Drivers of Thailand Inflation

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ABSTRACT

This study explores the driver of Thailand's inflation by employing a structural vector autoregression (SVAR) model, where monthly data on global oil prices, unemployment rates, inflation rates, policy interest rates, and exchange rates from 2002M1 to 2023M6 are deployed. The empirical results suggest that Thai inflation is primarily driven by a positive global oil price shock. Additionally, the volatility of Thai inflation is mostly explained by global oil prices, with a partial contribution from the policy rate. However, following an increase in inflation, the Bank of Thailand acts as an inflation fighter by hiking the policy rate, thereby reducing exchange rate depreciation. It is implied that a conventional monetary policy of hiking the policy rate would be optimal to fight against inflation for achieving and maintaining price stability, which is the primary objective of the Bank of Thailand, as well as beneficial for reducing Thai baht depreciation.

Keywords: Inflation, SVAR, Thailand

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Background and Significance of the Research Problem

Excessive and unpredictable inflation has detrimental consequences for both economic growth and overall welfare (Fischer, 1993; Fischer, Sahay and Vegh, 2002). Developing nations with fragile political and economic institutions often experienced persistently high and volatile inflation (Alesina & Stella, 2010; Yilmazkuday, 2022). Available evidence suggests that low, stable, and predicted inflation—or simply **price stability**—is crucial for sustaining macroeconomics and financial stability, which, in turn, promotes productive investment and facilitates higher rates of economic growth (Montiel, 2003; Poole & Wheelock, 2008). This justifies the view that the key, if not the sole, objective of monetary policy should be price stability (Hossain, 2009).

Inflation in Thailand remained high and volatile following the 1997-98 financial crisis. To stabilize the economy and restore confidence in the financial system, Thailand's monetary policy framework was significantly changed by shifting to a managed float exchange rate regime and implementing a flexible inflation targeting framework, where achieving and maintaining price stability is highlighted as its primary objective. Therefore, between 2000 and 2020, Thailand's inflation rate averages around 2%. However, it has remained unstable because Thailand experienced varying levels of inflation, induced by both domestic and global economic factors (see Figure 1).

Figure 1 Quarter-on-Quarter CPI-inflation, Thailand, 2002-2022

Source: Author's Compilation Based on the Bank of Thailand Website and CEIC Database (2023)

Additionally, the factor influencing inflation in Thailand are multifaceted and may evolve over time due to shifts changing economic conditions, policy frameworks and global dynamics. First, inflation is generally determined by economic conditions, such as demand-side and supply side factors. When the aggregate demand for products and services is greater than aggregate supply, the prices tend to increase, and this economic phenomenon is known as demand pull inflation. In contrast, cost push inflation is caused by supply-side factors that raise production costs of goods and services. Second, monetary policy has a dynamic relationship with inflation drivers. Under the inflation targeting framework, central banks conduct monetary policy via interest rates to respond to inflation, aiming to maintain price stability. Meanwhile, the success of monetary policy in managing inflation depends on accurately identifying inflation sources and implementing timely and appropriate measures. In addition, several studies relate changes in worldwide inflation dynamic to the globalization process (International Monetary Fund, 2006; Manopimoke, 2015). The presence of worldwide inflation indicates a substantial increase in the degree of inflation co-movement, implying a common force driving inflation across countries. As previously stated, Thailand has been conducting a flexible inflation targeting framework with a primary focus on price stability; yet, understanding the drivers of inflation is critical to devise an optimal policy for Thailand.

Accordingly, this paper attempts to investigate empirically the drivers of Thailand inflation and the corresponding role of monetary policy by using a structural vector autoregression (SVAR) model. Based on existing studies on inflation, it is indicated that global factors, such as commodity or energy prices, can serve as external drivers of domestic inflation (Ha et al., 2023; Manopimoke, 2018; Yilmazkuday, 2021, 2022). Hence, we have incorporated the global oil price in our investigation to account for this influence. The internal factors of monetary policy rate, unemployment rate, and exchange rate are recognized as potential drivers of inflation, as demonstrated in previous studies (Christiano et al., 1999; Hossain & Raghavan, 2020; Osorio & Unsal, 2013). In this context, employing a Structural Vector Autoregressive (SVAR) model is crucial to mitigate potential endogeneity issues. This is because inflation is not only influenced by both external and internal factors, as previously discussed, but also internal factors, such as monetary policy, unemployment, and exchange rate, can be affected by changes in inflation itself. By utilizing a SVAR model, we can better analyze the interrelationships and causal effects among these variables, thereby gaining a more comprehensive understanding of the dynamics between inflation and its driving factors.

