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### SAFE HAVEN AND HEDGE PERFORMANCE OF USD AND GOLD IN ASEAN-6 EQUITY MARKETS

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#### ABSTRACT

Investors in emerging ASEAN-6 equity markets face persistent challenges in identifying reliable safe-haven assets to protect portfolios during periods of heightened market volatility. Traditional safe havens, such as gold, may not consistently provide the expected protection in these markets, while the safe-haven role of the US dollar (USD) remains relatively underexplored. This study examines whether the USD and gold function as safe havens, hedges, or diversifiers for ASEAN-6 stock indices and evaluates their effectiveness within portfolio allocation strategies. Using daily data spanning 2013 to 2023, we estimate pairwise time-varying dependence between the USD, gold, and six ASEAN equity markets employing DCC-GARCH and dynamic copula models. The results indicate that the roles of the USD and gold vary across markets and over time. The USD consistently acts as a safe haven and a hedge, whereas gold's role alternates between that of a hedge and a diversifier depending on market conditions. Portfolio allocation results further show that the USD is generally prioritized over gold, particularly in strategies focused on variance reduction and diversification maximization. Overall, the findings offer important insights for portfolio management and risk mitigation in emerging ASEAN equity markets.

**Keywords:** Gold, US dollar, safe haven, ASEAN, hedge.

#### INTRODUCTION

The onset of the COVID-19 pandemic and the Russia–Ukraine conflict has profoundly reshaped the global financial landscape, rendering emerging, commodity-dependent economies increasingly vulnerable. Deeper integration into global financial markets has heightened these economies' exposure

to external shocks, thereby renewing interest in the identification of safe-haven assets during periods of heightened volatility. Recent evidence suggests that such crises have intensified risk spillovers between commodities and emerging stock markets, amplifying contagion effects and financial instability (Ghallabi et al., 2025). Prior studies indicate that gold has largely retained its role as a reliable safe haven, whereas digital assets such as Bitcoin have exhibited inconsistent hedging and safe-haven properties across markets (Havidz et al., 2023; Manzli & Jeribi, 2024). Traditional assets, including gold, bonds, and major reserve currencies, have generally remained defensive throughout the pandemic period (Chevallier, 2023). Moreover, increased financial integration has made emerging markets—particularly the ASEAN-6—more sensitive to global shocks, underscoring the need to reevaluate which assets genuinely provide resilience during times of uncertain (Sahay et al., 2025).

Against this backdrop, two key assets have emerged as prominent safe-haven candidates: the U.S. dollar (USD, hereafter) and gold. The USD, long recognised for its financial stability, has experienced a notable surge in global demand<sup>1</sup>, particularly amid heightened geopolitical tensions (Abdullah et al., 2023) and substantial fluctuations in commodity prices (Wen & Cheng, 2018), thereby reaffirming its role as the world's primary reserve currency (Bertaut et al., 2023). Gold, traditionally viewed as a dependable safeguard against stock market volatility (Ciner et al., 2013; Flavin et al., 2014; Bredin et al., 2015), has nonetheless faced increasing challenges to its protective effectiveness in emerging equity markets, as documented in recent studies (Baur & McDermott, 2010; Bekiros et al., 2017). These mixed findings highlight a gap in the literature on safe-haven assets in emerging markets. In particular, limited evidence exists on which assets genuinely provide refuge for ASEAN-6 equity portfolios and how such assets may be employed to enhance portfolio diversification and risk management.

Specifically, there has been a notable shift in scholarly discourse concerning the relationship between stock and commodity markets following the financialization of commodities (Tang & Xiong, 2012; Delatte & Lopez, 2013; Adams & Glück, 2015). Concurrently, evidence reported by Bekiros et al. (2017) indicate that gold assets are increasingly exhibiting stock-like behaviour. Most critically, a growing body of literature argues that gold's effectiveness as a safe-haven asset is weak or even negligible in the context of emerging stock markets (Baur & McDermott, 2010; Beckmann et al., 2015; Bekiros et al., 2017).

This evolving scholarly consensus calls for a reappraisal of gold's role as a conventional safe-haven asset and motivates renewed attention towards the USD as a potentially more effective instrument for risk mitigation in emerging equity markets, including those in ASEAN. This reassessment is particularly timely given the concurrent economic slowdown across ASEAN economies and the strengthening of the USD (Polyzos, 2023). Amid persistent global uncertainty, it is therefore essential to empirically investigate the USD's capacity to function as a safe-haven asset for emerging markets. Equally important is bridging the gap between academic research on safe-haven assets and their practical implications for portfolio management in the ASEAN-6 equity market. Recent studies have increasingly linked safe-haven assets to portfolio construction in emerging markets. For instance, Chang et al. (2023) suggest that incorporating assets such as gold and the USD into investment portfolios can enhance risk diversification during crisis periods. Similarly, Siahaan and Robiyanto (2021) find that bonds served as effective safe-haven assets for ASEAN-5 investors during the COVID-19 market crash. Collectively, these findings underscore the practical relevance of evaluating safe-haven assets within a portfolio framework for emerging markets, thereby reinforcing the motivation for the present investigation.

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<sup>1</sup> <https://www.reuters.com/markets/currencies/why-is-us-dollar-so-strong-again-2023-05-18/>

This study diverges from the existing literature on safe-haven and hedge assets in three important respects. First, it investigates the effects of the USD and gold on the ASEAN-6 stock markets as a regional group. Previous research on ASEAN equity markets has primarily focused on individual countries, such as Vietnam (Gürkün & Ünalımsı, 2018), Malaysia and Thailand (Wen & Cheng, 2018), or on the ASEAN-5 countries (Liow & Song, 2020). Second, the analysis encompasses four major stock market crises that severely impacted ASEAN markets between January 2013 and September 2023: the Chinese stock market meltdown (06/12/2015–02/10/2016), the US-China trade war (07/11/2018–01/15/2020), the COVID-19 pandemic (03/04/2020–02/24/2022), and the Russia-Ukraine conflict (02/25/2022–09/15/2023). Third, from a methodological perspective, this study integrates DCC-GARCH and dynamic copula models with multiple asset allocation strategies, thereby substantially extending the scope of prior research. While Yousaf et al. (2021) and Akhtaruzzaman et al. (2021) primarily utilise DCC-GARCH and quantile regression independently, and Siahaan and Robiyanto (2021) focus solely on quantile regression, the present study uniquely combines advanced volatility and dependence modelling with portfolio allocation approaches. This comprehensive framework enables more robust and practically relevant insights into the hedging effectiveness of the USD and gold across different crisis periods in the ASEAN-6 markets. Accordingly, the primary objective of this study is to rigorously assess whether the USD or gold serves as a more effective safe haven, hedge, and diversifier for ASEAN-6 stock markets during periods of extreme volatility. In addition, the study evaluates how the inclusion of USD or gold in ASEAN-6 equity portfolios influence risk-adjusted performance and diversification, thereby providing practical guidance for portfolio construction and risk management.

The findings indicate that the USD and gold play distinct and time-varying roles as safe havens, hedges, and diversifiers within ASEAN-6 stock markets. The USD consistently functions as both a safe haven and a hedge, whereas gold's role fluctuates between that of a hedge and a diversifier, depending on prevailing market conditions and global events. These results illuminate the complex and dynamic relationship between the USD, gold, and the ASEAN equity markets during periods of heightened volatility.

These insights carry important implications for investors seeking alternative safe-haven assets. For instance, Chinese government bonds (CGBs) have recently emerged as viable instruments, characterized by relatively low volatility and robust economic fundamentals (Lai, 2022). During periods of heightened global market volatility, CGBs have demonstrated resilience, yielded positive returns, and served as flight-to-quality asset. This suggests that investors in ASEAN-6 markets may further enhance portfolio resilience by incorporating CGBs as a broader diversification strategy during turbulent times. By recognizing the evolving roles of different asset classes, investors can construct more robust portfolios that are better positioned to withstand financial shocks.

