Research proposal
”Monetary Policy under Diagnostic Expectations”

Motivation

In recent years, the role of cognitive biases and belief distortions in macroeconomic dynamics has gained significant attention. Traditional macroeconomic models assume that agents form rational expectations (RE), integrating full information (FI). However, a growing body of research demonstrates that agents often deviate from RE, exhibiting systematic biases such as overreaction to recent data. Diagnostic expectations (DE) capture these biases by modeling agents who place excessive weight on recent information, leading to overreaction in economic forecasts. Integrating DE into macro-financial models has revealed insights into business cycle dynamics, credit cycles, and asset pricing, offering a more realistic perspective on economic fluctuations.

Despite this progress, the implications of DE for monetary policy remain insufficiently explored. While DE has been effectively applied to analyze the fiscal policy multiplier, its effects on monetary policy – particularly regarding the monetary policy multiplier and the economic costs of inflation reduction – are not yet fully understood.

Research question

The proposed research addresses key questions in applying DE to monetary policy, with a focus on how belief distortions influence the effectiveness of policy measures and the economic trade-offs between inflation and output. Specifically, I aim to investigate the following.

(1) How do DE affect the monetary policy multiplier compared to RE?
The monetary policy multiplier reflects the impact of policy changes on economic variables (primarily, inflation). Under DE, agents' biases may amplify or dampen this impact, potentially requiring central banks to adopt a tighter or more accommodative stance than in traditional RE settings to achieve their goals effectively.

(2) How do DE influence the costs of reducing inflation?
Under DE, agents' overreactions to recent economic conditions could raise the perceived persistence of inflation, potentially increasing the output costs of disinflation.

Literature review and research contribution

Incorporating DE in macro-financial models has significantly advanced the understanding of business cycle dynamics, credit cycles, and financial market behavior. Bordalo et al. (2018) pioneered the DE framework, building on Gennaioli and Shleifer's (2010) formalization of Kahneman and Tversky's (1972) representativeness heuristic. Their work illustrates how agents' overreactions to recent data drive cyclical credit expansions and contractions. Building on this, Bordalo et al. (2019) extend DE to stock markets, where analysts' optimistic or pessimistic earnings forecasts lead to systematic stock mispricing and eventual corrections. Subsequent

studies broadened the application of DE to macroeconomic forecasting and business cycle theory. Bordalo et al. (2020) examine overreaction and underreaction in forecasts introducing DE in the dispersed information framework (diagnostic Kalman Filter), providing an explanation for individual overreaction to news and consensus forecasts' underreaction. Bordalo et al. (2022) synthesize DE within a broader macroeconomic framework, emphasizing that cognitive biases contribute to amplified market volatility, particularly in high-risk economic environments. Meanwhile, Bordalo et al. (2021) integrate DE into a real business cycle (RBC) model, capturing the cyclical nature of investment, credit spreads, and leverage in response to changes in total factor productivity.

Camous and Van der Ghote (2022) incorporate diagnostic beliefs into a model with financial frictions, revealing how agents' optimism during economic upswings promotes overinvestment and increased risk exposure, while pessimistic expectations in downturns lead to underinvestment, slowing recovery. Maxted (2024) introduces a macro-finance model integrating DE with financial frictions in the intermediary sector. The proposed model reveals that interaction between behavioral and financial frictions creates a feedback loop that increases financial fragility during upturns and generates recovery limitations during downturns.

Recent advancements by Bianchi et al. (2024a, 2024b) further refine DE by introducing concepts such as "smooth diagnostic expectations", which incorporates shifts in conditional uncertainty, offering a nuanced explanation for asymmetrical economic cycles and countercyclical volatility. This innovation explains the asymmetry often seen in economic expansions and contractions, where downturns are steeper than upturns, aligning closely with empirical survey data on forecast biases (Bianchi et al., 2024a). Additionally, Bianchi et al. (2024b) apply DE to a dynamic stochastic general equilibrium model (DSGE), incorporating distant memory recall to demonstrate how delayed belief adjustments intensify cycles and reinforce prolonged deviations from steady states.

L'Huillier et al. (2024) integrate DE into a New Keynesian (NK) framework, illustrating how agents' overreactions can amplify cyclical fluctuations in output and inflation. Their findings suggest that DE heighten the effectiveness of fiscal policy multipliers by influencing agents' inflation expectations, which reduces perceived real interest rates during policy actions. Favero et al. (2024) develop a macro-financial model to explain bond price movements through a framework that integrates drifting equilibrium rates, demographic and productivity trends, and DE. Presented evidence shows that deviations from rational expectations in the form of DE can account for up to 30% of the yield cycle variability at 2–3-year maturities.