The empirical investigation uses monthly data for Thailand over the period 2002M1–2023M6 to examine the drivers that influence Thailand's inflation rate. The paper specifies and estimates a structural vector autoregression (SVAR) model with five variables, namely the global oil prices, inflation, policy rate, exchange rate, and unemployment rate. The empirical results suggest that Thai inflation is primarily driven by a positive global oil price shock. This is consistent with earlier studies such as those by Manopimoke (2018), Hossain & Raghavan (2020), Yilmazkuday (2022), and Ha et al. (2023), who have shown that the contribution of global factors has a high and significant impact on domestic inflation. Additionally, the volatility of Thai inflation is mostly explained by global oil prices, with a partial contribution from the policy rate. In addition, inflation responds negatively and substantially to a positive shock to the policy rate (tightening monetary policy). This response implies that the monetary policy under inflation targeting, with the policy rate as a monetary instrument, remains effective in reducing inflation, albeit with delayed effects. Conversely, when challenged with a rise in inflation, the Bank of Thailand acts as an inflation fighter by raising the policy rate. Additional results indicate that a higher interest rate can prevent exchange rate depreciation. It is implied that a conventional monetary policy of raising policy rates in response to rising inflation or a depreciation of the Thai baht would be appropriate for achieving and maintaining price stability in Thailand, which is the primary objective of the Bank of Thailand.

The remainder of the paper is structured as follows: objective of the study, research methodology and data. In the following section, the empirical results and discussion are presented. The last section is the conclusion, with suggestions.

Research Objective

This paper aims to investigate empirically the drivers of Thailand inflation and the corresponding role of monetary policy in striving to attain and maintain price stability.

Research Methodology

To achieve the objective, the empirical investigation is carried out using implication of the SVAR model of $\mathbf{y_t} = (\Delta \mathbf{o_t}, \Delta \mathbf{une_t}, \Delta \mathbf{p_t}, \Delta \mathbf{pr_t}, \Delta \mathbf{er_t})'$ based on monthly data, where $\Delta \mathbf{o_t}$ is percentage changes in global oil prices, $\Delta \mathbf{une_t}$ is changes in the Thailand unemployment, $\Delta \mathbf{p_t}$ is the Thailand inflation, $\Delta \mathbf{pr_t}$ is changes in Thailand policy rate and $\Delta \mathbf{er_t}$ is the percentage change in the exchange rate.

Generally, a structural vector autoregression (SVAR) model represents a multivariate system of a set of endogenous variables which maintain feedback relations in a dynamic sense. It is useful to examine the relationship between forecast errors and structural innovations in an n-variable VAR. In a modelling sense, a SVAR has been specified as follows:

$$\mathrm{Ay_t = A_1^s y_{t-1} + \cdots + A_p^s y_{t-p} + C^s x_t + Bu_t} \qquad [1]$$

where $\mathbf{y}$ is a $(n \times 1)$ vector of macroeconomic variables; A, all of the $\mathrm{A_i^s}$, $\mathrm{C^s}$ and B are $(n \times n)$ vector of the structural coefficients; and the $\mathrm{u_t}$ is a $(n \times 1)$ vector of unobserved structural innovations with $\mathrm{E(u_t u_t') = I_k}$

Pre-multiplying equation [1] with $\mathrm{A^{-1}}$, a reduced form VAR is specified:

$$\begin{aligned} \mathrm{y_t} &= \mathrm{A^{-1}A_1^s y_{t-1} + \cdots + A^{-1}A_p^s y_{t-p} + A^{-1}C^s x_t + A^{-1}Bu_t} \\ &= \mathrm{A_1 y_{t-1} + \cdots + A_p y_{t-p} + Cx_t + \epsilon_t} \qquad [2] \end{aligned}$$

where $\mathrm{A_i = A^{-1}A_i^s}$; $\mathrm{C = A^{-1}C^s}$; and $\mathrm{\epsilon_t = A^{-1}Bu_t = Su_t}$ which represents the reduced form error structure and S represents the short run restriction.

In compact form, a SVAR system relates to the following relations.

$$\mathrm{A\varepsilon_t = Bu_t} \qquad [3]$$

The equation [3] is called AB model (Amisano & Giannini, 1997). Where A is $(n \times n)$ matrix of contemporaneous relations between endogenous variables, B is $(n \times n)$ matrix that linearly relates the SVAR residuals to the structural innovations, ε_t is vector of reduced-form residual, $\mathrm{u_t}$ is vector of structural innovations. The residual ε_t in the reduced form are presumed to be white noise. Therefore, we can estimate the AB model by ordinary least square (OLS) or maximum likelihood (ML).

The formal investigation is conducted by using the SVAR model of $\mathrm{y_t = (\Delta o_t, \Delta une_t, \Delta p_t, \Delta pr_t, \Delta er_t)'}$,with monthly data, where Δo_t represents the percentage change in the global oil price, $\mathrm{\Delta u_t}$ represents changes in the Thailand unemployment rate, $\mathrm{\Delta p_t}$ represents the Thailand inflation, $\mathrm{\Delta pr_t}$ represents changes in the Thailand policy rate and $\mathrm{\Delta er_t}$ represents the percentage changes in the real effective exchange rate. The number of lags has been determined by minimizing the Akaike Information Criterion (AIC) across alternative lags (between 1 and 12). Additionally, it is postulated that the structural impact multiplier matrix $\mathrm{A^{-1}}$ has a recursive structure such that the reduced form errors ϵ_t can be decomposed according to $\mathrm{\epsilon_t = A^{-1}Bu_t = Su_t}$.