The remainder of the paper is structured as follows: Section 2 reviews the relevant literature, while Section 3 describes the methodology and data employed in the analysis. Section 4 presents and discusses the empirical results and Section 5 concludes the paper.

## **LITERATURE REVIEW**

A clear distinction between the concepts of a *safe haven*, a *hedge*, and a *diversifier* is crucial to understanding the role of alternative assets in financial markets. Drawing on the seminal contributions of Baur and Lucey (2010), Baur and McDermott (2010), Reboredo (2013), and Bekiros et al. (2017), an asset's classification as a safe haven relative to another asset is determined by their correlation during

periods of elevated market volatility. Specifically, the absence of correlation or the presence of a negative correlation during adverse market conditions qualifies an asset as a safe haven. Safe-haven asset, such as gold and the USD, typically increased demand during tumultuous market periods, providing stability and, in some cases, capital appreciation during economic crises. This behaviour was particularly evident during the COVID-19 pandemic, when elevated uncertainty and severe market instability led investors to seek refuge in safer assets. In such periods, the heightened correlations among riskier financial assets further reinforced the appeal of traditional safe havens. Consistent with this view, the literature frequently identifies assets such as gold, treasury bonds, and certain major currencies as having low or negative correlations with equities and bonds, especially during market downturns (Baur & Lucey, 2010; O'Connor et al., 2015). Importantly, however, the dynamic nature of financial markets implies that an asset's safe-haven and hedging properties may evolve over time.

A hedge, by contrast, is an asset that exhibits, on average, a negative correlation with another asset or portfolio under normal market conditions. Notably, hedging does not necessarily imply protection against losses during periods of extreme market volatility, as an asset that serves as a hedge in tranquil periods may show positive correlation during extreme conditions (Baur & Lucey, 2010). The USD is commonly cited as an example of such an asset, reflecting its central role in global trade and financial transactions. A *diversifier*, meanwhile, is defined as a financial asset that, on average, has a positive but imperfect correlation with another asset or portfolio. Like a hedge, a diversifier does not inherently reduce losses during severe volatile market periods. Instead, its primary function lies in improving portfolio efficiency through imperfect co-movement with other assets, with this positive correlation persisting on average regardless of market conditions. During the Covid-19 pandemic, correlations among major asset classes increased substantially, thereby diminishing the diversification benefits that investors had previously relied upon (Malhotra et al., 2024).

A substantial body of research has examined gold's role as a safe-haven asset in relation to stock markets, particularly in the aftermath of the global financial crisis. The majority of studies in this domain have focused on developed economies. For instance, Ciner et al. (2013) find that gold acted as a safe haven for US equities during the early 1990s as well as during the recent global financial crisis. Flavin et al. (2014) provide evidence supporting the classification of gold as a safe-haven asset for US equity fund managers, while Bredin et al. (2015) show that gold serves as a safe haven for equity investors over longer investment horizons of up to a year.

However, the empirical evidence is far from conclusive. Using data from the United States, Lucey and Li (2015) provide empirical support for the view that gold is neither the most robust nor the most reliable safe-haven asset, whereas Baur and Lucey (2010) argue that gold's safe-haven properties are confined to very short terms. Even more divergent findings emerge from studies examining gold's effectiveness as a hedge or safe haven in emerging stock markets. Bekiros et al. (2017) and Baur and McDermott (2010) report that gold does not function as a safe haven in the BRIC economies (Brazil, Russia, India, China, and South Africa). Similarly, Beckmann et al. (2015) find that gold does not meet the criteria for a safe haven in markets such as Russia and Indonesia, and exhibits only weak safe-haven attributes in other emerging economies, including China, Egypt, Korea, South Africa, Turkey, and Thailand.

In contrast to the extensive body of research on gold, relatively limited attention has been devoted to examining the role of the USD as a safe-haven asset in stock markets. Early evidence provided by Baur and McDermott (2010) using data from the 2008 financial crisis, suggests that gold holds strong safe-haven attributes alongside the USD. Similarly, Liu et al. (2016) demonstrate that both gold and the USD can function as safe havens for seven developed stock markets under most market conditions. Beyond

studies explicitly addressing the safe-haven role of the USD, a growing number of studies has explored the dependence structure between equity markets and the USD without specifically focusing on its safe-haven attributes. Such exploration nonetheless offers valuable insights into the potential of the USD to hedge extreme stock market risks. For example, Ning (2010) investigates symmetric tail dependence between stock and foreign exchange markets across six developed countries. More recently, Chang et al. (2023) provide evidence of asymmetric safe-haven effects, reporting stronger tail dependence between the USD and stock returns during market downturns than during upturns. In a related study, Reboredo et al. (2016) examine both negative and positive risk spillovers between stock and exchange rate markets in emerging economies, finding a positive relationship between equity returns and movements in the USD and euro exchange rates. Their results further reveal two-way spillovers of extreme risks between these markets.

Overall, the literature comparing gold and the USD as safe-haven assets produce mixed results. While some studies suggest that both assets are similarly effective in mitigating stock market risks, others indicate differing levels of effectiveness across markets and periods. Collectively, these findings underscore the importance of examining the safe-haven and hedging roles of gold and the USD, particularly in the context of portfolio management and risk mitigation strategies.

## DATA AND METHOD

### Data

This study employs daily data spanning the period from January 1, 2013, to September 15, 2023. The analysis is conducted over the full sample periods as well as across four distinct sub-periods corresponding to major stock market crises. These sub-periods include: (i) June 12, 2015, to February 10, 2016, covering the Chinese stock market crash; (ii) July 11, 2018, to January 15, 2020, representing the US-China trade war; (iii) March 4, 2020, to February 24, 2022, capturing the COVID-19 pandemic period; and (iv) February 25, 2022, to September 15, 2023, corresponding to the Russia-Ukraine war. The selection of these sub-periods is based on the occurrence of major stock market disruptions since 2013 that exerted considerable and direct effects on ASEAN stock markets. To investigate safe-haven assets, two key variables are considered: (A) the daily US nominal dollar broad index and (B) gold prices measured in USD per ounce. Stock market performance is represented by six ASEAN stock market indices, namely Malaysia (FTSE Bursa Malaysia KLCI), Singapore (Straits Times Index), Indonesia (IDX Composite), Vietnam (Ho Chi Minh Stock Exchange Index), Thailand (Stock Exchange of Thailand Index), and the Philippines (Philippine Stock Exchange Index, PSEi). All data series are sourced from the Thomson Reuters DataStream database. All indices are measured using log-returns, as represented by the following formula:

$$X_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

where  $P_t$  denotes the asset price at time  $t$ .

## Method

The methodological framework employed in this study follows the approach proposed by Martiradonna et al. (2023) and consists of three main stages:

- i) Pairwise dynamic correlations are estimated to capture the time-varying dependence between asset pairs. Specifically, dynamic conditional correlations are measured using both a bi-variate dynamic copula method (Meucci, 2011) and the Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity (DCC-GARCH) model developed by Engle (2002).
- ii) Safe haven identification is conducted by constructing a multivariate expectation-covariance ellipsoid. This framework is used to determine the ASEAN-6 stock markets in which the USD and/or gold provide the most effective safe haven, hedging, and diversification benefits. In addition, the relative effectiveness of the USD and gold is evaluated by comparing the strength and dynamics of their correlations with equity markets.
- iii) Portfolio performance analysis is performed using both *in-sample* and *out-of-sample* evaluations based on a range of performance indicators. This step assesses the contribution of the USD and gold to portfolio optimization and facilitates the identification of portfolios that deliver optimal performance.

