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Perspectives on Islamic Equities, Financial Contagion, and Risk Management: Benefits of Precious Metals

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Abstract
This research paper examined the hedging effectiveness, dynamic de pendence, safe haven ability and portfolio diversification benefits of alternative assets (Precious Metals) with Conventional and Islamic stock indices. The data ranged March 2011 to March 2021 and copula model with switching dependence is used. The estimated transition probabilities have shown high persistence of the same dependence regime in all estimated pairs. The research documented that the use of precious metals with stocks for diversification is a favorable choice, proving them to be best suitable solution to avoid risks. They also provide save heaven effect along with diversification benefits. Risk reduction benefits vary with respect to portfolio types. Findings of the research reveal that negative shocks pushes investors to seek refuge in safe haven assets in order to safeguard their investments from extreme negative shocks. For most of the situations studied, precious metals provides the best and effective hedge to stock returns. Overall addition of alternative assets in stocks portfolio reduces risks and provide better diversification benefit. Results vary depending upon the circumstances of the country. These findings endow with useful insights for policy makers, fund managers, investors, and risk management practitioner.

Keywords: Precious Metals, Islamic stocks, Diversification, Portfolio Strategies, Correlation Regimes, Risk, Copula.

1-Introduction

This world is global village presently, as countries are more and more interconnected. Changes in the conditions of one country impact the conditions in other countries. Changes in the conditions in one country impact it's neighboring countries and economies of its trading partners actively or passively. These changes include all types of physical and economical changes like law-in-order situation, political environment, economic policies, climatic conditions etc. The interdependence between economies has increased their financial dependence also(Azimli et al., 2022; Chang et al., 2022; Khalfaoui et al., 2021; Kumar et al., 2021). Countries are investing or purchasing from

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different countries to get competitive edge, they want to get best at lowest prices to make profit and prosperity. There are two distinct schools of thoughts for investment; one is conventional, second is Islamic. The conventional school of thought does not impose any restriction on investment. As their main concern is profit making, so they do not impose any restriction or wall for the use of their money. On the other hand, Islamic school of thought follows a specified dimensional pattern for their investments. As few things are prohibited by religion, so they avoid investment in those businesses taking care of Halal and Haram.

A Mutual fund works as a money pool made by collection of small amounts from individual investors and then invests in different assets or securities to maximize the wealth of shareholders. They made investments in different stocks of different companies, countries across the globe to get maximum from market with minimum loss or risk. This phenomenon is called diversification. The relation between equity markets and asset classes reveal a safe measure for policy makers during uncertainty and improves the stability of financial markets (Azimli et al., 2022; Shahzad et al., 2018). The interdependence of global commodity classes and equity markets is reported significantly high in short term (Bossman et al., 2022). Tiwari et al. (2020) has investigated local dependence among different markets e.g., agriculture, energy and metal using the copula model. The findings highlight strong dependence between commodity markets and energy stocks at the lower tail. Findings from researches in the past demonstrated that the relationship between stocks of economies is primarily responsible for global market integration. It is important to research the connections between the stock market and the alternative assets as well as its long-term effects on financial markets and for policymakers. For all market participants, the connection between the stock market and the precious metals is of utmost importance. Financial investors use a variety of portfolio diversification strategies to reduce the risk load brought on by the uncertainty of future investment values. Low asset correlations are necessary for these methods to achieve lower risk levels.

The abilities and characteristics of Islamic assets are of great concern and focus by researchers in current financial and economic environment due to rapid growth in its size and importance and, behavior in crisis. The financial system has experienced immense growth in Islamic investment and finance over last century as an alternative solution to traditional counterpart for both non-Muslim and Muslim countries across the world. There was huge pressure on Muslim economists to develop a compatible financial system to fulfill the needs of growing industries and economies of Muslim countries. After World War II, many Muslim countries got independence. Muslim economists started experimenting an interest-free financial system at modest level and expanded it after words. In early 1960s, emergence of banking institutions in Islamic countries started. "Nasser Social Bank", first interest-free institution was established in Egypt in 1971. The first Islamic bank was established by private initiative in 1975, named "Dubai Islamic Bank". It was established by businessmen with surplus funds (Molyneux & Iqbal, 2005). Islamic Development Bank (IDB) was established in 1975, this was another milestone in history of Islamic finance. It was established by member countries of Organization of Islamic Conference (OIC) as an international financial

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institution to deal with the financial needs of Islamic countries. The era was marked by the development of large number of private sector Islamic financial institutions. Islamic financial goods were also accepted as an alternative form of financial intermediation by the International Monetary Fund and the World Bank (Sundararajan & Errico, 2002; World Bank,2013). In the first ten years of this century, Shariah-compliant funds grew at annualized 26% rate, according to study by consulting firm Price water house Coopers (PwC) 2011. Global Islamic assets under management (AUM) were $70.8 billion at the end of 2017, according to Malaysia Islamic International Financial Center's report, which were $47 billion in 2008. Nevertheless, the market size of Islamic financial services in mid of 1990s was just around $150bn. It expanded by almost 400% till end of 2007, with annual growth rate of around 14% (McKenzie, 2009). By 2015, a rise of $2 trillion was experienced (Thomson Reuters, 2016). There are hundreds of Islamic stock indices offered by Standard &Poor's, FTSE, Dow Jones and MSCI Barra. They are currently offering more than 700 Islamic mutual funds in multiple assets (e.g. equity, real estate, Islamic shares and commodities).Diversification is a strategy used for risk management. A diversified portfolio is made by mixing different types of assets with different characteristics to minimize the risk of portfolio. Diversification is a technique used for construction of portfolio with optimum benefits. The purpose of using diversification technique is to construct a portfolio by the use of different types of assets and securities, which help in lowering the risk and higher the long-term returns of holdings on average. In today's competitive and interconnected world, diversification plays an important role for fund managers to get potential benefits (Tiwari et al., 2018).

Financial Contagion reffers as"the spread of market disturbances, mostly on the downside from one country to the other, a process observed through co-movements in exchange rates, stock prices, sovereign spreads, and capital flows". The economies integrating their financial systems internationally with financial institutions and markets may face risk of potential financial contagion. Contagion effect is transmission of economic crisis to other countries across neighbors or expands to across regions directly or indirectly.There are several branches for classifications that describe the financial contagion process."Spill-Over results" is the first. They are negative externalities often referred as contagion based on basics. They can have huge effect on neighboring nations, regionally and even internationally. Such co-movement does not necessarily constitute contagion, but if it happens during a time of crisis and its effect is adverse, it can be expressed as contagion.

Nobel Prize Economist (1952), Markowitz made the case that portfolio risk should be the focus of attention rather than the risk or volatility of any one item. Additionally, he claimed that a diversified portfolio is less erratic than the sum of its constituent components, even though each asset may be extremely erratic on its own. The whole portfolio's volatility may actually be relatively low. Precious metals are defined as metals, which are rare and carry a high economic value due to their features. These features include their scarcity, industrial usage, hedging ability against inflation, and their historic role as a store of value. The most famous precious metals for investments are gold, silver and platinum. In early times, precious metals were imperative as

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currency but are now a days, they are mainly regarded as raw material for investment and industrial purpose. Gold, platinum, palladium and silver have ISO currency code. They were mainly traded as portfolio diversifier and hedger for inflation. Investors and traders purchase precious metals through multiple mechanisms, such as; owning physical coin or bullion, derivatives or ETFs.There is a relationship among precious metals and stocks. The basic difference is that stocks are classified as "equities," interpreted as the stockholder owns a portion in stock issuing company. While they are classified as "commodities," which means the owner of metal holds a distinct, physical product. The investors of precious metals make money by rise in demand for precious metal. Immense rise in demand and price of precious metals is witnessed during last few years. There are several reasons caused this demand, the main causes are: loose monetary policy by main governments such as USA, they inject large quantity of cash into economy, which boosted commodities prices, increased money supply causes fear of inflation, also increases vitality in the market. Whenever stock markets faces extreme volatility, investors switch to commodities such as silver and gold, for hedging and reduction in risk, and for financial. Debt crises fear —Due to its high levels of leverage and debt, Europe was on the verge of collapse.Investors flock to gold and silver for safety as they worry about the consequences of a big nation failing, like Greece. And the alleged threat of conflict or other geopolitical turbulence. Traditional equities have a place in every portfolio, but since the afore mentioned problems seem to be near to being resolved, gold and silver are seen as a wiser and safer bet than the stock market.

Purpose of the Study

The Purpose of study is to investigate the diversification dimensions of portfolio with Islamic stocks and conventional stocks, to decrease their risks and maximize their returns. As Islamic financial markets are growing rapidly, so their characteristics are of great interest to investigate. Due to increasing volume of stock funds, researchers are trying to find the linkages and co-movements between Islamic and conventional equity markets to reduce risks and improve returns. Intent behind this study is to help investors and policy makers for investment choices and also the behavior of alternative assets; to cater with crisis and portfolio diversification. This research will help investors by giving a picture about the diversification ability of Islamic stock markets themselves, and also their characteristics when combined with precious metals for diversification. It will also provide the evidence on the transfer of crisis to markets by Islamic stock index, how they act during crisis; as they are believed to be not risk transferers, supporting them to be as cousin provider during financial downturn. The role of precious metals is checked, which were classified as "safe", by mixing them with stocks portfolios. This research will help investors in optimizing returns and reducing risks by diversification of stocks portfolio, with the addition of precious metals in portfolios along with looking at the risk adaptability and transferability. This will help investors in modeling their investments in financial turmoil period. Hence, this research will help both fund managers and policy makers and also help in developing a consensus in literature.Copula is used for analysis; regime switching copula is specially designed to capture complex multidimensional density functions. This will also help researchers to add more details on copula methods. The objectives can be narrated as:

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1. To examine the potential diversification benefits of Islamic / Conventional stocks when mixed with precious metals.
2. What is the risk structure of financial assets returns in positive and negative correlation regime?