The recursive structure imposed on $\mathrm{A^{-1}}$ requires an ordering of the variables used in the estimation. Accordingly, this study utilizes the ordering in $\mathrm{y_t = (\Delta o_t, \Delta une_t, \Delta p_t, \Delta pr_t, \Delta er_t)'}$, where the block exogeneity is imposed and the identification are based on the work of Sim (1992) and Kim and Roubini (2000). The global oil price ($\mathrm{\Delta o_t}$), which is determined globally, can influence other variables contemporaneously, while shocks on other variables cannot have an impact on it. The inflation ($\mathrm{\Delta p_t}$) is influenced contemporaneously by the global oil prices and domestic unemployment. Additionally, placing the policy rate ($\mathrm{\Delta pr_t}$) after unemployment

(Δune_t) and inflation (Δp_t) is to ensure that the monetary policy can immediately react to unemployment and inflation (Christiano et al., 1999). The exchange rate (Δer_t) is ordered after the policy rate (Δpr_t) so that it can immediately react to money policy shocks. Hence, the identifying restrictions is imposed in the following form:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_t^{gop} \\ \varepsilon_t^{une} \\ \varepsilon_t^{p} \\ \varepsilon_t^{pr} \\ \varepsilon_t^{er} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{bmatrix} \begin{bmatrix} u_t^{gop} \\ u_t^{une} \\ u_t^{p} \\ u_t^{pr} \\ u_t^{er} \end{bmatrix}$$

Data

Thailand data on consumer price index, central bank policy rate, exchange rate and unemployment rate were obtained from website of the Bank of Thailand (BOT) and CEIC database. The global oil prices, which are represented by the price of Brent crude in U.S. dollars per barrel, were from the Federal Reserve Economic Data (FRED) website. The sample period spans the months 2002M1 through 2023M6.

In the relation to the SVAR model, percentage changes in global oil prices (Δo_t) are computed using the log changes in the global Brent crude oil price. Changes in the unemployment rates (Δune_t) are calculated as the changes in the unemployment rate. Inflation rates (Δp_t) are computed as the log changes in the headline consumer price index. Changes in the policy rate (Δpr_t) are obtained as the changes in the policy rate. Percentage changes in the exchange rate (Δer_t) are measured by the log changes in the real effective exchange rate.

Results and Discussion

This section comprises two subsections. The estimation results are reported and discussed in the following section. The robustness check is shown in the second subsection.

Estimation Results

Before the model is estimated, a unit root test is conducted for all variables in the system. For this purpose, the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests are conducted. The major conclusion drawn from the results of these tests is that all the variables in the system are stationary at the level form (see Appendix A). In addition, this study uses the approach of Johansen (1988) to examine the existence of co-integrating relationships between system variables. Based on several criterion, the optimal lag order is set to two. The trace and maximum eigenvalue (λ_{max}) statistics suggest the presence of co-integrating relationships between the variables of the system (see Appendix B).

This subsection depicts the empirical results of Thai inflation drivers based on impulse response functions (IRF), its historical decomposition over time and its forecast error variance decomposition.

The estimation of the model results in the structural impulse responses (IRF) given in Figure 2 and Figure 3. As is evident from the IRFs of inflation (P) and its accumulated response (see Figure 2), a positive shock to the global oil price (GOP) significantly increases inflation, which is consistent with earlier studies such as those by Manopimoke (2018), Hossain & Raghavan (2020), and Ha et al. (2023), for at least three months. Regarding the corresponding magnitude, a 1% increase in global oil prices substantially leads to about 0.0023% and 0.0007% of a rise in inflation in the first and third months, respectively (see Figure 2). This shows that the global oil price is the primary source of Thailand's inflation, and its impact has persisted for more than three months. In addition, inflation responds negatively and substantially to a positive shock to the policy rate (tightening monetary policy), in the third month. This response implies that the monetary policy under inflation targeting, with the policy rate as a monetary instrument, remains effective in reducing inflation, albeit with delayed effects. While other factors, such as the unemployment rate and exchange rate, do not appear to be substantial sources of inflation.