### Pairwise Dynamic Correlation

The DCC GARCH model proposed by Engle (2002) enables the estimation of time-varying correlations among financial assets. The estimation of dynamic conditional correlations (DCC) proceeds in two stages. In the first stage, the conditional volatility of each time series is modelled using univariate GARCH specifications. In the second stage, the conditional correlation matrix is estimated using the DCC framework, where the standardized residuals obtained from the first stage serve as inputs.

The underlying DCC-GARCH model can be expressed as:

$$\mathbf{H}_t = \mathbf{D}_t \mathbf{R}_t \mathbf{D}_t, \quad (2)$$

where  $\mathbf{H}_t$  denotes the conditional covariance matrix,  $\mathbf{D}_t$  is a diagonal matrix containing conditional variances  $h_{i,t}$  on the diagonal, and  $\mathbf{R}_t$  represents the time-varying correlation matrix. A univariate GARCH( $Q_i, P_i$ ) model is used to estimate the conditional variance  $h_{i,t}$  specified as:

$$h_{i,t} = \omega_i + \sum_{p=1}^{P_i} \alpha_{i,p} (\Delta x_{i,t-p} - \mu_i)^2 + \sum_{q=1}^{Q_i} \beta_{i,q} h_{i,t-q}, \quad (3)$$

where  $i = 1, 2, \dots, n$  indexes the market indices,  $\Delta x_{i,t-p}$  denotes the value of the log return of index  $i$  at time  $t - p$ ,  $\mu_i$  is the mean return of index  $i$ ,  $h_{i,t-q}$  is the value of the conditional variance of index  $i$  at time  $t - q$ ,  $\omega_i, \alpha_{i,p}$  and  $\beta_{i,q}$  are non-negative, and  $\sum_{p=1}^{P_i} \alpha_{i,p} + \sum_{q=1}^{Q_i} \beta_{i,q} < 1 \forall i$ .

Standardized residuals  $u_t$  are recovered using the derivative residuals  $u_t$ , and conditional variances  $h_{i,t}$ , with elements:

$$u_{i,t} = \frac{\Delta x_{i,t} - \mu_i}{\sqrt{h_{i,t}}}, \quad (4)$$

where  $i = 1, 2, \dots, n$ . Following this, the DCC matrix  $\mathbf{R}_t$  is estimated using the formula:

$$\mathbf{R}_t = \text{diag}\{\mathbf{Q}_t\}^{-1/2} \mathbf{Q}_t \text{diag}\{\mathbf{Q}_t\}^{-1/2} \quad (5)$$

where  $Q_t$  is a positive-definite quasi-correlation matrix. The dynamic evolution of  $Q_t$  is governed by the following equation:

$$Q_t = (1 - a - b)\bar{Q} + au_{t-1}u'_{t-1} + bQ_{t-1}, \quad (6)$$

where  $\bar{Q}$  is the quasi-correlation matrix of the standardized residuals,  $Q_{t-1}$  is the standardized residuals' one-period lag, and  $u_{t-1}$  is the standardized residuals' one-period lag. The dynamic conditional correlation coefficients  $a$  and  $b$  are measures of its short- and long-term stability, respectively.

The following is a typical structure for correlations that can be utilized to express the value of the  $\rho_{ij,t}$  element of the conditional correlation matrix  $\mathbf{R}_t$ :  $\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ij,t}q_{ij,t}}}$ . Based on the definition of standardized residuals in Eq. (1), the standardized residuals are set as  $\{u_t\}_{t=0}^{t=T} = \{\xi_t\}_{t=0}^{t=T}$ .

### ***Expectation-covariance Ellipsoid***

The set of every point such that for a given random vector  $\mathbf{X}$ , the multivariate expectation-covariance ellipsoid of  $\mathbf{X}$  is:

$$\begin{aligned} \partial\mathcal{E}(\mathbb{E}\{\mathbf{X}\}, \mathbb{C}v\{\mathbf{X}\}) &= \\ &= \{x \in \mathbb{R}^n: \|z_X(x)\|^2 \equiv \\ &\equiv (x - \mathbb{E}\{\mathbf{X}\})'(\mathbb{C}v\{\mathbf{X}\})^{-1}(x - \mathbb{E}\{\mathbf{X}\}) = 1\}, \end{aligned} \quad (7)$$

where  $\mathbb{E}\{\mathbf{X}\}$  is the random vector's expected value,  $\mathbb{C}v\{\mathbf{X}\}$  is its variance-covariance matrix,  $n$  is the random vector's size, and  $\|z_X(x)\|^2$  is its square z-score. Ellipsoids are plotted for each possible set of indices  $(i, j)$  for the Russia-Ukraine war sub-period. The ellipsoid corresponding to the  $\{\epsilon_{i,t}\}_{t=0}^{t=T}$  and the ellipsoid corresponding to  $\{\epsilon_{j,t}\}_{t=0}^{t=T}$  are displayed. The unconditional correlation between two time series, represented by the element  $\bar{q}_{ij}$  of the matrix  $\bar{Q}$ , is used in the construction of the expectation-covariance ellipsoid. In general, ellipsoids associated with higher correlations exhibit a more elongated shape, whereas those corresponding to lower correlations tend to be more circular. Furthermore, a positive correlation induces a rightward tilt of the ellipsoid, while a negative correlation results in a leftward tilt.

### ***Asset Allocation Strategies***

Following Martiradonna et al. (2023), this study implements five portfolio allocation strategies to evaluate the investment performance of the USD and gold within ASEAN-6 equity portfolio. These strategies include: i) mean variance, ii) minimum variance, iii) risk parity, iv) conditional value-at-risk (CvaR) optimization, and v) maximum diversification.

### Mean-variance Strategy

Based on the seminal work of Markowitz (1952), the mean-variance allocation strategy determines portfolio weights by simultaneously maximizing expected portfolio returns and minimizing portfolio variance. Under the assumption of a zero risk-free interest rate, the optimal portfolio allocation problem can be formulated as follows:

$$\begin{aligned} \max w' \mu - w' \Sigma w \\ \text{s.t } w' \mathbf{1} = 1 \\ w \geq 0, \end{aligned} \quad (8)$$

where  $w$ ,  $\Sigma$ ,  $\mu$ , and  $\mathbf{1}$  are  $N \times 1$  vectors of asset weights,  $N \times N$  variance covariance matrix, estimated asset returns, and ones, respectively. The number of assets included in the portfolio allocation problem is represented by  $N$ .

### Minimum-variance Strategy

The minimum-variance allocation strategy determines portfolio weights by minimizing the overall portfolio variance. The corresponding optimization problem is formulated as follows:

$$\begin{aligned} \min w' \Sigma w \\ \text{s.t } w' \mathbf{1} = 1 \\ w \geq 0, \end{aligned} \quad (9)$$

where  $w$  is an  $N \times 1$  vector of asset weights,  $\Sigma$  denotes the  $N \times N$  variance-covariance matrix of asset returns, and  $\mathbf{1}$  is an  $N \times 1$  vector of ones. The parameter  $N$  represents the number of assets included in the portfolio allocation problem.

