Run Equilibrium

$$\begin{aligned} Y_t &= \bar{Y} \\ r_t &= \varrho \\ \pi_t &= \pi^* \\ \mathbb{E}_t\{\pi_{t+1}\} &= \pi^* \\ i_t &= \varrho + \pi^* \end{aligned}$$

2.3. PARAMETERS

Model Parameters

$\bar{Y} = 50$	$\pi^* = 2$
$\varrho = 2$	$\alpha = 1$
$\theta_\pi = 1$	$\theta_Y = 0.3$
$\phi = 0.6$	

2.4. DYNAMIC AS AND DYNAMIC AD EQUATIONS

The dynamic AS curve is displayed in equation 6 below:

$$\pi_t = \pi_{t-1} + \eta_{t-1} + \phi(Y_t - \bar{Y}) + v_t \tag{6}$$

The dynamic AD curve is displayed in equation 7 below:

$$Y_t = \bar{Y} - \frac{\alpha\theta_\pi}{1+\alpha\theta_Y}(\pi_t - \pi^*) + \frac{1}{1+\alpha\theta_Y}\epsilon_t + \frac{\alpha}{1+\alpha\theta_Y}\eta_t \tag{7}$$

In equilibrium, aggregate demand equals aggregate supply, which implies that:

$$\pi_t = \pi_{t-1} + \eta_{t-1} + \phi\left(\bar{Y} - \frac{\alpha\theta_\pi}{1+\alpha\theta_Y}(\pi_t - \pi^*) + \frac{1}{1+\alpha\theta_Y}\epsilon_t + \frac{\alpha}{1+\alpha\theta_Y}\eta_t - \bar{Y}\right) + v_t$$

Some further simplification yields:

$$\pi_t\left(1 + \frac{\phi \times \alpha \times \theta_\pi}{1+\alpha\theta_Y}\right) = \pi_{t-1} + \eta_{t-1} + \phi\left(\frac{\alpha\theta_\pi}{1+\alpha\theta_Y} \times \pi^* + \frac{1}{1+\alpha\theta_Y}\epsilon_t + \frac{\alpha}{1+\alpha\theta_Y}\eta_t\right) + v_t$$

Using some further notation for the purposes of simplification and assuming that $v_t = 0$ (assuming no supply shocks), I derive the following equations (8 and 9) for inflation and output in equilibrium. These equations can be solved for equilibrium levels of π_t and Y_t in any period, given the shocks, exogenous parameters (defined in last section) and past values[2] of π_{t-1} and η_{t-1}. Thus, one can compute the impulse responses for any forward horizon, given any initial shock to either η_t (expectation shock) or ϵ_t (demand shock).

[2]This is a backward looking model.

For instance, let's assume that we were in the long run equilibrium (i.e $\pi_{t-1} = \pi^* = 2\%$, $\bar{Y} = 50$, $i^* = 4\%$ and $r^* = 2\%$) before a positive, exogenous and one period (temporary) expectation shock i.e $\eta_t = 1$ hits the economy during period 1. In this case, can compute the impulse responses for inflation and output (using 8 and 9), before computing them for nominal and real interest rates (using equations 10 and 11 after we have solved for π_t and Y_t). Figure 1 of section 3 below depicts the impulse responses (50 periods) for exactly such a one period expectation shock.

$$\pi_t = \frac{\pi_{t-1} + \eta_{t-1} + \gamma \times \pi^* + \theta \times \epsilon_t + \beta\eta_t}{\zeta} \tag{8}$$

$$Y_t = \bar{Y} - \frac{\gamma}{\phi}\left(\pi_t - \pi^*\right) + \frac{\theta}{\phi}\epsilon_t + \frac{\beta}{\phi}\eta_t \tag{9}$$

$$i_t = \pi_t + \varrho + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y}),\ \theta_\pi, \theta_Y > 0 \tag{10}$$

$$r_t = i_t - (\pi_t + \eta_t) \tag{11}$$

Note that $\zeta = \left(1 + \frac{\phi \times \alpha \times \theta_\pi}{1+\alpha\theta_Y}\right)$, $\gamma = \left(\frac{\alpha \times \phi \times \theta_\pi}{1+\alpha\theta_Y}\right)$, $\theta = \left(\frac{\phi}{1+\alpha\theta_Y}\right)$, $\beta = \left(\frac{\phi \times \alpha}{1+\alpha\theta_Y}\right)$.

3. Impulse Responses

blah blah blah..

All of the graphs show responses to expectation shocks i.e various type of shocks to η_t.