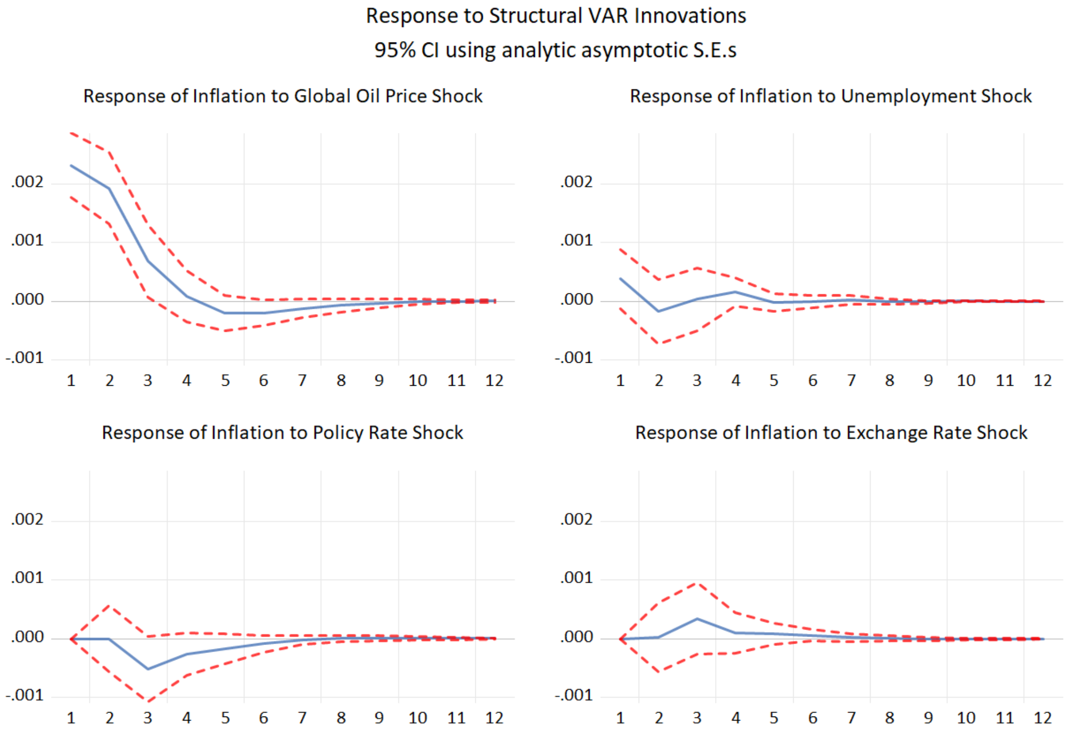

Figure 2 Impulse Responses of Inflation (P) with Respect to Alternative Variables

Source: Author's Study

In terms of monetary policy (see Figure 3), the policy rate (PR) responds positively and significantly to positive shocks from global oil prices (GOP) and domestic inflation during the first six months. Regarding the corresponding magnitude, a 1% increase in global oil prices results in about a 0.039% and 0.011% increase in the policy rate in the third and sixth months, respectively. Furthermore, a 1% increase in inflation leads to about a 0.024% and 0.006% increase in the policy rate in the third and sixth months, respectively. This is in accordance with the implication of a monetary policy in which the central bank raises its policy rate in response to a rise in inflation induced by both domestic and global factors (Clarida et al., 2001). Also, this response makes it evident that, under the inflation targeting framework, the policy rate is a monetary instrument used to attain price stability and that the Bank of Thailand acts as an inflation fighter by using the policy rate (Arwatchanakarn, 2019; Hossain & Arwatchanakarn, 2021).

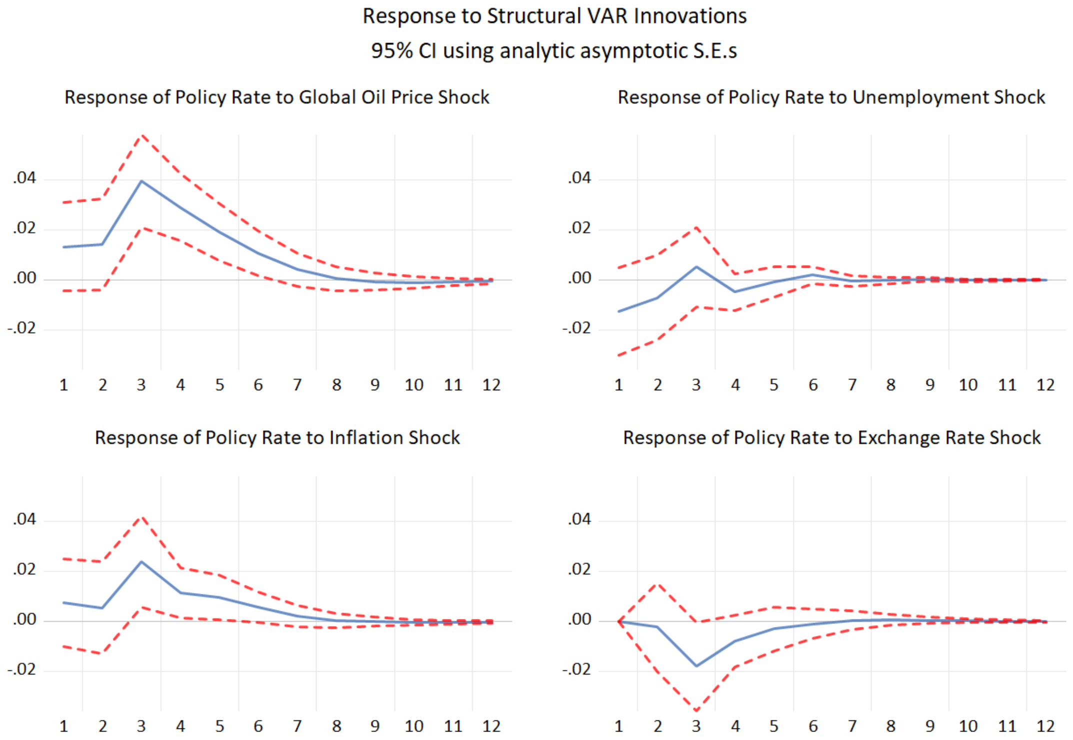

Figure 3 Impulse Responses of Policy Rate (PR) with Respect to Alternative Variables

