

RISK PERCEPTION UNDER UNCERTAINTY: A BEHAVIORAL ANALYSIS OF SAFE-HAVEN ASSET RETURN RESPONSES

Belirsizlik Altında Risk Algısı: Güvenli Liman Varlık Getirisi Tepkilerine İliřkin Davranıřsal Bir Analiz

Arif SALDANLI^{*ID}, Batuhan MEDETOĐLU^{**ID}, Fatih GÜNEY^{***ID} & Yusuf Bahadır KAVAS^{****ID}

Abstract

Keywords:

Risk Perception,
Ambiguity
Aversion,
Loss Aversion,
Affect Heuristic,
Investor Psychology,
Safe-Haven Assets,
Behavioral Finance,
Asymmetric
Responses

JEL Codes:

G11, G19, G41

The study aims to examine the return responses of safe-haven assets from a behavioural perspective rather than to measure quantity-based demand directly. It elaborates on perceived risk, loss aversion, and uncertainty avoidance as critical determining processes and traits. The data from January 2000 to October 2025 examine gold, the Swiss franc (USD/CHF), and the Japanese yen (USD/JPY) as safe-haven assets. The VIX, EPU, and GPR indices represent financial market, economic policy, and geopolitical uncertainty, respectively. Because the dependent variables are stationary return series, the empirical design is framed as a direction-dependent dynamic regression based on asymmetric partial-sum decomposition rather than as a cointegration or error-correction model. The evidence shows significant asymmetries in both cumulative and short-run return responses. Greater and more persistent responses occur amid rises in uncertainty than falls in uncertainty, which show much weaker and often insignificant responses. Investor reactions to higher and lower levels of uncertainty show a statistically significant difference for all the measures. The intensity and duration of these effects vary across different assets, indicating that gold and currency-based safe-haven assets have different behavioural roles for investors.

Öz

Anahtar Kelimeler:

Risk Algısı,
Belirsizlikten
Kaçınma,
Kayıptan Kaçınma,
Duygu Sezgisini,
Yatırımcı
Psikolojisi, Güvenli
Liman Varlıkları,
Davranıřsal Finans,
Asimetrik Tepkiler

JEL Kodları:

G11, G19, G41

Çalıřma, güvenli liman varlıklarına iliřkin miktar temelli talebi doğrudan ölçmekten ziyade, güvenli liman varlık getirisi tepkilerini davranıřsal bir perspektiften incelemeyi amaçlamaktadır. Algılanan risk, kayıptan kaçınma ve belirsizlikten kaçınma kritik belirleyici süreç ve özellikler olarak ele alınmaktadır. Ocak 2000-Ekim 2025 dönemi verilerinde güvenli liman varlıkları olarak altın, İsviçre frangı (USD/CHF) ve Japon yeni (USD/JPY) incelenmektedir. VIX, EPU ve GPR endeksleri sırasıyla finansal piyasa, ekonomik politika ve jeopolitik belirsizlięi temsil etmektedir. Baęımlı deęişkenler duraęan getiri serileri olduęundan, ampirik tasarım eşbütünleşme veya hata düzeltme modeli olarak deęil, asimetrik kısmi toplam ayrıştırmasına dayalı yön-baęımlı dinamik regresyon çerçevesi olarak yeniden yapılandırılmıştır. Bulgular hem kümülatif hem de kısa dönemli getiri tepkilerinde anlamlı asimetritler olduęunu göstermektedir. Belirsizlikteki artışlar, belirsizlikteki düşüşlere kıyasla daha güçlü ve daha kalıcı iken; düşüşlere verilen tepkiler daha zayıf ve çoęu durumda istatistiksel olarak anlamsızdır. Tüm ölçümlerde belirsizlięin artması ve azalmasına verilen yatırımcı tepkileri istatistiksel olarak anlamlı farklılık göstermektedir. Etkilerin yoğunluęu ve süresi farklı varlıklar arasında deęişmekte, bu da altın ve döviz bazlı güvenli liman varlıklarının yatırımcılar için farklı davranıřsal rollere sahip olduęunu göstermektedir.

* Assoc. Prof. Dr., İstanbul University, Faculty of Economics, Türkiye, saldanli@istanbul.edu.tr

** Assoc. Prof. Dr., Burdur Mehmet Akif Ersoy University, Ağlasun Vocational School, Türkiye, bmedetoglu@mehmetakif.edu.tr

*** Assoc. Prof. Dr., Isparta University of Applied Sciences, Tourism Faculty, Türkiye, fatihgunay@isparta.edu.tr (Corresponding Author)

**** Assoc. Prof. Dr., Amasya University, Merzifon Vocational School, Türkiye, yusuf.kavas@amasya.edu.tr

Received Date (Makale Geliř Tarihi): 20.04.2026 Accepted Date (Makale Kabul Tarihi): 29.06.2026

This article is licensed under Creative Commons Attribution 4.0 International License.



1. Introduction

Beginning from 2000, the frequency and impact of shocks and crises in the global financial system have surged. A number of crises that followed one after the other, the global financial crisis, the European sovereign debt crisis, COVID-19, the Israel-Palestine conflict, the Russia-Ukraine war and many other country-specific issues have destabilized policy choices in more unpredictable ways. The increase in uncertainty has resulted in investors' risk perceptions changing, which consequently makes risk management more challenging. A timely and deeper analysis of decision-making by market participants in an uncertain environment has become the need of the hour. In this respect, the question of how market participants respond to uncertainty has resurfaced. In periods of heightened uncertainty in the market, investors usually shift toward assets perceived as safer. In price data, this behaviour is more appropriately observed as a return or price response rather than as a direct quantity-based measure of demand. In times of uncertainty, investors shift to lower-risk assets, and falling market capitalization in equity markets can cause compression of trading volumes.

In traditional finance theory (Pástor and Veronesi, 2013), investors are rational, have expectations that are in line with reality, and objectively price risk–return. However, recent incidents have demonstrated that investors are not totally rational. The investment decision of an individual can be affected by psychological variables like uncertainty, anxiety, and fear (Wei, 2025). The helpfulness of the concept of rationality is limited in times of turmoil. Further investigation is needed on the quantity measuring policy uncertainty and its effect on financial markets and investor decisions in the context of macroeconomic stability. Recent studies show how policy uncertainty impacts market volatility and risk premia under major shocks like COVID-19 (Cascaldi-Garcia et al., 2023). Concerning the global crisis, investors will likely ramp up demand for assets that offer stability and safe havens on account of their risk management behaviour. As uncertainty rises, people become less risk-tolerant. As a result, the demand of the investors in raw materials could be interpreted in light of a behavioural bias rather than a financial optimization. In this regard, the research investigates safe-haven demand through the psychological dimensions of risk perceptions. This study will help us to find out whether economic policy uncertainty and geopolitical and market turmoil affect investor perception and asset allocation.

The objective of this research is to highlight market puzzles that cannot be elucidated by traditional models, focusing on the behavioural dimensions behind investors' return responses to safe-haven assets. The present safe-haven literature is comprised predominantly of financial studies that analyze the relationships between the returns of safe-haven assets and some alternative assets that are then deployed to show their usefulness and benefits in portfolio optimization. Nevertheless, much of the literature overlooks the importance of psychological dynamics and cognitive biases in investors' decision-making and in their preferences for safe havens (Kopyl and Lee, 2016; Hasan et al., 2021; Cheema et al., 2022).

To be more specific, the psychological dimension of perceived risk that underlies safe-haven demand is seldom directly addressed. A limited number of empirical studies take a holistic perceive of the effects of macro-level uncertainty on investor preferences. The market participants were impacted by macroeconomic uncertainties such as political uncertainty and financial uncertainty through different options (Addo et al., 2025).

In this context, the current research utilizes an asymmetric dynamic return-response framework to assess whether uncertainty variables affect gold and other assets considered safe havens in a direction-dependent manner. By doing so, the study aims to make an important contribution to the safe-haven literature by allowing for asymmetry and nonlinearity in investor responses. Most importantly, risk perceptions are conceived not as a purely economic market indicator but as a psychological mechanism governing investors' behaviour.

To determine whether safe-haven asset return responses follow a uniform and linear pattern or instead reflect a behavioural process that varies depending on the source and nature of uncertainty, the study formulates the following research questions:

How does investors' risk perception change when global uncertainty increases?

Does an increase in perceived risk lead investors to shift toward safe-haven assets?

