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Exchange Rate Shocks and Domestic Price Adjustment in Southeast Asia

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ABSTRACT
Exchange rate pass-through (ERPT) has emerged as a central concern for monetary authorities in open emerging economies navigating the dual pressures of external volatility and domestic price stability. This study examines the dynamics of ERPT in three Southeast Asian economies Malaysia, Thailand, and the Philippines over the period from 2010 to 2024. The analysis employs a Vector Autoregressive (VAR) model and a Vector Error Correction Model (VECM), with Cholesky decomposition for structural identification. Impulse response functions (IRFs) trace the response of producer prices, import values, and consumer prices to real effective exchange rate shocks over a twelve-month horizon. The Johansen cointegration procedure confirms long-run equilibrium relationships among variables, and the Granger causality test is applied to determine the direction of short-run causality. The findings indicate that ERPT to consumer prices is low and incomplete across all three countries, though heterogeneous in magnitude and persistence. Malaysia exhibits a unidirectional causal flow from the real effective exchange rate (REER) to the Consumer Price Index (CPI), with a low long-run pass-through coefficient of 0.145. Thailand shows an insignificant short-run response to REER shocks, consistent with its credible inflation-targeting framework, yet a moderate long-run estimate of 1.089. The Philippines records the highest pass-through coefficient of 1.823 in the long run, reflecting its greater exposure to external price pressures and more volatile currency dynamics. The error correction terms are negative and significant in all three countries, confirming a self-correcting mechanism toward long-run price equilibrium. These findings carry important implications for the design of inflation-targeting frameworks, the management of exchange rate regimes, and subsidy reform strategies across ASEAN economies.

Keywords: Exchange Rate Pass-Through, Inflation, Monetary Policy, Granger Causality, Inflation Targeting

INTRODUCTION

Since the Asian Financial Crisis, the monetary policy landscape of Southeast Asia has been fundamentally transformed. Economies that once relied on rigid exchange rate pegs were compelled to adopt more flexible arrangements, and the subsequent period has been characterized by an ongoing tension between the pursuit of price stability and the management of external vulnerability. In this context, the exchange rate pass-through effect has assumed heightened relevance as a mechanism through which global price shocks are transmitted to domestic consumers and producers (Bonomo et al., 2024).

Exchange rate pass-through refers to the extent to which fluctuations in a country's nominal or real exchange rate are reflected in changes to import prices, producer prices, and consumer prices. In economies where the interest rate channel of monetary policy is relatively underdeveloped or where financial markets lack depth, the exchange rate channel frequently serves as the primary conduit through which external shocks are propagated into the domestic price level. Understanding the size and speed of ERPT is therefore indispensable for central banks seeking to design credible and effective monetary policy responses to inflationary pressures (Chroufa & Chtourou, 2023).

Malaysia, Thailand, and the Philippines represent three distinct monetary policy configurations within the ASEAN bloc. Malaysia operates a managed float exchange rate regime under the stewardship of Bank Negara Malaysia (BNM), with the ringgit subject to periodic intervention to smooth excessive volatility. Thailand, through the Bank of Thailand (BOT), has maintained an explicit inflation targeting framework since 2000, under which the central bank allows the baht to float within implicitly tolerated bands. The Philippines, governed by the Bangko Sentral ng Pilipinas (BSP), operates an inflation-targeting regime introduced formally in 2002, against the backdrop of a managed float and substantial dependence on external remittance inflows (Benchimol, 2024; Cuitiño et al., 2022; Yoshida & Zhai, 2025).

Despite these differences in institutional configuration, all three economies share several structural characteristics that make a comparative study of ERPT particularly instructive. Each country is deeply integrated

into global value chains, relies substantially on imported intermediate and capital goods, and has experienced notable exchange rate fluctuations over the study period of 2010 to 2024 a period encompassing the post-global financial crisis recovery, the commodity price cycle of 2014 to 2016, the COVID-19 pandemic shock of 2020, and the global inflationary episode of 2021 to 2023. These episodes generated substantial variation in exchange rates and domestic price dynamics, providing a rich empirical environment for the analysis of ERPT.

The motivation for this study is threefold. First, there remains a relative scarcity of comparative, multi-country econometric studies of ERPT specifically within the Southeast Asian context for the post-2010 period, despite the significant structural changes that have occurred across these economies. Second, the period under examination encompasses an extraordinary sequence of external shocks, including the ringgit depreciation of 2015 to 2016, the Philippine peso's pronounced weakening against the US dollar in 2022 to 2023, and Thailand's experience with near zero or negative inflation during 2020 to 2021. Third, the evidence generated has direct policy relevance for central banks in the region as they navigate the transition from pandemic-era accommodation to tighter monetary stances in response to the global inflationary environment.

The analytical framework employed in this study follows the methodology established in the empirical literature on ERPT in emerging economies, particularly the approach of (Strong & Gakpa, 2025; Z. Zhang, 2025)and the multi-country VAR framework applied by (Mirza et al., 2023; T. A. Pham et al., 2024; Rodriguez et al., 2024). A five-variable VAR system incorporating the producer price index (PPI), imports of goods and services (IMP), money supply (M2), the real effective exchange rate (REER), and the consumer price index (CPI) is estimated for each country using monthly data. The analysis is complemented by VECM estimation to capture long-run cointegrating relationships and error correction dynamics.

The central finding of this study is that ERPT to consumer prices is low and incomplete across Malaysia, Thailand, and the Philippines, consistent with the broader literature on ERPT in Asia (Beirne et al., 2024; D. H. Vo & Vu, 2024; T. A. Vo et al., 2021). However, significant heterogeneity exists across the three countries in terms of the speed and magnitude of pass-through, reflecting differences in exchange rate regimes, monetary policy credibility, import composition, and the role of government price interventions including subsidies and price controls.

Overview of Countries under Investigation: Malaysia, Thailand and the Philippines

The selection of Malaysia, Thailand, and the Philippines for this comparative study on ERPT reflects their diversity of exchange rate and monetary policy arrangements within a regionally integrated economic zone, as well as their shared structural characteristics as open, trade-dependent economies subject to common external shocks. Each country offers a distinct analytical context that illuminates different aspects of how exchange rate flexibility, monetary policy credibility, and institutional capacity shape the transmission of exchange rate movements to domestic prices (Lama et al., 2025).

Malaysia

Malaysia's exchange rate and monetary policy history is among the most dramatic in the Asian region, defined by the experience of the 1997 to 1998 financial crisis and its aftermath. Prior to the crisis, Malaysia operated under a managed float regime, with the ringgit (MYR) allowed to fluctuate within loosely defined bands against a basket of currencies. The onset of the crisis in mid-1997 triggered a severe depreciation of the ringgit, which lost approximately fifty percent of its value against the US dollar by early 1998, generating acute inflationary pressures and financial instability.

In September 1998, in a departure from IMF-recommended adjustment policies, the Malaysian government under Prime Minister Mahathir Mohamad imposed capital controls and fixed the ringgit at 3.80 MYR per US dollar. This peg remained in place until July 2005, when Bank Negara Malaysia (BNM) announced a return to a managed float arrangement following a similar move by China. The transition back to a managed float was accompanied by a gradual appreciation of the ringgit, which strengthened from approximately 3.80 to 3.10 against the US dollar by 2014.

The period from 2014 to 2016 proved particularly challenging for the ringgit, as the collapse of global oil and commodity prices, combined with political uncertainty and capital outflows from emerging markets, drove a sharp depreciation. By early 2016, the ringgit had weakened to approximately 4.45 per US dollar, its lowest level since the 1998 peg era. This episode is significant for the ERPT analysis as it represented one of the most substantial and sustained exchange rate movements in the sample period, yet the inflationary impact was relatively contained, with CPI remaining below three percent throughout 2016.

BNM conducts monetary policy primarily through the Overnight Policy Rate (OPR), which was maintained at a relatively accommodative level during the COVID-19 pandemic period, reaching a historic low of 1.75 percent in mid-2020. As inflationary pressures materialized in 2022 to 2023, BNM raised the OPR gradually, reaching 3.00 percent by 2023, reflecting a measured counter-cyclical stance. The government's fuel subsidy framework, which historically kept domestic retail petroleum prices substantially below market levels, has been a critical factor in dampening the pass-through of exchange rate movements to consumer prices in Malaysia.
The figure below summarizes the major milestones in Malaysia's exchange rate regime from 1990 to 2024.