Source: Author's Study

In addition, the impulse responses of Thai unemployment and exchange rates are given in Figure 4. As is evident, unemployment decreases with a positive global oil price shock. Specifically, a 1% change in global oil prices is associated with a 0.05% decrease in unemployment in the third month. The negative effects of global oil prices on unemployment can be attributed to higher demand in the global economy. Furthermore, the real effective exchange rate exhibits a significant and positive response to a positive shock of the policy rate for at least the first months. Regarding the corresponding magnitude, in the first month, a 1% increase in the policy rate shock is associated with a 0.0025% increase in the exchange rate, indicating a 0.0025% appreciation in the Thai Baht. This suggests that a conventional monetary policy of hiking the policy rate would be beneficial for preventing Thai baht depreciation.

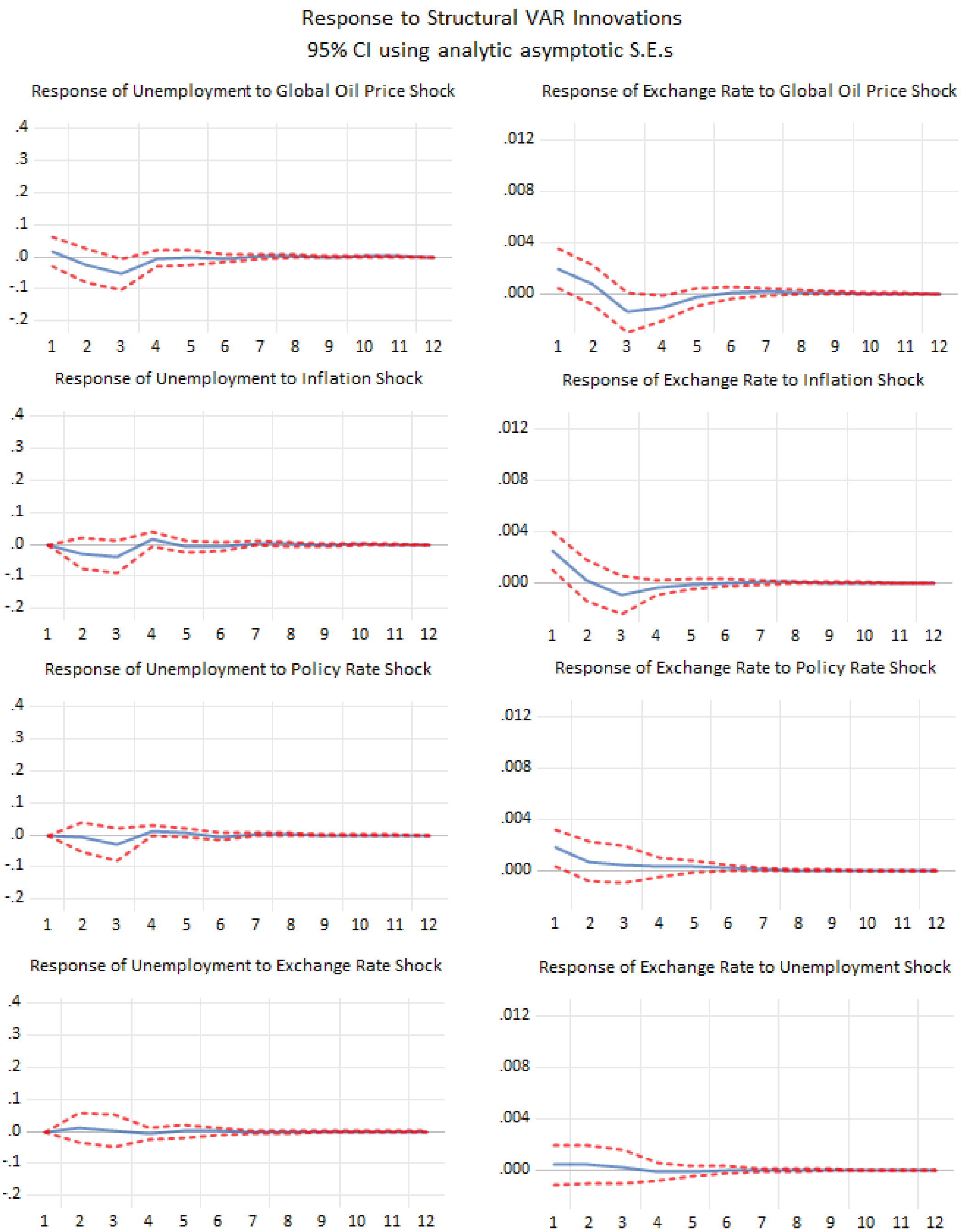

Figure 4 Impulse Responses of Unemployment (UNE) and Exchange Rate (ER) with Respect to Alternative Variables