2-Literature Review

Related literature is reviewed in this section. Efficacy and efficiency of traditional stock market and Islamic stock markets is verified, along with the literature on the role of precious metals. The related literature examining connections between stock markets and precious metals is also discussed, as well as, the literature showing possible use of Islamic stock funds as diversifier for traditional stocks risk; either they have diversification ability when invested with alternative assets. After that literature on contagion effect of stocks, both conventional stocks and Islamic stocks is explored and lastly the diversification ability of Islamic funds with assets classes of safe heaven. Several studies have examined the relationship between stocks indexes and alternative assets. The literature shows mixed evidences regarding stock markets efficiency and their relationship with alternative assets (Wu et al., 2020). According to some studies, Islamic stock markets are considered less efficient than their conventional counterparts. Asset allocation is the issue of central importance for the entire industry of asset management to get a best possible return-risk portfolio. As, these linkages are important for tactful asset allocation especially in case of positive correlation between stock and assets.

Gazi et al. (2019) investigated, how much are Islamic and conventional markets are efficient and
what is their diversification potential. They studied US, UK, Europe, Japan and emerging markets. They found evidence from country-level and regional markets that in short term, conventional stock markets are more efficient then Islamic stocks markets. However in medium term Islamic stock markets are more efficient. They also found that conventional and Islamic stock markets have same level of risk. Wajahat et al. (2019) investigated the Islamic sustainability equity indices and compared with benchmarks global equity market. They found investors are not supposed to pay price on their investment in sustainable or Islamic equity indices. By the combination of Islamic equity indices and sustainability investing strategies, an investor can get more benefits, especially during boom economic period, bullish markets and in the time of subprime crisis. Rizvi, Shaista and Aun (2015) have examined the nature and behavior of time-varying systematic risk of sectors indices for Islamic and non-Islamic indices.They found that a similar cyclical pattern is followed by both Islamic and conventional indices over time. They also stated that portfolio diversification opportunities can be obtained by lower systematic risk in Islamic equities. According to Hammoudeh et al. (2014) international Islamic equity indices market shows a significant dependence on three main global conventional equity indices of United States, Europe and Asia. They also found positive significant tail dependence between Islamic stocks. This positive dependence showed that they can't be used for hedging of extreme movements in conventional stock in disturbance periods. Saâdaoui et al. (2017) investigated dynamic relationship among Islamic and conventional stock markets. They

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used wavelet analysis approach. Their study's results indicated the existence of a clear low level of relationship between emerging markets, especially in short-term horizons. This weak relationship provides opportunities for diversification to portfolio managers and offers different alternatives for investment. Some studies also showed that Islamic stocks are usable for hedging against conventional stocks. Guyot (2011) made a study to analyze the cost benefit analysis of investment in Islamic stocks. They studied that whether the investors of shariah or moral investments sacrifice for stock liquidity or efficiency and whether they suffer from benefits of portfolio diversification. The results of study revealed that majority of Islamic and non-Islamic indices of Dow Jones index are not cointegrated, which implies that Islamic stocks investments can provide hedging and diversification benefits to investors of all types. Sensoy, Aras and Hacihasanoglu (2015) made a comparison between non-linear time-varying patterns of predictability of Islamic and conventional stock markets. They also analyzed the weak-form of efficiency in these markets. It is indicated that markets under study give different degree levels in time-varying predictability. They also acknowledged that conventional markets are overall more efficient than Islamic markets. Al-Khazali et al. (2016) found that Islamic stock markets are less efficient. However, they are more efficient during the time of financial turbulence. Malkiel (2003) stated in his study on equity indices of 10 sectors that there is a weak-form of efficiency in Islamic stock markets during 2008–2009 global financial crisis. They found that during financial crises, efficiency of Islamic stocks is affected negatively. Mghaieth's and El Mehdi (2017) examined the links of volatility between conventional and Islamic markets and support the argument to use Islamic stocks for hedging in effective manner. They found that an investor can achieve the benefit of risk-adjustment in a portfolio by diversifying it. The diversification can be done by the inclusion of Islamic and conventional indices in portfolio. Dimitris, Nader and Dimitrios (2016) investigated the contagion effects of Eurozone Sovereign Debt Crisis (ESDC) and the Global Financial Crisis (GFC) on Islamic bond and equity markets. They used Sample comprising Islamic stock indices of various emerging and developed markets and also global Islamic stock indices and bond indices (sukuk). They explored dynamics of conditional correlation asymmetries across stable and crisis periods and also across the two crises. Their results suggest that Islamic securities can act as a cushion against the risks and instabilities of market, especially in turmoil periods. Ho et al. (2014) made a comparison of Islamic and conventional stock indices markets. They used risk-adjusted performance of stocks and found that Islamic indices perform better than conventional counterparts during their crisis period. Rizvi et al. (2015) investigated the co-movements in Asia-Pacific, Islamic and US equity markets. The results suggested that Islamic equities and its composition can be taken as buffers in the times of financial turmoil.

Bouri, et al. (2019) examined the importance of crude oil and gold as safe-haven assets during extreme down movements of clean energy stock indices. They applied "Single" and "Mixed" copulas dependence checking between variables pairs. Empirical results of their study showed both gold and crude oil weak safe-haven assets for clean energy indices. However, crude oil is superior to gold in extreme market movements. Osamah

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et al. (2020) examined gold role for diversification in eight portfolios of "Dow Jones Islamic Stock Index" from 1996 to 2017. Their results showed that gold-Islamic stock portfolio performed better then the portfolio without gold. Their study suggested for risk-averse investors of Islamic stock indices should include gold in their portfolios for maximization of expected utilities. Jawad et al. (2019) compared gold and Bitcoin for the stock markets of countries of G7. Gold has been found as an undisputable hedge and safe haven for many stock indices of G7 countries. Furthermore, they also found that conditional benefits of diversification offered by gold to the equity investments for G7 markets are much higher and more stable.

The contagious impact of "Eurozone sovereign Debt Crisis" and "Global Financial Crisis" on Islamic bond and stock markets were examined by Kenourgios et al. (2016). No evidence of significant contagion between Islamic and traditional bonds and stock indexes has been identified. Their findings suggest that Islamic bonds and equities, especially in periods of volatility, may provide a buffer against market uncertainty and risk. Mensi et al. (2015) indicated that portfolio risk can be minimized by the inclusion of Islamic stocks or gold in global portfolio. Chen et al. (2011) has explored the volatility-related assets and their diversification benefits and found that investor's investment opportunities increases by addition of assets in portfolios. Michis (2014) studied the contribution of gold in portfolio risk. He made a comparison of risk of Treasury bills, gold and government bonds. He argues that gold contributes lowest in portfolio risk as compared to Treasury bills and bonds.

Maghyereh et al.(2016) investigated dynamic connectedness between gold, Sukuk and Islamic equities at multiple investment horizons. They documented that investor can get diversification benefits in short term by adding gold in the portfolios of Islamic equities. The poor connection between gold and Islamic stocks was identified by Nguyen and Masih (2013). Ciner et al. (2012) investigated the return relations among major asset classes. They investigated dynamic correlation between gold, oil, currency, bond and stock markets. They found gold market regarded as hedger for fluctuations in exchange rate, and supported by the data from both US and UK markets. Worldwide financial and economic shocks were explored by Hammoudeh et al. (2014) and Ajmi et al. (2014). According to the research, gold serves as a solid hedge against financial market losses and excessive oscillations. Beckmann et al. (2015) just conducted a thorough study on gold as safe-heaven. Depending on the particular economic situation under consideration, they discovered that gold functions as a hedge as well as a safe haven. The 2010 study by Baur and Lucey examined yellow metals' hedging and safe-haven properties. They looked into the correlations between the stock, bond, and gold returns in the US, UK, and Germany. They documented gold as a stock hedger and a safe refuge during stressful times. Hillier et al. (2006) investigated the precious metals' hedging properties. They looked into the possibility of using gold or other precious metals as a hedge under highly unpredictable market conditions. They discovered a weak link between stock indices and precious metals, demonstrating their potential as a diversification tool. Lucey et al. (2006) evaluated the effect of gold prices on the FTSE & NASDAQ indexes for the period of 1980 to 2003. They discovered that gold helped with portfolio diversification. Smith (2002) looked at how gold fits into

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diversifying portfolios. He conducted research on 17 European stock exchanges. He also provides credence to earlier research that claimed there was a weak or inverse relationship between stock indices and gold prices. Sherman (1982) conducted research on the effects of gold on bond and stock portfolios. He discovered that gold does not correlate strongly with other assets. In light of this, adding gold to a portfolio is advantageous for investors. McDonald and Solnik conducted a study to look at how gold affects portfolio diversity (1977). They found no correlation between gold and stock prices. For portfolio diversification, they discovered that gold and gold mining equities were both profitable.

3- Data and Methodology:

The sample period ranges from March 2011 to March 2021, yielding a total of 2501 daily observations. All the data sourced from Thomson Reuters. In this research, data consist of two stocks indices, GSPM (global precious metals index) as alternative assets. The selected stocks include Islamic stocks and conventional stocks. The selected sample countries includes Belgium, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Malaysia and Mexico. The dynamic dependences between stock indices (Islamic stock and conventional stock) and precious metals are modeled using a time-varying copula model with a switching dependence. The joint distribution of stock indices and alternative assets is obtained to estimate risk spillover across markets.

3.1-Copula Modeling

A copula is a multivariate distribution function on the interval of (0, 1) with uniform distributions for its margins. The marginal distribution functions of these two random variables are as follows: Sklar's (1959) theorem states that given bivariate time series $r_t = (r_{1,t}, r_{2,t})$, their joint distribution F may be described in terms of a copula function.

$$F(r_1, r_2; \theta) = C_t(F_1(r_1; \theta_1), F_2(r_2; \theta_2); \theta c) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

where C_t is the copula dependence structure, F_1 and F_2 are the marginal distribution functions of returns r_1 and r_2, respectively, and parameter $\theta = (\theta_1', \theta_2', \theta c')'$.

As a result, the joint density has the following expression:

$$f(r_1; r_2; \theta | \mathcal{F}_{t-1}) = c_t(F_1(r_1; \theta_1), F_2(r_2; \theta_2); \theta c) \cdot f_1(r_1; \theta_1) \cdot f_2(r_2; \theta_2) \ldots\ldots\ldots..(1.1)$$

where f_1 and f_2 are the marginal densities of r_1 and r_2, respectively, and c_t is the copula density.