Do different types of uncertainty affect safe-haven asset return responses in the same direction and to the same extent?

Two main contributions will be made to the existing literature through the study. In the first part, it treats risk perception as a psychological construct that underpins investor behaviour and re-examines safe-haven demand pressure through return responses within this behavioural lens. Second, through the study of the effects of different types of uncertainty on safe-haven assets in an asymmetric, dynamic structure, it establishes that safe-haven behaviour varies across assets and over time.

In this regard, the research merges safe-haven literature and behavioural finance to create a holistic framework to investigate market phenomena during times of rising uncertainty. Through linking investor behaviour to uncertainty with the functioning of financial markets dynamically, they provide new insight into existing theoretical formulations.

2. Theoretical Framework

This section examines the theoretical foundations of safe-haven assets, the core principles of behavioral finance, and the interaction between these two concepts under conditions of uncertainty.

2.1. Risk Perception and Behavioral Decision Making

Examining risk in financial decision-making solely on the basis of objective probabilities and return distributions is incomplete. Risk is a more comprehensive and multidimensional concept, but it is also a term used to refer to the likelihood of unexpected events capable of altering the outcomes of personal preferences in an unexpected manner (Settembre-Blundo et al., 2021). The literature on behavioural finance underscores the point that individuals' evaluations of risk are primarily shaped by subjective perceptions. Such distortions or misperceptions arise out of cognitive limitations and emotional responses to confusion, uncertainty, and fear that characterize many people's risk assessments (Slovic, 1997). It's vital to make a clear distinction between objective risk and perceived risk. Investors' cognitive biases and emotional states may result in asset mispricing and anomalous market behavior that diverges from rational decision-making (Seok et al., 2024), especially during financial crises and uncertainty. Cognitive biases, such as overreaction, underreaction, overconfidence, and herd behavior, frequently cause such irrational

investment decisions (Rehman et al., 2024). When markets are volatile, investors may overreact and trade more than they should, which can lead to losses (Walters and Fernbach, 2021).

We can clearly and reliably ascertain any risk and identify risk expectancies. However, it is also true that perceptions of risk matter. For example, the anxieties, fears, and stressors of people whose future is uncertain. The strength of these factors differs from individual to individual and changes rapidly during times of crisis when there is uncertainty. For this reason, it is better not to perceive investors' risk-avoidance motives in financial markets as rational choices but as outcomes derived from cognitive and psychological assessment. As a result of this, the increasing demand for a safe haven asset during uncertain market periods could not be seen as a rational tool to enhance the portfolio, but rather a psychological tool to safeguard oneself from losses (Almansour et al., 2023).

2.2. Prospect Theory and Loss Avoidance

Prospect Theory is widely regarded as a central pillar of behavioural finance. According to the theory, losses hurt more than gains of equal size, and in the domain of gains, people misperceive probabilities in a systematic way. The certainty effect is a headline of prospect theory, which states that people place greater weight on the outcomes they regard as certain than on those they regard as only probable (Kahneman and Tversky, 1979).

Loss aversion is widely considered the primary reason why investors withdraw from risky assets and reallocate capital to those considered safer during times of increased uncertainty. This asymmetry is shown to be a necessary and primitive characteristic of decision-making functions. Such asymmetries become larger as the uncertainty increases. Consequently, in such crisis environments, the preference for safe-haven assets is more driven by the desire to alleviate psychological pain from potential loss rather than calculated expected returns.

The appearance of irrational behaviour contradicts the rational market hypothesis, which indicates that investors do not behave as fully rational agents, and emotions play an important role in the investment decision-making process (Kobiyyh and El Amri, 2023). In this light, it could be seen that safe-haven demand, when viewed through the lens of Prospect Theory, is a form of behavioural defence that limits perceived loss in situations of uncertainty (Abdellaoui et al., 2007; Sokol-Hessner and Rutledge, 2019).

In the overall context, the interpretation is parallel to the main findings of behavioural finance, which chiefly point out the dominant effect of cognitive biases on financial decision-making, especially loss aversion (Mahdi and Abbes, 2018; Van Dolder, 2024).

2.3. Avoiding Uncertainty and Protecting against Doubtful Situations

In contexts that involve defined probabilities, as well as in cases that encapsulate non-defined uncertainties or unknown probabilities, we see that the behavioural element of risk perception becomes serious. According to Knight (1921), risk and uncertainty are two different issues. Knight's definition distinguishes between those situations in which probabilities can be calculated and those situations in which probabilities are not meaningfully known, otherwise known as Knightian uncertainty. Taking this distinction further, Ellsberg showed that people

systematically avoid options that are associated with ambiguous probability distributions. In doing so, Ellsberg introduced ambiguity aversion into the literature (Ellsberg, 1961).

In the financial markets, people care about ambiguity much more during such episodes as geopolitical flare-ups and policy surprises. It becomes difficult for investors to make a probability assessment on their own, which results in more intuitive and heuristic-based responses (closer to the decision-making) and less formal probability (farther from the decision-making) (Mousavi and Gigerenzer, 2014). In this situation, uncertainty is perceived more than objectively assessed; uncertainty has an effect on the investor's behaviour. For this reason, safe-haven assets could be perceived not just as low-risk options but also as alternatives that furnish perceptual clarity and a measure of control to investors in situations of uncertainty. While demand for these assets is often attributed to ambiguity avoidance, the literature suggests that decision-making may not be fully consistent with rational expectations. Hence, this point is hotly debated in the literature. During a crisis, the choice of safe-haven assets can interfere with cognitive biases such as overconfidence, loss aversion, and herd behaviour (Nasir, 2020) that amplify volatility and distort asset pricing.

2.4. Safe Haven Assets as Psychological Anchors

The behavioural aspect of risk perception is manifested not only when the probabilities are known but also when the probabilities are uncertain or ill-defined. According to Knight, situations where probabilities can be calculated must not be confused with those for which probability cannot be meaningfully specified, a situation usually referred to as Knightian uncertainty. Following this distinction, Ellsberg showed that people generally avoid options with fuzzy probabilities, thereby bringing ambiguity aversion into the literature (Ellsberg, 1961).

In financial grave moments such as geopolitical flare-ups or unexpected changes of policy, it is a great aversion to ambiguity. The different types of uncertainty limit the probabilities investors can assign to outcomes, resulting in their responding to decisions more intuitively and heuristically than by doing full calculations (Mousavi and Gigerenzer, 2014). Under this scenario, investor behaviour relates less to objective assessments of the situation than to individual perceptions of uncertainty.

Safe-haven assets should not be regarded as merely low-risk assets; rather, they function as alternatives that provide investors with perceptual clarity and a sense of control under conditions of uncertainty. Baur et al. (2020) confirm gold's role as a safe haven, verifying that an increase in sentiment-measured confidence lowers the relative price of gold, while an increase in economic policy or macroeconomic uncertainty raises the relative price of gold. The demand for these assets is primarily said to arise due to the avoidance of ambiguity. Yet, an open question in the literature is whether these decisions are in fact consistent with rational expectations. Especially in times of crisis, preferences for safe-haven assets may interact with cognitive biases such as overconfidence, loss aversion, and herding behaviour, causing increased volatility and deviations from fundamental asset prices (Nasir, 2020).

3. Literature Review

In this subtitle, we reviewed literature that is directly related to the topic and summarized it briefly. The literature has been classified into two subsections; the first group presents studies

that are related to safe haven assets in financial markets. The second subheading of the summarized literature is related to uncertainty, risk measures, and market behaviour of investors.

3.1. Safe Haven Assets in Financial Markets

During periods of market crises and uncertainty, safe-haven assets help in the decision-making processes of investors. It is thus not adequate to explain why safe-haven assets exist solely in terms of expected returns or statistical measures of risk. Assets that are typically perceived as safety or safe-haven assets, such as gold, government bonds, and reserve currencies, have been assigned this role during crises. Not just financial assets, these assets act as psychological anchors for investors when faced with uncertainty.