Source: Author's Study

The forecast error variance decompositions (FEVD) of all the key variables are given in Table 1 for alternative horizons. First, the FEVD of Thai inflation is shown in Table 1(a). Except for inflation itself, it is evident that global oil prices contribute the most to the volatility of inflation. Specifically, about one-third of the inflation variance is explained by global oil prices over a 24-month period, whereas about 1.30% of the variance is explained by the policy rate. Second, the FEVD of the Thai monetary policy rate is given in Table 1(b). Following their own shocks, global oil prices and inflation contribute the most to policy rate volatility. Specifically, over a 24-month period, about 11.75 of the policy rate variances is explained by global oil prices, whereas about 3.28% of the variance is explained by inflation. Hence, based on its forecast error variance decomposition, both Thai inflation and the policy rate are mostly driven by global oil prices. Also, the policy rate is influenced by inflation. Furthermore, the FEVD of Thai unemployment and exchange rates are given in Table 1(c) and 1(d), respectively. It suggests that both unemployment and exchange rate fluctuations are primarily caused by their own shocks with minimal contributions from global oil prices, inflation, and policy rate.

Overall, Thai inflation is primarily influenced by shocks of global oil prices. This is consistent with previous studies such as Manopimoke (2018), Hossain & Raghavan (2020), Yilmazkuday (2022), and Ha et al. (2023) who have shown that the contribution of global factors has a high and significant impact on domestic inflation. Also, the empirical results show that, in response to an increase in inflation, the Bank of Thailand acts as an inflation fighter by raising the policy rate. This is implied that a conventional monetary strategy of raising policy rate would be optimal for achieving and maintaining price stability, which is the primary objective of Bank of Thailand.

Table 1 Forecast Error Variance Decomposition of Inflation, Policy Rate, Unemployment and Exchange rate

(a) Inflation				
Contribution of:	**After 1 Month**	**After 1 Quarter**	**After 1 Year**	**After 2 Years**
Global Oil Prices	23.04%	33.76%	33.78%	33.78%
Unemployment	0.62%	0.63%	0.73%	0.73%
Inflation	73.33%	64.24%	63.69%	63.69%
Policy Rate	0.00%	0.94%	1.30 %	1.30%
Exchange Rate	0.00%	0.42%	0.49%	0.49%
(b) Policy Rate				
Contribution of:	**After 1 Month**	**After 1 Quarter**	**After 1 Year**	**After 2 Years**
Global Oil Prices	0.84%	7.41%	11.75%	11.75%
Unemployment	0.72%	0.88%	0.92%	0.92%
Inflation	0.27%	2.50%	3.28%	3.28%
Policy Rate	98.17%	87.97%	82.63%	82.63%
Exchange Rate	0.00%	1.23%	1.41%	1.41%
(c) Unemployment				
Contribution of:	**After 1 Month**	**After 1 Quarter**	**After 1 Year**	**After 2 Years**
Global Oil Prices	0.22%	2.07%	1.99%	1.99%
Unemployment	99.77%	96.19%	96.04%	96.04%
Inflation	0.00%	1.18%	1.30%	1.30%
Policy Rate	0.00%	0.47%	0.57%	0.57%
Exchange Rate	0.00%	0.09%	0.10%	0.10%
(d) Exchange Rate				
Contribution of:	**After 1 Month**	**After 1 Quarter**	**After 1 Year**	**After 2 Years**
Global Oil Prices	2.33%	3.63%	4.32%	4.32%
Unemployment	0.11%	0.25%	0.27%	0.27%
Inflation	3.79%	4.07%	4.11%	4.11%
Policy Rate	1.90%	2.22%	2.33%	2.33%
Exchange Rate	91.86%	89.82%	88.96%	88.96%

Source: Author's Study

Robustness Check

This subsection undertakes robustness checks to confirm the validity of the results in the previous section. The main focuses of this section are the drivers of Thailand inflation (measured by the forecast error variance decomposition of Thailand inflation) and the effectiveness of the monetary policy rate on Thailand inflation (measured by the impulse response of Thailand inflation with respect to alternative variables over 1 year).

The robustness check considered in this paper is connected to the ordering of variables. According to Calvo & Reinhart (2002), central banks in emerging countries typically raise interest rates to prevent currency depreciation. This can be used as an alternative strategy for placing the exchange rate (Δer_t) before the monetary policy rate (Δpr_t) in identifying restrictions for SVAR model. Hence, this paper uses the alternative ordering of variables as in $\mathrm{y_t} = (\Delta \mathrm{o_t}, \Delta \mathrm{une_t}, \Delta \mathrm{p_t}, \Delta \mathrm{er_t}, \Delta \mathrm{pr_t})'$ for the robustness check.