3.2- Dependence-Switching Modeling

A fluctuating link between stock indices and alternative asset dependence is typically found, which transitions between positive and negative regimes, while modelling the dependence structure between Islamic stock indices and conventional stock indices and alternative assets. The investing substitution impact is associated with the negative regime, whereas the portfolio linked effect is associated with the positive regime. Consequently, Wang et al. (2013)'s Markov-switching copula model, which establishes the unobserved state variable in both copula function and marginal models, is introduced in order to represent these two regimes.

Next, the design of a state-varying copula is as follows:

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$$C_{st}(u_{1,t}, u_{2,t}; \theta^{p}c; \theta^{n}c) = \begin{cases} C^{1}\left(u^{1}._{t}, \quad u^{2}._{t} \quad ; \theta^{1}c\right), & \text{if } s_t = P \\ C^{0}\left(u^{1}._{t}, \quad u^{2}._{t} \quad ; \theta^{0}c\right), & \text{if } s_t = N \end{cases} \quad \text{.....(2)}$$

And, according to their marginal distribution functions, $r_{1,t}$, $r_{2,t}$, and $u_{1,t}$, $u_{2,t}$ are probability integral transforms of those values. $S_t \in \{P, N\}$, where St is the state variable. The regime of positive dependence is indicated by P, whereas the regime of negative dependence is shown by N. Two mixed copulas having positive and negative dependence structures, respectively, are $C_o(\cdot)$ and $C_1(\cdot)$. Equation illustrates how the state variable St is subject to an order-one Markov chain that is parameterized by a transition probability matrix:

$$P = \begin{bmatrix} Pnn, & 1 - Pnn \\ 1 - Ppp, & Ppp \end{bmatrix} \quad \text{.....(2.1)}$$

where Pij = Pr[S_t= j|S_t = i] The probability of being in the negative dependency regime at time t, conditional on being in the same regime at t−1, is P_{nn} for i, j=N, P. probability of the positive dependency regime in a continuous two-day period is denoted by P_{pp}. In particular, the Clayton copula and its transformational copulas are selected to capture the asymmetric tail dependence. According to Liu et al. (2017a,b), the 180-degree Clayton copula can capture asymmetric positive dependency, but the Clayton copula merely has a lower tail dependence. Nonetheless, the negative reliance, which has an upper-lower tail dependence and a lower-upper tail dependence, can be captured by a 270-degree and 90-degree rotated Clayton, respectively. As a result, to represent positive dependency, the 180-degree and 90-degree rotating Clayton copulas are mixed as $C_1(.)$, and to represent negative dependence, the 270- and 90-degree rotating Clayton copulas are mixed as $C_o(.)$ (Wang et al., 2013; Liu et al., 2017b).

$C_1(u_{1,t}, u_{2,t}; \theta^{1}C) = 0.5\ Cc(u_{1,t}, u_{2,t}; \alpha_1) + 0.5\ CSC(u_{1,t}, u_{2,t}; \alpha_2)$.....(2.2)

$C_o(u_{1,t}, u_{2,t}; \theta^{1}C) = 0.5\ Cc(1-u_{1,t}, u_{2,t}; \alpha 3) + 0.5\ CSC(1-u_{1,t}, u_{2,t}; \alpha 4)$

where $Cc(u, v; \alpha) = (u^{-\alpha} + v^{-\alpha} - 1)^{-1/\alpha}$, $CSC(u, v; \alpha) = u + v - 1 + Cc(1-u, 1-v; \alpha)$ and $\alpha \in (0, \infty)$.

Two positive scenarios in which both markets are bullish or bearish may be measured by $C_1(\cdot)$, and two negative scenarios in which one market is bullish while the other is bearish can be measured by $C_o(\cdot)$. Additionally, by changing the copula parameters αi with τi = αi/(2 + αi), ρi = sin (π*τi/2) and φi = 0.5∗2¯1/αi for i = 1, 2, 3, and 4, one can obtain the Kendall's **τi**, the correlation coefficient **ρi**, and the tail dependency **φi** (Wang et al., 2013).

Consequently, the following is the joint density function that takes into account the unobserved regime variable s_t:

$$f(r_{1,t}, r_{2,t}; \theta^{p}c, \theta^{n}c, \theta^{p}, \theta^{k}) = \{\Sigma j \in (P=N)\ Pr(S_t = j)\ cj(u_{1,t}, u_{2,t}; \theta^{j}c)\}\ X \text{.....(2.3)}$$
$$\Pi^{2}_{k=1}\ \{\Sigma j \in (P=N)\ \ Pr(S_t = j)\ f_k(r_{k,t}; \theta^{j}, S_t = j)\}$$

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where cj(·) is the copula under regime j, $\theta^j c$ is its parameter set, and θ^j is the parameter set
of the marginal distribution under regime j.

3.3- Model Estimation

Individual estimates are made for the copula density and marginal densities in accordance with Li's (2005) estimations technique. As suggested by Joe and Xu (1996), the inference for the margins (IFM) is used for the mixed copula model estimations. The parameters in the marginal models are estimated in the first stage of this two-step IFM approach, and the copula parameters are estimated in the second step based on the marginal parameters. Combinations of the lag parameters m, n, p, and q are used to estimate the marginal ARMA(m,n)-GARCH(p,q) models, each of which has a skewed Student-t distribution. The values of the lags range from zero to a maximum of three. Using AIC, the optimal lag combination for each marginal model.

In theory, it is known how to alter the standardised residuals using a certain distribution. Since the precise distribution of the standardised residuals cannot be determined empirically, transforming the standardised residuals using a particular distribution might not provide a uniform distribution. The transformation of standardised residuals based on an empirical CDF will asymptotically always produce a uniform distribution, irrespective of the specification of the marginal models, as the canonical maximum likelihood (CML) approach emphasises. The following empirical marginal cumulative distribution function is used in the CML technique to convert the standardised residuals into a uniform distribution in order to prevent misspecification in the marginal models:

$$\hat{F}_k(\omega) = (1/T+1) \sum_{t=1}^{T} I(\hat{\eta}k \leq \omega) \quad \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

where I(.) is an indicator function that is one if $\hat{\eta}k;t \leq \omega$ and zero otherwise. Next, cumulative probability for each observation of $\hat{\eta}k;t$ by $u\hat{}_{k;j} = \hat{F}_k(\hat{\eta}k; j)$, $k = 1,2, j = 1, 2,\ldots,T.$ is obtained. Given the estimated marginal parameters, the copula is exstimated using parameters ψ by maximising the log-likelihood function $L_c(\psi_1)$. Because the dependence structure follows a Markov-switching process, Hamilton's filtered system is used to transform the log-likelihood function of model as follows:

$$L_c(\psi_1) = \log(\hat{\xi}' t/t-1\eta t)$$

The copula parameters $\psi_1 = (\alpha_1, \alpha_2, \alpha_3, \alpha_4, P_{11}, P_{00})'$ can then be estimated by maximizing $L_c(\psi_1)^3$;

$$\psi_1 = \arg_{\psi_1} \max \sum_{t=1}^{T} Lc(\psi_1) \quad \ldots\ldots\ldots\ldots\ldots\ldots(4.1)$$

4-Results and Discussions

The study's methodology is driven by the observation that, although returns are detrimentally low during times of market stress, the conditional variance of the stock portfolio, which consists of conventional and Islamic equities separately, increases at those times. Investor focus has shifted to alternative assets as a result of this fact, either to obtain safe haven benefits during economic downturns or to minimise risk through hedging. This study based on the arguments that no research has previously been conducted to analyze the asymmetric dynamics of financial asset returns, hedging effectiveness, safe haven ability and diversification benefits of global precious metals index (GSPM).This chapter summarizes the results and discussion with respect to objectives of the study.

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4.1-Descriptive Statistics

The descriptive statistics of the countries stock indices returns and alternative asset returns are reported in Table 1. In this research, data consist of two stocks indices and four alternative assets. The selected stocks include Islamic stocks and conventional stocks. The selected sample countries includes Belgium, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Malaysia and Mexico, and the selected alternative assets GSPM (global precious metals index). The sample period ranges from March 2011 to March 2021, yielding a total of 2501 daily observations.

Majority of the means of the returns are positive during the sample period for selected stocks and precious metals, Islamic stocks have the largest standard deviation. All the standard deviations of the returns are positive during the sample period.

Table 1: Discriptive statistics

		Mean	St.Dev	Kurtosis	Skewness	Min	Max	J-B	ADF
Belgium	***ISL***	0.001	0.012	138.00	31.91	-0.128	0.071	198.00	-100.69
	CON	0.002	0.011	233.00	47.45	-0.142	0.076	567.00	-270.75
France	***ISL***	0.002	0.012	239.00	48.40	-0.117	0.095	597.00	-345.10
	CON	0.003	0.012	244.00	49.21	-0.123	0.084	624.00	-490.31
Germany	***ISL***	0.003	0.012	246.00	49.43	-0.116	0.091	632.00	-579.30
	CON	0.004	0.012	247.00	49.64	-0.122	0.110	639.00	-731.06
HongKong	***ISL***	0.004	0.008	249.00	49.85	-0.072	0.047	646.00	-20.82
	CON	0.005	0.011	248.00	49.83	-0.058	0.056	645.00	-19.93
India	***ISL***	0.006	0.011	248.00	49.84	-0.116	0.097	646.00	-21.18

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	CON	0.007	0.010	249.00	49.89	-0.128	0.077	647.00	-21.23
Ireland	***ISL***	0.007	0.017	249.00	49.89	-0.132	0.119	647.00	-970.18
	CON	0.008	0.012	249.00	49.90	-0.099	0.069	648.00	-19.82
Italy	***ISL***	0.008	0.016	249.00	49.85	-0.169	0.145	646.00	-51.61
	CON	0.009	0.015	249.00	49.88	-0.169	0.089	647.00	-53.93
Japan	***ISL***	0.009	0.012	249.00	49.92	-0.073	0.080	648.00	-18.94
	CON	0.010	0.013	249.00	49.93	-0.079	0.080	648.00	-52.40
Malaysia	***ISL***	0.010	0.007	249.00	49.96	-0.052	0.058	650.00	-22.38
	CON	0.011	0.006	249.00	49.97	-0.053	0.069	650.00	-18.74
Mexico	***ISL***	0.011	0.011	249.00	49.95	-0.068	0.077	649.00	-18.38
	CON	0.012	0.010	249.00	49.96	-0.064	0.049	650.00	-18.56
GSPM	***GSPM***	0.025	0.011	249.00	49.97	-0.096	0.059	650.00	-24.74

Notes: J-B is the Jarque–Bera normality test. significance level is 1%.