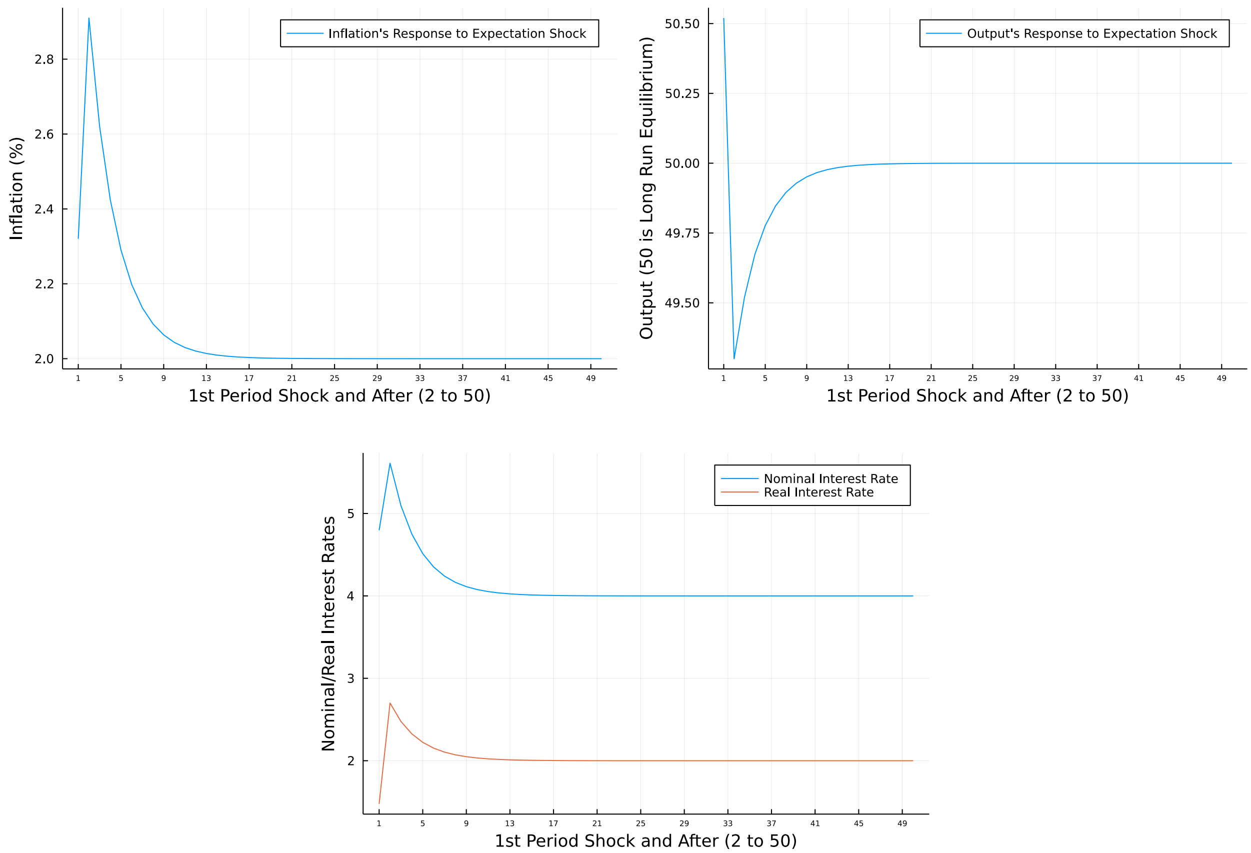

Figure 1: Impulse Responses For 1 Period Shock

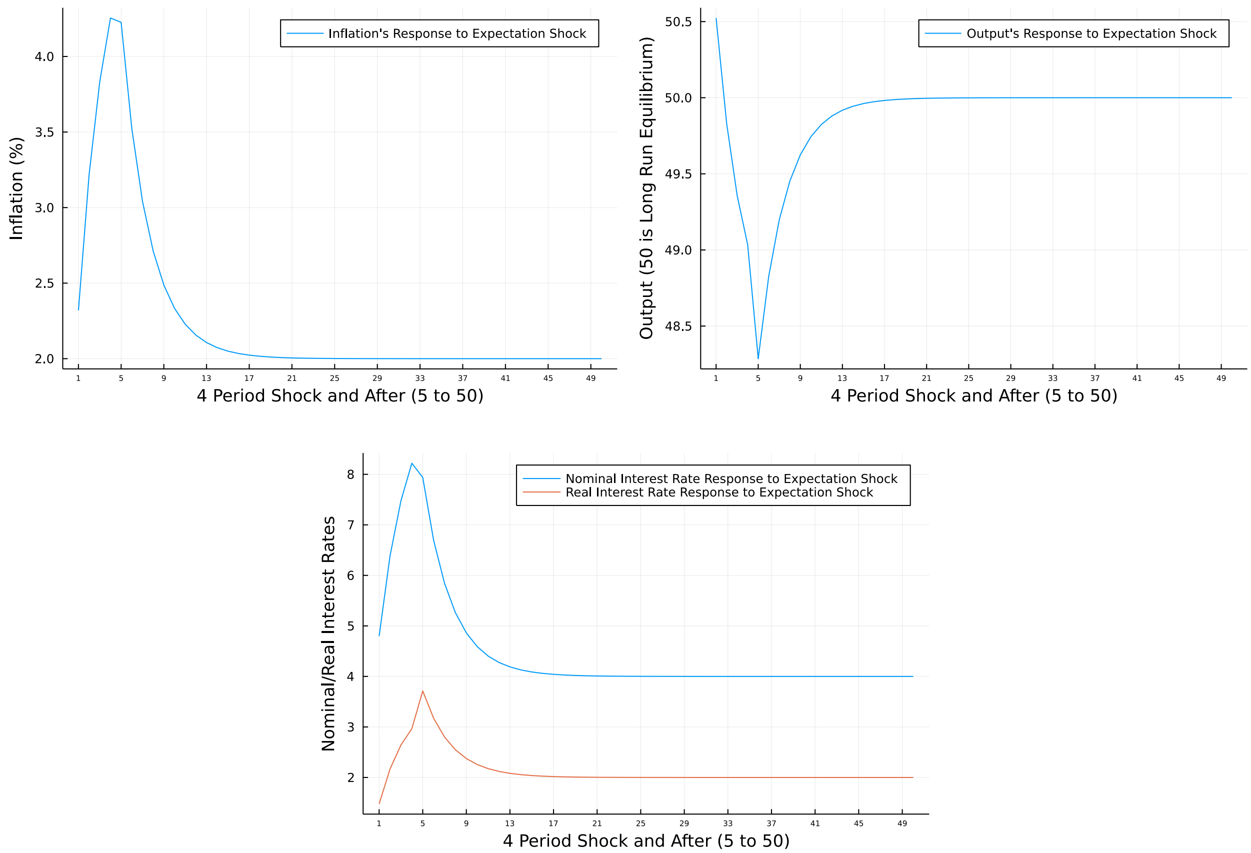

