Annexes: Selected Issues

1. Monetary Policy under High Uncertainty: A Scenario-Based Approach for Thailand[1]

Monetary policy has become increasingly complex amid heightened uncertainty and overlapping demand and supply shocks. In Thailand, the slowdown in domestic demand calls for policy support, yet the historically low policy rate calls for preservation of policy space. This note employs a New Keynesian framework that embeds the option value of waiting to analyze whether the central bank should act or wait when faced with uncertainty about the nature of shocks. The analysis highlights how the case for acting early versus waiting to preserve limited policy space depends critically on whether shocks are transitory or persistent, illustrated through a scenario of persistent domestic demand weakness in the context of Thailand.

A More Adaptive Monetary Policy Framework Amid Unprecedented Uncertainty

1. Monetary policy decision making has become increasingly challenging in recent years due to unprecedented uncertainty. Traditional frameworks—such as the Taylor Rule—presume stable relationships between key variables, but reality has diverged significantly. The convergence of diverse and evolving shocks—from the pandemic to supply disruptions and geopolitical tensions—has blurred the distinction between transitory and persistent shocks, complicating decisions on both the direction and timing of policy. This is no longer just noise—it is the new normal for central banks.

2. Thailand at the current juncture offers a clear example of this dilemma. Private consumption and overall domestic demand have weakened notably in Thailand, while external conditions remain highly uncertain. At the same time, the policy rate is already low, with limited room for further easing. This raises a difficult question: should the central bank act now to support growth or hold back and preserve space given the highly uncertain outlook? The Bank of Thailand has rightly emphasized the importance of a more flexible and robust policy framework under such circumstances.

3. This note draws on a New Keynesian model that embeds uncertainty and the option value of waiting for central bank action[2]. The central bank may optimally choose to act or wait in the face of a shock, depending on the nature and persistence of shocks, and the degree of uncertainty it faces. This approach is adapted to the case Thailand by developing a scenario-based strategy, focused on identifying the types of shocks most relevant to the Thai economy and evaluating the policy trade-offs between acting now and waiting.

4. The analysis shows that whether to ease policy in the face of weakening growth momentum depends critically on the persistence of the shock. In Thailand's case, the one of the most pressing issues is the risk of a prolonged weakness in domestic demand. This paper proposes a set of indicators and an empirical framework to assess that scenario, providing insights on whether immediate support or more caution is justified.

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[1] By Haobin Wang and Yuhong Wu.
[2] This note draws on a fuller discussion on monetary policy under high uncertainty in Ng and Wang (Forthcoming).

Basic Setup of the Theoretical Framework

5. The analytical framework extends the standard New Keynesian model by embedding uncertainty directly into the central bank's optimization problem, allowing policy decisions to explicitly account for the option value of waiting. By modeling the "option value of waiting," the framework captures the trade-off between immediate policy response and preserving policy space to respond once more is known about the nature of the shock, that is, whether it is transitory or persistent.

6. The model comprises two periods, $t = 1,2$, and is built around static representations of the IS and Phillips curves:

$$y_t = -\left(\frac{1}{\varphi}\right) \cdot (r_t - r^n) + \varepsilon_t^d \quad (IS\ Curve)$$

$$\pi_t = \kappa \cdot y_t + \varepsilon_t^s \quad (Phillips\ Curve)$$

where y_t is the output gap, π_t is inflation, r_t is the policy rate, and r^n is the natural rate of interest (normalized to zero). ε_t^d and ε_t^s represent demand and supply shocks, respectively. The central bank sets the nominal interest rate r_t each period.

Central Bank Objective and Policy Timing Structure

7. The policymaker minimizes the expected quadratic loss over the two periods:

$$L = \sum_{t=1}^{2} \left(\frac{1}{2} y_t^2 + \frac{\lambda}{2} \pi_t^2\right)$$

where $\lambda > 0$ captures the central bank's relative aversion to inflation versus output deviations

- In period 1, shocks $(\varepsilon_1^d, \varepsilon_1^s)$ are realized and perfectly observed by the central bank.
- In period 2, shocks $(\tilde{\varepsilon}_2^d, \tilde{\varepsilon}_2^s)$ are unknown at $t = 1$.
  The policymaker holds prior beliefs:
  - With probability p_2, a demand shock $\tilde{\varepsilon}_2^d$ occurs;
  - With probability $1 - p_2$, a supply shock $\tilde{\varepsilon}_2^s$ occurs.