The results obtained by the robustness check are provided in Figure 5 and Table 2 below. Both the FEVD and impulse responses exhibit that the drivers of Thai inflation are very similar to the benchmark results when this alternative ordering of variables is used. Therefore, the benchmark results are robust to consideration of alternative ordering of variables.

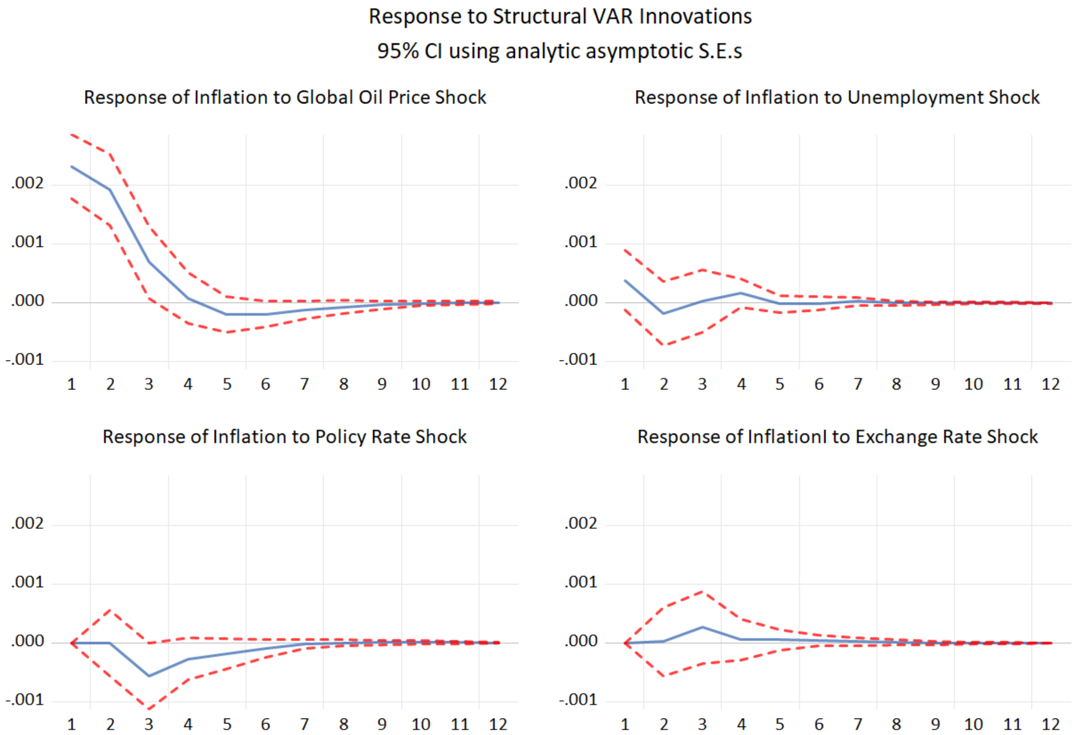

Figure 5 Robustness for the Impulse Response of Thailand Inflation with Respect to Alternative Variables

Source: Author's Study

Table 2 Robustness Check for FEVD of Inflation and Policy Rate

(a) Inflation				
Contribution of:	**After 1 Month**	**After 1 Quarter**	**After 1 Year**	**After 2 Years**
Global Oil Prices	23.04%	33.76%	33.78%	33.78%
Unemployment	0.63%	0.63%	0.73%	0.73%
Inflation	76.33%	64.24%	63.70%	63.70%
Policy Rate	0.00%	1.11%	1.50%	1.50%
Exchange Rate	0.00%	0.26%	0.29%	0.29%
(b) Policy Rate				
Contribution of:	**After 1 Month**	**After 1 Quarter**	**After 1 Year**	**After 2 Years**
Global Oil Prices	0.84%	7.41%	11.75%	11.75%
Unemployment	0.72%	0.88%	0.92%	0.92%
Inflation	0.27%	2.50%	3.28%	3.28%
Policy Rate	96.18%	86.87%	81.68%	81.68%
Exchange Rate	1.99%	2.33%	2.36%	2.36%

Source: Author’s Study

Conclusion and Suggestions:

This paper has undertaken an empirical investigation of the drivers of Thailand’s inflation. A structural autoregression (SVAR) model is employed, where monthly data on global oil prices, inflation, unemployment rate, monetary policy rate, and exchange rate from 2002M1 to 2023M6 are used. The key findings are as follows.