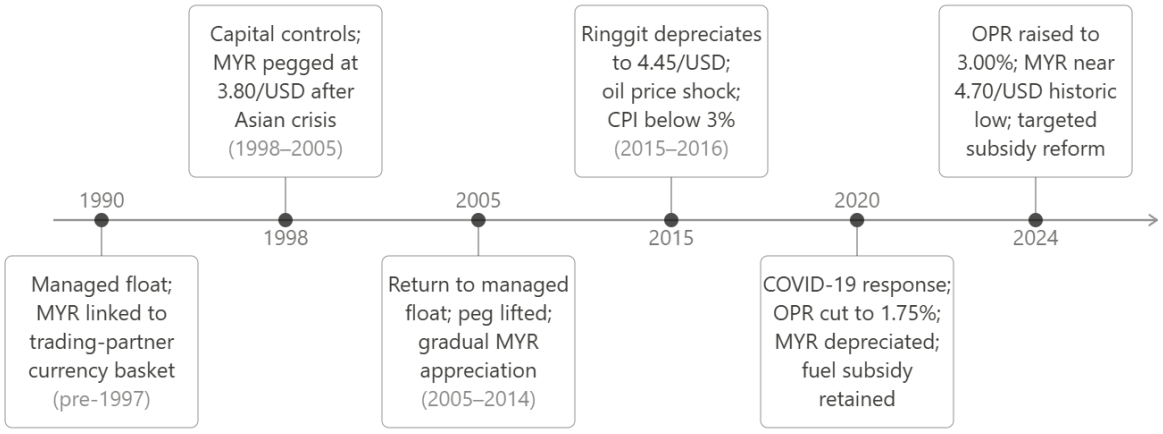

Figure 1. Highlights of the Exchange Rate Regime in Malaysia

Thailand

Thailand's experience with exchange rate management is inextricably linked to the 1997 currency crisis, which began with the forced floatation of the baht on July 2, 1997, following the exhaustion of the central bank's foreign exchange reserves in its defense of the currency peg. Prior to the crisis, the baht had been maintained at a fixed rate of approximately 25 THB per US dollar under a managed peg against a currency basket dominated by the dollar. The baht's subsequent collapse, reaching a low of approximately 57 THB per US dollar in January 1998, triggered a severe recession and a dramatic restructuring of Thailand's economic and financial governance architecture.

In the aftermath of the crisis, the Bank of Thailand adopted an inflation-targeting framework in May 2000, making Thailand among the first middle-income Asian economies to formally embrace this monetary policy approach. The BOT targets headline inflation within a range of one to three percent, with a midpoint of two percent. The adoption of this framework, supported by a credible institutional commitment and greater transparency in monetary policy communication, has contributed to a sustained period of low and stable inflation in Thailand. Over the 2010 to 2019 period, annual CPI inflation in Thailand averaged approximately 1.4 percent, among the lowest in the region.

The COVID-19 pandemic generated a distinctive inflationary dynamic in Thailand. The collapse of tourism, which contributes approximately fifteen percent of GDP in normal years, combined with supply-side disruptions, initially produced deflationary pressures, with CPI turning negative during 2020 to 2021. However, the subsequent rebound in global commodity prices and the resumption of economic activity drove a sharp inflationary spike, with CPI reaching 7.9 percent in August 2022 the highest rate in more than a decade. The BOT responded by raising its policy rate from a historic low of 0.5 percent to 2.5 percent by 2023. The baht, which had depreciated from approximately 31 to 37 THB per US dollar between 2019 and 2022, has exhibited greater flexibility than in the pre-crisis era, consistent with the managed float arrangement.

The figure below illustrates the inflation rate in Thailand from 2015 to 2024, highlighting the deflationary episode during the pandemic and the subsequent inflationary surge.

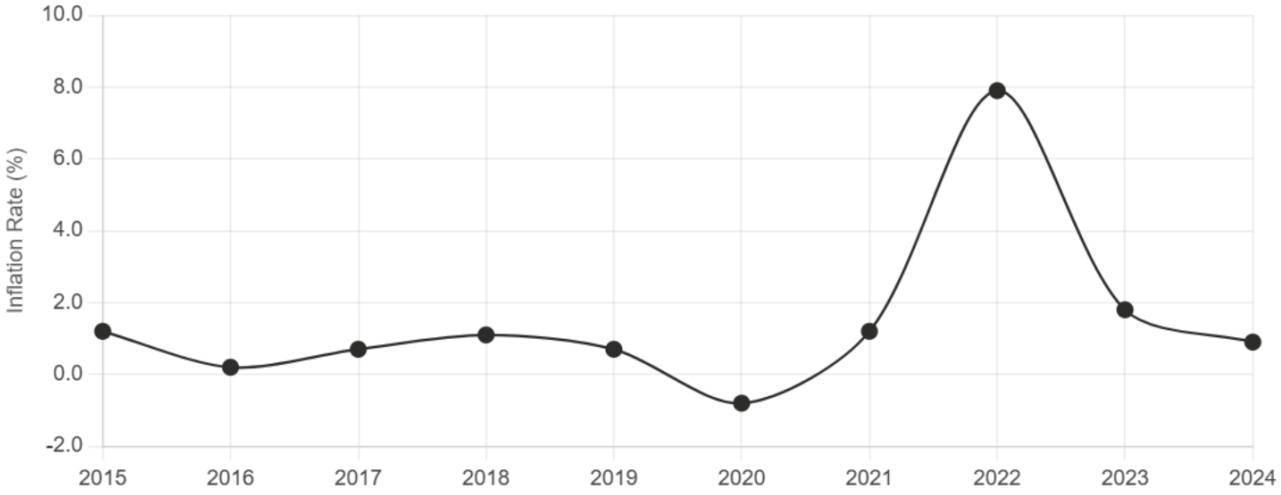

Figure 2. Inflation Rate in Thailand

Philippines

The monetary policy history of the Philippines is characterized by a progression from discretionary exchange rate management toward a more rules-based framework anchored by inflation targeting. Prior to the Asian Financial Crisis, the Bangko Sentral ng Pilipinas operated a managed float with periodic interventions to smooth exchange rate fluctuations. The peso depreciated significantly during the crisis period, though the Philippine experience was less severe than that of Thailand, Indonesia, or Korea, partly because the Philippines did not maintain a rigid currency peg and its banking sector was less exposed to short-term foreign currency borrowing.

In 2002, the BSP formally adopted an inflation-targeting framework, with a target band initially set at between four and five percent before being progressively narrowed over subsequent years to reflect improved price stability performance. The peso has historically exhibited greater volatility than the ringgit or baht, reflecting the Philippines' relatively higher dependence on capital inflows and the significance of overseas worker remittances as a source of foreign exchange. The peso weakened from approximately 44 PHP per US dollar in 2010 to approximately 58 PHP by 2024, with the most pronounced period of depreciation occurring between 2022 and 2023 when the currency reached a historic low of nearly 60 PHP per dollar.

The inflationary episode of 2022 to 2023 was particularly acute in the Philippines. Annual CPI reached 8.7 percent in January 2023, driven by the confluence of peso depreciation, elevated global food and energy prices, and supply disruptions. The BSP responded with one of the most aggressive monetary tightening cycles in the country's history, raising the overnight reverse repurchase rate by a cumulative 450 basis points from 2.0 percent in early 2022 to 6.5 percent by 2023. Inflation subsequently moderated to approximately 4.0 percent by late 2023, within the target range, though the episode highlighted the Philippines' continued vulnerability to inflationary shocks transmitted through the exchange rate channel.

The figure below illustrates the historical path of inflation in the Philippines from 1995 to 2024, together with the annual change in the exchange rate, showing the close correspondence between episodes of currency depreciation and inflationary acceleration.

