Monetary Policy Evaluation in Real Models

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Extended Abstract

November 13, 2023

Abstract

I showcase a method for evaluating monetary policy. I introduce a simple model, in which monetary policy can directly affect the magnitude of consumption growth. I argue that within such a framework evaluation of monetary policy can be simpler than the standard approach of the literature. In addition, a development of this approach could facilitate market-based evaluations of monetary policy that are based on fluctuations of real interest rates in response to monetary policy shocks.

1 Introduction

In this extended abstract, I propose a direct method for evaluating monetary policy based on its impact on real interest rates. Although the model I present here is highly simplified and incorporates a restrictive monetary policy tool, my aim is to showcase the evaluation method. I plan to develop this idea further into a paper, where I will introduce a more accurate model of the real term structure of interest rates that also accounts for actual monetary policy practices.

The basic concept is simple: within this consumption-based model, monetary policy can only work by changing the state of the economy. By observing the movements in real interest rates that are due to monetary policy we can determine how the state of the economy is affected. Then, given that the state of the economy is some basic economic quantity, we can easily conclude whether monetary policy has been conducted optimally or not.

2 Framework

The model is set in continuous time. Consumption evolves according to the stochastic process:

$$\frac{dC_t}{C_t} = \mu_c(x_t)dt + \sigma_c dB_t \tag{1}$$

B_{ct} is a standard Brownian motion, σ_c is the volatility of consumption and $\mu_c(x_t)$ is the deterministic trend that consumption follows. The function $\mu_c(\cdot)$ depends on the state variable x_t and has the form:

$$\mu_c(x_t) = x_t \tag{2}$$

And the state variable x_t follows:

$$dx_t = -m dq, \quad m > 0, \quad x_0 = \bar{\mu}, \tag{3}$$

So, consumption growth is initially equal to $\bar{\mu}$, but there is a small probability of a Poisson jump, which has intensity λ. This jump corresponds to the conduct of monetary policy. The monetary authority has two options at each point in time. It can either trigger the jump or not. If the jump is not triggered consumption growth remains at the high level of μ_0, if the jump is triggered then consumption growth falls my m. The first option is equivalent to monetary policy being optimal, which means that consumption growth remains at a high level. The second option corresponds to the monetary authority taking a suboptimal action. This moves the economy to an inferior state, in which consumption growth is lower.[1]

The next step is to introduce the utility of the representative agent. I assume flow utility with constant relative risk aversion (CRRA):

$$u(C) = \frac{C^{1-\gamma} - 1}{1 - \gamma} \tag{4}$$

[1]In a more complete setting, monetary policy should be able to remedy its mistake and return to the normal state of affairs. However, for simplicity, this possibility is not considered in this model.

And lifetime utility is:

$$U = E_0 \int_0^\infty e^{-\rho t} u(C_t) dt \tag{5}$$

ρ is the time preference parameter and γ is the risk aversion parameter of the CRRA utility. It is then easy to derive the stochastic discount factor (SDF), Λ:

$$\Lambda = e^{-\rho t} C^{-\gamma} \tag{6}$$

And then by Ito's Lemma it follows that:

$$\frac{d\Lambda}{\Lambda} = \Big(-\rho - \gamma \mu_c(x_t) + \frac{1}{2}\gamma^2 \sigma_c^2 \Big) dt - \gamma \sigma_c dB_t \tag{7}$$

The instantaneous real rate can also be derived, given that it is the opposite of the expectation of the SDF.

$$r_t = -E_t \left[\frac{d\Lambda}{\Lambda} \right] \frac{1}{dt} = \rho + \gamma \mu_c(x_t) - \frac{1}{2}\gamma^2 \sigma_c^2 \tag{8}$$

So, the instantaneous real rate depends on three components, (a) the time preference parameter, (b) consumption growth, which reflects the consumption smoothing motive of the agent and (c) consumption volatility, which reflects the precautionary motive of the agent.

An important implication of this model for monetary policy is that, close to $t = 0$, the instantaneous real rate is given by:

$$r_t = \begin{cases} \rho + \gamma \mu_0 - \frac{1}{2}\gamma^2 \sigma_c^2, & \text{if monetary policy is optimal} \\ \rho + \gamma(\mu_0 - m) - \frac{1}{2}\gamma^2 \sigma_c^2, & \text{if monetary policy is suboptimal} \end{cases} \tag{9}$$

Thus, we can just observe the real instantaneous rate and as long as the real rate remains constant monetary policy is conducted optimally (or at least the same as before), but as long as the real rate suddenly falls, this implies that a suboptimal monetary policy action has been taken. Moreover, we can quantitatively evaluate the effect of a suboptimal monetary policy, which is equivalent to decreasing consumption growth by m. Therefore, this model offers a simple and effective method for evaluating the conduct of monetary policy in this economy.