The central bank can either:

a) **Act Now:** Set $r_1 \neq 0$ based on observed shocks; the same rate is assumed to apply in period 2, i.e. $r_2 = r_1$, reflecting policy transmission lags and policy continuity across periods (cost of adjusting rate consecutively).

b) **Wait:** Let $r_1 = 0$ (natural rate) and optimally set r_2 in period 2 after observing new shocks.

Optimal Policy under Immediate Action vs Waiting

8. If the central bank acts in period 1 and maintains the same rate in period 2, the expected loss is:

$$E[L \mid \text{act}] = L_1(r) + E_2[L_2(r)]$$

The first-order condition yields the optimal policy rate**:**

$$r^* = \frac{\phi}{1+\lambda\kappa^2}(\varepsilon_1^d + p\mu_d - \lambda\kappa\varepsilon_1^s - \lambda\kappa(1-p)\mu_s)$$

where μ_d and μ_s are the expected future demand and supply shocks

If the central bank waits, the expected loss becomes:

$$E[L \mid \text{wait}] = L_1(r_1 = 0) + E_2[L_2(r_2^*)]$$

And optimal policy rates are:

$$r_1 = 0, r_2^* = \frac{\phi}{1+\lambda\kappa^2}(\tilde{\varepsilon}_2^d - \lambda\kappa\tilde{\varepsilon}_2^s)$$

Core Insight: The Threshold Rule

9. The central bank chooses to act in period 1 if the observed shocks are large enough to outweigh the option value of waiting. The threshold condition is expressed as:

$$\mid \varepsilon_1^d \mid + \frac{\lambda\kappa}{1+\lambda\kappa^2} \mid \varepsilon_1^s \mid > c \cdot \sqrt{p_2(\sigma_d^2 + \lambda\kappa^2\sigma_d^2) + (1-p_2)(\lambda\sigma_s^2 + \frac{\sigma_s^2}{\phi^2})}$$

where:

- The left-hand-side (LHS) represents the weighted magnitude of observed shocks (the motive to act now)
- The right-hand-side (RHS) captures the option value of waiting, which increases with future uncertainty; σ_d^2 and σ_s^2 measure the variance of shocks
- The constant $c \in (0,1)$ governs the degree of caution:
  - Lower c: more aggressive response (higher activism)
  - Higher c: more cautious response (greater willingness to wait)

The central bank acts if the above condition holds. Under high uncertainty, the central bank assigns greater value to waiting, to avoid the risk of miscalibration. The threshold rule captures this tradeoff: when uncertainty is high (higher RHS), the central bank tolerates larger deviations in inflation or output in period 1.

This setup helps explain why central banks may appear more cautious or slower to act during periods of heightened uncertainty, while also offering a criterion for intervention.

Shock Persistence and Policy Response

10. A useful extension and application of the model is to classify shocks along two dimensions: type (demand vs supply) and persistence (temporary vs. persistent). The policy implications vary depending on which quadrant the shock belongs to. For simplicity and illustrative purposes, consider only the presence of a demand shock with an assumed persistence structure.

Assume an **AR (1)** process for the demand shock:

$$\varepsilon_2 = \rho\varepsilon_1 + \eta, \eta \sim N(0, \sigma_\eta^2)$$

The losses under two regimes can be derived as:

(a) Act now

$$L_{\text{act}} = \lambda[(\varepsilon_1 - \phi r_1)^2 + (\rho\varepsilon_1 - \phi r_1)^2 + \sigma_\eta^2]$$

(b) Wait

$$L_{\text{wait}} = \lambda\varepsilon_1^2$$

Plug in optimal r_1, it can be derived that the policymaker prefers to act now if:

$$[1 - \frac{1}{2}(1-\rho)^2]\varepsilon_1^2 > \sigma_\eta^2$$

This captures two opposing forces:

- **Higher ρ (shock persistence)** increases the LHS, strengthening the case for acting now.
- **Higher σ_η^2 (uncertainty)** increases the option value of waiting, making delay more attractive

Similar results can be derived for supply shock. This simple framework offers scenario-based rules of thumb for monetary policy under uncertainty.

