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Make the Best from Comparing Conventional and Islamic Asset Classes: A Design of an *All-Seasons Combined Portfolio*

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Abstract: This paper aims to contribute to the existing literature in portfolio management and strategy by investigating the performance, diversification, and hedging benefits arising from integrating Sharia-compliant stocks into a conventional portfolio. Thus, this paper tests the performance of a Combined Portfolio, resulting from the combination of conventional Islamic instruments, covering different macroeconomic scenarios in the last decade (2010–2020). The strategic asset allocation was designed following the Global Macro Anima (GMA) strategy, solving a risk-parity optimisation problem using a specifically developed MATLAB™ algorithm. The findings will contribute to answering the question related to the possibility of including alternative instruments to increase diversification with hedging benefits by building asset allocations that perform well across different macroeconomic scenarios.

Keywords: asset allocation; portfolio management; risk parity; Islamic equities; macroeconomic conditions

JEL Classification: G11; G15; G17; G19

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"The COVID-19 is not a Black Swan. It was more predictable than people realise. The Black Swan was meant to explain why, in a networked world, we need to change business practices and social norms not to provide a cliché for any bad thing that surprises us."

Nassim Taleb

1. Introduction

COVID-19 has strongly stressed and tested the global financial markets, representing a tough challenge for asset management. The pandemic represents an exogenous economic shock, although this depends on unpredictable noneconomic factors, different from the global financial crisis in 2008 (GFC) or the European sovereign debt crisis in 2010–2013, which were endogenous shocks due to financial reasons (Borio 2020). It affects the global economy, triggering several sectors, such as labour markets, global supply chains, and consumption behaviour, since national authorities have declared lockdowns ordering the shutdown of most noncore business activities. These strict actions generated severe demand and supply-chain shrinking in the financial market following the outbreak. The emerging and developed stock markets have gradually fallen, declaring the hunt's open season to safe-haven assets to limit the contagion effects. For this purpose, scholars are also keeping an eye on the Islamic Financial System (IFS), which demonstrated more stability and resilience due to the intrinsic underpinnings of ethicality and sustainability of the Shariah-compliant principles (Arouri et al. 2013; Ashraf et al. 2020; Hengchao and Hamid 2015; Jawadi et al. 2014; Paltrinieri et al. 2019). Ashraf et al. (2020) test the performance of the S&P Dow Jones, confirming that it underperformed compared to its Islamic counterparts during Q1 of 2020, and supporting the hypothesis that Islamic equities provide portfolio-hedging benefits during severe market downfalls. Haroon et al. (2021) also reported Islamic equity diversification opportunities due to their lower systematic risk. However, Hasan et al. (2021) contested the decoupling hypothesis of the Islamic stock market from the conventional one, since the Shariah screening process fails to provide immunity. Furthermore, the major Islamic stock indexes outperformed their counterparts during the period 2019–2020, especially after the stock-market crash in March 2020 (Sherif 2020). The literature also focuses on the performance of Islamic mutual funds, compared with the conventional ones, depending on the managerial and market timing skills (Mansor et al. 2020). In addition, during the COVID-19 crash, which was severe and quick, every market crash awakened and reinforced some longstanding trending topics for academics and practitioners, such as:

- The renewed attention to assets uncorrelated or negatively correlated with other traditional assets, such as gold, precious metals, commodities, or treasuries, providing portfolio-diversification benefits in terms of volatility, downside risk, and maximum drawdown mitigation power, particularly during financial downturns (Baur and Lucey 2010; Baur and McDermott 2010; Bouri et al. 2020; Ji et al. 2020; Kristoufek 2020; Reboredo 2013).
- The hedging benefits and resilience of Islamic equities during the last great GFC are attributed to the limited exposure to high-leverage companies due to the Shariah screening (Ashraf et al. 2020; Jawadi et al. 2014). IFS distinguishes itself by promoting a more ethical approach to profit and risk sharing, facilitating fairness in financial matters (Al Rahahleh et al. 2019).
- The academic interest in the Islamic Stock Market (ISM) compared to the conventional one has divergent results in terms of performance (Belouafi et al. 2015; Delle Foglie and Panetta 2020; Hassan et al. 2019; Masih et al. 2018). Delle Foglie and Panetta (2020) proposed a change in the research approach, searching for the possibility to evaluate the Shariah-compliant instrument diversification, decoupling and hedging benefits, and combining the conventional portfolio and not merely different asset classes.
- The financial crisis increases the need to design a portfolio strategy that fits all macroeconomic environments, and faces the current postcrash scenario and future economic and financial uncertainty. Assuming every economic cycle is a set of unpredictable chronological events affecting each specific asset class performance, it seems unnecessary to forecast the next financial downturns, since it is impossible to predict the future (Economic machine—Bridgewater 2011). This principle also corresponds to the theoretical background underlying the foundation of Global Macro Anima (GMA), a strategic asset allocation based on the diversification across macroeconomic scenarios proposed by Pola (2013, 2021). The GMA approach overcomes the mean-variance framework that dominates portfolio strategies, declaring that "*asset–return dynamics can be explained mainly by variations of expectations rather than the levels of macroeconomic variables*".