Figure 2: Impulse Responses For 4 Period Shock

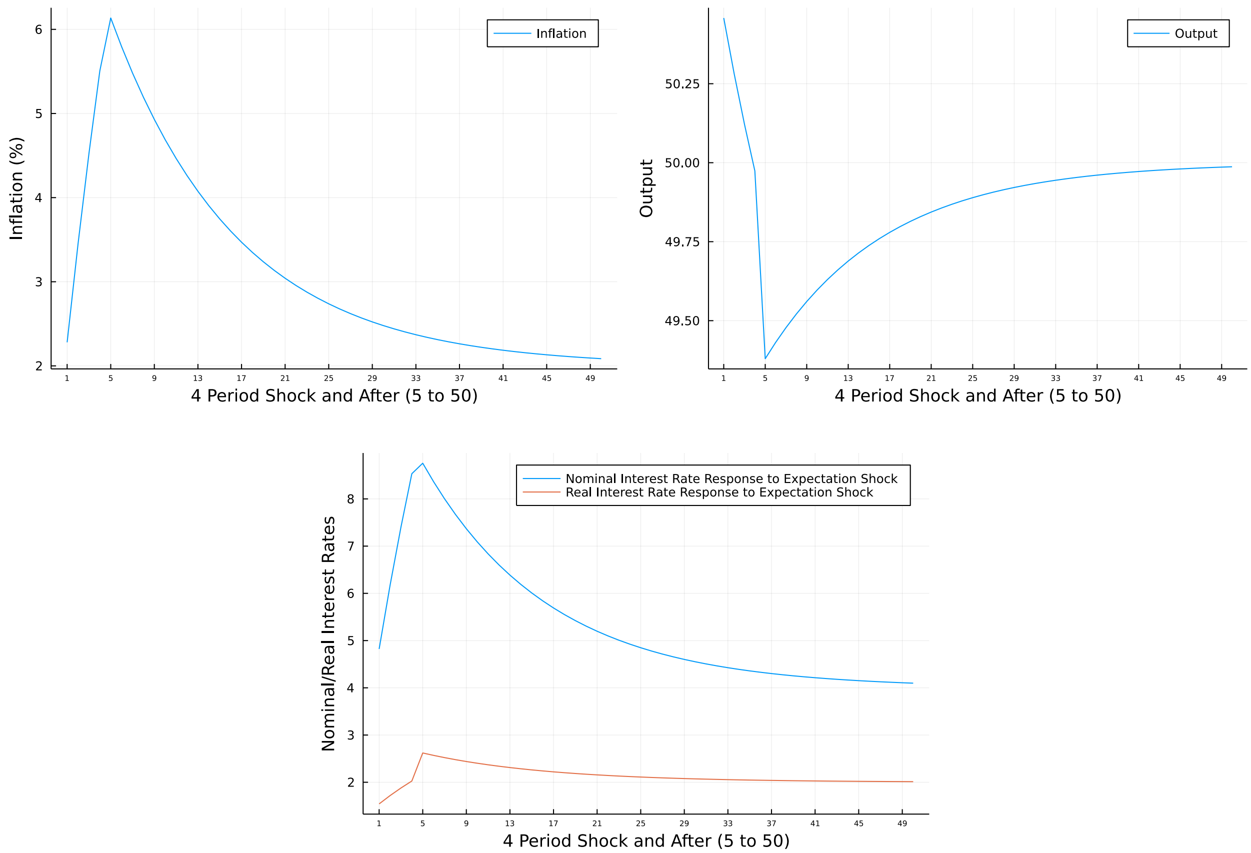

Figure 3: Impulse Responses For 4 Period Shock and Output Preference