The results based on the impulse response function show that Thailand’s inflation has primarily been driven by global oil prices, with an increase in global oil prices leading to a substantial rise in inflation in the first three months. Furthermore, a positive shock to the policy rate (tightening monetary policy) has a negative significant impact on inflation. This response implies that the monetary policy under inflation targeting, with the policy rate as a monetary instrument, remains effective in reducing inflation, albeit with delayed effects. Additional results show that monetary policy (via the policy rate) responds positively and significantly to a positive shock from global oil prices (GOP) and domestic inflation during the first six months. In terms of the exchange rate, the empirical results suggest that raising the policy rates can prevent currency depreciation. According to the forecast error variance decomposition analysis, Thai inflation has been driven by the shock of global oil prices. Although the policy rate shock has occasionally contributed to inflation, its contribution is limited compared to that of the shock of global oil prices. Additionally, these empirical results are robust to the consideration of alternative orderings of variables included in the analysis.

It can be concluded that Thai inflation is primarily driven by shocks of global oil prices. In response to increasing inflation, the Bank of Thailand acts as an inflation fighter by hiking the policy rate. As empirical results show, a conventional monetary policy of raising the policy rate would be optimal to fight against inflation for achieving and maintaining price stability, which is the primary objective of the Bank of Thailand, as well as beneficial for preventing Thai baht depreciation. In a nutshell, Thailand's inflation is highly sensitive to external factors, particularly global oil prices. Thai monetary authorities need to pay greater attention to external developments and react to a greater variety of shocks by focusing a rule-based monetary policy under a more flexible exchange rate regime, to insulate its economies from the external shocks. In the presence of external-driven inflation, the role of ruled-based monetary policy, especially under inflation targeting, requires a combination of effective communication, flexibility, and a measured approach to policy adjustments. For example, the central bank should communicate to the public about the external factors influencing inflation. The central bank may adjust its policy rate in response to external-driven inflation as demonstrated in our prior findings. Additionally, it is necessary for the central bank to regularly oversee exchange rates, as they serve as a conduit for external influences that can impact inflation.

Nevertheless, there are some limitations to this study. First, the unemployment rate appears to be a weak measure for a demand-side inflation determinant. It does not appear to have a significant relationship with inflation and other domestic macroeconomic indicators. Therefore, the further study should consider applying the variation of GDP, such as output gap and industrial production index as a proxy for demand pressure. Second, the structural breaks are not included in SVAR model, which would affect parameter estimates, impulse response function and forecast error variance decomposition of the model analysis. Several econometric approaches, such as Structural Break analysis, Time-Varying Parameter models, Cointegration analysis and Bayesian analysis, can be used to improve the estimation and understanding of Thai inflation.

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Appendix A Time Series Properties of Variables

Table A.1 Unit Root Test Results in Level Form

Variable	Constant (C); Trend (T)	The ADF Test Statistic			The KPSS Test Statistic		
		Lag Length	ADF-statistic	Inference at 5%	Bandwidth	LM-statistic	Inference at 5%
Δo	C, T	0	-11.76*	S, I(0)	3	0.040	S, I(0)
	C	0	-11.77*	S, I(0)	3	0.089	S, I(0)
Δune	C, T	12	-5.05*	S, I(0)	3	0.065	S, I(0)
	C	12	-5.02*	S, I(0)	3	0.230	S, I(0)
Δp	C, T	0	-11.88*	S, I(0)	4	0.070	S, I(0)
	C	0	-11.87*	S, I(0)	4	0.206	S, I(0)
Δpr	C, T	2	-5.99*	S, I(0)	9	0.062	S, I(0)
	C	2	-6.01*	S, I(0)	9	0.070	S, I(0)
Δer	C, T	0	-13.42*	S, I(0)	5	0.031	S, I(0)
	C	0	-13.42*	S, I(0)	5	0.108	S, I(0)

Table A.1 (Continued)

Notes:

(1) The ADF test examines the null hypothesis of non-stationarity (or the presence of unit root). The optimal lag for the ADF test is selected based on the SIC Criteria. Its critical values at 5% are -3.426 and 2.872 for the model with and without trend, respectively.

(2) The KPSS test examines the null hypothesis of stationarity. The bandwidth in the KPSS test is selected by the Newey-West automatic method. Its critical values at 5% are 0.146 and 0.463 for the model with and without trend, respectively.

(3) **S** represents stationary and **I(0)** represents stationary at the level form.

(4) * indicates statistical significance at 5% level

Source: Author's Study

Appendix B Cointegration test

Table B.1 The Johansen Cointegration Test Results.

H_0: Hypothesized number of cointegration vector	Trace Statistic	Max-Eigenvalue Statistic
$r = 0$	474.97*	166.30*
$r \leq 1$	308.67*	99.23*
$r \leq 2$	209.43*	90.09*
$r \leq 3$	119.33*	82.94*
$r \leq 4$	36.38*	36.38*

Notes:

(1) The assumption that cointegrating relationship include a constant, short-run dynamics include a constant as well as associated VAR has both a constant and trend, is employed for the Johansen Cointegration test.

(2) The optimal lag length is set to 2 based on AIC, HQ and FPE criterion.

(3) * indicates statistical significance at the 5% level

Source: Author's Study