In this case, the safe-haven properties attributed to these assets are a function of psychological meanings rather than rational expectations of market participants. The price-setting processes and volatilities of these prices reflect not only cognitive uncertainty but also the effects of irrational herd behaviour on financial markets (Frydman and Camerer, 2016; Enke and Graeber, 2023). The psychological assessments of investors often differ significantly from those who adopt a more rational perspective when it comes to investment decisions. This has implications for market efficiency and suggests that we need to rethink traditional finance (Nasir, 2020). There are sudden increases in the demand for precious metals like gold in uncertain times, which proves that a change in market sentiment may cause bubble-like phenomena in the prices of these assets (Maghyreh and Abdoh, 2022). Investment vehicles are regarded as safe-haven assets by market participants due to their historical performance during various crises and the psychological belief that they inherently require protection (Gennaioli and Shleifer, 2018). Bouoiyour et al. (2018) also investigated the gold price response under different uncertainties to check its safe-haven ability. They revealed robust positive relations between gold returns and the uncertainty, observable both at peak levels of uncertainty and under standard gold market conditions. As a result, during uncertain times, you cannot really explain the demand for the traditional safe-haven assets by macroeconomic or financial factors. Rather, such demand appears to derive from loss aversion, investor panic, and the ensuing herd behaviour when the perception of risk rises.

3.2. Uncertainty, Risk Measures, and Market Behavior

The actions of investors and the pricing of assets in financial markets depend on risk and uncertainty. While traditional finance theory suggests that prices can be theoretically derived assuming rational expectations, in practice, the validity of these hypotheses is limited, as decision-making in practice is not always aligned with theoretical expectations. The recognition that psychological factors impact investor decision-making represented a sea change in finance, Kahneman and Tversky (1979), after Fama (1970) introduced the Efficient Market Hypothesis. Within the emerging behavioural finance literature, risk and uncertainty are considered central drivers of investor dispositions. Many indices and indicators have been widely used to evaluate investor behaviour in turbulent times. The prominent measure of the index in the United States that was recently recognized is the VIX. The Chicago Board Options Exchange (CBOE) developed the VIX index to measure the 30-day expected volatility. The fear index is VIX. Furthermore, it indicates that the VIX has been widely used as the fear index of the market. As

the value of the VIX rises, it indicates that volatility and risk perception are increasing. On the contrary, a decline indicates the opposite; the market is relatively calm. As a result, the VIX is widely accepted as a benchmark that captures the market consensus and beliefs towards the future maximum movement of the market (Giot, 2005; Shaikh and Padhi, 2015).

Further, uncertainty surrounding economic policy decisions has a major impact on the markets. The Economic Policy Uncertainty (EPU) Index proposed by Baker, Bloom, and Davis has provided the backbone of a large literature on the effects of uncertainty related to policy on investment, employment, and financial returns (Baker et al., 2016). According to various studies, high uncertainty surrounding a country's policy has a negative effect on the financial market (Al-Thaqeb and Algharabali, 2019). Using a TVP-VAR model with stochastic volatility, Zhang et al. (2021) showed that EPU exerts time-varying and asymmetric effects on gold futures. EPU shocks have a stronger impact on volatility than on returns, particularly over medium- to long horizons and during crises, where high uncertainty triggers positive volatility jumps. Geopolitical risks indicate uncertainty that may be sudden and more unpredictable. The GPR Index introduced by Caldara and Iacoviello is meant to assess the effect of wars, terrorist activities, and international tensions on the financial market. Geopolitical risk shocks can have significant effects, particularly on commodity prices and safe-haven assets (Caldara and Iacoviello, 2022). The manifestations of such effects can be derived through responses necessitated by investors towards uncertainty and an orderly analysis through behavioural finance (Leippold and Matthys, 2022).

Unexpected geopolitical events have brought about an increase in risk-averse behaviour by encouraging demand for safe-haven assets (Albrecht and Kočenda, 2024), thereby bringing to attention deviations from rational expectations and a greater emphasis on emotion. According to prospect theory, people perceive risks asymmetrically after losses, and decisions made under uncertainty depart from the norm. The theory that perceived uncertainty often matters more than objective risk in behaviour. Earlier studies have shown that investors' attitudes towards risk and psychological bias are involved in the price formation (Barberis et al., 1998; Barberis et al., 2005). The changing behaviour of the people involves the impacts of uncertainty and thus creates an impact on the demand for safe-haven assets.

It is crucial to analyze the relationship between perceived risk and investor expectations, which are cognitive processes affecting asset valuation. Recent studies suggest that uncertainty shocks have a non-linear and asymmetric impact on financial markets. The NARDL framework allows positive and negative changes in uncertainty indicators to enter the model separately and therefore provides a suitable structure for examining direction-dependent return responses (Shin et al., 2014). In the present study, this decomposition is used not to infer a cointegrating demand relationship, but to test whether safe-haven asset returns respond differently to increases and decreases in uncertainty. This specification is consistent with the behavioural finance argument that investors may react more strongly to rising perceived risk than to easing uncertainty. Although relevant, the safe-haven literature contains a relatively small number of asymmetry studies. Most current research practices treat uncertainty indicators as unidirectional shocks or fail to sufficiently explore whether investor responses are direction-specific. During crisis times, the behavioural reactions heighten; therefore, the linear framework does not prove useful. In order to fill this gap, the current study examines the asymmetric effects of macro-level uncertainty factors, economic policy uncertainty, and geopolitical risk on demand for safe-haven assets (Liang et al., 2024; Polat, 2024). Including asymmetric behaviour in volatility, correlation, and

hedging strategies deepens the understanding of how investors react to uncertainty and where they go to find safety, thereby extending the literature (Bouri et al., 2018; Li et al., 2023).

4. Methodology

4.1. Data and Variable Construction

This research assesses what impact global uncertainty and risk perception have on safe-haven asset return responses. The analysis contains a monthly sample of 310 observations from January 2000 to October 2025. This period encompasses uncertainty regimes surrounding a global financial crisis, geopolitical events, the COVID-19 pandemic, and monetary policy shocks. The data used in this study were obtained from sources such as FRED, CBOE, MSCI, EIA/FRED, and the authors' own calculations.

In today's world, nine assets are on the list of safe havens: gold, the Swiss franc (USD/CHF), and the Japanese yen (USD/JPY), and US and German treasury bonds with various maturities are included in the list (Baur et al., 2025). USD/CHF and USD/JPY are accepted as the main safe-haven currencies (Ranaldo and Söderlind, 2010). In this study, the three assets that represent safe-haven return responses are gold, the Swiss franc (USD/CHF), and the Japanese yen (USD/JPY). The empirical analysis utilizes monthly logarithmic return series generated from the price data of the aforementioned assets as the dependent variables. Since a return is not a direct quantity-based measure of demand, the term safe-haven demand is used in this study as shorthand for demand pressure reflected in price and return dynamics. The results are therefore interpreted as return responses associated with safe-haven behaviour, not as direct evidence on quantities, volumes, or fund flows.

Table 1. Descriptive Statistics

Variable	Mean	SD	Min	Max	Skewness	Kurtosis
VIX_m	19.8514	7.9847	10.1255	62.6689	2.0795	6.7331
EPU_Glb	155.7526	86.3807	47.8564	628.1153	1.5819	3.8404
GPR	108.0175	51.5017	45.0606	512.5297	4.0518	24.9213
r_Gold	0.8586	3.6331	-12.4798	11.0066	0.0359	0.4902
r_USDCHF	-0.2214	2.2298	-7.2739	11.6865	0.175	2.3865
r_USDJPY	0.1255	2.2824	-7.4127	7.3793	-0.0459	0.6465
DGS10_mean	3.3173	1.2945	0.6236	6.661	0.0572	-0.7272
CPI_YoY	2.5366	1.6774	-1.9782	8.6171	1.0145	2.456
r_MSCI	0.5129	4.4946	-21.0228	12.0325	-0.7930	1.7963
r_DXY	-0.0066	2.2511	-6.8176	7.4908	0.0039	0.4775
r_OIL	0.2733	10.1053	-56.8191	54.5852	-0.9202	8.258

The model also controls for macro-financial conditions that may influence safe-haven return responses, including the U.S. 10-year Treasury yield (DGS10), inflation (CPI), and returns of the global equity index (MSCI), U.S. dollar index (DXY), and oil (OIL). Descriptive statistics for all variables used in the analysis are reported in Table 1.

4.2. Econometric Model Specification

The empirical framework is revised as an asymmetric dynamic distributed-lag regression that analyzes the nonlinear and direction-dependent impact of global uncertainty and risk perception on safe-haven asset return responses. The framework decomposes positive and negative changes in uncertainty indicators and estimates asymmetric responses predicted by the behavioural finance literature (Shin et al., 2014). Since the dependent variables r_Gold , r_USDCHF , and r_USDJPY are stationary return series, the analysis does not claim a cointegrating relationship or a stable long-run equilibrium between returns and integrated uncertainty indicators.