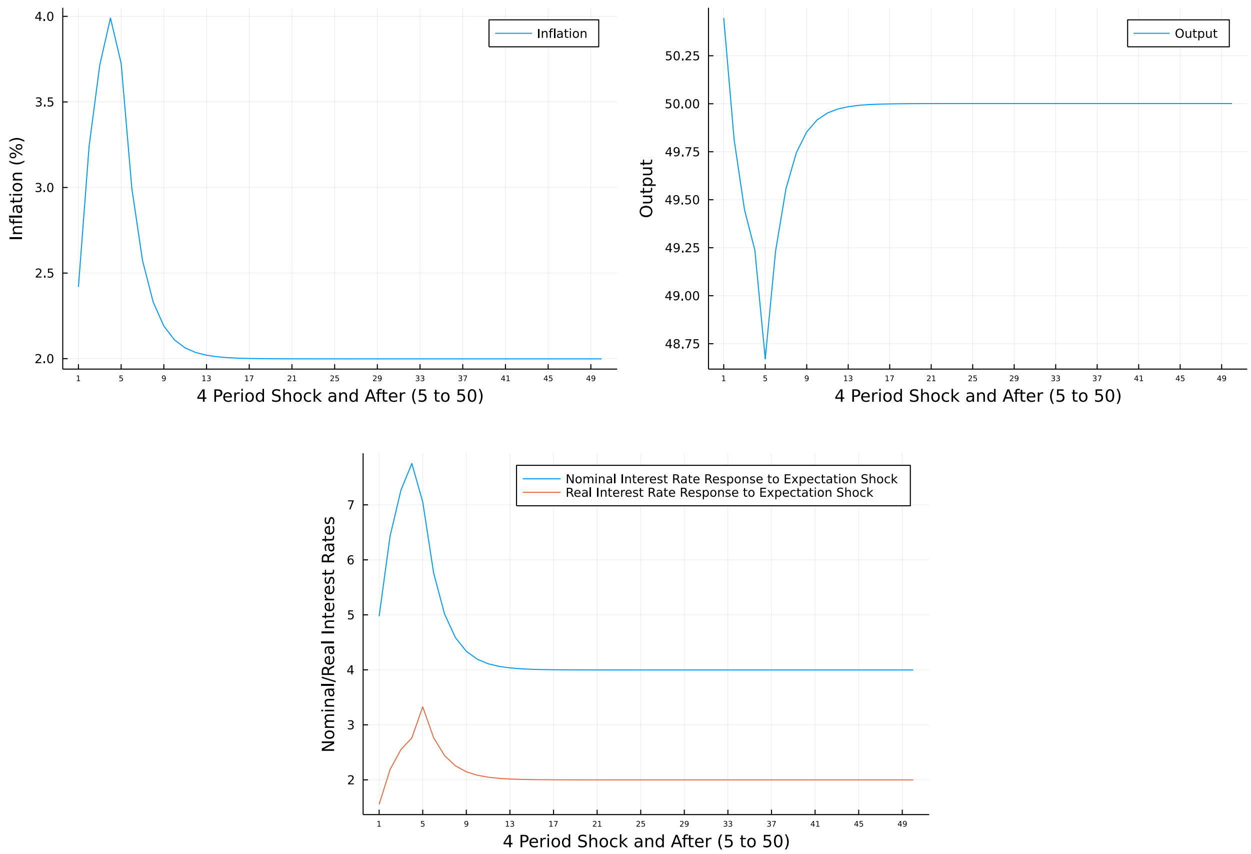

Figure 4: Impulse Responses For 4 Period Shock and $\phi = 0.95$

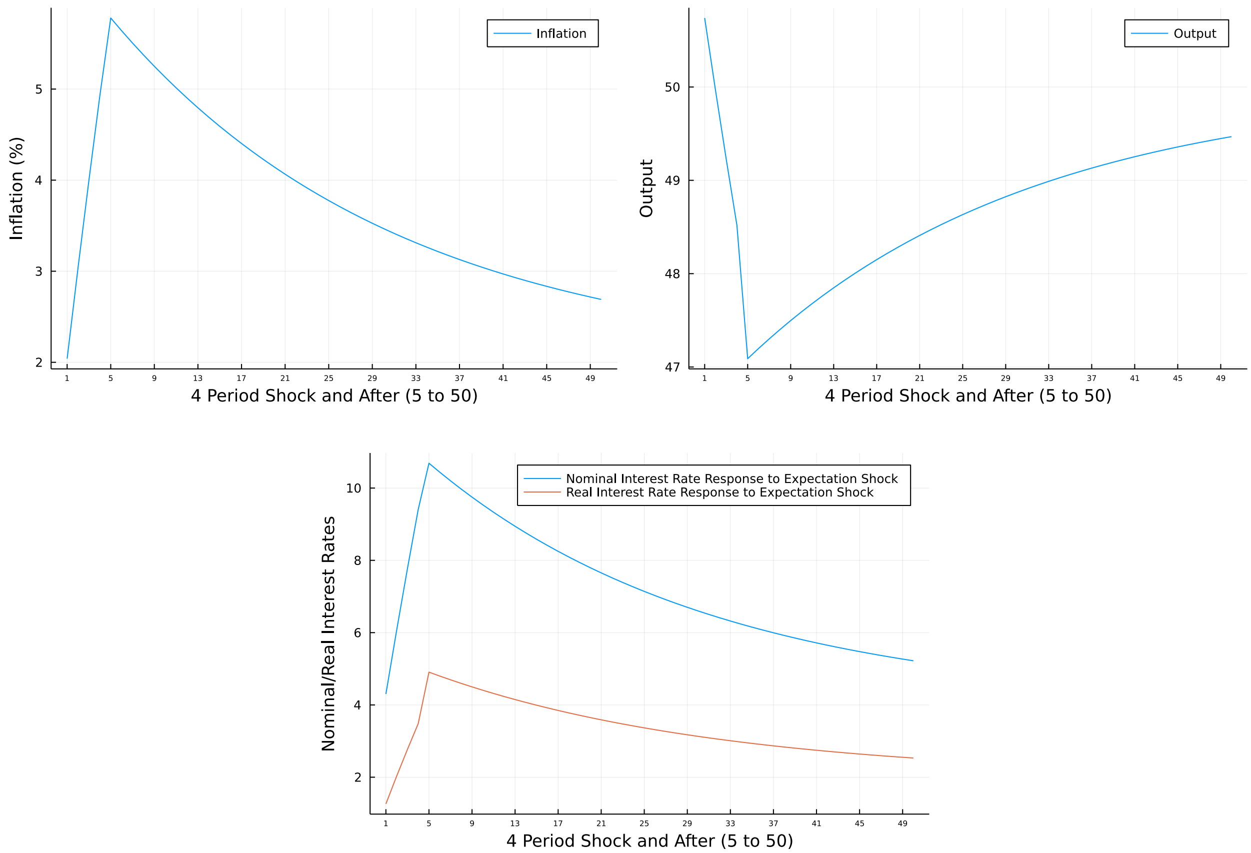