Shock Type	Persistence	Threshold Rule Implication	Policy Response
Negative demand shock	Temporary	High threshold; risk of overreaction	Wait and see
Negative demand shock	Persistent	Low threshold: early action avoids cumulative loss	Front-load easing
Negative supply shock	Temporary	Risk of over-tightening; inflation self-corrects	Wait and see
Negative supply shock	Persistent	Gradual, cautious tightening; need to balance policy trade-offs	Gradual tightening

Effective lower bound (ELB) and policy response.

11. The model can also be extended to examine how the risk of hitting an effective lower bound (ELB) could influence the optimal policy response. This consideration is particularly relevant for Thailand, where the policy rate is currently at a historically low level and concerns have emerged over the need to preserve monetary policy space despite subdued growth.

Assume that in period 2, the policymaker faces the constraint:

$$r_2 \geq \underline{r},$$

where $\underline{r} \leq 0$ represents the ELB. If the optimal unconstrained policy r_2^*falls below $\underline{r}$, the central bank is forced to set $r_2 = \underline{r}$, resulting in a suboptimal outcome.

Suppose the period-2 optimal policy under full information would have been:

$$r_2^* = \frac{1}{\phi}\epsilon_2.$$

Then the probability of hitting the ELB in period 2 is given by:

$$P_{\text{ELB}} = \mathbb{P}(r_2^* < \underline{r}) = \mathbb{P}(\epsilon_2 < \phi\underline{r}) = \Phi\left(\frac{\phi\underline{r} - \rho\epsilon_1}{\sigma_\eta}\right),$$

where $\Phi(\cdot)$is the cumulative distribution function of the standard normal distribution.

If the ELB binds in period 2, the central bank incurs an additional loss due to the inability to fully close the gap. The expected second-period loss becomes:

$$\mathbb{E}_1[L_2] = (1 - P_{\text{ELB}})\,\lambda\,(\epsilon_2 - \phi r_2^*)^2 + P_{\text{ELB}}\,\lambda\,(\epsilon_2 - \phi\underline{r})^2.$$

Modified threshold condition with ELB

12. The option value of waiting is reduced by the presence of the ELB. The threshold condition for waiting (versus acting in period 1) becomes:

$$\underbrace{\left[1 - \frac{1}{2}(1-\rho)^2\right]\varepsilon_1^2}_{\text{Benefit of acting}} > \underbrace{\sigma_\eta^2}_{\text{Option value of waiting}} - \underbrace{P_{\text{ELB}}\,\lambda\,\mathbb{E}_1[(\epsilon_2 - \phi\underline{r})^2 - (\epsilon_2 - \phi r_2^*)^2]}_{\text{ELB cost}}.$$

The ELB adjustment term on the right-hand side is always positive, reflecting the reduced value of waiting when the ELB binds. Thus, the condition for acting becomes easier to satisfy — the presence of ELB risk strengthens the incentive to act early.

The results suggest that while a persistent negative demand shock already warrants front-loaded easing, the presence of effective lower bound (ELB) risk would further strengthen the case for front-loading monetary accommodation. The inability to respond flexibly in period 2 can justify immediate easing, especially when:

- **ρ is high:** persistent shocks imply that inaction today leads to larger gaps tomorrow.
- **$\underline{r}$ is high**: the ELB constraint is more likely to bind.
- **σ_η is high**: future shock uncertainty amplifies the likelihood and cost of hitting the ELB.

Applying a Scenario-based Strategy in the Context of Thailand

13. In an environment of elevated uncertainty, a scenario-based strategy offers a practical way for central banks to prioritize and respond to the most pressing risks. In practice, central banks face substantial complexity and data noise. Trying to monitor and prepare for all possible shocks at once is inefficient. Instead, we propose a scenario-based strategy, where policymakers prioritize monitoring and respond according to the most relevant macroeconomic risks for their own economy.