### Risk-parity Strategy

The risk-contribution-parity approach proposed by Maillard et al. (2010) determine portfolio allocations such that each asset contributes equally to the overall portfolio risk. Consider a portfolio with weight vector  $w = (w_1, w_2, \dots, w_N)$  and portfolio volatility defined as  $\sigma(w) = \sqrt{w' \Sigma w}$ , the marginal contribution of  $i$ th asset to portfolio risk is expressed as:

$$\partial_{w_i} \sigma(w) = \frac{\partial(\sigma(w))}{\partial(w_i)} = \frac{\partial(\sqrt{w' \Sigma w})}{\partial(w_i)} = \frac{(\Sigma w)_i}{\sqrt{w' \Sigma w}} \quad (10)$$

and depicts portfolio volatility given a minor variation in one component's weight. Rewriting portfolio volatility as  $\sigma_i(w) = w_i \partial_{w_i} \sigma(w)$  reflects the overall risk contribution of the  $i$ th asset:

$$\sigma(w) = \sum_{i=1}^N \sigma_i(w) \quad (11)$$

The risk-parity technique must solve the following minimization problem:

$$\begin{aligned} \min \quad & \sum_{i=1}^N \left[ w_i - \frac{\sigma(w)^2}{(\Sigma w)_i} \right]^2 \\ \text{s.t} \quad & w'1 = 1 \\ & w \geq 0. \end{aligned} \tag{12}$$

### ***CVaR-optimization Strategy***

The Conditional-Value-at-Risk (CVaR) optimization approach determines portfolio weights by minimizing downside risk as measured by CVaR. Owing to its desirable properties, such as sub-additivity and convexity, CvaR is widely regarded as a coherent risk measure. Accordingly, portfolio weights are obtained by solving the following optimization problem:

$$\begin{aligned} \min \quad & CVaR_{\alpha} \\ \text{s.t} \quad & w'1 = 1 \\ & w \geq 0, \end{aligned} \tag{13}$$

where  $CVaR_{\alpha}$  denotes the Conditional Value at Risk at confidence level  $\alpha$ , as defined in Martiradonna et al. (2023, p.9).

### ***Maximum-diversification Strategy***

The maximum-diversification strategy proposed by Choueifaty and Coignard (2008) determines portfolio weights by maximizing the diversification ratio (DR), which is defined as:

$$DR = \frac{w' \sigma}{\sqrt{w' \Sigma w}}, \tag{14}$$

where  $\sigma$  denotes the asset volatility vector,  $w$  is the portfolio weight vector, and  $\Sigma$  represents the variance-covariance matrix of asset returns. The corresponding optimization problem is formulated as:

$$\begin{aligned} \max \quad & DR: \text{ s.t } w'1 = 1 \\ & w \geq 0. \end{aligned}$$

In this formulation, the denominator represents overall portfolio volatility, while the numerator captures the weighted average of asset volatility. A lower level of portfolio volatility relative to the weighted average asset volatility implies a higher DR.

## **RESULTS**

Table 1 presents the descriptive statistics for the USD, gold, and six ASEAN stock market indices: Malaysia (MAL), Indonesia (INDO), Singapore (SING), the Philippines (PHILIP), Thailand (THAI), and Vietnam (VIET). Across all assets, mean daily returns are relatively low, although Vietnam exhibits a slightly higher average return of 0.0004. Gold demonstrates the highest volatility, with a standard deviation of 0.0092, followed by the Philippine and Thai stock markets, which record volatilities of 0.0118 and 0.0094, respectively. In contrast, the USD exhibits the lowest volatility, with a standard deviation of 0.0031. Most markets exhibit negative skewness, particularly gold and equity markets,

indicating a higher frequency of extreme negative returns. Among the ASEAN markets, Thailand shows the most pronounced negative skewness, with a value of  $-1.4049$ . The kurtosis statistics reveal that all series are leptokurtic, implying heavier tails than those of a normal distribution. Notably, the Thai market shows an exceptionally high kurtosis value of 20.2441, signaling likelihood of extreme return realizations. Consistent with these observations, the Jarque-Bera test statistics are statistically significant for all series, indicating that the returns across all observed series do not follow a normal distribution.

**Table 1**

*Descriptive Statistics of Log Returns for the Full Sample*

	USD	GOLD	MAL	INDO	SING	PHILIP	THAI	VIET
Mean	0.0001	0.0000	-0.0001	0.0002	0.0000	0.0000	0.0000	0.0004
Minimum	-0.0208	-0.0888	-0.0540	-0.0681	-0.0764	-0.1432	-0.1143	-0.0691
Maximum	0.0191	0.0469	0.0663	0.0970	0.0589	0.0717	0.0765	0.0486
Std. Deviation	0.0031	0.0092	0.0066	0.0097	0.0080	0.0118	0.0094	0.0112
Skewness	0.1719	-0.5884	-0.1576	-0.2262	-0.5193	-1.2116	-1.4049	-0.9405
Kurtosis	3.7520	6.2807	9.0518	8.1459	9.4524	13.9713	20.2441	4.7125
Jarque-Bera	1644.3	4732.0	9508.1	7714.2	10481.4	23310.6	48430.1	2984.2

Table 2 presents descriptive statistics for the USD, gold, and the ASEAN-6 stock markets across four distinct sub-periods. Across all periods, mean returns for all assets remain close to zero, in each of the four periods, consistent with observations over the full sample. During the Chinese stock market crash, the Vietnam (VIET) market exhibited a slightly higher average return of 0.0004, while gold recorded the highest volatility at 0.0092. Similarly, the Indonesia (INDO) market also recorded a positive mean return during this period, suggesting relative resilience. In contrast, Malaysia (MAL) experienced declining returns, reflecting its susceptibility to external shocks. Throughout the US-China trade war, most markets experienced weak returns. However, INDO maintained positive mean returns, indicating relative stability amid ongoing trade tensions, whereas Malaysia's returns declined further, highlighting its heightened vulnerability.

During the COVID-19 pandemic, MAL registered a slight increase in mean return of 0.0001. In contrast, INDO and SING achieved higher average returns of 0.0004 and 0.0002, respectively, highlighting a heterogeneous response among ASEAN markets. Conversely, the Philippines saw an increase in volatility, reaching 0.0165, reflecting the significant economic disruptions caused by the pandemic. During the Russia-Ukraine conflict, when most assets experienced declines, INDO still recorded a modest positive mean return of 0.0001. Both SING and PHILIP showed near-zero average returns but exhibited increased volatility, while the USD and gold continued to experience persistent volatility throughout this period.

**Table 2**

*Descriptive Statistics for Returns during the Four Sub-periods*

	USD	GOLD	MAL	INDO	SING	PHILIP	THAI	VIET
<b>Chinese Stock Market Crash</b>								
Mean	0.0001	0.0000	-0.0001	0.0002	0.0000	0.0000	0.0000	0.0004
Minimum	-0.0208	-0.0888	-0.0540	-0.0681	-0.0764	-0.1432	-0.1143	-0.0691
Maximum	0.0191	0.0469	0.0663	0.0970	0.0589	0.0717	0.0765	0.0486
Std. Deviation	0.0031	0.0092	0.0066	0.0097	0.0080	0.0118	0.0094	0.0112
<b>US-China Trade War</b>								
Mean	0.0001	0.0005	-0.0002	0.0002	0.0000	0.0001	-0.0001	0.0002
Minimum	-0.0085	-0.0216	-0.0222	-0.0383	-0.0304	-0.0300	-0.0229	-0.0496
Maximum	0.0081	0.0244	0.0140	0.0195	0.0231	0.0342	0.0227	0.0289
Std. Deviation	0.0022	0.0068	0.0052	0.0078	0.0069	0.0097	0.0066	0.0080
<b>COVID-19</b>								
Mean	0.0000	0.0003	0.0001	0.0004	0.0002	0.0001	0.0004	0.0010
Minimum	-0.0194	-0.0590	-0.0540	-0.0681	-0.0764	-0.1432	-0.1143	-0.0691
Maximum	0.0191	0.0430	0.0663	0.0970	0.0589	0.0717	0.0765	0.0486
Std. Deviation	0.0034	0.0102	0.0096	0.0127	0.0115	0.0165	0.0135	0.0137
<b>Russia-Ukraine War</b>								
Mean	0.0001	0.0000	-0.0002	0.0001	0.0000	-0.0004	-0.0002	-0.0005
Minimum	-0.0124	-0.0301	-0.0217	-0.0452	-0.0191	-0.0435	-0.0318	-0.0508
Maximum	0.0097	0.0357	0.0396	0.0222	0.0197	0.0354	0.0266	0.0470
Std. Deviation	0.0036	0.0091	0.0066	0.0070	0.0065	0.0114	0.0068	0.0134

Table 3 presents the dynamic conditional correlations (DCC) between the USD, gold, and the ASEAN-6 stock markets over the period from January 1, 2013, to September 15, 2023. Throughout this period, gold consistently shows a significant negative correlation with the USD, with an average DCC of -0.4535, suggesting a potential hedging relationship between gold and the USD. Among ASEAN markets, Singapore (-0.1492, std: 0.0549) and Indonesia (-0.1179, std: 0.0464) also exhibit negative average correlations with the USD, highlighting its potential role as a hedge during this period.