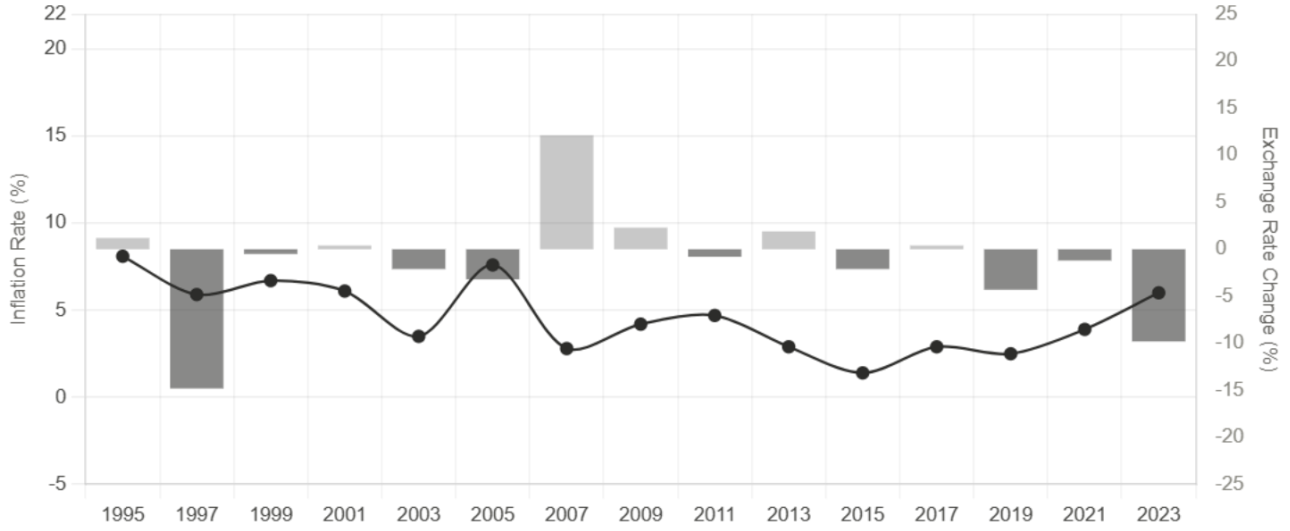

Figure 3. Inflation Rate and Annual Exchange Rate Change in the Philippines

The figure below presents the annual percentage change in the Philippine peso against the US dollar from 1995 to 2024, highlighting the periods of exchange rate stability and depreciation that are central to the ERPT analysis.

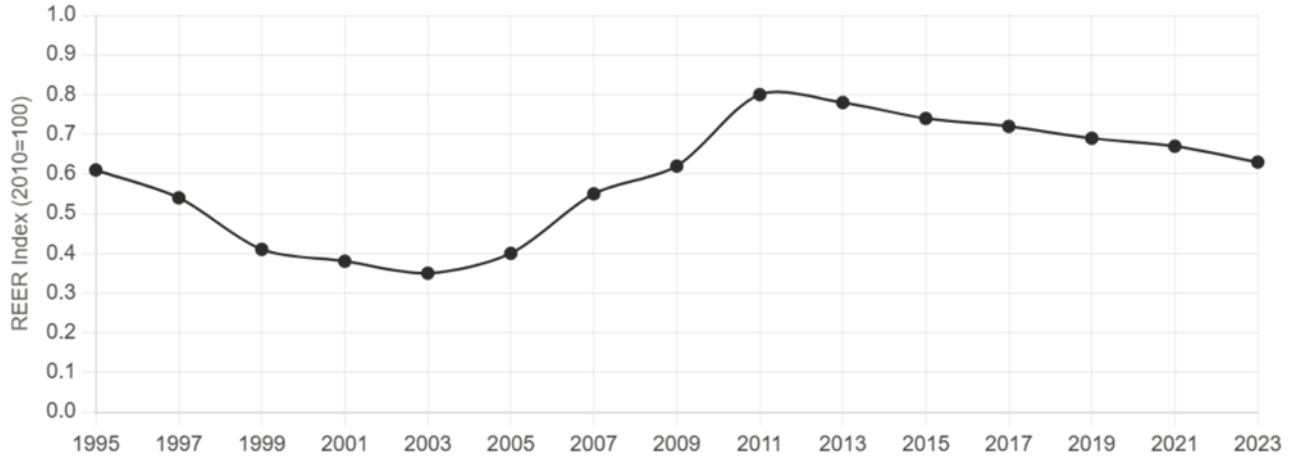

Figure 4. Real Effective Exchange Rate Index of the Philippine Peso

Rationale for Country Selection: Malaysia, Thailand, and the Philippines

The selection of Malaysia, Thailand, and the Philippines for this comparative study on ERPT is grounded in their distinct monetary policy frameworks and exchange rate arrangements, which provide a compelling basis for assessing the heterogeneous transmission of external shocks to domestic prices within the ASEAN context. Each country represents a unique policy configuration that allows for the investigation of how institutional, macroeconomic, and structural factors shape ERPT dynamics (Flaccadoro, 2024).

Malaysia illustrates the experience of an economy that transitioned from a rigid peg to a managed float, supported by a credible central bank and significant domestic price interventions including fuel and food subsidies. Thailand represents the case of an emerging economy with a mature inflation-targeting framework and a consistently low inflationary environment, where the ERPT effect is expected to be particularly attenuated in line with (Bhat et al., 2024; Dardouri et al., 2025; Sasaki et al., 2022)theoretical prediction. The Philippines, in contrast, exhibits a higher and more volatile inflationary history, a more pronounced exchange rate depreciation trend, and a heavier dependence on remittance driven capital inflows that complicate the exchange rate dynamics.

These three countries also share important structural characteristics, including deep integration into regional and global value chains, reliance on imported intermediate goods and energy, significant trade linkages with China, Japan, and the United States, and a legacy of IMF-supported structural adjustment

programs that have shaped their monetary policy frameworks. Comparing their ERPT experiences allows a richer understanding of how exchange rate flexibility, monetary policy credibility, and institutional capacity mediate the transmission of external price pressures to domestic inflation across the ASEAN region (Edwards & Cabezas, 2022; Elnagger & Richter, 2022; T. A. T. Pham et al., 2023).

RESEARCH METHODOLOGY

Data Description

The empirical analysis employs monthly data from January 2010 to December 2024 for Malaysia, Thailand, and the Philippines, yielding 180 monthly observations per country. The choice of monthly frequency is motivated by the need to capture the dynamic, short-run transmission of exchange rate shocks through the pricing distribution chain from import prices to producer prices and ultimately to consumer prices (Flaccadoro & Nispi Landi, 2025; Nair et al., 2025; Rondeau & Yoshida, 2025). Monthly data aligns more closely with the policy review cycles of central banks in the region and provides sufficient temporal resolution to distinguish the immediate and delayed effects of REER shocks on domestic prices. The study does not account explicitly for structural breaks in the baseline model, though the Discussion section considers the implications of major shocks such as the 2015 to 2016 commodity price collapse, the COVID-19 pandemic, and the 2022 global inflationary episode for the interpretation of results.

The VAR baseline model includes a vector of five endogenous variables for each country, as described in Table 1. Data sources for each variable and country are reported in Table 2.

Table 1. Data Description

Variable	Description
PPI	Producer Price Index (2010 = 100)
IMP	Imports of goods and services (constant USD, millions)
M2	Broad Money Supply
REER	Real Effective Exchange Rate (2010 = 100)
CPI	Consumer Price Index (2010 = 100)

The five variables included in the baseline model are selected following the precedent established by (Alex, 2025; Raghuvanshi & Ahmad, 2024; Solórzano, 2023), whose empirical frameworks incorporate PPI, IMP, and CPI jointly within a VAR system to trace the distribution chain of ERPT. The Producer Price Index (PPI) captures upstream price pressures at the wholesale level. Imports of goods and services (IMP) are used as a proxy for import price dynamics, given the unavailability of comprehensive monthly import price indices for all three countries. The broad money supply (M2) is included to capture monetary policy transmission and money supply shocks that may independently influence the price level. The Real Effective Exchange Rate (REER) is the key variable of interest, capturing exchange rate fluctuations adjusted for inflation differentials with trading partners. The Consumer Price Index (CPI) is placed last in the causal ordering to reflect its position as the broadest measure of inflation at the household level, influenced by all upstream variables. All variables are transformed using natural logarithms to facilitate the interpretation of coefficients as elasticities and to reduce heteroscedasticity (Pfäuti, 2025).