14. The key risk scenario for Thailand at the current conjuncture is a persistent weakness to private domestic demand. Weak income growth and confidence, tightened credit conditions, and ongoing political uncertainty could create a negative feedback loop that perpetuates domestic demand weakness. Household debt remains high, limiting consumption amid sluggish income growth and fragile confidence. Credit standards have tightened, further restraining both consumer and investment activity. Persistent credit constraints may erode borrower confidence and credit quality, reinforcing the downturn. If inflation expectations fall further, rising real debt burdens could add to the drag on demand, amplifying the adverse feedback loop.

15. In such a scenario, front-loaded monetary easing becomes more optimal. The New Keynesian framework with an option value of waiting shows that when downside risks are persistent, delayed action can lead to deeper and more protracted output losses. This insight aligns with existing literature on zero lower bound constraints (Eggertsson and Woodford, 2003), which suggests frontloading policy accommodation when the risk of hitting the bound is elevated. However, if the demand weakness is deemed transitory and uncertainty remains high, it may be more prudent to preserve monetary space until clearer signals emerge.

Monitoring Demand Shocks in Thailand

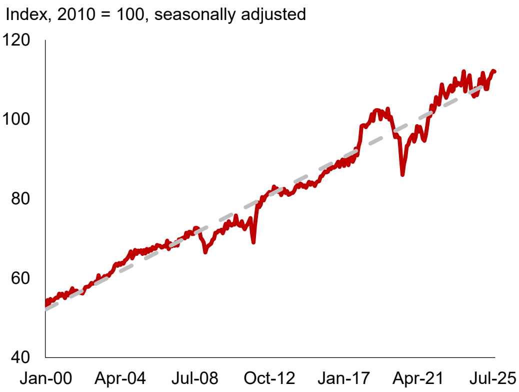
16. Evaluating this risk requires a systematic approach to monitoring demand-side conditions using timely and targeted indicators. The Bank of Thailand's Private Consumption and Private Investment Indices, disaggregated by durables vs. non-durables and machinery vs construction, can serve as core indicators for monitoring. External signals such as export orders from PMI surveys and the regional electronics cycle can offer complementary insights into demand momentum.

17. To extract the underlying demand shock, various methods can be employed. For illustrative purpose, a simple approach is presented here, following a process of the form:

$$x_t = \mu_t + \varepsilon_t, \quad \varepsilon_t = \phi \varepsilon_{t-1} + u_t$$

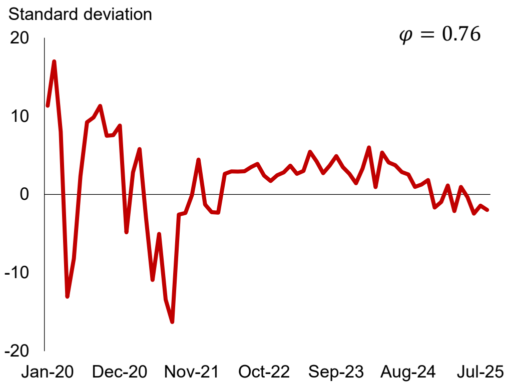
where x_t denotes the log-level of private consumption or investment, μ_t captures the trend or seasonally adjusted level, and ε_t is the autocorrelated demand shock with persistence ϕ. The innovation term u_t reflects sudden changes in demand. This framework allows us to detect persistent deviations from trend, which are more relevant for policy calibration, particularly under heightened uncertainty (Figure A1.1).

