# Assignment 6

Zhihan Yu (2101111618)

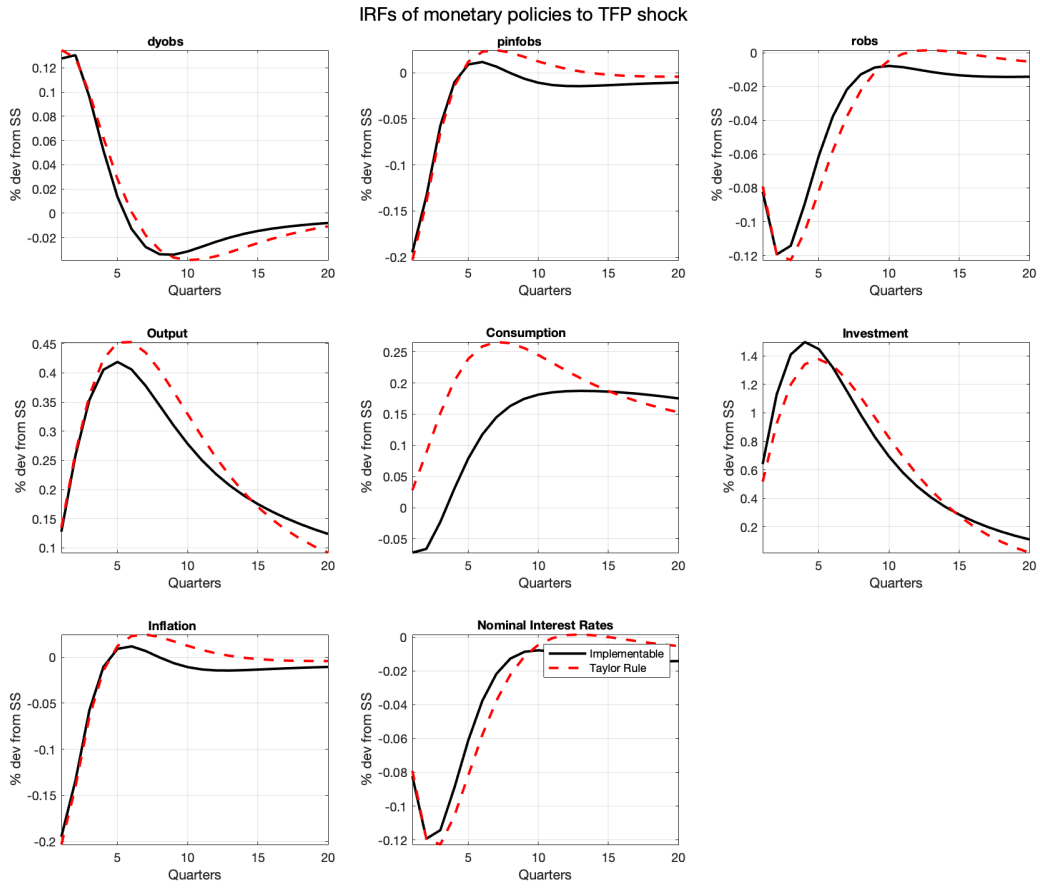
## Comparing Monetary Policy Rules using Basic Estimation

Do

- Run 'NKlinear_Est.mod' with either the Implementable Rule or the Taylor Rule
  - *Revise lines 217-220.*

Results

- *< IMPTAYLOR-TFPshock.png>*




- *For remaining shocks, see the corresponding png files.*

**Discussion**

This figure illustrates the response of different monetary policy rules (implementable in black; Taylor rule in red) to a positive TFP shock. Immediately, we see that the TFP shock has qualitatively the same effects on the economy for both types of monetary policy rules. The biggest quantitative difference between the two monetary rules lies with the impulse response of aggregate consumption. We see that the TFP shock pushed up aggregate output roughly the same amount in the first couple quarters but the impact for

aggregate output is more sustained under the Taylor Rule. This more sustained output gain (compared to the implementable rule) is a result of the consumption-investment dynamic. Under the Taylor Rule, interest rates are affected by both output gap and inflation levels. In a flexible price economy, under the same positive TFP shock, the boon will propagate frictionlessly and result in a gain in output; this output gain is slightly muted in an economy with price rigidity. As such, in face of a positive TFP shock, the output gap would widen, and because output gap $Y - Y^{\text{Flex}}$ is a negative number, the Taylor Rule would dictate a drop in interest rates. Because of the productivity gain, prices, *ceteris paribus*, will drop, as depicted by the initial deflationary process. Under the Taylor Rule, where both output gap and inflation are policy-targeted objects, consumption and investment dynamics imply a more sustained effect.