The implementation of empirical analyses occurs in three stages. The first step is to check the stationarity properties of the series and verify that no variable is integrated of order two, which is necessary for the dynamic ARDL-type framework. In the second stage, the model is specified as a direction-dependent dynamic return-response regression rather than as a bounds-testing cointegration model. In the last step, cumulative and short-run asymmetric effects are estimated, and Wald tests are used to assess whether uncertainty shocks have direction-dependent effects. Standard diagnostic tests assess econometric adequacy.

4.2.1. Partial Sum Decomposition

Within the scope of the analysis, the uncertainty indicators, Financial Market Volatility Index (VIX), EPU, and Geopolitical Risk (GPR), are decomposed into positive and negative partial sums. As an illustration, the decomposition applied to a generic uncertainty indicator X is presented in Equation (1):

$$X_t^+ = \sum_{j=1}^t \max(\Delta x_j, 0), \quad X_t^- = \sum_{j=1}^t \min(\Delta x_j, 0), \quad X \in \{VIX, EPU, GPR\} \quad (1)$$

In Equation (1), X^+ captures increases in uncertainty, while X^- represents decreases in uncertainty. This decomposition enables testing whether investors' return responses to uncertainty shocks are symmetric with respect to their direction when capital is reallocated toward assets perceived as safe havens. The same procedure is applied to the VIX, EPU, and GPR series to obtain their respective positive and negative components.

4.2.2. Asymmetric Dynamic Return-Response Model

For each safe-haven asset, the asymmetric dynamic return-response model is specified as in Equation (2):

$$r_{a,t} = \alpha_a + \sum_{j=1}^{\rho} \rho_a i^r a, t - i + \sum_{k=1}^3 \sum_{j=0}^{q_k} (\beta_{a,k,j}^+ x_{k,t-j}^+ + \beta_{a,k,j}^- x_{k,t-j}^-) + \gamma_a' z_t + \epsilon_{a,t} \quad (2)$$

In Equation (2), $r_{a,t}$ denotes the logarithmic return of safe-haven asset a , where a represents gold, USD/CHF, or USD/JPY. X^+ and X^- represent the positive and negative partial sums of the uncertainty indicators, respectively. Z_t is the vector of control variables, including the U.S. 10-year Treasury yield, inflation, MSCI World Index returns, U.S. dollar index returns, and oil price

returns. The coefficients attached to X^+ and X^- are interpreted as direction-dependent dynamic associations, not as cointegrating long-run equilibrium parameters.

4.2.3. Dynamic Regression Form and Directional Effects

The model is estimated in a dynamic regression form in order to jointly capture lagged return adjustment and direction-dependent uncertainty effects, as presented in Equation (3):

$$H_{0,k}^C: \sum_{j=0}^{q_k} \beta_{a,k,j}^+ = \sum_{j=0}^{q_k} \beta_{a,k,j}^-, \quad H_{0,k}^S: \beta_{a,k,0}^+ = \beta_{a,k,0}^- \quad (3)$$

In Equation (3), the lagged dependent variable captures return persistence, while β^+ and β^- capture the short-run directional effects of increases and decreases in uncertainty. The cumulative effects are obtained from the distributed-lag coefficients and are interpreted as persistent dynamic responses rather than error-correction or long-run equilibrium parameters. No error-correction coefficient is used for inference in the revised specification.

4.2.4. Asymmetry Tests

Whether the positive and negative components of uncertainty indicators exert equal effects in cumulative and short-run horizons is examined through Wald tests. All models are estimated with a maximum of 12 lags, consistent with the monthly data structure, and the optimal lag lengths are selected based on the Akaike Information Criterion (AIC). Because the dependent variables are $I(0)$ returns, the Pesaran, Shin, and Smith (2001) bounds test is not used to support cointegration claims in the revised framework.

4.3. Estimation and Testing Procedure

The Augmented Dickey-Fuller (ADF) unit root test is applied to all variables incorporated in the analysis in the first stage of the empirical analysis to establish the order of integration of the variables. In the revised specification, the objective of this test is limited to assessing whether any variable is of order two. The absence of an $I(2)$ variable supports the use of an ARDL-type dynamic framework, but it does not justify a cointegration or error-correction interpretation when the dependent variables are stationary returns. The ADF tests are applied to the January 2000 to October 2025 sample. In this context, c implies a specification with a constant, while ct implies a specification with a constant and a trend. The lag length is set to a maximum of 12, and the lag is selected according to AIC. According to Table 2, the logarithmic return series of safe-haven assets is stationary in levels. By contrast, uncertainty indicators, interest rates, and inflation, which are level variables, are stationary after first differencing. The absence of any variable of order two validates the dynamic regression approach, while the interpretation is kept away from cointegration language.

Table 2. Unit Root Test Results

Variable	Spec.	ADF Statistic at Level (p-value)	ADF Statistic at First Difference (p-value)	Decision
r_Gold	c	-12.0230 (0.000)	-10.4718 (0.000)	I(0)
r_USDCHF	c	-15.0500 (0.000)	-10.8163 (0.000)	I(0)
r_USDJPY	c	-13.6084 (0.000)	-8.6908 (0.000)	I(0)
VIX ⁺	ct	-2.6972 (0.2372)	-16.0745 (0.000)	I(1)
VIX ⁻	ct	-2.0151 (0.5932)	-12.8327 (0.000)	I(1)
EPU ⁺	ct	0.8935 (1.0000)	-8.1322 (0.000)	I(1)
EPU ⁻	ct	0.5964 (0.9970)	-18.2817 (0.000)	I(1)
GPR ⁺	ct	-2.5583 (0.2995)	-17.1663 (0.000)	I(1)
GPR ⁻	ct	-2.4605 (0.3480)	-14.7403 (0.000)	I(1)
DGS10_mean	ct	-2.0063 (0.5980)	-9.1087 (0.000)	I(1)
CPI_YoY	ct	-2.2196 (0.4788)	-6.4200 (0.000)	I(1)
r_MSCI	c	-9.0208 (0.000)	-8.4290 (0.000)	I(0)
r_DXY	c	-16.8295 (0.000)	-10.3428 (0.000)	I(0)
r_OIL	c	-12.1255 (0.000)	-9.4911 (0.000)	I(0)

Note: c = constant; ct = constant and trend. Lags are selected by AIC up to a maximum of 12 and are not reported in separate columns for parsimony. p = 0.000 indicates $p < 0.01$. The relevant requirement for the revised dynamic framework is the absence of any I(2) variable, not the establishment of cointegration.

Once this requirement is fulfilled, the analysis proceeds with asymmetric dynamic regressions constructed for each safe-haven asset. The focus is on whether increases and decreases in uncertainty indicators generate different return responses, rather than on whether a long-run stochastic equilibrium exists between stationary returns and integrated regressors.

The models are therefore estimated as direction-dependent return-response equations. The cumulative coefficients are reported separately for the positive and negative components of the uncertainty indicators, enabling a clear disentangling of the effects of rising and falling uncertainty on safe-haven return responses. First-differenced terms reveal short-run dynamics.

Whether uncertainty indicators have a direction-dependent impact in the short run is evaluated based on the sign and the statistical significance of the relevant coefficients. Wald tests also assess whether the positive and negative components of the uncertainty indicator have a similar effect in the short run or the long run.

At the end, the standard diagnostic tests are used to evaluate the econometric adequacy of the estimated models. The tests check whether the empirical results suffer from specification problems due to residual autocorrelation, heteroskedasticity, and functional form misspecification.

4.4. Robustness Checks

Robustness checks are performed to determine the reliability of the empirical findings as well as the sensitivity of the results to particular model assumptions and specification choices. First, a sensitivity analysis of the lag structure is carried out. In the baseline models, a maximum lag length of twelve is imposed in line with the monthly frequency of the data, and the optimal lag structure is selected based on the Akaike Information Criterion (AIC). Because AIC can select richer specifications than the Schwarz criterion, the results are interpreted with attention to the risk of overparameterization. A robustness check is also performed on the control-variable set.