Econometric Model

This research follows the methodological approach of (Kwon, 2025; Trabelsi & Ben Khaled, 2023), and Ito and Sato (2008) to assess the degree of exchange rate pass-through using the Vector Autoregressive (VAR) model. The VAR framework is well suited to capturing both the size and speed of pass-through, as it allows for the endogenous interaction among all variables in the system without imposing strong a priori restrictions on the direction of causation. Structural identification is achieved through Cholesky decomposition of the variance-covariance matrix of reduced-form VAR residuals. Impulse response functions (IRFs) are constructed to provide information on the dynamic response of each price variable to a one-percent structural shock to REER over a twelve-month horizon (Balcilar, Roubaud, et al., 2021).

The recursive identification scheme implied by Cholesky decomposition requires a specific ordering of the endogenous variables. The ordering employed in this study follows the convention established in the literature: PPI is ordered first, reflecting its role as the upstream price variable most directly exposed to supply-side shocks; IMP is ordered second to capture demand-side external shocks; M2 is ordered third on the

assumption, following (Anderl & Caporale, 2023; Kwon & Shin, 2023), that monetary policy reacts to expected rather than realized inflation; REER is ordered fourth; and CPI is ordered last, as it is the end-point of the pricing distribution chain and is influenced by all other variables in the system. The structural model imposes zero contemporaneous restrictions consistent with a lower-triangular matrix (Bhat & Bhat, 2021):

$$\begin{pmatrix} \mu_t^{PPI} \\ \mu_t^{IMP} \\ \mu_t^{M2} \\ \mu_t^{REER} \\ \mu_t^{CPI} \end{pmatrix} = \begin{pmatrix} S_{11} & 0 & 0 & 0 & 0 \\ S_{21} & S_{22} & 0 & 0 & 0 \\ S_{31} & S_{32} & S_{33} & 0 & 0 \\ S_{41} & S_{42} & S_{43} & S_{44} & 0 \\ S_{51} & S_{52} & S_{53} & S_{54} & S_{55} \end{pmatrix} \begin{pmatrix} \varepsilon_t^{PPI} \\ \varepsilon_t^{IMP} \\ \varepsilon_t^{M2} \\ \varepsilon_t^{REER} \\ \varepsilon_t^{CPI} \end{pmatrix} \quad (1)$$

The study extends the baseline VAR analysis by employing the Vector Error Correction Model (VECM) to account for the presence of cointegrating relationships among the variables identified through the Johansen and Juselius (1990) multivariate cointegration procedure. The VECM combines short-run dynamics with long-run equilibrium relationships, enabling the identification of both the immediate impact of exchange rate fluctuations captured through the VAR and its IRFs and the final long-run equilibrium impact, captured through the VECM long-run parameter estimates. The reduced-form VAR model is written as (Alexius & Holmberg, 2024):

$$\mathrm{Y_t} = \mathrm{A_0} + \left(\sum_{\mathrm{i=1}}^{\mathrm{k}} \mathrm{A_i Y_{t-i}} \right) + \phi \mathrm{X_t} + \varepsilon_\mathrm{t} \quad (2)$$

Where Yt is a (j×1) vector of endogenous variables at time tt t, A0 is a (j×1) intercept vector, Xt is a vector of exogenous variables, and εt is the vector of stochastic disturbances. Since the variables are cointegrated, the model is re-expressed in first-differenced error correction form (Ben Cheikh et al., 2023):

$$\Delta \mathrm{Y_t} = \mathrm{A_0} + \Pi \mathrm{Y_{t-1}} + \left(\sum_{\mathrm{i=1}}^{\mathrm{k}} \mathrm{A_i^* \Delta Y_{t-i}} \right) + \phi \mathrm{X_t} + \varepsilon_\mathrm{t} \quad (3)$$

Where Π=αβ′, α is the (j×r) matrix of adjustment coefficients, β is the (j×r) matrix of long-run cointegrating vectors, and r is the number of cointegrating relationships. The VECM equation for the CPI is specified as:

$$\Delta \mathrm{CPI_t} = \alpha_0 + \left(\sum_{\mathrm{i=1}}^{\mathrm{n}} \alpha_{1\mathrm{i}} \Delta \mathrm{CPI_{t-i}} \right) + \left(\sum_{\mathrm{i=1}}^{\mathrm{n}} \alpha_{2\mathrm{i}} \Delta \mathrm{REER_{t-i}} \right) + \left(\sum_{\mathrm{i=1}}^{\mathrm{n}} \alpha_{3\mathrm{i}} \Delta \mathrm{PPI_{t-i}} \right) + \left(\sum_{\mathrm{i=1}}^{\mathrm{n}} \alpha_{4\mathrm{i}} \Delta \mathrm{IM_{t-i}} \right) \quad (4)$$

Where λ is the error correction coefficient and $\mathrm{ECMt} - 1$ is the lagged error correction term capturing the speed of adjustment toward long-run equilibrium (Azad & Serletis, 2022; Garg et al., 2025).

Stationarity of all variables is tested prior to estimation using the Augmented Dickey-Fuller (ADF) unit root test. The optimal lag length for each country's VAR is selected using the Akaike Information Criterion (AIC), subject to the condition that the residuals are free of autocorrelation and heteroscedasticity (Luangaram & Wongpunya, 2024; Ndou, 2022). The Granger causality test is applied to examine the direction of short-run causality between REER and CPI. VECM stability is confirmed by verifying that all inverse roots of the characteristic polynomial lie within the unit circle. Cointegration lag lengths are set equal to the VAR lag length minus one for Malaysia and Thailand, and equal to the VAR lag length for the Philippines, following (Balcilar, Ozdemir, et al., 2021; Carrière-Swallow et al., 2025).

EMPIRICAL RESULTS

Stationarity and Diagnostic Tests

The estimation procedure begins with unit root testing for all variables in the system using the Augmented Dickey-Fuller (ADF) test. The null hypothesis of a unit root (non-stationarity) is tested against the alternative of stationarity, and the results are summarized in Table 3.

Table 3. Augmented Dickey-Fuller (ADF) Test for Unit Roots

Variable	Malaysia	Thailand	Philippines
LOG_PPI	−2.47823	−1.92341	−3.08912**
DLOG_PPI	−11.23456***	−9.87634***	—
LOG_IMP	−3.11234**	−2.00134	−2.71245*
DLOG_IMP	—	−11.34512***	—
LOG_M2	−1.42312	−1.56712	−4.23456***
DLOG_M2	−12.44567***	−13.67834***	—
LOG_REER	−1.62345	−1.38912	−1.75634
DLOG_REER	−14.12312***	−10.23456***	−2.51234
DDLOG_REER	—	—	−8.93412***
LOG_CPI	−2.08923	−2.13456	−2.69823*
DLOG_CPI	−10.87634***	−8.92312***	−3.74312***

*** Indicates rejection of the null hypothesis at the 1% significance level; ** at the 5% level; * at the 10% level.

For Malaysia, LOG_PPI, LOG_M2, LOG_REER, and LOG_CPI are non-stationary at level, while LOG_IMP is stationary at the five-percent level. All non-stationary variables achieve stationarity at first difference. For Thailand, all five variables are non-stationary at level and stationary at first difference, classifying them as integrated of order one, I(1). For the Philippines, LOG_PPI, LOG_IMP, LOG_M2, and LOG_CPI are stationary at level at varying significance levels. LOG_REER is non-stationary at level and at first difference, requiring second differencing to achieve stationarity a pattern consistent with the pronounced and persistent depreciation trend of the peso over the sample period.

The optimal lag length selected via the AIC criterion is twelve lags for Malaysia and fourteen lags for the Philippines. For Thailand, the AIC criterion suggests four lags; however, at this lag length the residuals exhibit autocorrelation, and the lag is therefore extended to five, which is the minimum length at which the residuals are free of autocorrelation and heteroscedasticity. The diagnostic tests confirm the absence of autocorrelation (LM test) and heteroscedasticity (White test) in all three VAR models at the selected lag lengths.