Finally, the top panel of impulse response functions shed light on how the various monetary policy rules may affect the Bayesian estimation of parameters. While both models were given the information (raw data, parameter priors, ect.), the estimated results still differ. A straightforward metric to look at is the persistence parameter for TFP shocks. In the model of Taylor Rule, $\rho_A^{\text{Tay}} = 0.8252$, while $\rho_A^{\text{Imp}} = 0.8667$. Such fundamental difference in the shock process would necessarily lead to different IRFs. This observation also underscores the fact that Bayesian estimation is a joint estimation process that factors in data and the model specification.

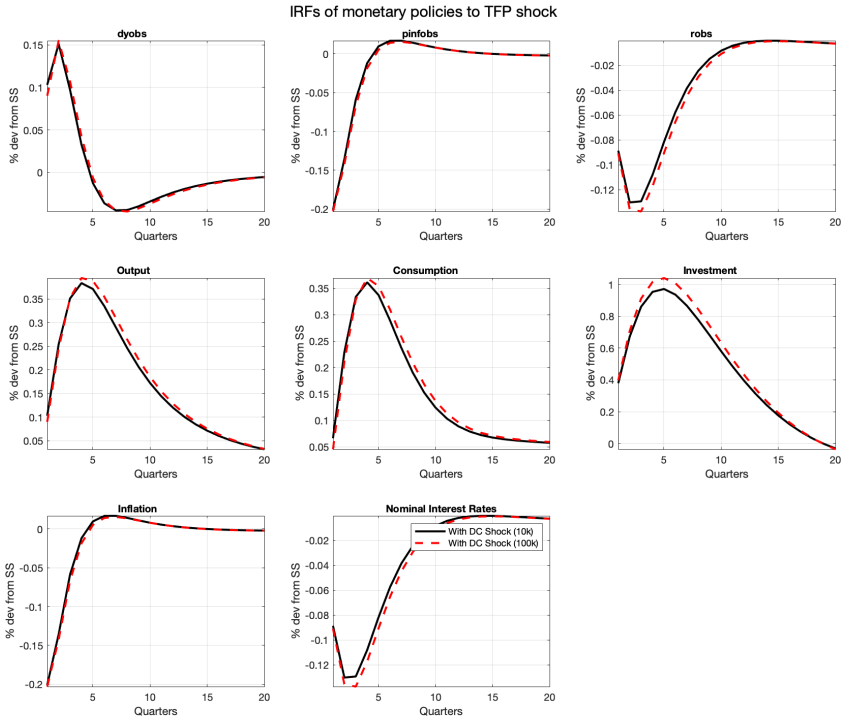
## Comparing Monte Carlo Simulation Magnitudes

Do

- Run 'NKlinear_Est.mod' Implementable Rule for 10k and 100k times.
  - *Revise line 302.*

Results

- < *MONTECARLO-TFPshock.png*>




**Discussion**

In this part, I ran the same Implementable Rule model under different number of Monte Carlo simulations. Initially, the number of samples was set to 10,000 (for immediate results), and later set to 100,000. Obviously, increasing the number of samples will allow the algorithm to explore a greater space and potentially yield better estimates.