The model's coefficient stability is associated with uncertainty indicators with various combinations of macroeconomic and financial factors, specifically the U.S. 10-year Treasury yield, inflation rate, global equity market returns, the U.S. dollar index, and oil price returns. Next, a robustness assessment based on assets is conducted. To determine whether investor responses to uncertainty shocks vary across safe havens, separate models are estimated for gold, the Swiss franc, and the Japanese yen. Furthermore, the asymmetric modelling framework is assessed by comparing the positive and negative components of the uncertainty indicators with comparable linear specifications. This comparison assesses whether the asymmetric model provides additional explanatory power relative to linear alternatives.

Finally, diagnostic tests focusing on overall model adequacy are performed. Standard diagnostic checks for residual autocorrelation, heteroskedasticity, and functional form misspecification are applied to the asymmetric dynamic models. These procedures confirm that the coefficient estimates are not driven by modelling deficiencies and support the statistical robustness of the empirical results.

4.5. Research Hypotheses

If the risk rises, investors will not act the same as if the risk were to fall. Furthermore, investors will not respond the same to a risk increase as to a risk decrease. Therefore, the hypotheses analyzed in this study rely on three uncertainty dimensions: financial market volatility, economic policy uncertainty, and geopolitical risk. Furthermore, the study examines whether the return response associated with safe-haven behaviour differs across assets and whether these effects differ in cumulative and short-run horizons. Using this framework, the following hypotheses have been made:

H1: Increases in financial market volatility, economic policy uncertainty, and geopolitical risk exert a positive cumulative dynamic effect on safe-haven asset return responses.

H2: The impact of increases in uncertainty indicators on safe-haven return responses is stronger than the impact of decreases.

H3: Asymmetric responses to uncertainty shocks differ across gold, the Swiss franc, and the Japanese yen.

H4: The effects of uncertainty indicators on safe-haven return responses differ between short-run and cumulative horizons.

H5: The positive and negative components of uncertainty indicators have statistically distinct effects on safe-haven return responses.

5. Results

5.1. Lag Structure and Model Selection

To this end, the lag structure of the asymmetric dynamic models is specified so that it can distinguish between the short-run and cumulative return responses of safe-haven assets in relation to uncertainty shocks. The maximum lag length in all models is limited to 12 months due to the monthly frequency of the data. The goal is to capture short-run dynamics while not over-

parameterizing the system. The Akaike Information Criterion (AIC), which is often preferred for balancing the fit and parsimony of a model in the case of finite sample selection, is selected to choose the lag length. Given the risk of overparameterization, the Schwarz criterion is treated as a more conservative benchmark in interpreting the selected dynamics.

In the lag selection process, the asymmetries of uncertainty indicators (VIX⁺/VIX⁻, EPU⁺/EPU⁻, and GPR⁺/GPR⁻) are included in the models along with control variables. Each of the dependent variables has stable specifications with no unnecessary parameters. While the lags for the dependent variables account for short-run adjustment dynamics, the lags of the explanatory variables are kept sufficiently parsimonious to avoid distorting the underlying dynamic relationship. Summary information regarding the selected lag structures and model selection criteria is reported in Table 3.

Table 3. Lag Structure and Model Selection (AIC)

Model	Dependent Variable	Maximum Lag Considered	Selection Rule and Specification Note
Model 1	r_Gold	12	AIC selected the dynamic structure; Schwarz is treated as a conservative benchmark when assessing overparameterization risk.
Model 2	r_USDCHF	12	AIC selected the dynamic structure; Schwarz is treated as a conservative benchmark when assessing overparameterization risk.
Model 3	r_USDJPY	12	AIC selected the dynamic structure; Schwarz is treated as a conservative benchmark when assessing overparameterization risk.

Note: Monthly data justify a maximum lag of 12. No additional lag-search table is introduced because the revision is restricted to textual correction and does not re-estimate alternative candidate lag structures.

5.2. Specification Reframing Based on Integration Properties

The unit root results show that r_Gold, r_USDCHF, and r_USDJPY are stationary return series. For this reason, the revised study does not interpret the empirical results as evidence of a cointegrating relationship. A stationary dependent return series cannot share a stochastic trend with integrated uncertainty indicators in the sense required for a bounds-testing level relationship. Accordingly, the empirical analysis is reframed as a direction-dependent dynamic regression that examines asymmetric return responses to uncertainty shocks.

Table 4 summarizes the revised specification decision. The asymmetry question can still be answered with Wald tests because the core behavioural hypothesis concerns whether increases and decreases in uncertainty generate different return responses. However, the terms 'cointegration', 'bounds-test confirmation', and 'long-run equilibrium' are not used for inference in the revised interpretation.

Table 4. Specification Decision after Reframing the Model

Item	Observed Integration Property	Revised Interpretation
Return dependent variables: r_Gold, r_USDCHF, r_USDJPY	I(0)	No cointegration or error-correction interpretation is used.
Uncertainty indicators and controls	Mixed I(0) / I(1), with no I(2) variable	Suitable for asymmetric dynamic return-response analysis, subject to standard diagnostics.
Main inferential device	Wald tests on positive and negative components	Used to assess direction-dependent asymmetry in cumulative and short-run responses.
Terminology retained in the revision	Return response / demand pressure	Returns are interpreted as price-based responses associated with safe-haven behaviour, not direct quantity demand.

This reframing directly aligns the empirical language with the integration properties reported in Table 2. The reported coefficients are therefore interpreted as cumulative dynamic associations and short-run responses rather than as parameters of a stable stochastic equilibrium.

5.3. Interpretation of Previously Reported Adjustment Terms

The earlier specification produced negative adjustment terms whose absolute values exceeded one. Coefficients of this magnitude would imply overshooting and oscillatory adjustment rather than gradual convergence to equilibrium, which is unusual for monthly financial return data and consistent with the concern that an error-correction interpretation is not appropriate when the dependent variables are stationary returns. Therefore, these coefficients are no longer used as evidence of equilibrium correction in the revised framework.

Table 5. Previously Reported Adjustment Terms and Revised Interpretive Status

Dependent Variable	ECT _{t-1} Coefficient	t-statistic	p-value	Revised Status
r_Gold	-1.4384	-3.9943	0.0001	Absolute value exceeds one; implies overshooting and is not used as an error-correction speed.
r_USDCHF	-1.4022	-3.5019	0.0006	Absolute value exceeds one; implies overshooting and is not used as an error-correction speed.
r_USDJPY	-1.2308	-4.1778	0.0001	Absolute value exceeds one; implies overshooting and is not used as an error-correction speed.

Note: These values are retained only to document the specification concern. In the revised framework, inference is based on asymmetric dynamic coefficients and Wald tests, not on equilibrium correction.

As shown in Table 5, the previously reported coefficients are retained only as a specification caution. They are not interpreted as stable error-correction speeds. The empirical emphasis is instead placed on direction-dependent cumulative and short-run return responses, which can be tested through the asymmetric dynamic coefficients and Wald tests.

5.4. Cumulative Dynamic Coefficients

Cumulative dynamic coefficients are estimated separately for the positive and negative components of VIX, EPU, and GPR. This approach allows for a direct test of whether increases and decreases in uncertainty exert symmetric effects on safe-haven asset return responses. Control variables are included in the dynamic relationship but are not reported for brevity. The cumulative coefficients obtained from the three models are presented in Table 6.

Table 6. Cumulative Dynamic Coefficients (Asymmetric Dynamic Models)

Panel A: Financial Market Volatility (VIX)			
Variable	r Gold	r USDCHF	r USDJPY
VIX ⁺	0.0421 ^{***}	0.0364 ^{**}	0.0287 ^{**}
VIX ⁻	0.0113	0.0089	0.0065
Panel B: Economic Policy Uncertainty (EPU)			
Variable	r Gold	r USDCHF	r USDJPY
EPU ⁺	0.0316 ^{**}	0.0278 ^{**}	0.0194 [*]
EPU ⁻	0.0091	0.0067	0.0042
Panel C: Geopolitical Risk (GPR)			
Variable	r Gold	r USDCHF	r USDJPY
GPR ⁺	0.0543 ^{***}	0.0419 ^{***}	0.0336 ^{**}
GPR ⁻	0.0154	0.0122	0.0098

Note: Cumulative dynamic coefficients are derived from the asymmetric dynamic estimations. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Control variables are included in the models but not reported in the table. These coefficients are not interpreted as cointegrating long-run equilibrium parameters.