The descriptive statistics reported in table 1 shows that the average daily mean returns of all stock indices and precious metals ranged from 0.001 to 0.025. Average returns for Islamic stock indices ranges from 0.001 to 0.011 and to 0.002 to 0.012 for conventional stock indices. The mean is highest for GSPM with 0.025 values. However, the standard deviation ranges from 0.006 to 0.016. The highest standard deviation is

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reported for Italy for Islamic stock indices, and Malaysia reported lowest standard deviation. The values range from 0.007 to 0.017 for Islamic stock indices, 0.006 to 0.015 for conventional stock indices. Islamic stock markets have the larger range for the maximum and minimum then conventional stock market, and their behavior is more volatile than conventional stocks. The return distributions for the stock indices (Islamic and conventional) and GSPM are positively skewed. The right tail is longer; the mass of the distribution is concentrated on the left of the distribution. All the return series exhibit excess kurtosis and are rejected following a normal distribution. The kurtosis coefficient and Jarque-Bera test statistics show that the return series are not normally distributed. The null hypothesis of normality is rejected at of the significance level of 1%. The unit root tests of ADF are calculated. These tests show consistent results: each variable is stationary by significant ADF.

4.2-Correlation and Risk Contagions between Islamic /Conventional Stock Indices and Global Precious Metals Index.

4.2.1-Marginal Model's Estimations

The results of the parameter estimation using the marginal specification of the ARMA-GARCH skewed-t model, the most appropriate estimation model for the methodology under study, are shown in Table 2. The AIC for the various combinations of values between zero and three establishes the ideal lagged order of the model for each return. The findings demonstrate that while each return adheres to a distinct set of ARMA (m, n) type mean equations, the majority of coefficients are significant at the 1% level. For each volatility equation, the total of the ARCH and GARCH terms approaches one, suggesting strong volatility persistence. The skewed-t distribution's values degree of freedom, which varies from 2 to 8, shows that the error terms were non-normal and had a heavy tail.

All series have a positive and substantial asymmetry coefficient at the 1% level, which further supports the heavy tail's rightward skew. Large positive returns are therefore more probable than large negative returns. At the 1% significant level, the null hypothesis that there is no serial correlation and conditional heteroscedasticity is not rejected by the ARCH-LM tests, the Ljung-Box statistics of Q(20) and $Q^2(20)$, and the Ljung-Box statistics. The developed ARMA-GARCH skewed-t models shown in table 2 provide well-specified marginal distributions as compared to descriptive statistics.

Table 2

Table.2 : Marginal Model's Estimations between Islamic /Conventional Stock Indices and Alternative Assets (GSPM).

	Belgium		France		Germany		HONG KONG		INDIA	
	ISL	CON	ISL	CON	ISL	CON	ISL	CON	ISL	CON

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Panel A : Mean equation										
Constant	**0.001 (0.000)**	**0.001 (0.000)**	**0.001 (0.000)**	**0.001 (0.000)**	**0.001 (0.000)**	**0.001 (0.000)**	**0.000^ (0.000)**	**0.000* (0.000)**	**0.001* (0.000)**	**0.001 (0.000)**
AR(1)					**0.142 (0.000)**		**0.076 (0.005)**	**0.066 (0.000)**	**0.062 (0.001)**	**0.055 (0.000)**
AR(2)										
MA(1)	0.000 (0.020)	0.005 (0.021)	**-0.054 (0.020)**	**-0.041* (0.020)**	**-0.178 (0.019)**	-0.025 (0.019)	**-0.065 (0.020)**		-0.004 (0.019)	0.007 (0.020)
MA(2)	-0.029 (0.021)	-0.003 (0.023)	-0.005 (0.022)	-0.011 (0.022)		-0.001 (0.022)				0.003 (0.022)
MA(3)	0.0015 (0.0203)									
Panel B : Variance equation										
Constant	**0.103 (0.033)**	**0.104 (0.028)**	**0.096 (0.024)**	**0.117 (0.0324)**	**0.023 (0.008)**	**0.193 (0.053)**	**0.014 (0.006)**	**0.017* (0.008)**	**0.047 (0.017)**	**0.033 (0.010)**
ARCH(Alpha1)	**0.129 (0.027)**	**0.207 (0.031)**	**0.240 (0.032)**	**0.266 (0.039)**	**0.069 (0.015)**	**0.260 (0.039)**	**0.052 (0.013)**	**0.052 (0.011)**	**0.061 (0.013)**	**0.044 (0.016)**
ARCH(Alpha2)	**0.795 (0.043)**									0.037

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										(0.024)
GARCH(Beta1)		**0.716 (0.040)**	**0.721 (0.030)**	**0.695 (0.038)**	**0.917 (0.016)**	**0.665 (0.042)**	**0.926 (0.020)**	**0.936 (0.014)**	**0.893 (0.026)**	**0.883 (0.025)**
Asymmetry	-0.035 (0.025)	-0.037 (0.025)	-0.041 (0.025)	**-0.046^ (0.025)**	**-0.071 (0.022)**	-0.033 (0.022)	**-0.050 (0.023)**	**-0.042^ (0.022)**	**-0.056 (0.023)**	**-0.103 (0.025)**
Tail	**5.174 (0.756)**	**4.748 (0.614)**	**4.259 (0.474)**	**4.019 (0.412)**	**4.765 (0.546)**	**3.577 (0.332)**	**5.070 (0.541)**	**5.127 (0.540)**	**5.560 (0.656)**	**5.600 (0.6858)**
Panel C : Diagnostic tests										
LL	7811.52	8065.42	7905.59	7848.01	7822.03	7761.40	8646.69	7888.64	8039.62	8283.85
AIC	-6.240	-6.441	-6.313	-6.267	-6.246	-6.198	-6.905	-6.300	-6.420	-6.614
ARCH LM(10)	[0.438]	[0.151]	[0.062]	[0.164]	[0.486]	[0.056]	[0.104]	[0.484]	[0.363]	[0.834]
Q(20)	[0.891]	[0.973]	[0.986]	[0.993]	[0.183]	[0.996]	[0.413]	[0.672]	[0.348]	[0.330]
Q²(20)	[1.000]	[1.000]	[1.000]	[1.000]	[0.999]	[1.000]	[0.999]	[0.405]	[0.800]	[0.5910]

Cont…

Table.2 : Marginal Model's Estimations between Islamic /Conventional Stock Indices and Alternative Assets (GSPM).

	IRELAND	**ITALY**	**JAPAN**	**MALAYSIA**	**MEXICO**	**GS PM**

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	ISL	CON	ISL	CON	ISL	CON	ISL	CON	ISL	CON	
Panel A : Mean equation											
Constant	**0.001 (0.000)**	**0.001 (0.000)**	0.000 (0.000)	**0.000 (0.000)**	**0.001 (0.000)**	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	**0.000^ (0.000)**	0.000 (0.000)
AR(1)	**0.052 (0.000)**	**0.047 (0.000)**		0.208 (0.442)	0.012 (0.314)				-0.229 (0.179)	-0.289 (0.233)	
AR(2)											
MA(1)		**-0.047* (0.**	**-0.077 (0.**	-0.224 (0.	-0.049 (0.	0.019 (0.0	0.027 (0.0	0.244 (0.1	0.341 (0.224)	**-0.074 (0.016)**	

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			0.021)	**0.020)**	0.435)	0.314)	0.19)	0.21)	0.87)		
MA(2)			0.015 (0.020)	0.009 (0.020)		0.021 (0.026)		0.006 (0.020)			0.023 (0.018)
MA(3)											
Panel B : Variance equation											
Constant	**0.095 (0.030)**	**0.051 (0.020)**	**0.042 (0.018)**	**0.031 (0.014)**	**0.036* (0.016)**	**0.047* (0.021)**	**0.326^ (0.190)**	**0.476* (0.204)**	**0.014* (0.005)**	**1.577 (0.650)**	**1.321 (0.134)**
ARCH(Alpha1)	**0.081 (0.017)**	0.040 (0.0	**0.068 (0.083 (0.123 (0.117 (0.054 (0.077 (0.0**	**0.054 (0.**	**0.068 (0.026)**	0.035 (0.025)

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		0 2 9)	**0 1 8)**	**0 1 8)**	**0 3 6)**	**0 3 7)**	**0 1 7)**	**1 6)**	**0 1 1)**		
ARCH(Alpha2)		**0 . 0 6 1 ^ (0 . 0 3 6)**			- 0 . 0 1 7 (0 . 0 4 4)	- 0 . 0 0 6 (0 . 0 4 7)				0.008 (0.030)	
GARCH(Beta1)	**0.879 (0.026)**	**0 . 8 5 4 (0 . 0 3 5)**	**0 . 9 1 3 (0 . 0 2 3)**	**0 . 9 0 5 (0 . 0 2 1)**	**0 . 8 7 6 (0 . 0 3 3)**	**0 . 8 7 0 (0 . 0 3 8)**	**0 . 9 4 2 (0 . 0 1 8)**	**0 . 9 1 2 (0 . 0 1 8)**	**0 . 9 3 5 (0 . 0 1 3)**	**0.906 (0.020)**	
Asymmetry	**0.047* (0.024)**	- 0 . 0 1 1 (0 . 0 2	**- 0 . 0 4 7 ^ (0 . 0**	**- 0 . 0 7 5 (0 . 0 2**	**- 0 . 0 4 3 * (0 . 0**	- 0 . 0 1 7 (0 . 0 2	0 . 0 0 5 (0 . 0 2	**- 0 . 0 6 0 (0 . 0 2**	0 . 0 1 1 (0 . 0 2	-0.023 (0.023)	0.008 (0.022)

