

Assignment 3: Optimal Monetary Policy

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November 11, 2025

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1 Inflation targeting as Optimal Monetary Policy

1.1 Explain the theoretical foundations of inflation targeting as optimal monetary policy (section 3 only).

Section three of [Clarida et al. \(1999\)](#), "Optimal Monetary Policy without Commitment" describes monetary policy with *discretion*, a scenario where the central bank re-optimize its policy period by period without binding future activities. It is argued in the paper that "...this scenario accords best with reality". Under the benchmark case of discretion the central bank chooses the triplet $\{x_t, \pi_t, i_t\}$, consisting of two target variables and the policy instrument, to maximize the objective. In the absence of commitment the central bank cannot credibly manipulate beliefs, thus it takes it as given. The central bank aims to maximize the [Quadratic loss function \(1\)](#) in each period:

$$L_t = -\frac{1}{2} (\pi_t^2 + \alpha x_t^2) \quad (1)$$

subject to the [New Keynesian Phillips Curve \(1\)](#):

$$\pi_t = \lambda x_t + \beta E_t \pi_{t+1} + u_t \quad (1)$$

where x_t is the output gap, π_t denotes inflation, and u_t is a cost-push shock. Under discretion, the central bank re-optimizes each period, taking private expectations ($E_t \pi_{t+1}$) as given. The result, using Lagrange and setting first order conditions with respect to x_t and π_t equal to zero gives:

$$x_t = -\frac{\lambda}{\alpha} \pi_t \quad (2)$$

, which basically says, that the central bank should contract demand below capacity, by raising the interest rate, when inflation is above target and vice versa. This gives the optimal short-run trade-off between output and inflation stabilization. Section 1.2 will show what this exactly mean in the context of inflation targeting.

1.2 What exactly is meant by inflation targeting in that context?

From using equation [Equation \(2\)](#) and the fact that the central bank takes private sector expectations as given, that is $E_t\pi_{t+1} = \rho\pi_t = \rho\alpha q u_t$ [Equation \(2.1\)](#) of [Clarida et al. \(1999\)](#) can be re-arranged to give:

$$i_t = \gamma_\pi E_t\pi_{t+1} + \frac{1}{\varphi}g_t, \quad (4)$$

where

$$\gamma_\pi = 1 + \frac{(1 - \rho)\lambda}{\rho\varphi\alpha} > 1 \quad (5)$$

[Equation \(4\)](#) shows how the central bank should set the short term nominal interest rate i_t in response to expected future inflation $E_t\pi_{t+1}$ and demand shocks g_t . Since the coefficient on expected inflation $\gamma_\pi > 1^1$, it means that i_t should be changed by more than one for one with a change in expected inflation. This is known as the Taylor principle. The second term on the RHS shows how i_t should be changed in response to demand shocks g_t , where the strength of adjustment of a one-unit demand shock is given by $\frac{1}{\varphi}$. Substituting this into the Phillips curve implies that inflation gradually returns to target following shocks, reflecting flexible inflation targeting—the central bank tolerates some short-run output variation to stabilize inflation over time. This rule aims to anchor inflation expectations and aims to stabilizing, both inflation and output.

¹Variables defining γ_π are: Lambda (λ), which gives the steepness of the Phillips curve. Higher λ means that the central bank must respond more aggressively. Alpha (α) shows how much they care about output. Phi (φ) shows how steep the IS curve is and Rho ρ gives the persistency to shocks.

2 Paul Bernanke’s speech “On Inflation Targeting”

2.1 How does the concept of inflation targeting as laid out in the paper correspond to the concept of inflation targeting as discussed by Paul Bernanke in his recent speech “On Inflation Targeting” delivered on March 6, 2025 at the Reserve Bank of New Zealand?

The purely discretionary policy described by [Clarida et al. \(1999\)](#) involves the policy committee evaluating the economic outlook and adjusting its policy on a period-by-period basis. This flexibility allows policymakers to respond more easily when the economy evolves or circumstances change, unlike a rule-based policy, which is more constraining. However, a downside of discretionary policies is that, from the outside, they can appear arbitrary and difficult to forecast. As discussed by [Bernanke \(2025\)](#), discretionary policies are also subject to the so-called time inconsistency problem, in which there is a short-run incentive to overstimulate the economy in order to increase output and employment. Bernanke further argues that this strategy is ultimately self-defeating, as the public will eventually come to expect higher inflation, leaving the central bank unable to generate short-run output gains while losing control over inflation. These problems led New Zealand to adopt inflation targeting 35 years ago. Bernanke describes inflation targeting as a form of “constrained discretion”, which balances the inflexibility of strict rules with the lack of discipline inherent in a purely discretionary approach. While the central bank still reacts to currently available information to stabilize output and employment, it is constrained by its public commitment to keep inflation low and stable over the medium term. The advantage of this approach is that the central bank can respond to short-term disturbances while targeting medium-term inflation, thereby anchoring inflation expectations. Additionally, clear and publicly understandable communication plays a major role in inflation targeting, as it reduces uncertainty about future policy actions and clarifies the goals of the current strategy. Although Bernanke also argues that communication could be more effective, by emphasizing the uncertainty of economic forecasts and clearly explaining how policy would respond under alternative scenarios, rather than focusing solely on the baseline outlook.

3 Structure of the underlying model with respect previous discussions the Phillips Curve.

3.1 Discuss the structure of the underlying model with respect to our previous discussions about inflation expectations and the Phillips Curve.