During the Chinese stock market crash (June 12, 2015–February 10, 2016), gold continued to maintain a negative correlation with the USD, reinforcing its hedging function. Correlations between most ASEAN markets and the USD weakened slightly during this period. Singapore recorded an average DCC of -0.0395 (std: 0.0657), while Indonesia had -0.0950 (std: 0.0228). Although these correlations were less pronounced than in the full sample, they still indicate the USD's potential as a hedge. Thailand exhibited a stronger negative average correlation of -0.0999 (std: 0.0398), further underscoring the dollar's hedging capacity. Conversely, Vietnam's near-zero average correlation of -0.0285 (std: 0.0006) suggests that the USD acted more as a diversifier in this market.

During the US-China trade war (July 11, 2018–January 15, 2020), Malaysia recorded an average DCC of -0.0149 (std: 0.0456). While this negative correlation was relatively small, it still implies a minor hedging role for the USD. In contrast, Indonesia and Thailand exhibited stronger negative correlations, with averages of -0.1045 (std: 0.0329) and -0.1343 (std: 0.0341), respectively, indicating a more

pronounced hedging function. The Philippines showed a slightly positive average correlation of 0.0059 (std: 0.0111), reflecting the USD's role as a potential diversifier in that market.

During the market turmoil caused by COVID-19 (March 4, 2020–February 24, 2022), gold exhibited a strong negative correlation with the USD, averaging -0.3772, highlighting its consistent hedging potential. Among the ASEAN-6 equity markets, Singapore reported an average DCC of -0.2590 (std: 0.0837), while Indonesia recorded an average of -0.1800 (std: 0.1074). These results indicate a robust negative relationship, suggesting that the USD functioned as a safe-haven asset during this period. Although the Philippines showed a weaker negative correlation of -0.1447 (std: 0.0935), it still reflected a partial safe-haven role. In Vietnam, the correlation was more negative than in previous periods at -0.0937 (std: 0.0823); however, the USD's role in this market remained more consistent with that of a diversifier.

During the Russia-Ukraine war (February 25, 2022–September 15, 2023), gold continued to display a significant negative correlation with the USD, averaging -0.4934. Singapore reported a DCC average of -0.2020 (std: 0.0632), further reinforcing the USD's safe-haven status. In contrast, Vietnam exhibited a near neutral correlation of -0.0162 (std: 0.0783), indicating that the USD continued to serve as a diversifier in this market.

**Table 3**

*DCC Summary of US Dollar Pairs*

All periods		Average	Minimum	Maximum	Std deviation
	Gold	-0.4535	-0.5359	-0.2396	0.0542
	Malaysia	-0.0885	-0.2085	0.0204	0.0389
	Indonesia	-0.1179	-0.2211	0.0397	0.0464
	Singapore	-0.1492	-0.3247	-0.0052	0.0549
	Philippines	-0.0491	-0.1852	0.0568	0.0382
	Thailand	-0.1261	-0.2631	0.0001	0.0427
	Vietnam	-0.0118	-0.0923	0.0884	0.0323
<b>Chinese Stock Market Crash</b>					
	Gold	-0.4117	-0.4728	-0.3222	0.0297
	Malaysia	-0.0149	-0.0883	0.0781	0.0456
	Indonesia	-0.0950	-0.1449	-0.0458	0.0228
	Singapore	-0.0395	-0.1401	0.0773	0.0657
	Philippines	-0.0632	-0.1138	0.0064	0.0287
	Thailand	-0.0999	-0.1696	-0.0220	0.0398
	Vietnam	-0.0285	-0.0297	-0.0269	0.0006
<b>US-China Trade War</b>					
	Gold	-0.1130	-0.2056	0.0063	0.0677
	Malaysia	-0.0746	-0.1603	0.0068	0.0392
	Indonesia	-0.1045	-0.1758	-0.0366	0.0329
	Singapore	-0.1351	-0.2136	-0.0417	0.0347
	Philippines	0.0059	-0.0337	0.0321	0.0111
	Thailand	-0.1343	-0.2036	-0.0321	0.0341
	Vietnam	-0.0429	-0.0942	0.0378	0.0312

(continued)

COVID-19					
	Gold	-0.3772	-0.5161	-0.1894	0.0765
	Malaysia	-0.1614	-0.3459	-0.0377	0.0847
	Indonesia	-0.1800	-0.4523	-0.0581	0.1074
	Singapore	-0.2590	-0.4187	-0.1099	0.0837
	Philippines	-0.1447	-0.3640	0.0052	0.0935
	Thailand	-0.2746	-0.4879	-0.1352	0.0862
	Vietnam	-0.0937	-0.3081	0.0496	0.0823
Russia-Ukraine War					
	Gold	-0.4934	-0.5824	-0.3277	0.0533
	Malaysia	-0.1080	-0.1647	-0.0744	0.0113
	Indonesia	-0.1402	-0.2665	-0.0639	0.0445
	Singapore	-0.2020	-0.2991	-0.0388	0.0632
	Philippines	-0.0675	-0.1457	0.0047	0.0318
	Thailand	-0.1652	-0.2795	-0.0405	0.0588
	Vietnam	-0.0162	-0.1661	0.1145	0.0783

Table 4 presents the estimated dynamic conditional correlations (DCC) between gold and the ASEAN-6 stock indices. Over the full sample period (January 1, 2013–September 15, 2023), the DCC values between gold and the six ASEAN stock markets exhibit heterogeneous dynamics. Malaysia displays an average DCC of 0.0071 (std: 0.0375), suggesting that gold may serve as a potential diversifier in the long term. Similarly, Singapore with an average DCC of 0.0212 (std: 0.0617), and Indonesia (0.0318, std: 0.0492) also suggest a tendency for gold to function as a diversifier. In contrast, Vietnam (-0.0320, std: 0.0506) and the Philippines (-0.0101, std: 0.0320) show slight negative correlations, indicating that gold serves as a mild hedge in these markets. Thailand with an average correlation of 0.0300 (std: 0.0429), aligns with the diversifier role.

During the Chinese stock market crash (June 12, 2015–February 10, 2016), all ASEAN markets demonstrated a negative correlation with gold. Malaysia recorded the most pronounced negative correlations (-0.1409), followed by Singapore (-0.1260), indicating that gold served as a distinct safe-haven asset during this period of market stress across the region.

Throughout the US-China trade war (July 11, 2018–January 15, 2020), negative correlations with gold persisted across several markets. The Philippines had an average DCC of -0.0885 (std: 0.0360), while Vietnam recorded -0.0867 (std: 0.0373). Malaysia, Singapore, and Indonesia also showed negative correlations, highlighting gold's potential as a hedge during this period. Thailand exhibited a milder negative average of -0.0461 (std: 0.0075), indicating a partial hedging role.