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		5)	**26)**	**6)**	**23)**	2)	0)	**3)**	2)		
Tail	**6.800 (0.900)**	**6.959 (0.909)**	**6.167 (0.797)**	**5.453 (0.579)**	**4.5576 (0.441)**	4.275 (0.410)	**4.3841 (0.416)**	**5.1520 (0.560)**	**6.0820 (0.740)**	**7.119 (0.925)**	**2.971 (0.201)**
Panel C : Diagnostic tests											
LL	7033.34	7972.32	7185.37	7300.23	7863.96	7714.76	9236.74	9532.37	7920.47	8363.35	8085.67
AIC	-5.617	-6.3666	-5.7442	-5.8334	-6.2844	-6.1644	-7.3844	-7.6190	-6.3330	-6.683	-6.463
ARCH LM(10)	[0.459]	[0.1591]	[0.0063]	[0.0000]	[0.7988]	[0.5222]	[0.0155]	[0.0295]	[0.0200]	[0.002]	[0.000]
Q(20)	[0.189]	[0.]	[0.1]	[0.]	[0.5]	[0.]	[0.]	[0.]	[0.]	[0.665]	[0.122]

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		611]	08]	642]	01]	818]	425]	262]	197]		
Q²(20)	[0.334]	[0.0785]	[0.002]	[0.0000]	[0.4587]	[0.4070]	[0.0100]	[0.1888]	[0.0500]	[0.014]	[0.000]

4.2.1-Switching Copula Estimation between Stock Indices and Precious Metals Index:

In order to quantify the dependence between stocks and alternative assets (Precious Metals), six single-copula models, including normal, t, and four different versions of the Clayton copula are initially employed, as mentioned by Wang et al. (2013). The Global Precious Metal Index and the coefficient estimates for each pair of stock indices are shown in Table 3. The findings demonstrate the significance of the parameters calculated by the t, normal, 180-degree, and Clayton methods at the 1%, 5%, and 10% levels for each pair. With the exception of Mexico, all pairs are significant for GSPM and Islamic stock; pairs with conventional stock alone are insignificant for Malaysia.

Upon comparing the log likelihood, AIC, and BIC values of various copulas for every pair, it is evident that no copula outperforms the others. Liu et al. (2017a) state that while the t copula and normal copula may both express symmetric positive and negative dependence, the t copula has symmetric tail dependence and the normal copula has no tail dependence. Consequently, the mixed Clayton copulas are further employed for the dependent-switching copula model in order to capture the asymmetric tail dependence.

Table 3

Table.3: Switching Copula Estimation between Stock Indices and Alternative Assets.

	BELGIUM		**FRANCE**		**Germany**		**Hong Kong**		**INDIA**	
	GSPM		**GSPM**		**GSPM**		**GSPM**		**GSPM**	
	ISL	**CON**	**ISL**	**CON**	**ISL**	**CON**	**ISL**	**CON**	**ISL**	**CON**
Normal capula										
ρ	**-0.009**	**-0.004**	**-0.024**	**0.000 (0.020)**	-0.030^	**-0.009**	**0.027 (0.020)**	**0.003 (0.020)**	**0.018 (0.020)**	**0.013**

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	(0.020)	**(0.020)**	**(0.020)**		(0.020)	**(0.020)**				**(0.020)**
LL	-0.108	-0.023	-0.730	0.000	-1.148	-0.121	-0.931	-0.014	-0.418	-0.238
AIC	1.783	1.955	0.539	2.000	-0.297	1.758	0.138	1.972	1.165	1.525
BIC	7.607	7.779	6.364	7.824	5.528	7.583	5.962	7.797	6.989	7.349
Student's t capula										
ρ	**-0.021 (0.022)**	**-0.006 (0.021)**	**-0.034 (0.022)**	**-0.002 (0.021)**	**-0.044^ (0.022)**	**-0.013 (0.021)**	**0.020 (0.022)**	**0.001 (0.021)**	**0.007 (0.021)**	**0.010 (0.026)**
DOF	7.317 (1.274)	**33.334 (23.222)**	6.333 (0.963)	**33.014 (23.430)**	5.305 (0.696)	**31.455 (20.580)**	8.860 (1.843)	**54.710 (57.603)**	7.876 (1.43)	**35.931 (78.111)**
LL	-20.657	-1.173	-27.454	-1.217	-36.783	-1.426	-15.096	-0.444	-19.111	-1.331
AIC	-39.314	-0.346	-52.908	-0.434	-71.566	-0.851	-28.192	1.112	-36.222	-0.662
BIC	-33.489	5.478	-47.083	5.390	-65.742	4.973	-22.368	6.937	-30.397	5.162
Clayton (u, v)										
α	**0.030 (0.020)**	**0.000 (0.021)**	**0.011 (0.019)**	**0.000 (0.021)**	**0.007 (0.018)**	**0.000 (0.021)**	**0.025 (0.021)**	**0.000 (0.020)**	**0.027 (0.020)**	**0.005 (0.020)**
LL	-1.300	0.006	-0.180	0.004	-0.072	0.005	-0.814	0.002	-1.008	0.062
AIC	-0.601	2.012	1.640	2.007	1.856	2.010	0.372	2.004	-0.016	2.123
BIC	5.224	7.837	7.464	7.832	7.680	7.834	6.197	7.829	5.808	7.948
Clayton (1-u, 1-v)										

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α	**0.012 (0.018)**	**0.031 (0.020)**	**0.012 (0.018)**	**0.029 (0.020)**	**0.017 (0.018)**	**0.021 (0.020)**	0.061 (0.021)	**0.0273 (0.020)**	**0.053* (0.021)**	**0.042* (0.020)**
LL	-0.240	-1.341	-0.249	-1.185	-0.462	-0.624	-4.990	-1.034	-3.878	-2.416
AIC	1.520	-0.682	1.502	-0.370	1.077	0.752	-7.981	-0.068	-5.756	-2.831
BIC	7.344	5.142	7.327	5.455	6.901	6.577	-2.156	5.757	0.069	2.993
Clayton (1.u, v)										
α	**0.035^ (0.022)**	**0.022 (0.021)**	**0.057* (0.022)**	**0.015 (0.021)**	0.069 (0.023)	**0.021 (0.021)**	**0.010 (0.020)**	**0.013 (0.021)**	**0.020 (0.020)**	**0.000 (0.021)**
LL	-1.482	-0.544	-3.829	-0.284	-5.301	-0.485	-0.148	-0.189	-0.573	0.001
AIC	-0.963	0.912	-5.659	1.432	-8.603	1.031	1.705	1.623	0.853	2.003
BIC	4.861	6.737	0.166	7.256	-2.778	6.855	7.529	7.447	6.678	7.827
Clayton (u, 1-v)										
α	**0.015 (0.021)**	**0.000 (0.021)**	**0.029 (0.022)**	**0.000 (0.021)**	**0.034 (0.022)**	**0.000 (0.021)**	**0.000 (0.022)**	**0.000 (0.023)**	**0.000 (0.021)**	**0.000 (0.022)**
LL	-0.250	0.003	-0.965	0.003	-1.254	0.000	0.006	0.006	0.004	0.005
AIC	1.501	2.005	0.071	2.006	-0.507	2.000	2.012	2.011	2.009	2.009
BIC	7.325	7.830	5.895	7.830	5.317	7.825	7.836	7.836	7.833	7.834

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Table.3: Switching Copula Estimation between Stock Indices and Alternative Assets.

	IRELAND	ITALY	JAPAN	MALAYSIA	MEXICO

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	GSPM		GSPM		GSPM		GSPM		GSPM	
	ISL	CON	ISL	CON	ISL	CON	ISL	CON	ISL	CON
Normal capula										
ρ	**-0.040 (0.019)**	**-0.009 (0.019)**	**-0.006 (0.020)**	**-0.012 (0.020)**	**-0.048* (0.020)**	**0.001 (0.020)**	**0.018 (0.020)**	0.057 (0.020)	0.125 (0.020)	**-0.010 (0.020)**
LL	-2.050	-0.104	-0.045	-0.190	-2.921	-0.002	-0.440	-4.124	-19.885	-0.133
AIC	-2.100	1.792	1.910	1.620	-3.842	1.996	1.119	-6.248	-37.770	1.734
BIC	3.724	7.616	7.734	7.444	1.982	7.820	6.944	-0.424	-31.946	7.558
Student's t capula										
ρ	**-0.054* (0.021)**	**-0.011 (0.021)**	**-0.012 (0.022)**	**-0.013 (0.020)**	**-0.049* (0.021)**	**0.001 (0.019)**	**0.018 (0.021)**	0.057 (0.021)	0.118 (0.021)	**-0.013 (0.036)**
DOF	8.162 (1.561)	**34.319 (26.33)**	7.378 (1.285)	**96.000 (145.09)**	10.379 (2.474)	**56.053 (141.61)**	14.447 (4.78)	**81.149 (138.08)**	7.931 (1.50)	**24.003 (46.64)**
LL	-18.639	-1.093	-20.123	-0.226	-13.478	-0.344	-5.779	-4.302	-36.627	-2.075
AIC	-35.278	-0.185	-38.246	1.548	-24.957	1.311	-9.559	-6.604	-71.255	-2.151
BIC	-29.454	5.639	-32.422	7.372	-19.133	7.136	-3.735	-0.780	-65.431	3.674
Clayton (u, v)										
α	**0.005**	**0.000**	**0.019**	**0.000 (0.021)**	**0.000**	**0.000 (0.021)**	**0.039^**	**0.016 (0.022)**	0.136	**0.007**

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	(0.018)	**(0.020)**	**(0.020)**		**(0.020)**		**(0.021)**		(0.025)	**(0.020)**
LL	0.057	0.005	-0.514	0.007	0.006	0.005	-1.849	-0.289	-19.257	-0.082
AIC	2.113	2.009	0.972	2.014	2.012	2.009	-1.699	1.421	-36.514	1.835
BIC	7.937	7.833	6.796	7.838	7.836	7.833	4.125	7.245	-30.690	7.659
Clayton (1-u, 1-v)										
α	**0.000 (0.018)**	**0.018 (0.020)**	**0.020 (0.019)**	**0.011 (0.020)**	**0.000 (0.019)**	**0.026 (0.021)**	**0.016 (0.021)**	0.085 (0.023)	0.142 (0.025)	**0.000 (0.020)**
LL	0.002	-0.431	-0.562	-0.177	0.006	-0.896	-0.337	-8.206	-20.227	0.002
AIC	2.004	1.137	0.876	1.646	2.011	0.209	1.326	-14.412	-38.453	2.003
BIC	7.828	6.961	6.700	7.470	7.835	6.033	7.150	-8.588	-32.629	7.827
Clayton (1.u, v)										
α	0.076 (0.023)	**0.023 (0.021)**	**0.044* (0.021)**	**0.027 (0.021)**	0.069 (0.023)	**0.016 (0.021)**	**0.004 (0.020)**	**0.000 (0.022)**	**0.000 (0.022)**	**0.007 (0.021)**
LL	-6.485	-0.663	-2.398	-0.856	-5.436	-0.318	-0.022	0.011	0.020	-0.065
AIC	-10.970	0.674	-2.796	0.288	-8.873	1.365	1.955	2.022	2.039	1.870
BIC	-5.146	6.498	3.028	6.112	-3.049	7.189	7.779	7.846	7.863	7.694
Clayton (u, 1-v)										