Figure A1.1. Private Consumption Index



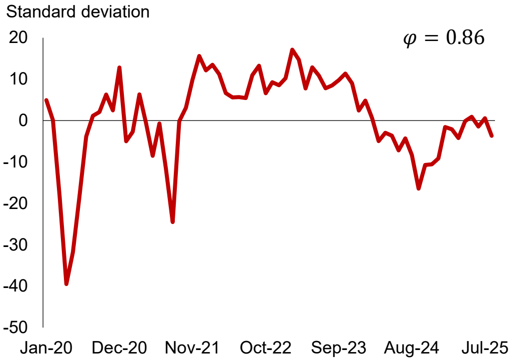
Source: BOT; AMRO staff calculation

Figure A1.2. Autocorrelated Shocks for Private Consumption Index



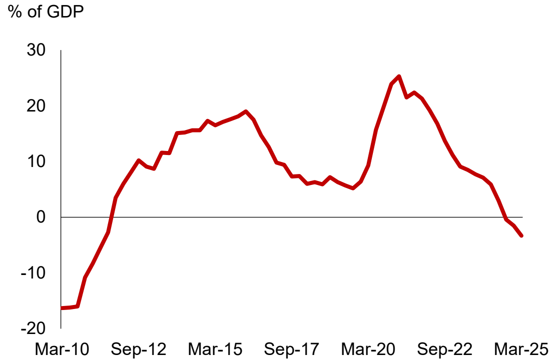
Source: BOT; AMRO staff calculation

Figure A1.3. Autocorrelated Shocks for Durables Index



Source: BOT; AMRO staff calculation
Note: Durables index is the composite index comprising of sales of commercial cars, sales of Passenger cars, and sales of motorcycles.

Figure A1.4. Credit Gaps



Source: BIS

18. Thailand's private consumption, after rebounding to above its pre-COVID trend, has recently fallen below the trendline. This turning point raises concern that the post-pandemic recovery may be losing steam. The estimated shocks have turned negative in recent months, with persistence coefficient around 0.7–0.8—suggesting the slowdown is relatively persistent (Figure A1.2). The weakness is more pronounced in durable goods consumption, where negative shocks have emerged with high persistence above 0.8 (Figure A1.3). Durables are particularly sensitive to credit availability and forward-looking household sentiment, making them a leading indicator of consumption trends. If the weakness in durables is sustained, broader domestic demand could weaken further.

19. These consumption patterns are mirrored in credit dynamics. Thailand's credit-to-GDP gap has steadily narrowed and recently turned negative (Figure A1.4). This suggests that credit availability is falling behind its historical trend, despite still-elevated household debt levels. Tighter credit in an already leveraged household sector risks reinforcing demand weakness through reduced borrowing and spending.

20. These signals warrant close monitoring, as persistent negative demand shocks would call for decisive early action. If demand shocks are both negative and persistent—indicated by sustained declines and high ρ_t estimates (near 0.8–1)—there is a strong case for proactive easing to preempt a prolonged slowdown that could erode the effectiveness of future policy actions. Conversely, if shocks appear transitory or mild, a wait-and-see approach would be more appropriate, preserving policy space for more severe scenarios. This tailored strategy equips Thai authorities with a simple and transparent framework to guide monetary policy decisions amid high uncertainty and evolving conditions.

Conclusion

21. This note proposes a scenario-based strategy to assess whether the Bank of Thailand should act to support growth or wait to preserve policy space, drawing on a theoretical model that incorporates the option value of waiting. The key consideration is the perceived persistence of the demand shock. In Thailand's case, where inflation remains subdued and domestic demand continues to weaken, there are signs that a prolonged shortfall may be unfolding. This note uses a simple method to assess the persistence of demand weakness for Thailand in the recent period. While illustrative rather than definitive, the analysis shows that private demand weakness has been persistent and thus provides a justification for the current policy easing stance by the Bank of Thailand. If weakness persists further, our analysis suggests there would be a strong case for further easing.

22. Frontloading of easing makes sense amid persistent demand weakness. If the central bank delays action despite limited space, cumulative output losses could build, reinforce weak sentiment, and accelerate the downturn—raising the likelihood of hitting the lower bound sooner. Acting early may slow this spiral and better anchor expectations. Of course, judgment should remain data-driven, and ongoing assessment of key data is essential to ensure timely and well-informed policy action.

References

Eggertsson, Gauti B., and Michael Woodford. 2003. *The Zero Bound on Interest Rates and Optimal Monetary Policy*. Brookings Papers on Economic Activity, 2003(1): 139–211.

Ng, Allen, and Haobin Wang. Forthcoming. Monetary Policy under High Uncertainty: Demand and Supply Shocks and the Option Value of Waiting. AMRO Working Paper, ASEAN+3 Macroeconomic Research Office, Singapore.