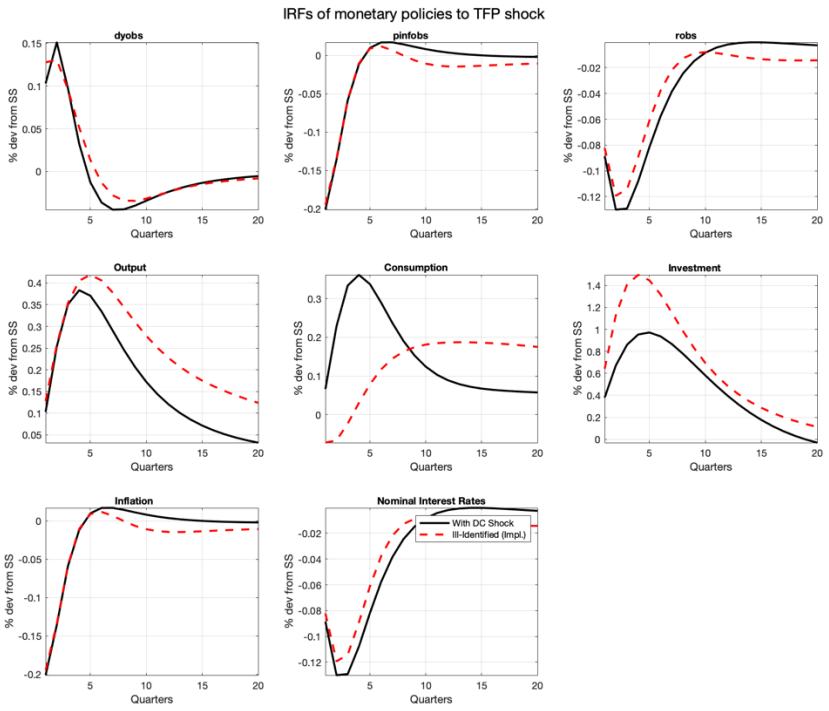
## Comparing Monte Carlo Simulation Magnitudes

Do

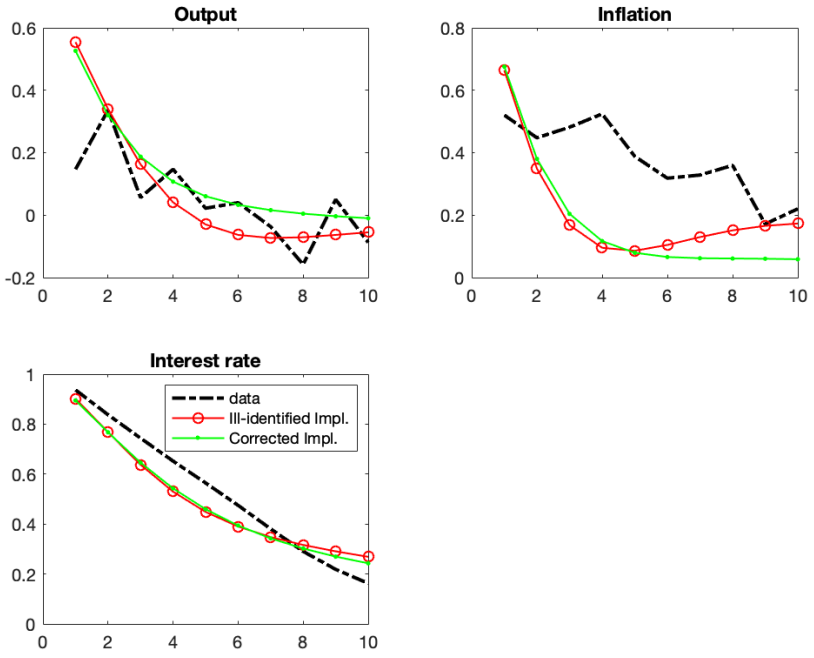
- Run 'NKlinear_Est2.mod' with Implementable Rule
- Include variable dc and ctrend so that $dc_t = C_t - C_{t-1} + ctrend$
  - *Revise lines 18 (declare var/param)*

Results

- < *ILL-TFPshock.png*>




- <*ACF_comparisons.png*>




**Discussion**

Under a positive TFP shock, the greatest difference is lies in the impulse response of consumption patterns (thereby also affecting investment dynamics since output dynamics are roughly the same). When there is an additional observable, we can see

that the autocorrelation of output computed matches the data better, while both inflation and interest rate ACF remain relatively consistent. Under proper identification, consumption increase immediately and then quickly returns back to steady state; the dynamics under the ill-identified model is less responsive to the transitory TFP shock, and returns back to steady state in a much prolonged fashion. Looking at the ACFs, we see that 'Ill-identified' models tend to deviate from the actual data, suggesting a model misfit. The corrected model seems to better capture the dynamics of the data for all three variables. The actual data suggest that all three variables exhibit some level of persistence, with interest rates appearing to be the most persistent. This implies that shocks to the interest rates would have lasting effects on the economy.