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α	**0.023 (0.022)**	**0.005 (0.021)**	**0.007 (0.020)**	**0.000 (0.021)**	**0.046* (0.022)**	**0.000 (0.022)**	**0.000 (0.0020)**	**0.000 (0.021)**	**0.000 (0.021)**	**0.019 (0.021)**
LL	-0.538	0.083	-0.066	0.002	-2.515	0.003	0.003	0.011	0.021	-0.440
AIC	0.923	2.166	1.867	2.004	-3.030	2.007	2.006	2.022	2.042	1.119
BIC	6.747	7.990	7.691	7.828	2.794	7.831	7.830	7.846	7.866	6.943

4.3.1- Switching Copula Estimation between Global Precious Metals Index and Islamic Stocks

The estimated transition probabilities are shown by Pnn and Ppp, those are close to 1 indicating a high persistence of the same dependence regime in all estimated pairs. All the copula parameters are significant in the positive correlation regime, when stock and GSPM are bearish, for Hong Kong, India, Japan and Malaysia.

This negative relationship indicates that portfolio risk can be minimized by the inclusion of precious metals in Islamic stocks portfolio. Mensi et al. (2015) also found that during financial downturn times, precious metals offers strong hedging benefits to Islamic stocks. Osamah et al. (2020) suggested as per their study, for risk-averse investors of Islamic stock indices to include precious metals in their portfolios to diversify risks. It also provide safe-haven asset for equity markets in United States (Hood & Malik, 2013). Positive significant dependence is reported for Hong Kong, India, Japan and Malaysia, and the depence with ranges from 0.047 to 0.204, with tail dependence value ranges from 0.000 to 0.122. while no dependence is reported for Belgium, France, Germany, Ireland, Italy and Mexico. Hillier et al. (2006) also found low correlation value between stock indices and precious metals. Similarly, Ghazali et al. (2015) & Raza et al. (2019) studied role of precious metals as hedger. They concluded that precious metals do not serve safe haven purpose or hedger during downturns of equity market. Hence, absence of significant positive dependence among majority of countries makes GSPM suitable for risk reduction of portfolio, as GSPM is in bearish market and having dependence with Islamic stocks in bearish market. In the case, when both stock index and GSPM are in bullish market states under positive correlation regime, significant positive dependence is reported for Ireland, Italy, Japan and Malaysia. The value for dependence ranges from 0.029 to 0.218, and tail dependence ranges from 0.000 to 0.127. It shows that, both stock indices and alternative asset are facing spike in prices at same time in these countries and rise in the price of precious metals stocks can add more value in the revenues of Islamic stocks portfolios of these countries. On the otherhand, no significant dependence is found for Belgium, France, Germany, Hongkong, India and Mexico, resulting investors of Islamic stock in these countries cannot get any benefit from rise in revenues of precious metals.

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Most importantly, this study also studies the market dependence where Islamic stock index is in bearish market state (lower tail) and GSPM in bullish state (upper tail). Findings show a significant dependence between lower tails of Islamic with the upper tail of GSPM for Hong Kong, Malaysia and Mexico. Positive dependence found for Hong Kong, Malaysia and Mexico.The value ranges from 0.066 to 0.306 and tail dependence ranges from 0.000 to 0.151. It indicates that at the same time losses in Islamic stock index can be off set with the investment in GSPM. Further these findings suggest that GSPM can be regarded as safe haven asset for Islamic stock indices. In addition, Saiti et al. (2014) found precious metals as safe heaven. Raza et al. (2016) also documented that precious metals could provide the Islamic stock portfolio with diversification advantages. Nagayev and Masih (2013) reported that, during crisis times, precious metals serves as a hedging asset. Chkili (2017) reported that precious metals can be used as weak hedger and a strong safe haven for drastic fluctuations in the Islamic stock market. Maghyereh et al. (2019) found that precious metals plays role in hedging and diversifying Islamic equities. Abdoha et al. (2016) investigated dynamic connectedness between precious metals and Islamic equities. Their results also indicated that a low level of correlation among them, proved gold as good diversifier. Negative significant dependencecan be interpreted as that the losses in that country's stocks cannot be safeguarded by profits in precious metal.

In the case, when Islamic stock index is bullish and GSPM is bearish, significant dependence is reported for all countries other than France. There is negative dependence found for Hong Kong and India, with values ranges from -0.032 to -0.041. A negative dependence means that bearish market state of GSPM will have no impact on Islamic stock portfolio. Osamah et al. (2020) suggested that risk-averse investors of Islamic stock indices should include precious metals in their portfolios for maximization of their expected utilities and to diversify risks. On the other hand, positive dependence is found between pairs of GSPM and Islamic stock in Belgium, Germany, Ireland, Italy, Japan, Malaysia and Mexico, with value range 0.061 to 0.213. The value of tail dependence ranges from 0.000 to 0.311. This dependence is inferred as; lower tail of GSPM will impact the upper tail of Islamic stock of these countries. So for the investors of these countries, GSPM are not a viable choice to include in their portfolio, as its losses will decrease benefits of portfolio.

4.3.2- Global Precious Metals Index and Conventional stocks

In second part while studying the relationship when the conventional stocks index and GSPM are in bearish market states under positive correlation regime, significant dependence is reported for all sample countries. A negative dependence is documented for Belgium, France, India, Ireland, Italy, Japan and Malaysia.The value for dependence ranged from -0.018 to -0.074. Tail dependence value ranges from 0.000 to 0.632. Negative dependence is inferred as when both the markets are in extreme losses they are not following each other. According to Baur and Lucey (2010), precious metal is a safe haven for stocks. Smith (2002) also examined role of precious metals in portfolio diversifications. He found the existence of a weak or negative correlation between precious metals and stock indices.Sherman (1982) made investigation on the impact of precious metals on stock portfolios. Addition of precious metals in portfolio is

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profitable for investors. Recently, Beckmann et al., (2015) made a broad study for precious metals as safe-heaven. They found that precious metals is a safe haven and also serves as a hedger. Jawad et al., (2019) found precious metals as an undisputable hedge and safe haven for many stock indices. While significant positive dependence is reported for Germany, Hong Kong and Mexico, with a range from 0.012 to 0.089. On the other hand, positive dependence is interpreted as they are following each other. As their inclusion in portfolio will add more rick in portfolio. Hence for the countries with positive dependence, GSPM is not an option for investment for the managers of conventional portfolio. Choudhry et al., (2015) also found interdependence among precious metals and stock market; accordingly, precious metals cannot be used as safe haven during financial Crisis period.

When both stock index and GSPM are in bullish market trends under positive correlation regime, results are significant for France, Ireland, Italy, Japan and Mexico. Positive dependence is found for France, Ireland, Italy and Japan, while negative dependence is repoted for Mexico. Vale of positive dependence ranged from 0.011 to 0.393. The tail dependence ranges from 0.000 to 0.435. Positive dependence among the pairs of these countries shows that, both stock indices and alternative asset are earning profit at the same time. It will lead to the conclusion that, when GSPM are in bullish market and included in conventional stock portfolio in boom market, investor can get additional benefit. Both the markets will earn profits in positive episodes. Negative dependence is found among the pairs of GSPM and conventional stocks in bullish market in Mexico, with a value of -0.003. This means that no benefit can be earned by conventional stock portfolio investors from GSPM in bullish market state.

In second part of this study, the market dependence where conventional stock index is in bearish market state (lower tail) and GSPM in bullish state (upper tail) is studied. Findings show a significant dependence between lower tail of conventional and upper tail of GSPM is reported for the sample countries except India and Mexico.Positive dependence found for Belgium, France, Germany, Hong Kong, Ireland, Italy and Japan. The value of positive dependence ranges from 0.055 to 0.275, and tail dependence lies within range of 0.000 to 0.289. It indicates that at the same time losses in conventional stock index can be off set with the investment in GSPM. Previous studies also documented that conventional stock indices are riskier and not resilient in the episodes of negative downturn. Further these findings suggest that GSPM can be regarded as safe haven assets for conventional stock indices. McCown and Zimmerman (2006) made a study on precious metal, that it carries no market risk. Recently, Beckmann et al., (2015) made a broad study for precious metal as safe-heaven. They found that precious metal is a safe haven and also serves as a hedger. Diebold & Yilmaz (2012), Mensi et al. (2017a, 2017b) also studied spillover of volatility between stock markets and precious metals. They reported that precious metal receive volatility spillover shocks from the selected stock markets during financial crisis. Baur and Lucey (2010) documented precious metals as hedger for stocks and also safe-haven for stress periods. Negative significance dependence is found for Malaysia with a value of from -0.090, this negative dependence is documenting that the episodes of negative downturn of

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stock markets cannot be safeguarded with the investment in GSPM. They do not provide hedging benefit, as boom in GSPM market cannot be used to get some benefit in Islamic stock portfolio.

In the case, when conventional stock index is bullish market and GSPM is bearish market state, significant dependence is reported for countries other than Japan. There is negative dependence found for France, Hong Kong, India, Ireland and Italy, with values ranges from -0.016 to -0.077. The values of tail dependence range from 0.000 to 0.818. A negative dependence means that bearish market state of GSPM will have no impact on conventional stock portfolio. On the other hand, positive dependence is found between pairs of GSPM and conventional stock in Belgium, Germany, Malaysia and Mexico, with values from 0.000 to 0.120. This dependence is inferred as; lower tail of GSPM will impact the upper tail of conventional stock of these countries. So for the investors of these countries, GSPM are not a viable choice to include in their portfolio, as its losses will decrease benefits of portfolio. Lucey et al. (2010) also found precious metals useful for portfolio diversification. A study made by McDonald and Solnik (1977) also reported that precious metal is profitable for portfolio diversification. Michis (2014) studied the contribution of precious metal in determining the risk of portfolio. He found that precious metal contributes lowest in portfolio risk. Studies also showed ability of gold as safe haven in financial crisis.