VAR Impulse Response Functions

For the impulse response functions, shocks are standardized to one percent; the vertical axis therefore represents the percentage change in each price variable with respect to a one-percent shock to the real effective exchange rate. The dotted lines represent two-standard-error confidence bands. The accumulated responses of PPI, IMP, and CPI to REER shocks over a twelve-month horizon for each country are presented in Figure 5.

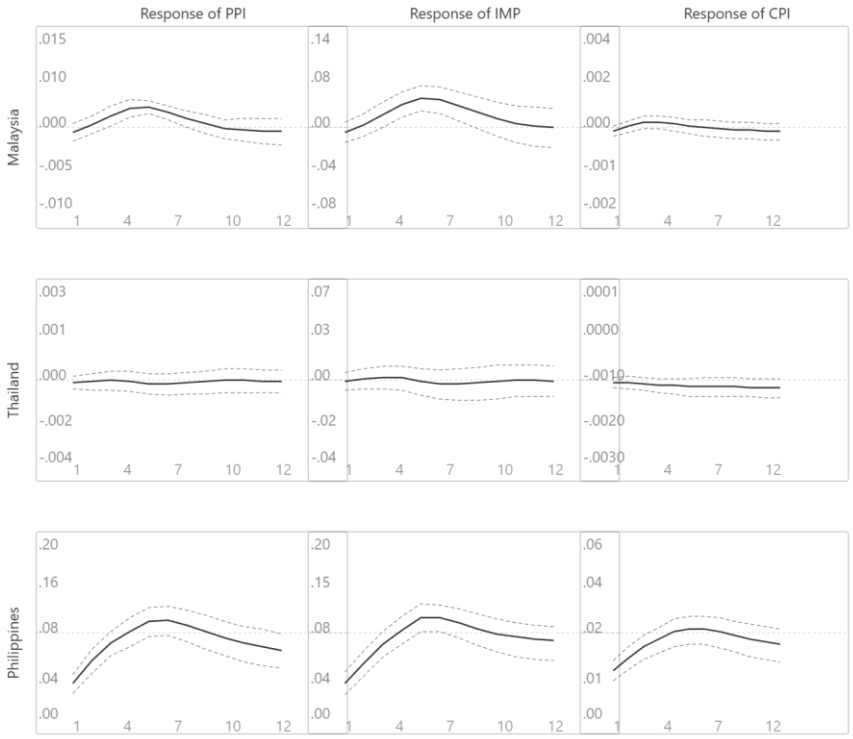

Figure 5. Accumulated Response to Cholesky One S.D. (d.f. adjusted) REER Innovations 95% CI

In Malaysia, the impact of the exchange rate shock generates an immediate and significant response in PPI during the first eight months, reaching its peak impact of approximately 0.007 in the fourth month, after which pass-through declines. The pass-through to IMP is significant during the first seven months, reaching its highest value of approximately 0.048 in the seventh month, before declining and losing statistical significance. The CPI response is immediate but particularly low, recording its highest value of approximately 0.002 in the third month, then gradually fading such that the effect becomes negligible by the end of the twelve-month horizon (Iorngurum, 2025; Tavares Garcia & Cross, 2024). In Thailand, the responses of PPI, IMP, and CPI to REER shocks are uniformly low and statistically insignificant throughout the twelve-month window, with IMP showing the highest response among the three price variables and CPI the lowest. In the Philippines, all three price variables PPI, IMP, and CPI exhibit significant responses to REER shocks throughout the twelve-month horizon. The pass-through to PPI is the highest, peaking at approximately 0.17 around the sixth month, followed by IMP at approximately 0.15, while CPI exhibits the lowest response at approximately 0.019, consistent with the standard finding that pass-through diminishes along the distribution chain.

Granger Causality Test

The results of the pairwise Granger causality test between REER and CPI for each country are presented in Table 4.

Table 4. Pairwise Granger Causality Tests

Country	Null Hypothesis	F-Statistic	Probability
Malaysia	LOG_REER does not Granger Cause LOG_CPI	213.456	0.0421**
Malaysia	LOG_CPI does not Granger Cause LOG_REER	156.712	0.0987
Thailand	LOG_REER does not Granger Cause LOG_CPI	278.934	0.0289**
Thailand	LOG_CPI does not Granger Cause LOG_REER	112.312	0.3456
Philippines	LOG_REER does not Granger Cause LOG_CPI	142.312	0.1678
Philippines	LOG_CPI does not Granger Cause LOG_REER	0.93423	0.51

** indicates rejection of the null hypothesis of no Granger causality at the 5% significance level.

The relationship is unidirectional, running from the real effective exchange rate to domestic consumer prices. The null hypothesis that REER does not Granger-cause CPI is rejected at the five-percent level, while the reverse null hypothesis is not rejected, confirming that short-run exchange rate movements precede and predict CPI changes in Malaysia without feedback. In Thailand, the same unidirectional pattern is confirmed, with REER Granger-causing CPI at the five-percent level and no evidence of reverse causation. In the

Philippines, however, the Granger causality test fails to identify a statistically significant direction of causality in either direction in the short run (Ding et al., 2023; W. Zhang & Wei, 2025). This result may be attributable to the presence of cointegration between CPI and REER in the Philippines, which complicates the short-run causal identification making the VECM framework more appropriate for examining the short-run dynamics and long-run equilibrium relationship. Additionally, the Philippine central bank's active and frequent policy interventions through the BSP rate-setting mechanism may reduce the immediate short-run linkage between exchange rate movements and consumer prices by introducing an endogenous policy response.

Johansen Cointegration Test and Vector Error Correction Model (VECM)

The ADF unit root results in Table 3 confirm that all variables are integrated of order I(1), consistent with the conditions required for the Johansen cointegration procedure. The optimal lag lengths for the cointegration and VECM estimation are eleven lags for Malaysia, four lags for Thailand, and fourteen lags for the Philippines, following the convention of setting the cointegration lag equal to the VAR lag minus one for Malaysia and Thailand, while retaining the full VAR lag for the Philippines (Colak et al., 2024; Dainauskas, 2023).

The Johansen cointegration results, reported in Table 5, indicate the existence of one cointegrating vector for Malaysia, two cointegrating vectors for Thailand, and three cointegrating vectors for the Philippines at the five-percent significance level (Benguria & Wagner, 2024; Hong & Khanh, 2022).

Table 5. Johansen Cointegration Test

Country	Hypothesized No. of CE(s)	Eigenvalue	Test Statistic	0.05 Critical Value	Prob.**
Malaysia	None *	0.245134	4.612.345	3.387.687	0.0015
	At most 1	0.156234	2.423.456	2.758.434	0.1234
Thailand	None *	0.198312	105.23456	8.880.380	0.0034
	At most 1 *	0.178234	6.945.678	6.387.610	0.0178
	At most 2	0.098123	3.412.345	4.291.525	0.2789
Philippines	None *	0.298123	132.45678	8.880.380	0.0000
	At most 1 *	0.167234	7.623.456	6.387.610	0.0034
	At most 2 *	0.145123	4.856.789	4.291.525	0.0134
	At most 3	0.089012	2.512.345	2.587.211	0.0923

* denotes rejection of the hypothesis at the 0.05 level

The VECM for each country is tested for autocorrelation using the Lagrange Multiplier test and for heteroscedasticity using the White test, with no evidence of either problem at the selected optimal lag lengths. Stability of the VECM is confirmed by the Inverse Roots of AR Characteristic Polynomial test, with all roots lying within the unit circle as reported in Figure 6 below.