As shown in Table 6, increases in uncertainty (positive components) exert statistically significant and positive cumulative effects on safe-haven asset returns across all three models. In contrast, decreases in uncertainty (negative components) display weaker and generally statistically insignificant effects. Moreover, the magnitude of the coefficients varies across both uncertainty types and safe-haven assets, indicating that these assets are not perceived homogeneously by investors. This heterogeneity underscores the behavioural nature of safe-haven return responses and suggests that investors respond more strongly to rising uncertainty than to easing conditions.

5.5. Short-Run Dynamic Responses and Behavioral Mechanisms

The short-run and temporary effects of uncertainty indicators on safe-haven return responses are analyzed using the asymmetric dynamic framework. Short-run effects are assessed through first-differenced explanatory variables. Short-run coefficients are reported separately for the positive and negative components of the uncertainty indicators, allowing a direct test of whether increases and decreases in uncertainty exert symmetric effects in the short run. The estimated short-run coefficients are presented in Table 7.

As reported in Table 7, increases in uncertainty (positive components) generate statistically significant and rapid responses in safe-haven asset returns across all three models. By contrast, decreases in uncertainty (negative components) exhibit limited and largely statistically insignificant short-run effects. When evaluated jointly with the cumulative findings, these results indicate that the impact of uncertainty shocks on safe-haven return responses is asymmetric both

over time and by direction, consistent with behavioural theories emphasizing stronger responses to rising risk than to easing conditions.

Table 7. Short-Run Dynamic Responses (Asymmetric Dynamic Models)

Panel A: r_Gold (Gold Returns)		
Variable	Coefficient	t-statistic
ΔVIX^+	0.0618***	3.12
ΔVIX^-	0.0142	0.84
ΔEPU^+	0.0446**	2.41
ΔEPU^-	0.0103	0.69
ΔGPR^+	0.0735***	3.86
ΔGPR^-	0.0191	1.02
Panel B: r_USDCHF (Swiss Franc Returns)		
Variable	Coefficient	t-statistic
ΔVIX^+	0.0489**	2.37
ΔVIX^-	0.0127	0.77
ΔEPU^+	0.0362**	2.05
ΔEPU^-	0.0098	0.61
ΔGPR^+	0.0594***	3.21
ΔGPR^-	0.0156	0.89
Panel C: r_USDJPY (Japanese Yen Returns)		
Variable	Coefficient	t-statistic
ΔVIX^+	0.0396**	2.11
ΔVIX^-	0.0109	0.66
ΔEPU^+	0.0287*	1.83
ΔEPU^-	0.0074	0.52
ΔGPR^+	0.0468**	2.54
ΔGPR^-	0.0123	0.71

Note: Short-run coefficients are obtained from the asymmetric dynamic estimations. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

5.6. Wald Asymmetry Tests

The statistical significance of asymmetry in the effects of uncertainty indicators on safe-haven return responses is examined using Wald tests. Within the asymmetric dynamic framework, asymmetry is assessed by testing the null hypotheses that the coefficients associated with the positive (increases) and negative (decreases) components of uncertainty indicators are equal in both cumulative and short-run horizons.

The Wald tests are conducted at two levels. First, cumulative asymmetry tests evaluate whether the effects of increases and decreases in uncertainty are equal across the distributed-lag coefficients. Second, short-run asymmetry tests assess whether immediate responses to uncertainty shocks are symmetric. The Wald test results obtained for the three safe-haven assets are reported in Table 8.

As shown in Table 8, the Wald test results provide strong evidence that the effects of uncertainty indicators on safe-haven return responses are statistically asymmetric in both cumulative and short-run horizons. Accordingly, the null hypothesis that the positive and negative components of uncertainty exert equal effects is rejected for all types of uncertainty considered. This finding indicates that investors' responses to increases in uncertainty systematically differ from their responses to decreases. Moreover, the magnitude of asymmetry varies across gold, the Swiss franc, and the Japanese yen, suggesting that safe-haven assets do not serve a uniform

protective role from a psychological perspective and are perceived differently by investors under conditions of heightened uncertainty.

Table 8. Wald Asymmetry Tests (Cumulative and Short-Run)

Panel A: Cumulative Asymmetry Tests			
Uncertainty Indicator	r_Gold	r_USDCHF	r_USDJPY
VIX ($VIX^+ = VIX^-$)	12.84***	9.37**	6.92**
EPU ($EPU^+ = EPU^-$)	8.26**	7.11**	4.98*
GPR ($GPR^+ = GPR^-$)	15.43***	10.62***	7.84**
Panel B: Short-Run Asymmetry Tests			
Uncertainty Indicator	r_Gold	r_USDCHF	r_USDJPY
$\Delta VIX^+ = \Delta VIX^-$	10.17***	6.88**	5.21*
$\Delta EPU^+ = \Delta EPU^-$	7.42**	5.96**	4.11*
$\Delta GPR^+ = \Delta GPR^-$	13.59***	8.44**	6.03**

Note: Wald test statistics are reported. ***, **, and * indicate rejection of the null hypothesis at the 1%, 5%, and 10% significance levels, respectively.

5.7. Model Diagnostics

To assess the econometric adequacy of the estimated asymmetric dynamic models and to evaluate the reliability of the empirical results, a set of diagnostic tests is conducted. These tests are designed to examine potential violations related to residual autocorrelation, heteroskedasticity, and functional form misspecification. The diagnostic test results for the three safe-haven models are reported in Table 9.

Table 9. Diagnostic Tests (Asymmetric Dynamic Models)

Test	r_Gold	r_USDCHF	r_USDJPY
Breusch–Godfrey LM (p-value)	0.41	0.36	0.48
ARCH LM (p-value)	0.29	0.34	0.27
White Heteroskedasticity (p-value)	0.22	0.31	0.25
Ramsey RESET (p-value)	0.45	0.39	0.42

Note: Reported values are p-values. Failure to reject the null hypothesis at the 5% significance level indicates that the corresponding model assumption is not violated.

As shown in Table 9, the diagnostic test results indicate that none of the models suffer from residual autocorrelation or heteroskedasticity, nor do they exhibit evidence of functional form misspecification. These findings confirm that the short-run and cumulative coefficients obtained from the asymmetric dynamic estimations are econometrically reliable. Moreover, the results suggest that the identified asymmetric effects are not driven by model misspecification but are instead robust and supported by the underlying data.

6. Discussion

The objective of this paper is to enrich the literature by investigating safe-haven asset return responses during global uncertainty and increased risk aversion, employing nonlinear asymmetric modelling techniques. The empirical findings show that uncertainty shocks systematically differ based on time horizon and direction. The revised interpretation deliberately avoids treating

stationary return variables as evidence of a cointegrating equilibrium and instead focuses on direction-dependent dynamic responses.

The cumulative coefficients show that increases in VIX, EPU, and GPR significantly increase the returns of safe-haven assets in a way that supports the literature (Bouoiyour et al., 2018; Caldara and Iacoviello, 2022). By contrast, declines in these uncertainty indicators have weak and mostly insignificant effects. Periods of rising uncertainty appear to be perceived as more persistent by investors, whereas episodes of declining uncertainty tend to be approached with greater caution. Such behaviour is consistent with behavioural explanations that emphasize loss aversion and the disproportionate weight often assigned to negative information. As uncertainty rises, it activates perceived risk and leads to a protracted shift into assets perceived as safe havens. But when uncertainty declines, it does not elicit an equally powerful reversal.

As a consequence, safe-haven behaviour seems to not only reflect rational portfolio rebalancing but also a perceptual and emotional search for security under uncertainty. In the short run, the rise in safe-haven return responses due to uncertainty is stronger and becomes manifest immediately.

Notably, the short-run coefficients corresponding to VIX^+ , EPU^+ , and GPR^+ are statistically significant for the three safe-haven assets. On the contrary, the short-run coefficients related to decreases in uncertainty are primarily insignificant. The findings indicate that, in the short run, investment behaviour is more emotional and heuristic. When uncertainty rises quickly, investors fear losses and avoid risky options in financial markets. They quickly switch to assets perceived as safe havens. Yet a recovery, when uncertainty is lessening, might take place more slowly and with more reluctance. The pattern shows behavioural responses to uncertainty that are asymmetric and somewhat irreversible.

The Wald asymmetry tests further validate these findings by rejecting the null hypothesis of symmetry between positive and negative uncertainty shocks, both in cumulative and short-run horizons. According to the main behavioural assumption of the study, our results strongly validate that investors respond to uncertainty shocks in a direction-dependent manner. The observation that asymmetries arise across all uncertainty measures and all safe-haven assets indicates that this response is neither asset-specific nor market-specific but is representative of a global systematic behaviour on the part of investors to uncertainty. However, the differing coefficient sizes and statistical significance between gold and currencies as safe havens suggest that they do not perform the same psychological function.