Table 4. Regime Switching Copula between Stocks and Precious Metals:

	BELGIUM		**FRANCE**		**GERMANY**		**HONGKONG**		**INDIA**	
	GSPM		**GSPM**		**GSPM**		**GSPM**		**GSPM**	
	ISL	**CON**	**ISL**	**CON**	**ISL**	**CON**	**ISL**	**CON**	**ISL**	**CON**
Panel A: Positive correlation regime										
Both markets are bearish										
α1	0.681 (0.200)	**-0.023 (0.172)**	0.630 (0.181)	**-0.143** (0.308)	0.669 (0.167)	**0.120 (0.176)**	**0.119** (0.128)	**0.015** (0.328)	**0.062** (0.097)	**-0.032** (0.045)
ρ1	0.388 (0.080)	**-0.018**	0.367 (0.076)	**-0.120**	0.383 (0.068)	**0.089 (0.122)**	**0.088** (0.089)	**0.012** (0.253)	**0.047** (0.071)	**-0.026**

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		(0.138)		(0.278)						(0.037)
ϕ1	0.181 (0.053)	**0.518 (1.677)**	0.166 (0.052)	**0.632** (0.659)	0.177 (0.046)	**0.001 (0.013)**	**0.001** (0.009)	**0.000** (0.000)	**0.000** (0.000)	0.704 (0.206)
Both markets are bullish										
α2	**1.285* (0.519)**	1.092 (0.399)	0.432 (0.139)	**0.693** (0.537)	0.505 (0.148)	**0.454 (0.287)**	0.346 (0.122)	6.067 ^ (3.040)	0.464 (0.160)	**0.140** ^ (0.055)
ρ2	0.576 (0.123)	0.526 (0.111)	0.275 (0.071)	**0.393** ^ **(**0.213)	0.311 (0.070)	**0.286 * (0.143)**	0.229 (0.068)	0.925 (0.055)	0.291 (0.079)	0.102 (0.038)
ϕ2	0.291 (0.063)	0.265 (0.061)	**0.100** ^ **(**0.052)	**0.184** (0.142)	**0.127 * (0.051)**	**0.108 (0.105)**	**0.067** (0.047)	0.446 (0.025)	**0.112** ^ (0.057)	**0.003** (0.007)
Panel B: Negative correlation regime										
Stock market is bearish, Aasset market is bullish										
α3	**0.204* (0.079)**	**0.143 * (0.070)**	0.369 (0.107)	**0.073** (0.069)	0.497 (0.112)	**0.165 (0.116)**	**0.153 * (**0.072)	**0.072** (0.051)	0.286 (0.101)	**0.580** ^ (0.301)
ρ3	0.145 (0.050)	**0.105 * (0.048)**	0.242 (0.058)	**0.055** (0.051)	0.307 (0.053)	**0.119 (0.077)**	**0.111 * (**0.048)	**0.055** (0.037)	0.195 (0.059)	0.346 (0.133)
ϕ3	**0.016 (0.022)**	**0.004 (0.009)**	0.076 ^ (0.041)	**0.000** (0.000)	0.124 (0.039)	**0.007 (0.022)**	**0.005** (0.011)	**0.000** (0.002)	**0.044** (0.037)	**0.151** (0.093)
Stock market is bullish, Asset market is bearish										
α4	**0.126^ (0.071)**	**0.001 (0.055)**	**0.207 *** (0.082)	**-0.021** (0.054)	**0.140 ^ (0.073)**	**0.046 (0.083)**	**-0.040** (0.061)	**-0.056** (0.040)	**-0.052** (0.062)	**-0.054** (0.138)

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ρ4	**0.093^ (0.049)**	**0.001 (0.044)**	0.146 (0.052)	**-0.016** (0.043)	**0.102 * (0.050)**	**0.035 (0.062)**	**-0.032** (0.050)	**-0.045** (0.033)	**-0.041** (0.051)	**-0.044** (0.114)
ϕ4	**0.002 (0.006)**	**0.000 (0.000)**	**0.017** (0.023)	**0.119** (0.538)	**0.003 (0.009)**	**0.000 (0.000)**	**0.128** (0.333)	**0.105** (0.934)	**0.311** (0.499)	**0.155** (0.495)
Regime Switching										
Ppp	0.9740	0.9620	0.9839	0.8003	0.9827	0.9564	0.995	0.915	0.9957	0.9992
Pnn	0.9967	0.9915	0.9947	0.9758	0.9948	0.9853	0.998	1	0.9981	0.9949
LL	-5380.04	-5418.70	-5376.49	-5423.96	-5365.92	-5423.48	-5417.88	-5418.81	-5410.76	-5424.29
AIC	10800.08	10877.39	10792.97	10887.92	10771.85	10886.96	10875.76	10877.63	10861.51	10888.59
BIC	10916.57	10993.88	10909.46	11004.41	10888.33	11003.44	10992.25	10994.12	10978.00	11005.08

Notes: ρi and ϕi are measures of tail dependency and dependence, respectively, while αi is the shape parameter of the dependence-switching copula. In the table, ρ3 and ρ4 indicate a positive correlation but a negative relationship between stocks and alternative assets. Standard deviations are indicated by the values in parenthesis. Numbers with bold faces denote significance at the 1% level. * Faced numbers denote significance at the 10% level, whereas ^ show significance at the 5% level. The calculated log likelihood value, the Akaike information criterion, and the Bayes information criterion are represented by the symbols LL, AIC, and BIC, respectively. There are two transition probabilities: Ppp and Pnn.

	IRELAND		**ITALY**		**JAPAN**		**MALAYSIA**		**MEXICO**	
	GSPM		**GSPM**		**GSPM**		**GSPM**		**GSPM**	
	ISL	**CON**	**ISL**	**CON**	**ISL**	**CON**	**ISL**	**CON**	**ISL**	**CON**
Panel A: Positive correlation regime										
Both markets are bearish										
α1	0.365 (0.118)	**-0.063** (0.057)	0.279 (0.101)	**-0.076** (0.061)	**0.168** ^ (0.095)	**-0.090** (0.050)	**0.301** * (0.132)	**-0.033** (0.042)	0.491 (0.149)	**0.105** ^ (0.060)

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ρ1	0.240 (0.064)	**-0.051** (0.048)	0.191 (0.060)	**-0.062** (0.052)	**0.122** ^ (0.063)	**-0.074** (0.043)	**0.204** * (0.076)	**-0.026** (0.034)	0.304 (0.072)	**0.078** ^ (0.042)
ϕ1	**0.074** (0.046)	**0.276** (0.275)	**0.041** (0.037)	**0.444** (0.325)	**0.008** (0.019)	**0.106** (0.453)	**0.050** (0.050)	0.517 (0.137)	**0.122** * (0.052)	**0.001** (0.002)
Both markets are bullish										
α2	**0.327** * (0.155)	**0.127** (0.081)	**0.201** * (0.094)	**0.014** (0.068)	**0.064** (0.078)	**0.068** (0.057)	**0.037** (0.075)	0.190 (0.059)	0.688 (0.176)	**-0.003** (0.055)
ρ2	**0.218** * (0.088)	**0.093** ^ (0.056)	**0.142** * (0.061)	**0.011** (0.052)	**0.049** (0.057)	**0.052** (0.042)	**0.029** (0.057)	0.135 (0.038)	0.391 (0.070)	**-0.003** (0.043)
ϕ2	**0.060** (0.060)	**0.002** (0.007)	**0.015** (0.025)	**0.000** (0.000)	**0.000** (0.000)	**0.000** (0.000)	**0.000** (0.000)	**0.013** (0.014)	0.182 (0.047)	**0.435** (0.642)
Panel B: Negative correlation regime										
Stock market is bearish, Aasset market is bullish										
α3	0.484 (0.109)	**0.432** ^ (0.243)	0.657 (0.204)	**0.119** (0.093)	**0.579** * (0.228)	**0.093** (0.246)	**0.493** (0.463)	**-0.109** (0.153)	**0.087** (0.095)	**0.715** ^ (0.386)
ρ3	0.301 (0.052)	**0.275** * (0.124)	0.378 (0.084)	**0.088** (0.064)	0.345 (0.101)	**0.070** (0.175)	**0.306** (0.222)	**-0.090** (0.134)	**0.066** (0.068)	0.402 (0.150)
ϕ3	0.119 (0.038)	**0.101** (0.091)	0.174 (0.057)	**0.001** (0.006)	**0.151** * (0.071)	**0.000** (0.006)	**0.122** (0.161)	**0.289** (0.258)	**0.000** (0.002)	**0.189** ^ (0.099)
Stock market is bullish, Asset market is bearish										
α4	**0.141** (0.091)	**-0.055** (0.158)	**0.251** ^ (0.133)	**-0.093** (0.063)	**0.316** ^ (0.184)	-0.158 (0.000)	**0.109** (0.155)	**0.118** (0.177)	**0.081** (0.089)	**0.486** ^ (0.273)

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ρ4	**0.103 ^** (0.062)	**-0.044** (0.131)	**0.174 *** (0.081)	**-0.077** (0.054)	**0.213 *** (0.105)	-0.134 (0.000)	**0.081** (0.109)	**0.087** (0.124)	**0.061** (0.064)	**0.302 *** (0.132)
ϕ4	**0.003** (0.012)	**0.137** (0.491)	**0.031** (0.046)	**0.818 ^** (0.410)	**0.056** (0.071)	0.399 (0.000)	**0.001** (0.008)	**0.001** (0.012)	**0.000** (0.001)	**0.120** (0.096)
Regime switching										
Ppp	0.9886	0.9983	0.9872	1	0.9561	0.9992	0.9876	1	0.9628	0.9864
Pnn	0.9953	0.9932	0.984	0.999	0.9384	0.9915	0.9775	0.995	0.9743	0.9044
LL	-5382.42	-5423.46	-5392.96	-5425.04	-5411.61	-5425.01	-5417.66	-5419.7	-5384.12	-5422.31
AIC	10804.84	10886.92	10825.9	10890.0	10863.2	10890.0	10875.3	10879.5	10808.24	10884.62
BIC	10921.32	11003.40	10942.40	11006.57	10979.71	11006.49	10991.81	0.11	10924.72	11001.10