Equation (4) shows the theoretical framework how the central banks sets the nominal interest rate without commitment in response to future inflation and demand shocks:

$$i_t = \gamma_\pi E_t \pi_{t+1} + \frac{1}{\varphi} g_t \quad (4)$$

The γ_π coefficient reflects the Taylor principle, where the ensuring that nominal rates rise more than one-for-one with expected inflation so that real interest rates increase. The coefficient $\frac{1}{\varphi}$ how much i_t should be changed in response to a one-unit demand shocks g_t . The underlying Phillips Curve is **forward-looking**, and as discussed by Bernanke (2025), credible and transparent policy is essential for stabilizing expectations and achieving price stability. This equation captures the theoretical foundation of inflation targeting and stabilizing inflation through systematic policy reactions.

Equation (6) is the empirical Phillips Curve estimated in the in the World Economic Outlook Annex IMF (2024b). It gives the pre and post COVID Phillips curve. The slope coefficient β measures the sensitivity of inflation to the output gap, while ϕ captures how expectations drive inflation:

$$\pi_{i,t} = \alpha_i + \beta \text{gap}_{i,t} + \gamma \text{COVID}_t * \text{gap}_{i,t} + \delta \text{COVID}_t + \phi \pi_{i,t}^e + \theta X_{i,t} + \varepsilon_{i,t} \quad (6)$$

Unlike the mainly forward-looking New Keynesian Phillips Curve in Clarida et al. (1999), this empirical specification of the Phillips Curve is **mainly backward-looking**, since it relies on current-period slack and survey or lagged measures of inflation expectations. Since IMF (2024a) shows that inflation expectations stayed anchored pre and post COVID, the steepening of the post COVID was also driven by the higher responsiveness to economic slack.

4 Equation 3.6 in the context of the Taylor Rule

4.1 Equation 3.6 is a fundamental result about optimal monetary policy in the New Keynesian model. Provide an in-depth discussion of the optimal interest rate rule.

Equation (3.6) from Clarida et al. (1999) is here denoted as Equation (4) represents the optimal monetary policy rule under discretion (without commitment) in the New Keynesian framework. Where the central bank sets the nominal interest rate i_t in response to expected future inflation $E_t\pi_{t+1}$ and aggregate demand shocks g_t :

$$i_t = \gamma_\pi E_t\pi_{t+1} + \frac{1}{\varphi}g_t \quad (4)$$

This equation combines the IS-Curve (7), which links the output gap x_t inversely to the real interest rate,

$$x_t = -\varphi(i_t - E_t\pi_{t+1}) + g_t \quad (7)$$

and the New Keynesian Phillips Curve (NKPC) (8), that describes how current inflation depends on expected future inflation and economic activity:

$$\pi_t = \beta E_t\pi_{t+1} + \lambda x_t + u_t. \quad (8)$$

The central bank wants to maximize the Quadratic loss function (1) in each period under discretion, which is optimizing in each period without commitment:

$$L_t = -\frac{1}{2} (\pi_t^2 + \alpha x_t^2), \quad (1)$$

trading off inflation stability against output gap stabilization, where negative and positive deviations from the target are equally treated, while greater deviations compared to smaller deviations are treated more aggressively.

The first term in Equation (4), $\gamma_\pi E_t\pi_{t+1}$ captures how the central bank react to a change in expected inflation. Since the $\gamma_\pi > 1$, the Taylor principle is reflected, where the nominal interest rate must rise by more than one-for-one with a positive change of expected inflation, ensuring that the real interest rate increases, reducing aggregate demand and bringing inflation back to target. If $\gamma_\pi \leq 1$, real rates would fall as inflation expectations rise, leading to self-reinforcing inflation and instability in the economy. The

second term $\frac{1}{\varphi}g_t$ shows how strong the central bank adjusts i_t in response to a demand shock. Since a demand shock moves inflation and output in the same direction, they do not create a trade-off between inflation and output stabilization.

[Equation \(4\)](#) depicts the forward-looking nature of optimal policy, where inflation today depends on expected future inflation, which needs to be managed by central banks building an corner stone of inflation targeting.

4.2 Does this rule have practical relevance for central bank policy decision-making? Discuss this question within the context of the Taylor rule analyzed in section 7.

Yes, [Equation \(4\)](#) has strong practical relevance for central bank decision-making. It provides the theoretical foundation for modern inflation-targeting frameworks, in which communication, credibility, and the anchoring of inflation expectations are essential. Section 7 of [Clarida et al. \(1999\)](#) analyzes different versions of the simple Taylor rule and compares inflation targeting with price-level and nominal-GDP targeting, concluding that inflation targeting remains the most effective framework. The [forward-looking Taylor rule \(8\)](#) introduced in Section 7 describes how central banks adjust policy rates in response to expected inflation and output. Empirical evidence shows that such systematic, forward-looking behavior under inflation targeting enhances macroeconomic stability. Thus, [Equation \(4\)](#) corresponds closely to [Equation \(8\)](#) and provides a strong theoretical justification for the rules-based approach observed in modern central banking.

$$i_t^* = \alpha + \gamma_\pi (E_t \pi_{t+1} - \pi^*) + \gamma_x x_t, \quad (8)$$

5 Has the ECB followed the Taylor principle when stabilizing inflation during the period 2022-2024?

The Taylor Principle requires that central banks raise nominal interest rates **more than one-for-one with inflation**, to raise real interest rate when inflation rises in order to stabilize inflation expectations. During 2022-2024 the ECB initially lagged behind the surge in inflation that followed the pandemic supply disruption and the energy-price shock accompanying the war in Ukraine. During 2022 the real policy rate remained negative, although it was raised in the third quarter, which is a violation of the Taylor principle. Only in the third quarter of 2023 the real policy rate becomes positive again, as shown by Figure 2.8 in [IMF \(2024a\)](#). This shows that the ECB did not initially follow the Taylor principle or was too slow to react when inflation first spiked but over time aligned with it as tightening was intensified in 2023-2024. This returned euro-area inflation back to the ECB's symmetric inflation target.

References

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