Proposed contribution

While diagnostic expectations have been extensively studied across various macroeconomic and financial frameworks, research has yet to examine monetary policy under diagnostic expectations. Key questions remain: *"Should optimal monetary policy be tighter under DE to manage inflation, and how do the costs of disinflation compare to those in an RE environment?"*

The first part of the research can be built on L'Huillier et al. (2024) who integrate DE into a NK framework. In a standard NK model, the fiscal multiplier – defined as the change in output resulting from a change in government spending – is generally less than one under RE. L'Huillier et al. show that DE amplify the fiscal multiplier by lowering agents' perceived real interest rates. In the DE framework, when there is a surprise inflation increase due to government spending, agents anticipate future inflation as well, leading them to expect lower real interest rates. This

reduction in the subjective real interest rate stimulates current consumption, creating a demand boost. The equilibrium equations with government expenditures are the following.

$$\hat{g}_t = \rho_g \hat{g}_{t-1} + \varepsilon_{g,t}$$

$$\hat{a}_t = \rho_a \hat{a}_{t-1} + \varepsilon_{a,t}$$

$$\hat{y}_t = \hat{c}_t + \hat{g}_t$$

$$\hat{c}_t = \mathbb{E}_t^{\theta}[\hat{c}_{t+1}] - \left(\hat{i}_t - \mathbb{E}_t^{\theta}[\hat{p}_{t+1}] - \hat{p}_t\right)$$

$$\hat{\pi}_t = \beta \mathbb{E}_t^{\theta}[\hat{\pi}_{t+1}] + \tilde{\kappa}(\hat{c}_t - \hat{a}_t) + \tilde{\kappa}\nu(\hat{y}_t - \hat{a}_t)$$

$$\hat{i}_t = \phi_\pi \hat{\pi}_t + \phi_x(\hat{y}_t - \hat{a}_t)$$

In the last equation the monetary policy shock can be introduced:

$$\hat{i}_t = \phi_\pi \hat{\pi}_t + \phi_x(\hat{y}_t - \hat{a}_t) + \varepsilon_{i,t}$$

Perhaps, it would require also slight modifications for the Euler equation – adding diagnostic expectation operator before $\hat{i}_t$ – as far as in the original model at time t the interest is known:

$$\hat{c}_t = \mathbb{E}_t^{\theta}[\hat{c}_{t+1}] - \left(\mathbb{E}_t^{\theta}\left[\hat{i}_t\right] - \mathbb{E}_t^{\theta}[\hat{p}_{t+1}] - \hat{p}_t\right)$$

As in L'Huillier et al. (2024), the theoretical properties of the monetary policy multiplier under DE can be derived. Additionally, using calibrated models for both RE and DE, we can obtain and compare estimates of the monetary policy multiplier.

The second part of the research can be built on insights from Debortoli, Iovino, Pavoni, and Zhang (2023) – DIPZ, who measure the output costs of inflation reduction under limited awareness.

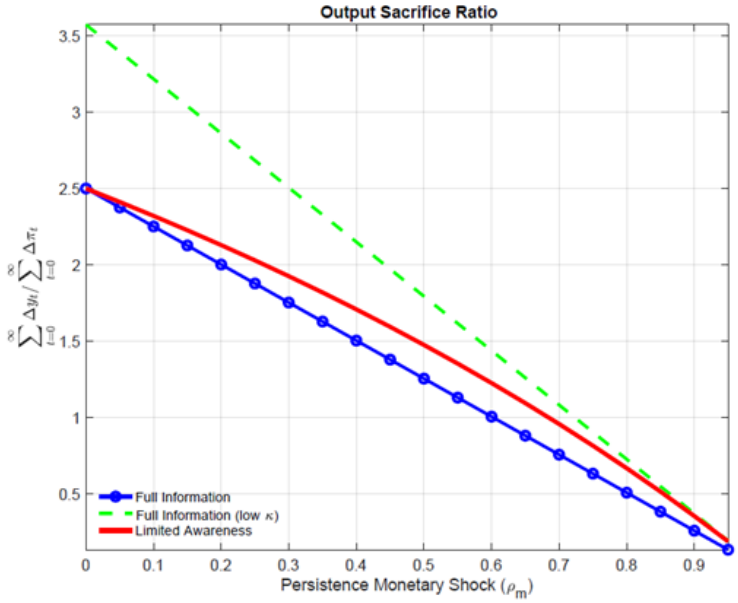

Figure 1
Output Cost of Reducing Inflation. Debortoli et al. (2023).

In their approach, agents underweight or ignore supply shocks, placing disproportionate emphasis on demand shocks in forming inflation and output forecasts. This misperception raises the output cost of disinflation, particularly as the persistence of monetary shocks increases. Their "Output Sacrifice Ratio" graph illustrates that with limited awareness (Figure 1), the cost of reducing inflation – measured as output loss per unit reduction in inflation – is higher than under full information. A similar analysis could be applied by varying the diagnosticity parameter (θ) on the x-axis to observe how belief distortions impact the costs of disinflation. Alternatively, one could replicate Figure 1 for $\theta = 0$ (RE) and $\theta = 0.73$ (DE, as in L'Huillier et al.).

Research pipeline

(1) Replication of L'Huillier et al. (2024) NK DSGE model.
The first step involves replication packages implementation from L'Huillier et al. (2024).

(2) Introducing the monetary policy shock to the model.
The next step will extend the NK DSGE model by introducing a monetary policy shock. This involves modifying the monetary policy rule to include an additional shock term. Following this, the theoretical properties of the monetary policy multiplier will be derived under DE compared to RE.

(3) Calibration of extended model with monetary policy shocks.
After introducing monetary policy shocks, the model will be calibrated, requiring an additional parameter σ_i to capture the variance of interest rate shocks.

(4) Monetary policy multiplier estimation.
Using the calibrated models for both RE and DE frameworks, the monetary policy multiplier will be estimated and compared.

(5) Analysis of disinflation costs under DE compared to RE.
Building on insights from Debortoli, Iovino, Pavoni, and Zhang (2023), the output sacrifice ratio will be examined for inflation reduction under DE and RE.

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