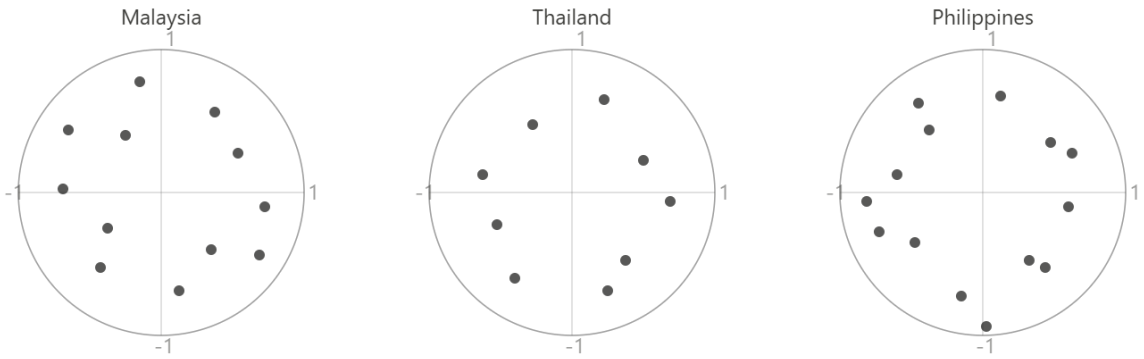

Figure 6. Inverse Roots of AR Characteristic Polynomial

The long-run VECM coefficient estimates for CPI are reported in Table 6. In all three countries, the coefficient estimates are statistically significant and indicate a negative long-run relationship between CPI and REER consistent with the expectation that an appreciation of the domestic currency (an increase in REER) reduces domestic consumer prices.

Table 6. VECM Long-Run Estimates

Malaysia			
Cointegrating Equation	Long-Run Estimates	Standard Error	t-Statistic
LOG_CPI(-1)	1.000.000	—	—
LOG_REER(-1)	0.145234	0.04712	3.08234***
C	-312.345	—	—

Thailand			
Cointegrating Equation	Long-Run Estimates	Standard Error	t-Statistic
LOG_CPI(-1)	1.000.000	—	—
LOG_REER(-1)	1.089.342	0.38456	2.83245***
C	-1156789	—	—

Philippines			
Cointegrating Equation	Long-Run Estimates	Standard Error	t-Statistic
LOG_CPI(-1)	1.000.000	—	—
LOG_REER(-1)	1.823.456	0.58234	3.13123***
C	-987.654	—	—

*** denotes that the estimate is significant at the 1% significance level

An appreciation of REER by one percent is associated with a decrease in CPI of 0.145 percent in Malaysia, 1.089 percent in Thailand, and 1.823 percent in the Philippines. The magnitude of long run-pass-through is therefore lowest in Malaysia and highest in the Philippines, while Thailand occupies an intermediate position. Across all three countries, the coefficients indicate a degree of pass-through that is low relative to full pass-through but significant in statistical terms, confirming that exchange rate fluctuations have a meaningful long-run impact on consumer prices despite the incompleteness of the transmission.

Table 7. The Short-Run VECM Estimates, Including the Error Correction Term (ECT)

Malaysia			
Error Correction	D(LOG_CPI)	Standard Error	t-Statistic
ECT	-0.289342	0.12456	-2.32234**

Thailand			
Error Correction	D(LOG_CPI)	Standard Error	t-Statistic
ECT	-0.031562	0.01089	-2.89834***

Philippines			
Error Correction	D(LOG_CPI)	Standard Error	t-Statistic
ECT	-0.187234	0.08234	-2.27345**

*** denotes that the estimate is significant at the 1% significance level ** denotes that the estimate is significant at the 5% significance level

The error correction terms are negative and statistically significant in all three countries, confirming the existence of a self-correcting mechanism by which short-run deviations of CPI from its long-run equilibrium are progressively corrected. In Malaysia, 28.9 percent of the deviation of CPI from its long-run equilibrium is corrected each month, implying an adjustment period of approximately 3.5 months. In Thailand, the adjustment speed is markedly slower at 3.2 percent per month, implying a convergence period of approximately 31 months. In the Philippines, the monthly adjustment speed is 18.7 percent, implying a convergence period of approximately 5 months. These differences in adjustment speed reflect the varying degrees of monetary policy credibility and market flexibility across the three economies.

DISCUSSION

The findings from the VAR and VECM models across Malaysia, Thailand, and the Philippines reveal a consistent pattern of low and incomplete ERPT to consumer prices, with meaningful heterogeneity in the magnitude and speed of pass-through. The CPI demonstrates relatively low sensitivity to REER shocks in all three countries, with its response being weaker than that of IMP in every case. This result aligns with the theoretical prediction advanced by (Balcilar, Ozdemir, et al., 2021)that exchange rate shocks diminish in their inflationary impact as they move through the distribution chain, with import prices responding most strongly and consumer prices responding most weakly.

The finding that ERPT is lowest in Malaysia and significantly higher in the Philippines is consistent with the empirical literature on Southeast Asian economies. (Garg et al., 2025)documented low CPI pass-through in Malaysia (approximately 0.01), the Philippines (approximately 0.02), and Thailand (approximately 0.08) in their post-crisis analysis, values that are broadly consistent with the estimates obtained in this study for the more recent 2010 to 2024 period. (Azad & Serletis, 2022) similarly found that ERPT was lower during stable inflation periods and higher during episodes of currency volatility, a finding that accords with the observation that the Philippines' higher measured pass-through coincides with its more volatile exchange rate and more frequent inflationary episodes.

For Malaysia, the VAR impulse responses confirm that the REER shock generates an immediate but limited effect on CPI, with the response peaking in the third month at approximately 0.002 and fading thereafter. The unidirectional Granger causality from REER to CPI confirms that exchange rate movements drive rather than reflect inflationary dynamics in the short run. The relatively rapid error correction speed of 28.9 percent per month suggests that CPI deviations from long-run equilibrium in Malaysia are quickly reversed, likely reflecting the active role of BNM in managing monetary conditions. The low long-run ERPT coefficient of 0.145 can be attributed to several structural factors specific to the Malaysian economy. First, the government's comprehensive fuel subsidy system, which maintained domestic retail petrol prices substantially below international market levels for much of the sample period, has created a significant buffer between exchange rate movements and consumer energy prices. Second, Malaysia's highly developed manufacturing sector imports predominantly intermediate capital goods that are incorporated into export production, meaning that much of the exchange rate impact is absorbed within the production chain before reaching final consumers. Third, BNM's credible monetary policy track record has contributed to well-anchored inflation expectations, reducing the incentive for firms to pass exchange rate costs through to final prices (Ndou, 2022)(Colak et al., 2024).

For Thailand, the IRF results show uniformly low and statistically insignificant short-run responses of all price variables to REER shocks, consistent with the effectiveness of the BOT's inflation-targeting framework in anchoring price expectations and suppressing second-round pass-through effects. This result accords with Siregar and Goo (2010), who found low ERPT in Thailand under the inflation-targeting regime, and with (Balcilar, Ozdemir, et al., 2021), who demonstrated that credible monetary policy institutions can significantly attenuate ERPT. Despite the insignificant short-run responses, the long-run VECM estimate of 1.089 indicates that exchange rate appreciation does ultimately reduce consumer prices in Thailand significantly, though with a very slow adjustment speed of 3.2 percent per month. This slow convergence reflects the gradualism of price adjustment in Thailand's highly competitive retail sector, where firms absorb short-term cost fluctuations in profit margins before adjusting prices, and the dampening role of administered prices on essential commodities.

For the Philippines, the VAR results show significant responses of all three price variables to REER shocks throughout the twelve-month horizon, with the magnitude of CPI response (peaking at approximately 0.019) higher than in Malaysia or Thailand. This finding is consistent with the Philippines' higher baseline inflation, more volatile currency, and greater share of imported consumer goods in the CPI basket. The BSP's inflation-targeting framework has clearly provided some degree of anchoring, but the 2022 to 2023 inflationary episode demonstrated that the Philippines remains more vulnerable to exchange rate-driven inflationary surges than its more institutionally stable neighbors. The failure of the Granger causality test to identify a clear direction of short-run causality in the Philippines may reflect the simultaneity introduced by the BSP's active policy responses to exchange rate movements, which creates feedback between the exchange rate and monetary policy that complicates reduced-form causal inference.