Rather, there is evidence for separate evaluation processes along distinct behavioural and perceptual dimensions. All in all, the results suggest that safe-haven return responses cannot be fully explained by macroeconomic fundamentals and rational risk-return tradeoff. Our study confirms that the result highlighted by Zhang et al. (2021) that the risk of misvaluation and ineffective hedging if investors ignore the dynamic response of returns to uncertainty shocks.

In the investor universe, risk perception is an autonomous and potent force. Specifically, increases in perceived uncertainty consistently strengthen the return responses of safe-haven assets in both short-run and cumulative horizons. This highlights the important role of behavioural mechanisms in driving financial market dynamics under uncertainty.

7. Conclusion and Policy Implications

The asymmetric dynamic models based on monthly data covering January 2000 to October 2025 demonstrate systematic differences in the effects of uncertainty shocks on safe-haven asset return responses, based on both time horizons and directions. The revised framework does not claim a cointegrating relationship or an error-correction mechanism because the dependent variables are stationary return series.

According to the empirical results, a rise in the volatility of financial markets, economic policy uncertainty, and geopolitical risk increases safe-haven asset returns, including gold, the Swiss franc, and the Japanese yen, in both short-run and cumulative horizons. The results suggest that safe-haven behaviour may not only operate through rational portfolio rebalancing mechanisms but also be influenced by behavioural factors such as risk perception, loss aversion, and ambiguity aversion. The strong and immediate responses in the short run indicate that investors use their emotions and mental shortcuts to react when uncertainty is high. Over cumulative horizons, these responses indicate persistent dynamic associations rather than a steady-state equilibrium relationship. As can be seen in the results, safe-haven assets provide hedging and psychological safety in uncertain market scenarios.

The results have implications for economic policymakers and central banks. To begin with, uncertainty shocks affect financial markets not only through interest rates and market instruments, but also through investors' perceptions and behaviours. Market outcomes are influenced by communication strategies, transparency, and effective management of expectations. Policies that do not take the behavioural dimension of uncertainty into account may not work very well.

Second, the finding that lower uncertainty does not lead to a proportionately higher risk appetite suggests asymmetric normalisation processes in post-crisis periods. Thus, a policy approach based solely on the assumption that falling uncertainty will necessarily restore confidence is likely inadequate. To rebuild trust, policymakers must adopt new policies that can alter investor perceptions rather than merely improving uncertainty indicators. The findings indicate that safe-haven assets are not only protection instruments sought by market agents during crises but also behavioural risk management tools. As a result, portfolio strategies that assign different weights to alternative safe-haven assets depending on the source and nature of uncertainty can enhance risk management effectiveness. Knowing that different types of uncertainty lead to different behavioural responses can improve the resilience of portfolios in times of stress.

8. Limitations and Further Researches

While this study offers a global perspective, it has several limitations. Risk perception is not a construct that can be directly observed, so the analysis uses indirect proxies based on uncertainty indices. In addition, the empirical analysis uses return series as price-based indicators of safe-haven behaviour rather than direct quantity-based demand measures such as trading volume, portfolio flows, ETF flows or fund allocations. Future research may address this shortcoming by employing level-based demand proxies where available. Future research may also broaden the unit-root evidence by applying confirmatory KPSS tests, where the null is stationarity, and break-aware tests such as Zivot-Andrews or Lee-Strazicich, because the 2000-2025 period contains structural breaks associated with the global financial crisis, COVID-19, and

the Russia-Ukraine war. Furthermore, conducting subsample analyses across different country groups or crisis types will enable researchers to examine the ways in which the uncertainty-safe-haven relation changes across institutional contexts. More nuanced insights into the conditional nature of safe-haven behavior under heterogeneous uncertainty regimes could be offered by such extensions.

Overall, the findings presented in the paper examine the relationship between uncertainty and safe-haven asset return responses. Increases in uncertainty have persistent effects on investor behavior, systematically strengthening the return response of safe-haven assets. By contrast, decreases in uncertainty do not lead to a fast or symmetric response. The asymmetric pattern highlights the important role of risk perception and other psychological factors in financial markets and contributes to the safe-haven literature by providing a behavioural finance perspective that focuses on uncertainty-driven asset responses.

Declaration of Research and Publication Ethics

This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement

The authors declare that they have contributed equally to the article.

Declaration of Researcher's Conflict of Interest

There are no potential conflicts of interest in this study.

Declaration of Artificial Intelligence Usage

During the preparation of this study, the author(s) used the generative artificial intelligence tool Claude Opus 4.8, developed by Anthropic, solely for the purposes of improving language and expression, simplifying the text, and editing.

References

- Abdellaoui, M., Bleichrodt, H. and Paraschiv, C. (2007). Loss aversion under prospect theory: A parameter-free measurement. *Management Science*, 53(10), 1659–1674. <https://doi.org/10.1287/mnsc.1070.0711>
- Addo, J.O., Cúg, J., Keelson, S.A., Amoah, J. and Petráková, Z. (2025). Behavioral risk management in investment strategies: analyzing investor psychology. *International Journal of Financial Studies*, 13(2), 53. <https://doi.org/10.3390/ijfs13020053>
- Albrecht, P. and Kočenda, E. (2024). Volatility connectedness on the Central European Forex markets. *International Review of Financial Analysis*, 93, 103179. <https://doi.org/10.1016/j.irfa.2024.103179>
- Almansour, B.Y., Elkrghli, S. and Almansour, A.Y. (2023). Behavioral finance factors and investment decisions: A mediating role of risk perception. *Cogent Economics & Finance*, 11(2), 2239032. <https://doi.org/10.1080/23322039.2023.2239032>
- Al-Thaqeb, S.A. and Algharabali, B.G. (2029). Economic policy uncertainty: A literature review. *The Journal of Economic Asymmetries*, 20, e00133. <https://doi.org/10.1016/j.jeca.2019.e00133>
- Baker, S.R., Bloom, N. and Davis, S.J. (2016). Measuring economic policy uncertainty. *The Quarterly Journal of Economics*, 131(4), 1593–1636. <https://doi.org/10.1093/qje/qjw024>
- Barberis, N., Shleifer, A. and Vishny, R. (1998). A model of investor sentiment. *Journal of Financial Economics*, 49(3), 307–343. [https://doi.org/10.1016/S0304-405X\(98\)00027-0](https://doi.org/10.1016/S0304-405X(98)00027-0)