3 Comments

The benefit of such an approach is that it potentially circumvents the need of having to perform any non-trivial welfare analysis. In particular, it is obvious in this simple model that having higher consumption is preferable and hence the monetary policy actions associated with this outcome is superior. In other words, in this simplified model the real rate contains the information about the welfare of the representative agent. This is likely true even in more complicated models. On the contrary, the representative agent's welfare may not be so obvious when one focuses on quantities like inflation, employment and output, because these variables can have a non-uniform effect on welfare.[2] To sum up, my hypothesis is that for most models a monetary policy induced decrease of the real rate corresponds to a suboptimal monetary policy action, while a monetary policy induced increase in the real rate should correspond to a better than expected monetary policy action.

In addition, this approach can take advantage of the important literature that focuses on monetary policy surprises (Kuttner 2001; Gertler and Karadi 2015; Jarociński and Karadi 2020; Altavilla, Brugnolini, Gürkaynak, Motto and Ragusa 2019). In particular, an important paper that is very relevant for this paper is Beechey and Wright (2009), which finds that real rates (even long-term rates) are indeed affected by surprises associated with monetary policy. Ideally, each monetary policy surprise should be analysed based on its effect on the real rate. This would enable a quantitative evaluation of monetary policy. Namely, depending on the model being used the monetary policy action that produced a specific movement of the real rate should imply a corresponding movement in some state variable, like for example short-term consumption growth. This in turn implies an evaluation of the monetary policy action.

Another feature of this approach is that it does not require the measurement of any macroeconomic variable. As long as real risk-free bonds are being traded the evaluation only relies on the prices of these assets.[3] I regard this as an advantage because consumption may not be well measured in practice, especially at relatively high frequen-

[2]Notice for example that in a consumption-based model, consumption also includes the utility from leisure, whereas in typical DSGE models consumption and leisure are separate.

[3]In practice inflation adjusted bonds do partly rely on the measured inflation that is relevant for the inflation adjustment.

cies. On the other hand, this also implies that only the welfare of the *representative* investor will be taken into account and this investor may be very different compared to the representative consumer or the median consumer.

In practice the model that is described above would not be sufficient as it is too simple or plainly wrong. In particular, we need a consumption-based model that can relatively accurately capture the behaviour of real rates and the corresponding term structure. The literature is not really there yet, but I think that it is still useful to explore this approach using the best models that are currently available. Moreover, monetary policy is not conducted in the way shown in the simple model above. Instead, monetary policy should be able to have dynamic effects. This aspect is probably not that difficult to model.

There are also challenges with this approach, even if real rates and monetary policy are modelled perfectly. Firstly, the investor may already anticipate a suboptimal monetary policy. In this case, this approach may not be able to evaluate policy fully, but only provide bounds on how optimal or suboptimal it is. Secondly, recent literature has shown that what may be identified as a monetary policy surprise may not strictly be associated with a monetary policy action. Instead, the monetary authority may be revealing information about the state of the economy, and the movements in real rates could be due to this information, which would have been revealed in any case at some point even without the monetary authority. Thirdly, in some cases the monetary policy action may have an ambiguous effect. For example, it may decrease short-term rates but increase long-term rates. In this case monetary policy evaluation may require further analysis. Finally, in more complicated models it may not be possible to determine which state variables moved based on some movements of real rates. In other words, there could be multiple combinations of state variables that produce the same level of real rates, while the remaining economic quantities are different. Hopefully, this situation is minimised by the fact that we do not only observe one real rate, but the entire term structure curve. In addition, even if there is still indeterminacy about the particular state of the economy, the optimality or suboptimality of monetary policy could still be determined.

4 Conclusion

This note suggests a method for the evaluation of monetary policy. This evaluation is state-based and it may have some advantages over standard methods of evaluating monetary policy. This project is at an early stage, but as far as I know the literature has not approached the evaluation of monetary policy in the way that I have described above. My plan is to develop these ideas in a paper in which I utilise the best possible model of the term structure of real interest rates. At the same time the model should account for current monetary policy practices, including forward guidance. Based on this framework it should be possible to evaluate the monetary policy actions associated with identified monetary policy surprises.

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