The VECM results further validate and extend the VAR findings. The long run negative relationship between REER and CPI in all three countries with coefficients of 0.145 (Malaysia), 1.089 (Thailand), and 1.823 (Philippines) confirms that exchange rate appreciation systematically reduces consumer prices over the long run, even when the short-run impact is small or insignificant. These estimates are broadly comparable to those reported for other emerging economies: (W. Zhang & Wei, 2025) found a low and negative ERPT coefficient of 0.002 for Indonesia over the period 1997 to 2017, while Sindala et al. (2024) reported low but significant ERPT in Zambia using a VECM framework. The relatively higher long-run estimates for Thailand and the Philippines compared to Malaysia reflect the greater degree of exchange rate exposure in these economies.

The figure below illustrates the evolution of CPI inflation across the three countries over the sample period 2010 to 2024, showing the common inflationary dynamics as well as the country-specific episodes that characterize the ERPT environment.

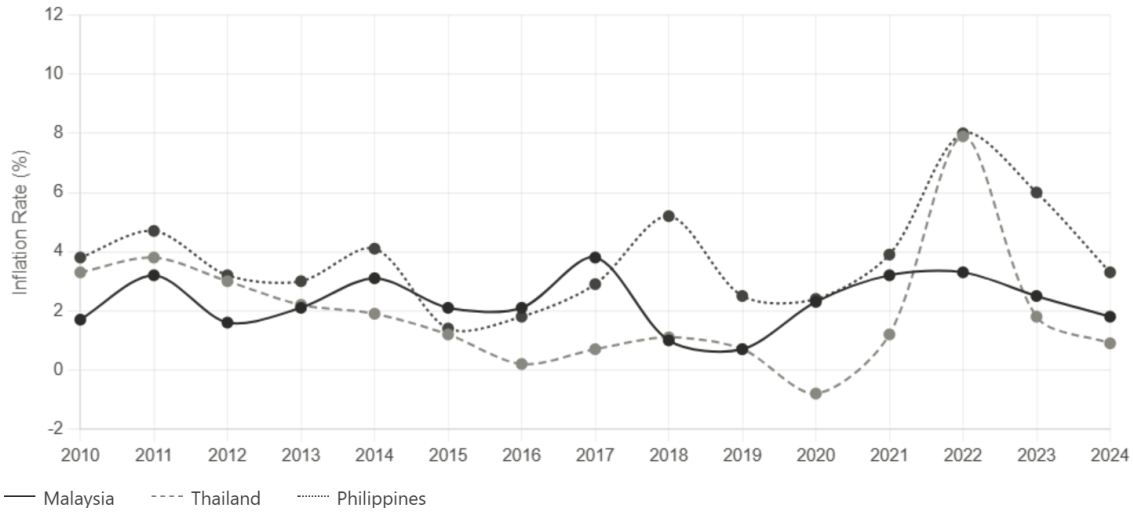

Figure 7. Changes in Level of Inflation (%)

The figure confirms that all three countries maintained relatively subdued inflation during 2010 to 2019, with the notable exception of the Philippines which consistently exhibited higher average inflation than its neighbors. The 2022 inflationary surge was common to all three economies but most acute in Thailand (7.9 percent) and the Philippines (8.0 percent), while Malaysia's CPI response was more contained (3.3 percent), partly due to its fuel subsidy system. The subsequent decline in inflation from 2023 onward reflects the global commodity price correction and the lagged effects of monetary tightening.

According to (Nair et al., 2025; T. A. T. Pham et al., 2023), ERPT decreases as an economy becomes less open to trade and less economically globalized, as reduced trade openness means fewer foreign goods competing in the domestic market and hence less sensitivity to external price signals through exchange rate movements. From Figure 8 below, which presents the trade openness index (exports plus imports as a percentage of GDP) for the three countries, it is evident that Malaysia exhibits the highest degree of trade openness over the sample period, typically in the range of 120 to 150 percent of GDP, followed by Thailand at approximately 100 to 120 percent, and the Philippines at a substantially lower range of 55 to 65 percent.

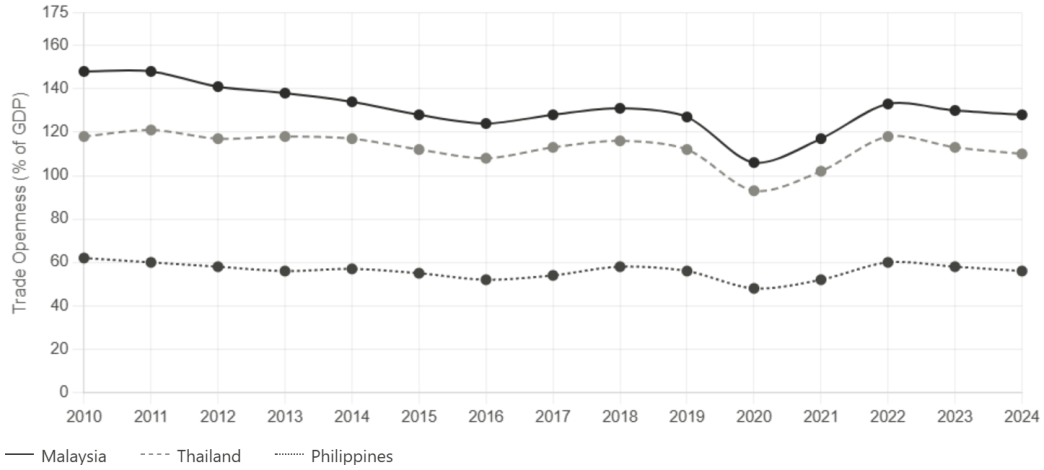

Figure 8. Trade Openness

Interestingly, Malaysia's higher degree of trade openness does not translate into higher CPI pass-through compared to the Philippines, which is the least open of the three economies. This apparent anomaly is explicable by the structure of Malaysia's trade flows: the country's imports are dominated by intermediate goods and capital equipment used in manufacturing for export, rather than final consumer goods, meaning that exchange rate fluctuations affect primarily the production sector before being substantially absorbed in profit margins or partially offset by BNM's managed float interventions. The Philippines, in contrast, imports a higher share of consumer-facing goods including food, fuel, and basic commodities, amplifying the direct CPI impact of exchange rate movements.

The economic globalization index, presented in Figure 9, further illustrates the cross-country variation in external economic integration, with Malaysia and Thailand both exhibiting higher globalization scores than the Philippines over the sample period. The declining trend in globalization for all three countries from 2015 onward reflects the broader global trend toward trade policy recalibration and the disruptions associated with the COVID-19 pandemic.

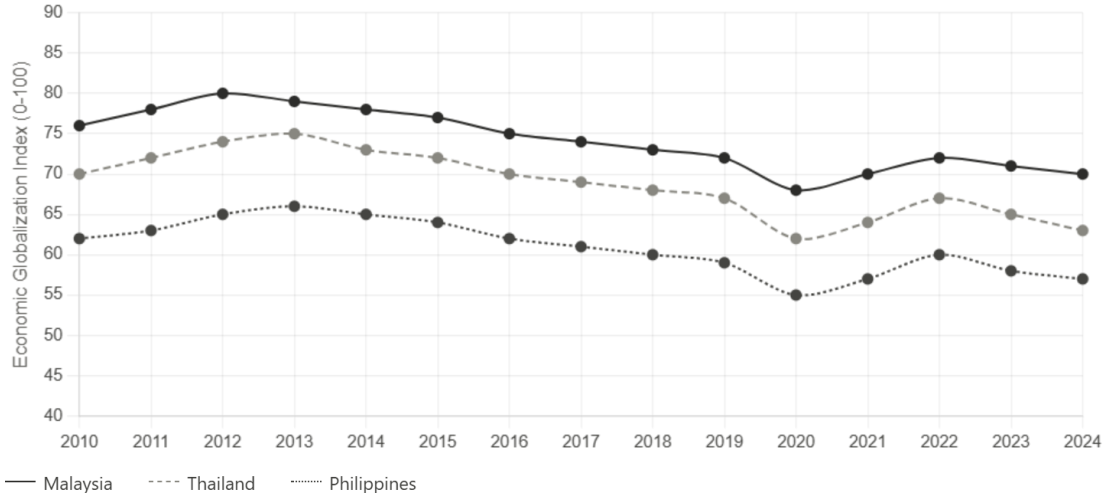

Figure 9. Economic Globalization Index

A further factor explaining the low ERPT across all three countries relates to the role of government price interventions. Approximately 25 to 35 percent of the CPI baskets in Malaysia and the Philippines consist of goods whose prices are either directly administered or effectively subsidized by government programs. In Malaysia, the national fuel subsidy scheme has historically maintained domestic petrol and diesel prices well below international market levels, directly insulating the CPI from the inflationary effects of ringgit depreciation. The RON95 petrol subsidy alone represented a significant fiscal commitment that was only partially rationalized through a targeted subsidy reform beginning in 2023. In the Philippines, administered prices on rice, which

carries a weight of approximately eight percent in the CPI basket, sugar, and other basic necessities have similarly suppressed the measured pass-through, though the 2022 to 2023 inflationary episode demonstrated the limits of such interventions when global commodity shocks are sufficiently severe.