During the COVID-19 pandemic (March 4, 2020–February 24, 2022), the correlation dynamics of gold investments with ASEAN-6 equity markets shifted. Malaysia exhibited a positive average correlation of 0.0832 (std: 0.0654), indicating that gold primarily acted as a diversifier in investment portfolios. Similarly, Singapore and Thailand reflected a diversification role for gold with positive averages of 0.0362 (std: 0.0480) and 0.0530 (std: 0.0435), respectively. The Philippines also showed a positive correlation of 0.0476 (std: 0.0587), reinforcing gold's function as a portfolio diversifier. In contrast, Indonesia and Vietnam displayed near-zero and slightly negative averages, suggesting a neutral or mild hedging role for gold. These observations differ from findings in developed markets such as France, Germany, Italy, and Spain, where gold served as a safe-haven asset during the COVID-19 pandemic (Siemaszkiewicz, 2021). Additionally, Akhtaruzzaman et al. (2021) highlight gold's safe-haven role for several major international indices, including the S&P 500, Euro Stoxx 50, Nikkei 225, and China FTSE A50.

During the Russia-Ukraine war (February 25, 2022–September 15, 2023), Indonesia exhibited a strong positive DCC average of 0.1122 (std: 0.0513), indicating that gold served as an effective diversifier. Similarly, Singapore (0.0808, std: 0.0303), and Thailand (0.0765, std: 0.0150) showed evidence of gold’s diversification role. In contrast, Vietnam (0.0221, std: 0.0845) and the Philippines (0.0046, std: 0.0119) displayed near-zero correlations, suggesting that gold played a more neutral role in these markets during this period.

**Table 4**

*DCC Summary of Gold Pairs*

All periods		Average	Minimum	Maximum	Std deviation
	Malaysia	0.0071	-0.1130	0.1156	0.0375
	Indonesia	0.0318	-0.1133	0.1665	0.0492
	Singapore	0.0212	-0.1193	0.1776	0.0617
	Philippines	-0.0101	-0.1141	0.0632	0.0320
	Thailand	0.0300	-0.0912	0.1181	0.0429
	Vietnam	-0.0320	-0.1456	0.1193	0.0506
<b>Chinese Stock Market Crash</b>					
	Malaysia	-0.1409	-0.1409	-0.1409	0.0000
	Indonesia	-0.0330	-0.0330	-0.0330	0.0000
	Singapore	-0.1260	-0.1260	-0.1260	0.0000
	Philippines	-0.0258	-0.0258	-0.0258	0.0000
	Thailand	-0.0292	-0.0292	-0.0292	0.0000
	Vietnam	-0.0451	-0.0451	-0.0451	0.0000
<b>US-China Trade War</b>					
	Malaysia	-0.0686	-0.0973	-0.0340	0.0130
	Indonesia	-0.0650	-0.1247	0.0012	0.0275
	Singapore	-0.0737	-0.1743	0.0232	0.0313
	Philippines	-0.0885	-0.1675	-0.0095	0.0360
	Thailand	-0.0461	-0.0626	-0.0293	0.0075
	Vietnam	-0.0867	-0.1880	-0.0030	0.0373
<b>COVID-19</b>					
	Malaysia	0.0832	-0.0808	0.2125	0.0654
	Indonesia	-0.0002	-0.0397	0.0426	0.0172
	Singapore	0.0362	-0.0802	0.1542	0.0480
	Philippines	0.0476	-0.1081	0.1420	0.0587
	Thailand	0.0530	-0.0415	0.2240	0.0435
	Vietnam	-0.0383	-0.1394	0.0994	0.0419
<b>Russia-Ukraine War</b>					
	Malaysia	0.0629	-0.1042	0.1437	0.0567
	Indonesia	0.1122	0.0085	0.2655	0.0513
	Singapore	0.0808	-0.0178	0.1536	0.0303
	Philippines	0.0046	-0.0554	0.0447	0.0119
	Thailand	0.0765	-0.0016	0.1280	0.0150
	Vietnam	0.0221	-0.1286	0.1727	0.0845

Tables 3 and 4 show that both USD and gold assume varying roles as safe havens, hedges, or diversifiers across the ASEAN-6 stock markets and over different time periods. Overall, the USD predominantly

functions as a safe haven, whereas gold's role is more dynamic, alternating between a diversifier and a hedge depending on market-specific conditions and prevailing global events. Results of the analysis consistently identify the USD as a more effective safe haven and hedge asset compared to gold for the ASEAN-6 stock markets. With the exception of the Philippines during the US-China trade war, the predominantly negative correlations between the USD and stock market returns reinforce the dollar's safe-haven role during periods of heightened market volatility. The analysis also reaffirms gold's historical significance as a safe-haven asset by documenting a strong inverse relationship between gold and the USD. Gold maintains a negative correlation with the USD across all market conditions and global events considered, underscoring its value as a wealth-preserving asset and a risk-mitigation instrument during turbulent periods.

Further insights emerge when examining market-specific dynamics. The USD consistently serves as a safe haven across various ASEAN markets. In Malaysia, Singapore, and Indonesia, negative correlations with the USD suggest a clear perception of the dollar as a safe-haven asset. Conversely, the Philippines, Thailand, and Vietnam display weaker and more variable negative correlations, indicating that while the USD functions as a hedge in these markets, its safe-haven effectiveness is comparatively less stable.

Gold, however, occupies a more nuanced role across the ASEAN region. In Malaysia, Indonesia, and Singapore, it is mainly regarded as a diversifier, as evidenced by consistently positive correlations with equity markets. Conversely, gold functions more as a hedge in the Philippines, Thailand, and Vietnam, where correlations are weaker and occasionally negative. This hedging behaviour is particularly evident during major global events, such as the US-China trade war and the COVID-19 pandemic, when gold's correlation with these markets turns negative.

An examination of the sub-periods reveal that both the USD and gold acted as safe havens across all ASEAN markets during the Chinese stock market crash (June 12, 2015–February 10, 2016). The presence of strong negative correlations during this episode highlights their appeal to investors seeking protection amid severe market turbulence. These findings are consistent with Liu et al. (2016), who show that both the USD and gold can serve as safe-havens during stock market crashes. During the US-China trade war (July 11, 2018–January 15, 2020), the USD predominantly functioned as a hedge across most ASEAN markets, offering a buffer against unfavourable market conditions. Gold, by contrast, exhibited more heterogeneous behaviour, acting as a diversifier in certain markets, such as Malaysia and Singapore, while serving as a hedge in others, including Indonesia and the Philippines.

During the COVID-19 pandemic period (March 4, 2020–February 24, 2022), gold predominantly served as a diversifier, with more pronounced positive correlations observed in markets such as Malaysia, Singapore, and Thailand. The USD continued to operate either as a safe haven or a hedge, depending on market-specific conditions. Finally, during the Russia-Ukraine war (February 25, 2022–September 15, 2023), both gold and the USD were primarily employed as diversifiers. Gold's diversification role became more prominent during this period, highlighting its appeal as an asset that offers diversification benefits during periods of heightened geopolitical uncertainty.

### **Expectation-unconditional Covariance Ellipsoids**

This section presents expectation-unconditional covariance ellipsoids for each asset-index pair, with specific focus on the Russia-Ukraine conflict. This episode is selected because it represents the most recent and ongoing geopolitical disturbance substantially affecting global financial markets. Although

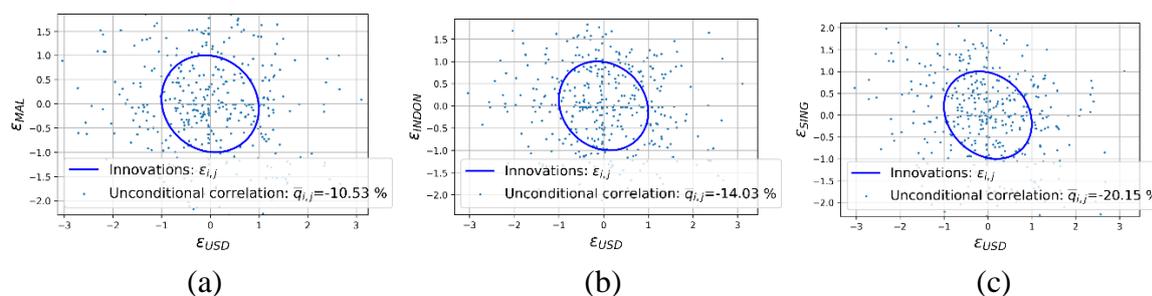
the discussion is kept concise, the ellipsoid visualisations serve as a complementary diagnostic to the dynamic conditional correlation (DCC) computations reported earlier.