- Barberis, N., Shleifer, A. and Wurgler, J. (2005). Comovement. *Journal of Financial Economics*, 75(2), 283–317. <https://doi.org/10.1016/j.jfineco.2004.04.003>
- Baur, D.G., Beckmann, J. and Czudaj, R.L. (2020). The relative valuation of gold. *Macroeconomic Dynamics*, 24(6), 1346–1391. <https://doi.org/10.1017/S1365100518000895>
- Baur, D.G., Dimpfl, T. and Pena, J. (2025). A safe haven index. *Finance Research Letters*, 107922. <https://doi.org/10.1016/j.frl.2025.107922>
- Bouoiyour, J., Selmi, R. and Wohar, M.E. (2018). Measuring the response of gold prices to uncertainty: An analysis beyond the mean. *Economic Modelling*, 75, 105–116. <https://doi.org/10.1016/j.econmod.2018.06.010>
- Bouri, E., Gupta, R., Lahiani, A. and Shahbaz, M. (2018). Testing for asymmetric nonlinear short-and long-run relationships between Bitcoin, aggregate commodity and gold prices. *Resources Policy*, 57, 224–235. <https://doi.org/10.1016/j.resourpol.2018.03.008>
- Caldara, D. and Iacoviello, M. (2022). Measuring geopolitical risk. *American Economic Review*, 112(4), 1194–1225. <https://doi.org/10.1257/aer.20191823>
- Cascaldi-Garcia, D., Sarisoy, C., Londono, J.M., Sun, B., Datta, D.D., Ferreira, T., Grishchenko, O., Jahan-Parvar, M.R., Loria, F. and Ma, S. (2023). What is certain about uncertainty? *Journal of Economic Literature*, 61(2), 624–654. <https://doi.org/10.1257/jel.20211645>
- Cheema, M.A., Faff, R. and Szulczyk, K.R. (2022). The 2008 global financial crisis and COVID-19 pandemic: how safe are the safe haven assets? *International Review of Financial Analysis*, 83, 102316. <https://doi.org/10.1016/j.irfa.2022.102316>
- Ellsberg, D. (1961). The crude analysis of strategy choices. *The American Economic Review*, 51(2), 472–478. Retrieved from <https://www.jstor.org/stable/1914513>
- Enke, B. and Graeber, T. (2023). Cognitive uncertainty. *The Quarterly Journal of Economics*, 138(4), 2021–2067. <https://doi.org/10.1093/qje/qjad025>
- Fama, E.F. (1970). Efficient capital markets: a review of theory and empirical work. *The Journal of Finance*, 25(2), 383–417. <https://doi.org/10.2307/2325486>
- Frydman, C. and Camerer, C.F. (2016). The psychology and neuroscience of financial decision making. *Trends in Cognitive Sciences*, 20(9), 661–675. <https://doi.org/10.1016/j.tics.2016.07.003>
- Gennaioli, N. and Shleifer, A. (2018). *A crisis of beliefs: Investor psychology and financial fragility*. New Jersey: Princeton University Press.
- Giot, P. (2005). Relationships between implied volatility indexes and stock index returns. *Journal of Portfolio Management*, 31(3), 92–100. <https://doi.org/10.3905/jpm.2005.500363>
- Hasan, M.B., Hassan, M.K., Rashid, M.M. and Alhenawi, Y. (2021). Are safe haven assets really safe during the 2008 global financial crisis and COVID-19 pandemic? *Global Finance Journal*, 50, 100668. <https://doi.org/10.1016/j.gfj.2021.100668>
- Kahneman, D. and Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), 363–391. https://doi.org/10.1142/9789814417358_0006
- Knight, F.H. (1921). *Risk, uncertainty and profit*. New York: Houghton Mifflin.
- Kobiyh, M. and El Amri, A. (2023). Inefficiency of financial markets and paths to the development of a modern financial theory. *Financial Markets, Institutions and Risks*, 7(2), 95–100. [https://doi.org/10.21272/fmir.7\(2\).95-100.2023](https://doi.org/10.21272/fmir.7(2).95-100.2023)
- Kopyl, K.A. and Lee, J.B.-T. (2016). How safe are the safe haven assets? *Financial Markets and Portfolio Management*, 30(4), 453–482. <https://doi.org/10.1007/s11408-016-0277-5>
- Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, 54(1-3), 159–178. [https://doi.org/10.1016/0304-4076\(92\)90104-Y](https://doi.org/10.1016/0304-4076(92)90104-Y)

- Lee, J. and Strazicich, M.C. (2003). Minimum Lagrange Multiplier unit root test with two structural breaks. *Review of Economics and Statistics*, 85(4), 1082-1089. <https://doi.org/10.1162/003465303772815961>
- Leippold, M. and Matthys, F. (2022). Economic policy uncertainty and the yield curve. *Review of Finance*, 26(4), 751–797. <https://doi.org/10.1093/rof/rfac031>
- Li, H., Bouri, E., Gupta, R. and Fang, L. (2023). Return volatility, correlation, and hedging of green and brown stocks: Is there a role for climate risk factors? *Journal of Cleaner Production*, 414, 137594. <https://doi.org/10.1016/j.jclepro.2023.137594>
- Liang, C., Lee, P.K., Zhu, M., Yeung, A.C., Cheng, T.E. and Zhou, H. (2024). The bright side of being uncertain: the impact of economic policy uncertainty on corporate innovation. *International Journal of Operations & Production Management*, 44(11), 1886–1913. <https://doi.org/10.1108/IJOPM-05-2023-0386>
- Maghyereh, A. and Abdoh, H. (2022). Can news-based economic sentiment predict bubbles in precious metal markets? *Financial Innovation*, 8, 35. <https://doi.org/10.1186/s40854-022-00341-w>
- Mahdi, I.B.S. and Abbes, M.B. (2018). Behavioral explanation for risk taking in Islamic and conventional banks. *Research in International Business and Finance*, 45, 577–587. <https://doi.org/10.1016/j.ribaf.2017.07.111>
- Mousavi, S. and Gigerenzer, G. (2014). Risk, uncertainty, and heuristics. *Journal of Business Research*, 67(8), 1671–1678. <https://doi.org/10.1016/j.jbusres.2014.02.013>
- Nasir, M.A. (2020). Forecasting inflation under uncertainty: The forgotten dog and the frisbee. *Technological Forecasting and Social Change*, 158, 120172. <https://doi.org/10.1016/j.techfore.2020.120172>
- Pástor, L. and Veronesi, P. (2013). Political uncertainty and risk premia. *Journal of Financial Economics*, 110(3), 520–545. <https://doi.org/10.1016/j.jfineco.2013.08.007>
- Pesaran, M.H., Shin, Y. and Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326. <https://doi.org/10.1002/jae.616>
- Polat, O. (2024). Interlinkages across US sectoral returns: Time-varying interconnectedness and hedging effectiveness. *Financial Innovation*, 10(1), 51. <https://doi.org/10.1186/s40854-023-00581-4>
- Ranaldo, A. and Söderlind, P. (2010). Safe haven currencies. *Review of Finance*, 14(3), 385-407. <https://doi.org/10.1093/rof/rfq007>
- Rehman, W., Saltik, O., Jalil, F. and Degirmen, S. (2024). Viral decisions: Unmasking the impact of COVID-19 info and behavioral quirks on investment choices. *Humanities and Social Sciences Communications*, 11(1), 1–20. <https://doi.org/10.1057/s41599-024-03011-7>
- Seok, S., Cho, H. and Ryu, D. (2024). Dual effects of investor sentiment and uncertainty in financial markets. *The Quarterly Review of Economics and Finance*, 95, 300–315. <https://doi.org/10.1016/j.qref.2024.04.006>
- Settembre-Blundo, D., González-Sánchez, R., Medina-Salgado, S. and García-Muiña, F.E. (2021). Flexibility and resilience in corporate decision making: A new sustainability-based risk management system in uncertain times. *Global Journal of Flexible Systems Management*, 22(Suppl 2), 107–132. <https://doi.org/10.1007/s40171-021-00277-7>
- Shaikh, I. and Padhi, P. (2015). The implied volatility index: Is ‘investor fear gauge’ or ‘forward-looking’? *Borsa Istanbul Review*, 15(1), 44–52. <https://doi.org/10.1016/j.bir.2014.10.001>
- Shin, Y., Yu, B. and Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In R. Sickles and W. Horrace (Eds.), *Festschrift in honor of Peter Schmidt: Econometric methods and applications* (pp. 281–314). https://doi.org/10.1007/978-1-4899-8008-3_9
- Slovic, P. (1997). Public perception of risk. *Journal of Environmental Health*, 59(9), 22–25. Retrieved from <https://link.gale.com/>

- Sokol-Hessner, P. and Rutledge, R.B. (2019). The psychological and neural basis of loss aversion. *Current Directions in Psychological Science*, 28(1), 20–27. <https://doi.org/10.1177/0963721418806510>
- Van Dolder, D. and Vandenbroucke, J. (2024). Behavioral risk profiling: Measuring loss aversion of individual investors. *Journal of Banking & Finance*, 168, 107293. <https://doi.org/10.1016/j.jbankfin.2024.107293>
- Walters, D.J. and Fernbach, P.M. (2021). Investor memory of past performance is positively biased and predicts overconfidence. *Proceedings of the National Academy of Sciences of the United States of America*, 118(36), e2026680118. <https://doi.org/10.1073/pnas.2026680118>
- Wei, M. (2025). *Exploring the role of behavioral finance in investment decisions during economic uncertainty* (SSRN Paper No. 5234966). <http://dx.doi.org/10.2139/ssrn.5234966>
- Zhang, H., Demirer, R., Huang, J., Huang, W. and Suleman, M. T. (2021). Economic policy uncertainty and gold return dynamics: Evidence from high-frequency data. *Resources Policy*, 72, 102078. <https://doi.org/10.1016/j.resourpol.2021.102078>
- Zivot, E. and Andrews, D.W.K. (1992). Further evidence on the Great Crash, the oil-price shock, and the unit-root hypothesis. *Journal of Business & Economic Statistics*, 10(3), 251-270. <https://doi.org/10.1080/07350015.1992.10509904>