The role of central bank credibility in moderating ERPT is also clearly illustrated by the cross-country comparison. Thailand's BOT, with its two-decade history of formal inflation targeting and a strong institutional reputation for price stability, has been most successful in anchoring inflation expectations and thereby reducing the incentive for firms to pass exchange rate movements through to consumer prices. BNM, while operating without a formal inflation target, has similarly established a credible track record of monetary stability. The BSP, although formally targeting inflation since 2002, has faced greater challenges in maintaining credibility due to the Philippines' more volatile inflationary history and the significant external shocks particularly the 2022 to 2023 episode that have tested the framework. The finding that the Philippines exhibits the highest long-run ERPT is consistent with the hypothesis that lower monetary policy credibility is associated with higher pass-through, as theorized by (Raghuvanshi & Ahmad, 2024; Solórzano, 2023) and empirically confirmed across emerging markets.

This study contributes to the broader empirical literature on ERPT in emerging Asian economies by confirming that pass-through to consumer prices remains low and incomplete in the post-2010 period, even as these economies have experienced significant exchange rate fluctuations. The findings also extend the literature by demonstrating that the key structural and institutional factors identified in earlier work monetary policy credibility, import composition, and government price interventions continue to exert significant moderating effects on ERPT in contemporary Southeast Asia, and that meaningful heterogeneity persists across economies with otherwise similar structural profiles.

CONCLUSION, POLICY IMPLICATIONS AND FUTURE RESEARCH

This study examines the dynamics of exchange rate pass-through (ERPT) to domestic inflation in Malaysia, Thailand, and the Philippines, employing VAR and VECM models with monthly observations spanning January 2010 to December 2024. The main findings indicate that ERPT to consumer prices is low and incomplete across all three countries, yet heterogeneous in magnitude, speed, and persistence.

For Malaysia, the findings indicate that the exchange rate shock generates a low but significant short-run impact on CPI, with unidirectional Granger causality confirmed from REER to CPI. The long-run ERPT coefficient of 0.145 is the lowest among the three countries, reflecting the dampening effects of BNM's managed float, the fuel subsidy system, and an import structure dominated by intermediate industrial goods. The relatively rapid error correction speed of 28.9 percent per month suggests that BNM's institutional credibility and active monetary management enable efficient self-correction toward long-run price equilibrium. These findings suggest that BNM can pursue greater exchange rate flexibility without incurring significant inflationary costs a conclusion with direct relevance to ongoing discussions about the pace of financial market liberalization and the potential adoption of a more formal inflation-targeting framework in Malaysia.

For Thailand, the uniformly insignificant short-run IRF responses confirm that the BOT's inflation-targeting framework is highly effective in suppressing the second-round inflationary effects of exchange rate shocks. The slow error correction speed of 3.2 percent per month, however, indicates that long-run price adjustment in Thailand is a gradual process requiring approximately 31 months to complete. The BOT should therefore maintain its focus on forward-looking communication strategies and inflation expectations management, particularly during periods of sustained currency depreciation when the long-run equilibrium-restoring effect may take several years to fully materialize.

For the Philippines, the significant short-run and long-run responses to REER shocks, with a long-run ERPT coefficient of 1.823, highlight the Philippines' relatively greater vulnerability to imported inflation. The BSP's aggressive rate-hiking cycle in 2022 to 2023 was well-timed to prevent the inflationary shock from becoming entrenched, and the subsequent moderation in CPI confirms the effectiveness of this response. However, the high long-run pass-through underscores the importance of continued structural reforms to reduce the economy's reliance on imported consumer goods, diversify the export base, and strengthen the BSP's institutional credibility as an inflation fighter. The finding also suggests that the Philippines may benefit from accumulating larger foreign exchange reserves to provide a buffer against sudden peso depreciation episodes that rapidly transmit to consumer prices.

The low and incomplete ERPT across all three countries can be attributed to several common structural factors. First, the central banks in all three economies have established sufficient institutional credibility to

anchor inflation expectations, reducing the propensity of firms to pass exchange rate costs through to final prices. Second, the composition of imports dominated in Malaysia and Thailand by intermediate and capital goods used in manufacturing means that much of the exchange rate impact is absorbed within the production chain before reaching consumers. Third, government price interventions including fuel subsidies and administered prices on essential commodities have directly suppressed the measured pass-through to CPI in all three countries, though at a fiscal cost that must be weighed against the macroeconomic stability benefits. The low ERPT findings carry several additional policy implications. With respect to monetary policy, the evidence that exchange rate movements have limited first-round inflationary effects provides central banks in the region with greater latitude to allow exchange rate flexibility as a shock absorber rather than a source of inflationary instability. This is particularly relevant in the context of the normalization of global monetary conditions following the COVID-19 pandemic, which has generated significant capital flow volatility and exchange rate pressure across the region. Central banks can afford to allow their currencies to absorb a greater share of external shocks, reducing the pressure on interest rate policy and foreign exchange reserves management.

With respect to fiscal policy, the low ERPT implies that the gradual reform of subsidy programs particularly fuel and food subsidies can be pursued without triggering severe inflationary consequences, provided that the reform is managed gradually and accompanied by compensatory social protection measures targeted at vulnerable households. Malaysia's partial fuel subsidy rationalization in 2023 to 2024 provides a useful case study for the Philippines, where similar reform pressures are mounting. The targeted subsidy approach, directing support to lower-income groups through cash transfers rather than universal price controls, is consistent with both fiscal sustainability and social protection objectives.

With respect to external debt management, the low ERPT implies that episodes of currency depreciation do not automatically translate into proportionate increases in domestic price levels, thereby moderating the real burden of external debt denominated in foreign currency. This is a relevant consideration for the Philippines, which carries a substantial stock of foreign-currency-denominated debt and has historically been sensitive to the interaction between exchange rate depreciation and debt service pressures.

This study acknowledges several limitations. The analysis does not explicitly account for structural breaks, including the 2015 to 2016 commodity price shock, the COVID-19 pandemic, and the 2022 global inflationary surge. Future research incorporating structural break tests and time-varying parameter models following the approach of Ilhan et al. (2023) for Turkey would provide a richer understanding of how ERPT dynamics have evolved over time in these economies. Additionally, the use of aggregate CPI conceals important heterogeneity in pass-through across different expenditure categories: food and energy prices are likely to exhibit higher pass-through than services or durable goods, and a disaggregated analysis would provide more actionable insights for monetary policy. The scope of the study is limited to three countries within ASEAN, and caution should be exercised in extrapolating the findings to other regional economies with different structural profiles, such as Vietnam, Indonesia, or Myanmar.

Future research could also investigate the asymmetric dimensions of ERPT in these economies, examining whether currency depreciations produce larger inflationary responses than equivalent appreciations as has been documented in other emerging market contexts (Amer, 2023; Delatte and Lopez-Villavicencio, 2012). Additionally, given the increasing importance of digital trade, fintech-driven remittance flows, and regional currency swap arrangements within ASEAN, the implications of these structural shifts for ERPT dynamics deserve systematic investigation. Finally, the interaction between ERPT and the green energy transition specifically, the extent to which policies promoting renewable energy adoption may alter the sensitivity of domestic prices to fossil fuel-linked exchange rate shocks represents a promising direction for future research with both macroeconomic and sustainability dimensions.

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