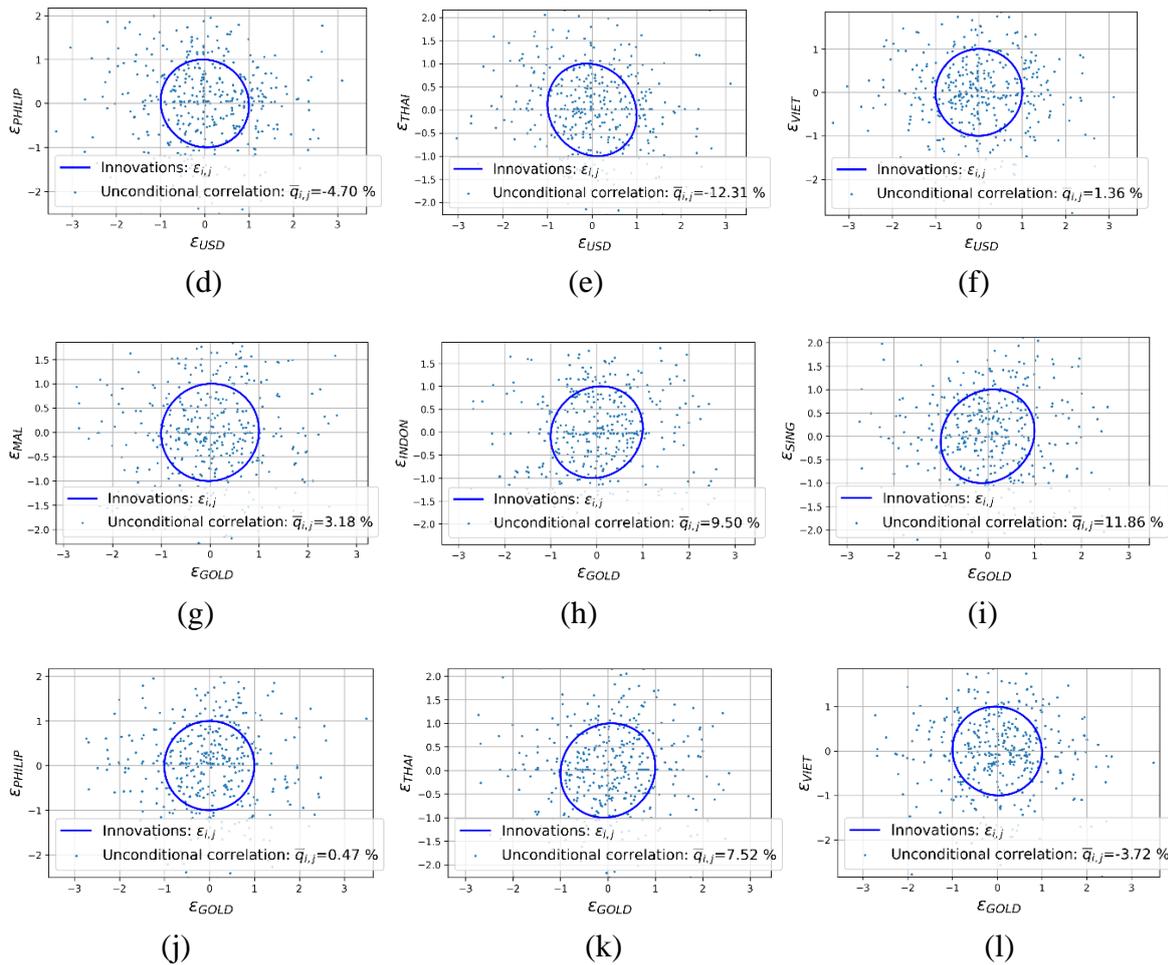
Consistent with the DCC estimates in Table 3, the Russia-Ukraine war period reveals a persistent negative correlation between the USD and the ASEAN-6 equity markets. While the magnitude of this relationship is slightly weaker than that observed during the Covid-19 sub-period, it nevertheless confirms the USD's continued role as a hedge or safe haven. The expectation-unconditional correlations illustrated by the ellipsoids in Figure 1 further reinforce this finding. Specifically, the ellipsoids for Malaysia (MAL), Indonesia (INDO), Singapore (SING), and Thailand (THAI), depicted in Subfigures (a), (b), (c), and (e), respectively, fall within the negative domain, with correlation values ranging from approximately -10.5% to -20.15%. In contrast, the ellipsoid representing the relationship between the USD and the Philippines (PHIL) appears more circular than during the pandemic period, indicating a weaker dependence structure. Nevertheless, the unconditional correlation remains negative at -4.7% as shown in Subfigure (d), suggesting that the USD retains limited hedging properties in this market. In the case of gold, the unconditional correlations shift away from the negative region towards positive values for most ASEAN-6 indices, with the notable exception of Vietnam. This transition is distinctly illustrated in Subfigures (g) through (k), which depict gold's evolving dependence structure during the Russia-Ukraine conflict.

Figure 1 shows a clear and consistent pattern in the roles of the USD and gold across the ASEAN-6 equity markets. The USD persistently demonstrates safe-haven characteristics, as evidenced by its negative unconditional correlations with the majority of ASEAN stock indices. Gold, on the other hand, assumes a more multifaceted role, functioning at different times as a hedge and as a diversifier across the ASEAN-6 indices. The ellipsoids depicted in Figure 1 further reinforce these findings. In particular, Malaysia, Indonesia, Singapore, and Thailand exhibit strong negative unconditional correlations with the USD, reinforcing its role as a safe have during periods of market stress. Conversely, gold's evolving dependence structure—especially the emergence of positive correlations with several ASEAN equity markets—highlight its versatility as a risk-management instrument rather than a consistently strong safe haven. Ellipsoid plots for the remaining sub-periods are available from the authors upon request.

**Figure 1**

*Russia-Ukraine Sub-period Ellipsoids*





### Asset Allocation Strategies

#### In-Sample Analysis

Table 5 presents the in-sample asset portfolio weights obtained under various asset allocation strategies. Across all strategies, a substantial proportion of the portfolio is consistently allocated to either the USD or gold. Under the mean-variance strategy, the USD receives the largest allocation, accounting for 56.5% of the portfolio. This pronounced preference reflects the historical stability and resilience of the USD relative to regional ASEAN markets. Additionally, gold is assigned a considerable weight of 22%, highlighting its function as a hedge against market volatility.

The minimum-variance strategy places an even greater emphasis on the USD, allocating 66% of total portfolio weights to this asset. This outcome is consistent with the strategy's aim: of minimizing overall portfolio volatility; as the USD's status as a global reserve currency contributes to lower volatility. In this strategy, gold represents 13.6% of the allocation, a slightly smaller share than under mean-variance optimization, yet still indicative of its risk-mitigating function. In the risk-parity strategy, which is designed to equalize the contribution of each asset to total portfolio risk, allocations of 48.9% to the USD and 13.5% to gold emerge. This relatively balanced distribution reflects an effort to optimize risk-adjusted returns while effectively hedging against risks.