Results of the dependence switching copula models for each pair of stocks and precious metals are presented above. The precious metals are paired with the Islamic stock indices and their conventional counterparts subsequently. Overall it shows that adding GSPM in Islamic stock portfolio can safeguard the stock portfolios in extreme losses periods. This is favorable for investor, as the assets can provide cousin in financial crisis. When they are moving independently in their respective trend, they will not intensify loses. On the other hand, positive dependence is interpreted as they are following each other, so their inclusion in portfolio will add more risks to the portfolio. When it comes with the bullish market trend, a positive dependence among the pairs of stocks and precious metals will lead to the conclusion that investor can get additional benefit. These findings are supported by Elfakhani, Sidani & Hassan (2006), Ho et al. (2014), Rizvi, Alam and Arshad (2015), Wajahat et al. (2019), Raza et al. (2019), Dewandaru, Masih & Obiyathulla (2016), Mansur M. Masih (2016). GSPM have positive dependence with Islamic stock portfolio, providing them opportunity to earn additional returns in boom market. For negative market regime, when GSPM is moving upward, and Islamic stock moving downward, significant dependence is reported for Islamic stocks, making GSPM as good hedger for Islamic stock portfolio in downturn. These findings are coincides with the reported literature for instance; Elfakhani et al. (2006) Ho et al. (2014), Rizvi et al. (2015), Wajahat et al. (2019), Daskalaki et al. (2017). It is a viable choice for investors to include precious metals as alternative assets in portfolio as they provide safe haven benefit and as well as hedging benefit.

5-Conclusion

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The study's methodology is driven by the observation that, although returns are detrimentally low during times of market stress, the conditional variance of the stock portfolio consisting conventional and Islamic equities separately, increases at those times. Due to this fact, investors' focus has shifted to alternative assets in an attempt to hedge risk or obtain a safe haven advantage in case of an economic downturn. This study is predicated on the claims that no prior research has examined the asymmetric dynamics of financial asset returns, the efficacy of these alternative assets as a safe haven, their capacity to hedge, and their benefits for diversification. In this research, data consist of two stocks indices and an alternative assets. The selected stocks include Islamic stocks and conventional stocks. The selected sample countries includes Belgium, France, Germany, Hong Kong, India, Ireland, Italy, Japan, Malaysia and Mexico. The selected alternative asset is GSPM (global precious metals index). The sample period ranges March 2011 to March 2021.

Majority of the means of the returns are positive during the sample period for selected stocks and alternative assets, Islamic stocks have the largest mean and largest standard deviation. All the standard deviations of the returns are positive during the sample period. Islamic stock markets have the larger range for the maximum and minimum then conventional stock market, and their behavior is more volatile than conventional stocks. The return distributions for the stock indices (Islamic and conventional) and alternative assets (GSPM) are positively skewed. The mass of the distribution is concentrated on the left side of the distribution, with the right tail being longer. After a normal distribution, all of the return series show excess kurtosis and are rejected to follow normal distribution. For each volatility equation, the total of the ARCH and GARCH terms approaches one, suggesting strong volatility persistence. The skewed-t distribution's values degree of freedom, which varies from 2 to 8, shows that the error terms were non-normal and had a heavy tail. All series have a positive and substantial asymmetry coefficient at the 1% level, which further supports the heavy tail's rightward skewed. Large positive returns are therefore more probable than large negative returns.In order to quantify the dependence between stocks and precious metals, six single-copula models, including normal, t, and four various forms of the Clayton copula are initially employed, as mentioned by Wang et al. (2013). For every pair of stock indexes and precious metals (alternative assets), the coefficient estimations are shown. The findings demonstrate the significance of the parameters calculated by the t, normal, 180-degree, and Clayton methods at the 1%, 5%, and 10% levels for each pair. With the exception of Mexico, all pairs are important for GSPM and Islamic stock. Upon comparing the log likelihood, AIC, and BIC values of various copulas for every pair, it is evident that no copula outperforms the others.

Liu et al. (2019a) state that while the t-copula and normal copula may both express symmetric positive and negative reliance, the t-copula has symmetric tail dependence and the normal copula has no tail dependence. Consequently, the mixed Clayton copulas are further employed for the dependent-switching copula model in order to capture the asymmetric tail dependence. For every pair of stocks and precious metals, the outcomes of reliance switching copula models are estimated. The precious metals are paired first with Islamic stock indices.The predicted transition probabilities in all

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assessed pairs are close to 1, indicating strong persistence of the same dependence regime. For Hong Kong, India, Japan, and Malaysia, all the copula parameters are significant in the positive correlation regime when the Islamic stock and GSPM are in a bearish state. However, there have been reports of positive reliance for Malaysia, Japan, India, and Hong Kong. Therefore, the majority of countries have positive dependence, which renders GSPM inappropriate for reducing portfolio risk. When the Islamic stock index and the GSPM are both experiencing bullish market conditions under a regime of positive correlation, Ireland, Italy, Japan, and Malaysia are found to have strong positive dependence, indicating a simultaneous price jump.

Above all, this study examines the relationship between the Islamic stock index and the market, with the former in a bullish state (upper tail) and the latter in a bearish market state (lower tail). Results indicate a strong correlation between the upper tail of GSPM for Hong Kong, Malaysia, and Mexico and the lower tails of Islamic. Positive dependence found for Hong Kong, Malaysia and Mexico. It indicates that at the same time losses in Islamic stock index can be off set with the investment in GSPM. These findings suggest that GSPM can be regarded as safe haven asset for Islamic stock indices.When Islamic stock index is bullish and GSPM is bearish, significant dependence is reported for all countries. There is negative dependence found for Hong Kong and India, showing that bearish market state GSPM will have no impact on Islamic stock portfolio. On the other hand, positive dependence is found between pairs of GSPM and Islamic stock in Belgium, Germany, Ireland, Italy, Japan, Malaysia and Mexico, showing that lower tail of GSPM will impact upper tail of Islamic stock of these countries, making GSPM are not a viable choice.

Secondly, when the conventional stocks index and GSPM are in bearish market states under positive correlation regime, significant dependence is reported for all countries. A negative dependence is documented for Belgium, France, India, Ireland, Italy, Japan, and Malaysia. Significant positive dependence is reported for Germany, Hong Kong and Mexico. When both stock index and GSPM are in bullish market trends under positive correlation regime, results for countries are significant except Belgium, Germany, Hong Kong, India and Malaysia. Positive dependence is found for France, Ireland, Italy and Japan. It will lead to the conclusion that, GSPM in bullish market is beneficial for investors to be included in conventional stock portfolio in boom market. Negative dependence is found among the pairs of GSPM and conventional stocks in bullish market in Mexico, showing no benefit.

Furthermore, findings show significant dependence between lower tail of conventional stocks and upper tail of GSPM for sample countries except India and Mexico. Positive dependence found for Belgium, France, Germany, Hong Kong, Ireland, Italy and Japan. It indicates that at the same time losses in conventional stock index can be off set with the investment in GSPM. Negative significance dependence is found for Malaysia. When conventional stock index is bullish market and GSPM is bearish market state, significant dependence is reported for all countries other than Japan. Negative dependence is found for France, Hong Kong, India, Ireland and Italy, and positive dependence is found between pairs of GSPM and conventional stock in Belgium,

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Germany, Malaysia and Mexico. This is inferred as; lower tail of GSPM will impact the upper tail of conventional stock of these countries, making GSPM unfavorable.

6- Research Implications

To represent the conditional dependency between traditional stock indices and Islamic stock indices and alternative assets(precious metals) in a more realistic way than the previous studies, a relatively new modeling technique, time-varying copula with switching dependence is used. Dependence-switching copula represents a reliance structure more accurately and realistically than a single copula regime because the dependence may alter between positive and negative correlation regimes with time. The fluctuating behavior of markets has significant impact on economic variables; especially downward trend during crisis. There is growing investigation on portfolio management to safe investors from risks and also avoid market turmoil. Conditional dependence between stock indices and alternative assets such as Global Precious Metals Index(GSPM) is examined. Overall, addition of alternative assets in stocks portfolio reduces risks and provide better diversification benefit. Results vary depending upon circumstances of country.

These findings have significant ramifications for investors who diversify their stock portfolios

with non-traditional assets in an attempt to increase the risk-return trade-off they receive from international stock markets. Precious metals are a good way to reduce portfolio risk and safeguard against emergencies.The significance of creating diverse asset portfolios for diversification was thus emphasised by the outcomes.While the advantages differ based on the hedging assets included and the makeup of the portfolio, this analysis indicates that the emergence of Islamic stock indexes is offering new ways for portfolio diversification on a worldwide scale. In addition to offering investors with ethical and religious convictions new options for investment and trading, the Islamic stock markets are generating significant returns. These returns can be compared to those of regular stock market investments.

7-Research Limitation

Beside the discussed implications, significance and findings of the study, there are also some limitations. Firstly, this study focused on investigating the role of precious metals for portfolio diversification, and their role in times of economic instability specially. It focused on the role of precious metals to be included in portfolios comprising Islamic stocks or conventional stocks. It ignores the role of combined portfolio, which may include both Islamic and conventional stocks or/and along with alternative assets.

A larger data set comprising of more sample countries and covering more time span can help understanding broader spectrum. The results vary depending upon the economic conditions of the countries, other factors like country's financial condition, social and political environment, law and order situation can also be considered.

The existing study is limited to few copula families and risk reduction measures, it can be prolonged by adopting more copula families with their distinguish characteristics with different implications and more financial tools and techniques.

8-Future Research Directions

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The empirical study can be prolonged by including more countries for the research. The study can also be extended by examining the possible influences of other alternative assets. A combined portfolio comprising of conventional stocks, Islamic stock and alternatives assets can also be taken for future research.
Furthermore, there are several ways of estimating the marginal distributions for copula model estimations. The current article used ARMA-GARCH for residual estimations. To provide differential benefits and attributes regarding stock returns stylized facts, serial autocorrelation, heteroskedastisity and normality of the series is used, future researchers can check with other estimators for residual extraction prior to copula models.The existing study can be prolonged by adopting more copula families with their distinguish characteristics with different implications.

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