Figure 5: Impulse Responses For 4 Period Shock and $\phi = 0.05$

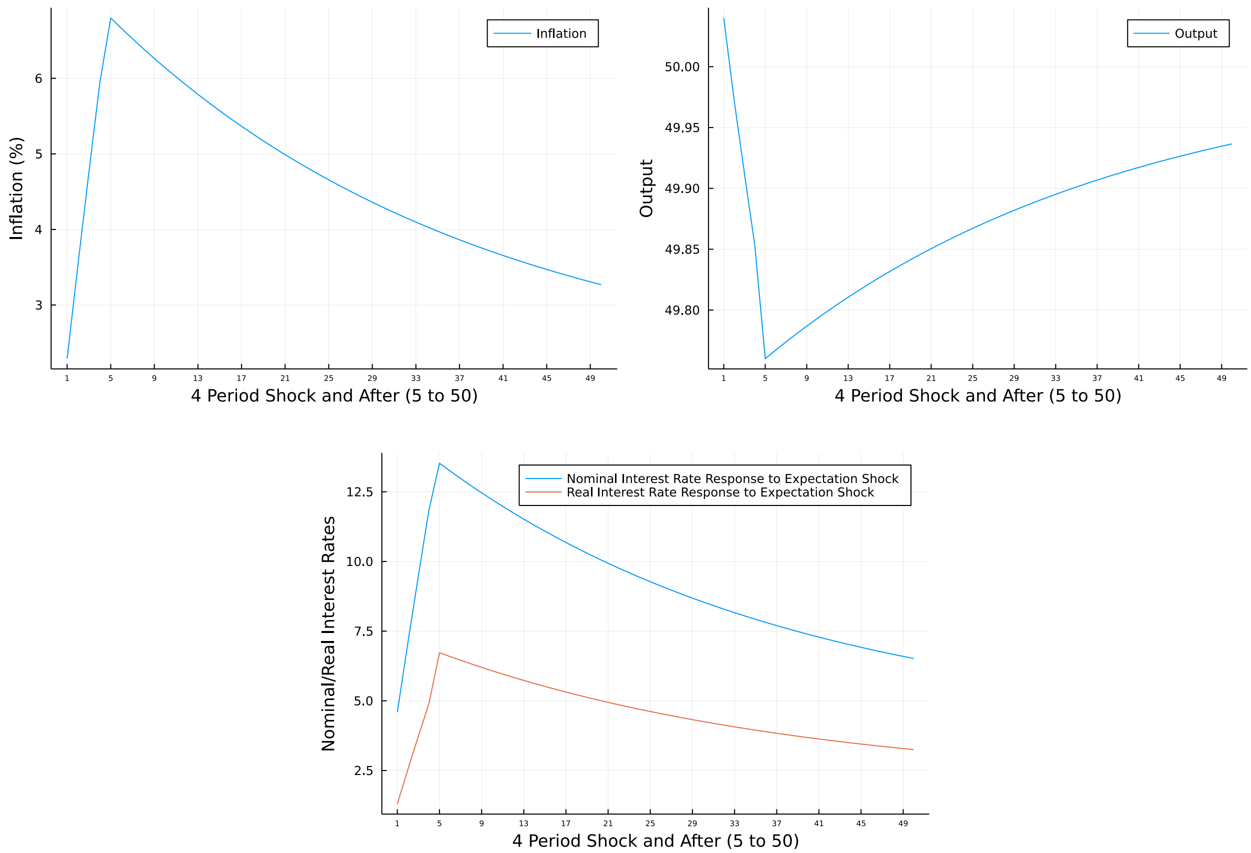

Figure 6: Impulse