The CvaR optimisation strategy, designed to minimize downside risk, assigns the highest weight to the USD at 67.5%. Gold accounts for 12.7% of the portfolio, complementing the strategy's risk-averse orientation. Finally, the maximum diversification strategy allocates 56.7% to the USD and 16.7% to gold, seeking to leverage the distinct diversification benefits offered by both assets. Overall, the results demonstrate the dominant role of the USD across allocation frameworks, with gold consistently serving as a secondary yet important stabilizing asset.

### ***Out-of-Sample Analysis***

Table 6 reports the out-of-sample portfolio allocations across different crisis periods. During the Chinese stock market crash, the mean-variance strategy allocated 24.1% to the portfolio to the USD and 8.6% to gold. This allocation reflects investors' reliance on the USD as a perceived safe-haven asset in light of the global ramifications of the crash. In the subsequent US-China trade war, the mean-variance strategy demonstrated increased confidence in the USD, assigning a substantial allocation of 49.9%. Gold received an allocation of 16%, reinforcing its role as a hedge during periods of heightened trade uncertainty and geopolitical tensions.

During the COVID-19 pandemic, the strategy adopted a more balanced allocation, with 36.6% invested in the USD and 16.5% in gold. This distribution reflects a dual emphasis on the stability of the USD and the protective qualities of gold in extreme uncertainty. Similarly, during the Russia-Ukraine war, geopolitical tensions prompted the mean-variance strategy to allocate 45.2% to the USD and 21.1% to gold highlights the strategy's intention to safeguard portfolio performance through exposure to both defensive assets.

The risk parity strategy aimed for a more balanced distribution of risk, as evidenced by the relatively aligned allocations to the USD and gold during the Russia-Ukraine conflict. In contrast, the CVaR optimization strategy showed a strong preference for the USD, particularly during high-risk periods such as the US-China trade war. The maximum-diversification strategy consistently favoured the USD across all sub-periods, while gold remained an important complementary asset, especially during periods of elevated global uncertainty. Overall, these findings align with Shah et al. (2023), who advocate the inclusion of both gold and the USD in portfolio allocation strategies due to their risk-mitigating capacity, particularly during periods of financial distress.

**Table 5**

### *In Sample % Weights*

Strategy	USD	GOLD	MAL	INDO	SING	PHILIP	THAI	VIET
Mean Variance	56.5	22	0	9.6	0	0	0.3	11.6
Minimum Variance	66	13.6	6	3.3	5.2	0	4.3	1.6
Risk Parity	48.9	13.5	8	6.1	6.7	4.7	6.4	5.8
CvaR Optimization	67.5	12.7	4.3	2.3	6.4	0.6	4.7	1.5
Maximum Diversification	56.7	16.7	3.8	4.3	5.4	2.8	5.6	4.8

**Table 6**

*Out-of-sample Means % Weights*

Strategy	USD	GOLD	MAL	INDO	SING	PHILIP	THAI	VIET
<b>Mean Variance</b>								
Chinese Stock Market Crash	24.1	8.6	5	10.1	10.6	6.2	14.3	21.1
Us-China Trade War	49.9	16	2.7	6	10.2	0.8	6.3	8.1
Covid19	36.6	16.5	3	8.6	8.1	4.2	5.8	17.3
Russia-Ukraine War	45.2	21.1	4.3	9.6	8	2.6	5.4	3.9
<b>Minimum Variance</b>								
Chinese Stock Market Crash	46.3	12.3	17.6	3.2	3.8	1.3	9.2	6.4
Us-China Trade War	65.3	15.8	3.7	2.6	3.6	0.4	5.9	2.6
Covid19	69.1	11.6	2.7	2.5	6.4	1.1	4	2.5
Russia-Ukraine War	58.5	13.3	6.5	4.1	8.2	0.6	7.8	0.9
<b>Risk Parity</b>								
Chinese Stock Market Crash	28.9	13	13.1	8.1	9	6.1	11.1	10.5
Us-China Trade War	40.1	17.5	8.2	6.5	6.8	4.9	8.9	7.1
Covid19	34.7	16.2	9.6	7.7	9	5.9	8	8.9
Russia-Ukraine War	16.3	17.4	12.8	12.3	13.1	8.5	12.5	7.2
<b>CVaR Optimization</b>								
Chinese Stock Market Crash	44	12.6	13.7	3.7	5.5	3.6	9.1	7.9
Us-China Trade War	68.1	15.7	2.2	2.7	3.3	1.9	3.2	2.9
Covid19	65.2	10.7	3.1	4.2	6.1	2.7	4.1	4
Russia-Ukraine War	56.5	11.5	8	4.3	6.4	1.9	9.8	1.5
<b>Max Diversification</b>								
Chinese Stock Market Crash	41.9	16.1	7.7	5.5	7.3	3.8	8.4	9.3
Us-China Trade War	53.9	19.5	1.7	4.9	4.4	2.3	7.5	5.7
Covid19	59.2	14.2	3.1	3.7	6.8	2.8	5.1	5.2
Russia-Ukraine War	53	16.4	5.9	4.8	7.6	3.8	5.1	3.3

**CONCLUSION**

This study investigates the effectiveness of the USD and gold as safe-haven and hedging assets for the ASEAN-6 equity markets, with the objective of identifying optimal investment strategies involving these financial assets. To accomplish this, we employed bi-variate dynamic copula models and the DCC-GARCH framework to assess the time-varying dependence between the USD, gold, and ASEAN-6 stock markets. Additionally, both in-sample and out-of-sample portfolio performance analyses were conducted using multiple asset allocation strategies to evaluate, the practical implications of incorporating these assets into investment portfolios.

The empirical results indicate that the roles of the USD and gold differ across ASEAN-6 stock markets and evolve over time. The USD consistently functions as both a safe haven and a hedge, demonstrating robust defensive properties across various market conditions. In contrast, gold exhibits a more dynamic role, alternating between a hedging instrument and a diversifier depending on prevailing market conditions and global events. The portfolio allocation results further show that, across all strategies considered, greater emphasis is generally placed on the USD than to gold, particularly in strategies focused on minimizing portfolio variance and maximizing diversification benefits.

Our findings shed light on the nuanced and evolving roles of the USD and gold in the ASEAN equity markets during periods of financial turbulence. These results offer valuable insights for investors seeking to construct well-diversified and resilient portfolios, emphasizing the importance of understanding time-varying asset dynamics. Furthermore, the analysis encourages investors to look beyond conventional options by exploring alternative safe-haven assets. For instance, Chinese government bonds (CGBs) have attracted increasing attention due to their relatively low volatility and solid fundamentals. In times of global market instability, CGBs have demonstrated resilience by delivering positive returns and functioning as flight-to-quality assets. This suggests that investors in the ASEAN-6 markets may enhance portfolio diversification and risk mitigation by incorporating CGBs. However, considerations such as currency risk, market accessibility, and liquidity constraints remain critical when integrating CGBs into investment strategies.

From a policy perspective, the findings underscore the importance of developing deeper and more resilient domestic capital markets within ASEAN economies. Strengthening local government bond markets and ensuring their stability could provide investors with credible domestic safe-haven alternatives, thereby reducing over-reliance on external assets such as the USD.

Despite its contributions, this study is subject to several limitations. The analysis focuses solely on the USD and gold as potential safe-haven assets, whereas other assets—such as major international currencies, global safe bonds, or cryptocurrencies—may also fulfil similar functions. Future studies could expand the asset set to provide a more comprehensive assessment of safe-haven options for emerging market investors. Furthermore, extending the analysis to other emerging economies and conducting cross-country comparisons would help ascertain whether the observed patterns are unique to the ASEAN-6 region or reflect broader dynamics across emerging markets. By addressing these limitations and pursuing the suggested research directions, future studies can further advance portfolio protection strategies and risk management practices in an increasingly uncertain global financial environment.

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