Responses For 4 Period Shock and $\alpha = 0.05$

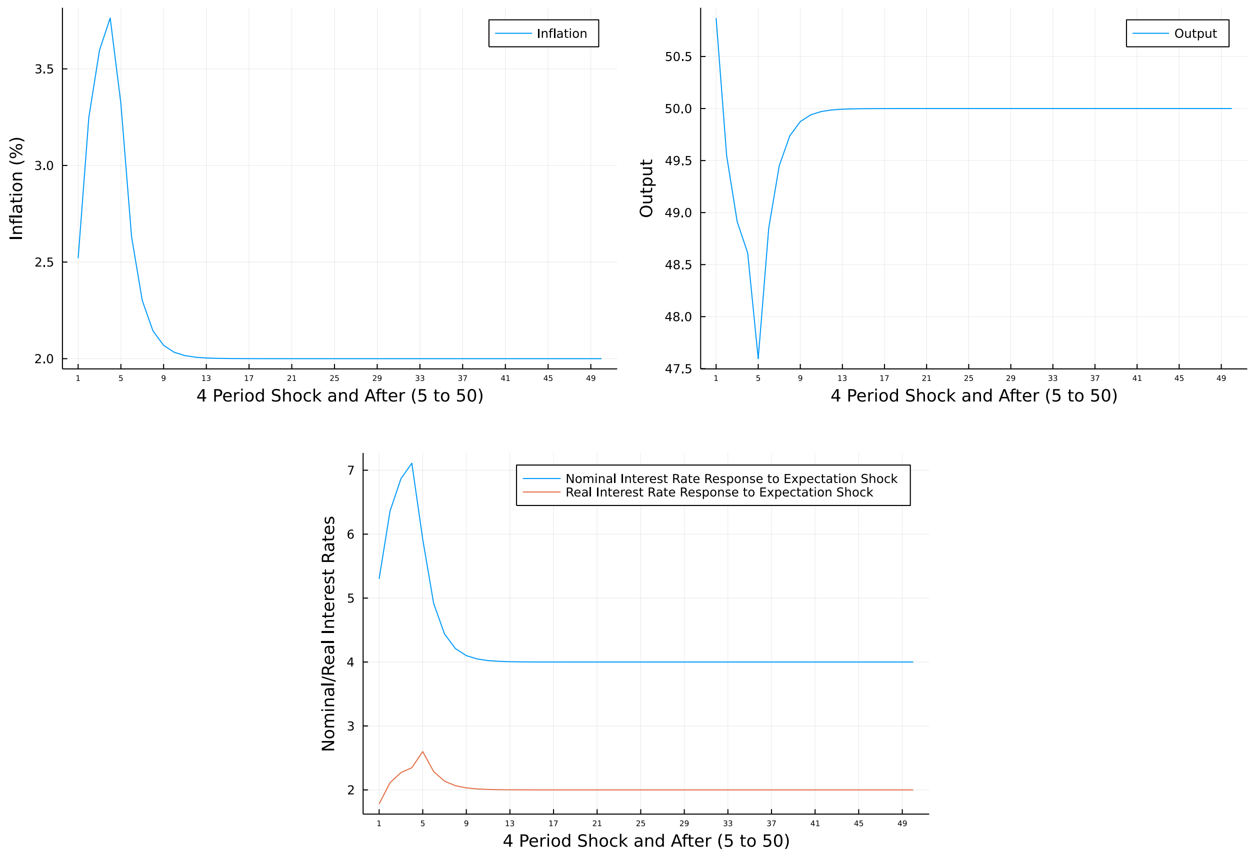

Figure 7: Impulse Responses For 4 Period Shock and $\alpha = 4$

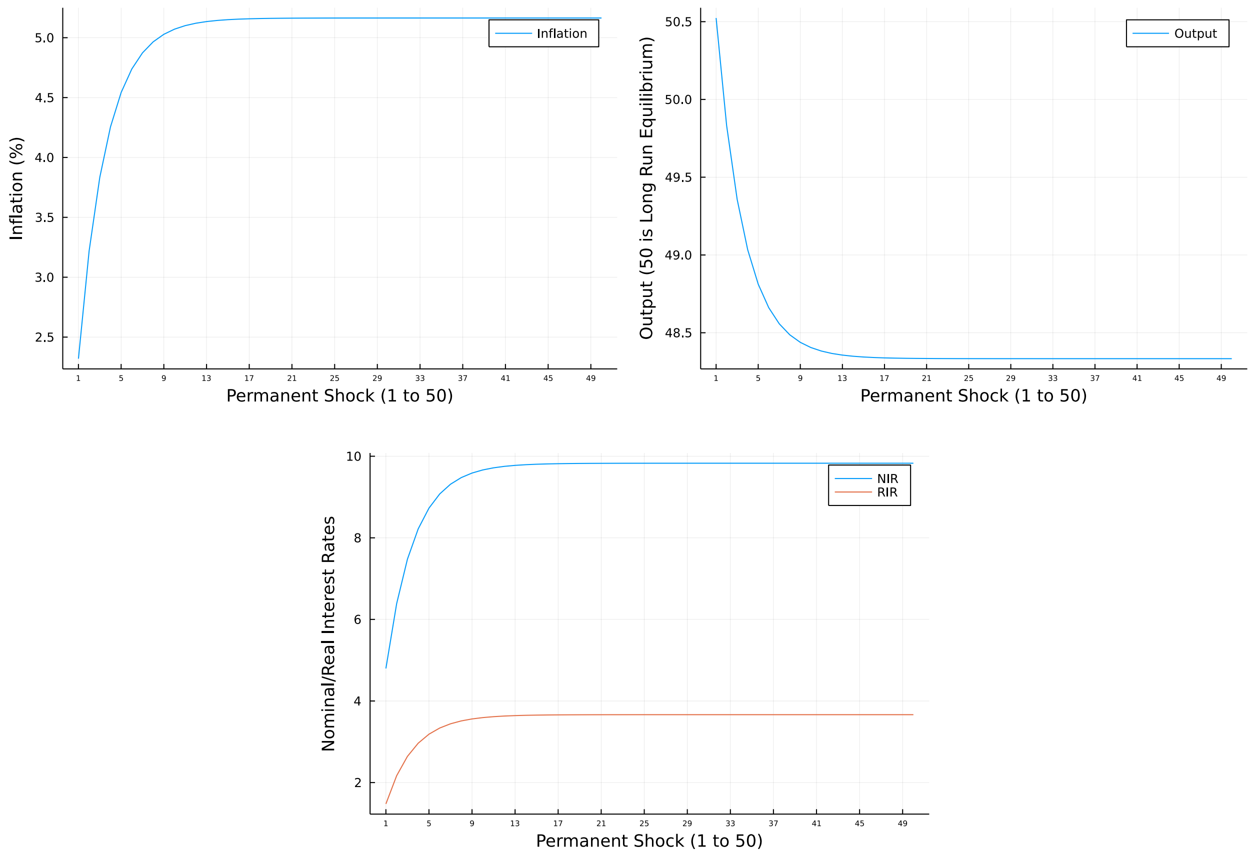

Figure 8: Impulse Responses For Permanent Shock

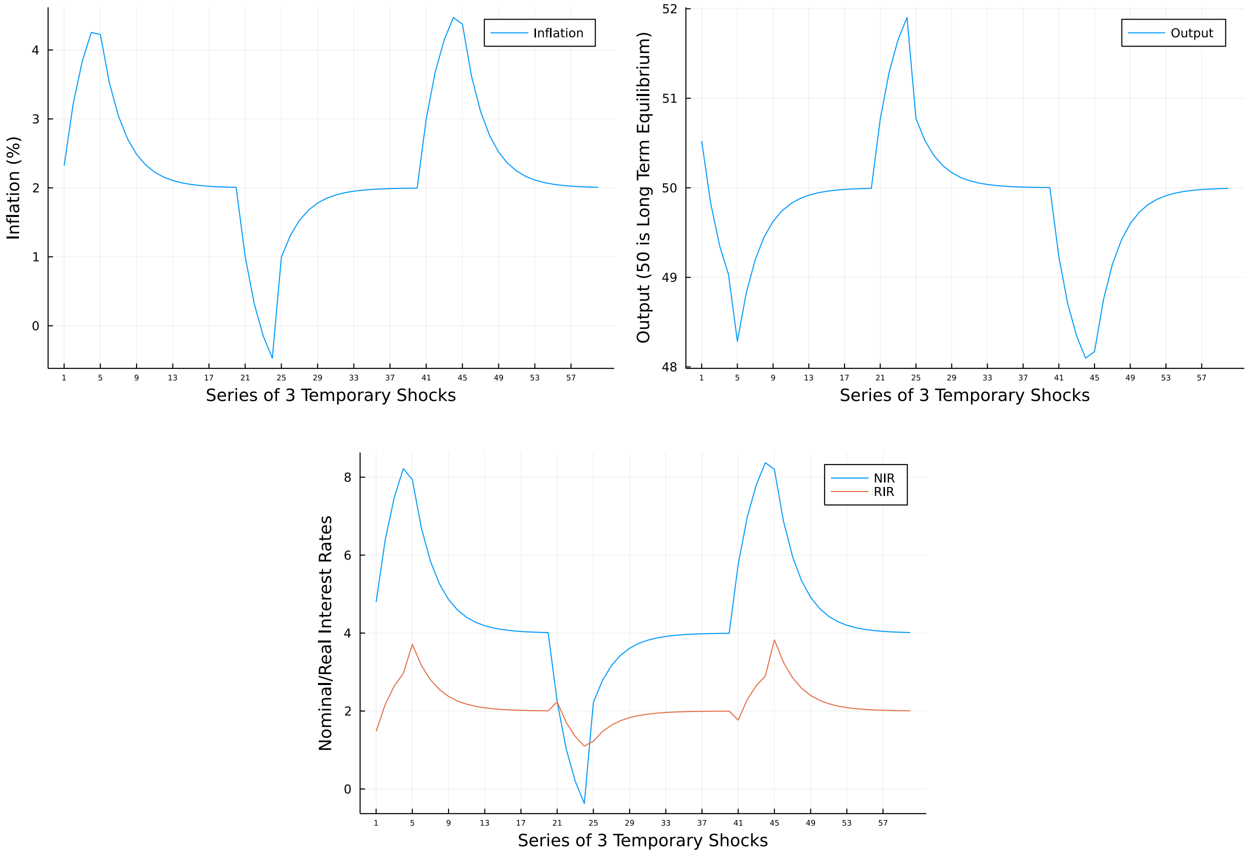

Figure 9: Impulse Responses For Series of 3 Temporary (4 Period Each) Shocks

4. NEW KEYNESIAN FRAMEWORK

5. CONCLUSION

6. APPENDIX

REFERENCES