Finally, this paper aims to contribute to the literature of portfolio-management and asset-allocation strategies, considering typical safe-haven assets combined with Islamic stocks, following a *Combined Portfolio* approach (Delle Foglie and Panetta 2020). According to Delle Foglie and Panetta (2020), the literature has focused so far on the contraposition of the ISM with the conventional market without investigating the possible positive effects of their combination in a portfolio-management logic. The *Combined Portfolio* aims to overcome the mere comparative approach (Islamic vs. conventional), changing the investigation approach of the phenomenon through the lens of integration. Notably, this study does not intend to determine the best portfolio asset allocation and strategy to beat the market. Contrastingly, it returns to the question related to the possibility of including alternative stock instruments to increase diversification with hedging benefits, building asset allocations that perform well over time. In this regard, this paper also follows the literature strands founded on the GMA and *All-Weather* (AW) philosophy of Bridgewater (2012) into the strategic asset-allocation choice, combining them with a *Risk Parity* (RP) model

(Qian 2005) as a good asset allocation selection criterion for these strategies. The remainder of this paper is organised as follows. Section 2 provides the methodology, focusing on the fundamentals of the GMA strategy, the AW, and the risk-parity heuristic approach. The optimisation problem of the risk parity is solved using the specifically designed MATLAB algorithm. Section 3 presents and debates the data, descriptive statistics, and empirical results of the portfolios. Finally, the main conclusions and further remarks are disclosed in Section 4.

2. Methodology

2.1. The All-Weather Philosophy and the GMA Strategy

"What kind of investment portfolio would you hold that would perform well across all environments, be it a devaluation or something completely different?" AW engineering is based on an approach in which asset returns are broken down into building blocks. This process lies in the Post-Modern Portfolio Theory (PMPT) literature. The strand of literature studying the Modern Portfolio Theory (MPT) considers asset allocation as the asset class combination based on expected returns, risks, and correlations. According to Lee (2011), the global financial crisis of 2008 demonstrated the weakness of typical portfolio strategies such as the mean-variance optimisation, 60/40, and MPT, which have problems with diversification and the underestimation of risk. Instead, in the PMPT proposed by AW (Bridgewater 2012), any total investment return can be split into its intrinsic components and analysed while considering the leading components of those individual parts. Thus, this return is a function of the return on cash (the risk-free position), the excess return of markets above the cash rate (the betas), and the alpha as the managerial skills in stock selection. In summary:

$$\textit{Investment return} = \textit{risk-free} + \textit{beta} + \textit{alpha}$$

Therefore, the AW philosophy is based on three other fundamental keys providing different interpretations of the investor's mindset: the role of market expectations, the environmental biases, and the role of cash. First, AW considers markets that are breakable into several components. Markets move considering their intrinsic expectations and the shift in their price conditions. Thus, there is a relationship between market expectations and the definition of surprise. Clearly, the greater the gap, the larger the market expectations. Second, all asset classes have environmental biases. The idea of environmental bias is linked to the notion of asset correlation. Some assets perform well in certain economic seasons and poorly in others. Asset-class pricing and performance will depend on market expectations, since they discount future economic scenarios.

Moreover, asset-class pricing will consider the role of cash. As previously mentioned, the return of cash represents the investors' risk-free position. The larger the investment risk, the larger the compensation investors require (risk premium). As a result, investment return depends on the return of any constituent asset. It considers the changes in the risk premium and the unpredictable alterations in the economic cycle (environmental biases). The economic cycle typically depends on the volume of economic activity (growth) and its pricing (inflation). The asset-allocation mix will depend on the investor sentiment of the future condition of higher/lower inflation growth (market expectations). Figure 1 below summarises the fundamentals of the AW strategy. The result is that asset allocation will capture the four risk exposures, mitigating the risk through the differences in environmental correlation between asset classes (Figure 1). Thus, following the investment return formula, in the long term, investment choices must consider assets that should provide a return above cash (risk-free). Pola (2013) introduced the GMA strategy with the same fundamentals, considering that asset returns are mainly affected by changes in macroeconomic and stress factor expectations. *"Stocks move not due to low or high growth but mainly due to the fact that growth is above or below expectations"*.

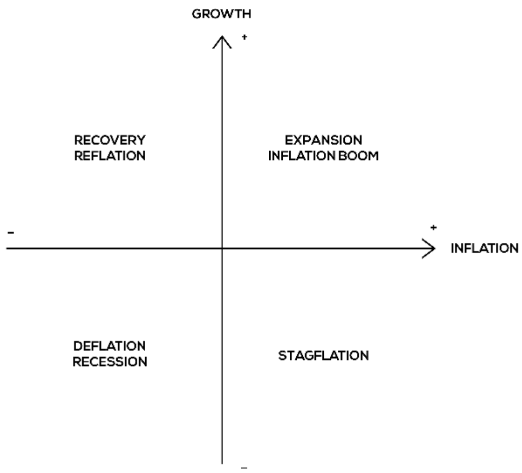

Figure 1. Quadrant of the macroeconomic scenario. Source: authors' elaboration.

The GMA strategy supports the mean-variance framework criticisms related to significant input parameter errors and the lack of diversification characterising the 60/40 (equity/bond) portfolio. The 60/40 portfolio is designed for disinflation and rising growth scenarios with a high concentration of equity risk. On the contrary, the GMA aims to build portfolios that limit exposure to unexpected macroeconomic environments, and considers and manages unfavourable inflation scenarios (Pola 2021). GMA considers the core and hidden drivers of asset return as the volume of economic activity (growth), pricing (inflation), and potential market stress. Pola (2013) established the relationship between asset sensitivity and factor dynamics using a polarisation coefficient. Each single asset class shows different behaviour to the inflation/growth scenario. Table 1 summarises the inflation–growth polarisation results, reporting the relationship between the asset classes and the different macroeconomic conditions.

Table 1. Relation between the asset classes, trends, and macroeconomic conditions.

		Macroeconomic Conditions		
		Growth	**Inflation**	**Market Stress**
Trend	**Rising**	Commodities Emerging debt in local currency Equities	Commodities Emerging debt in local currency Gold Inflation-linked bonds	Nominal bonds Corporate IG bonds Gold
	Falling	Nominal bonds Gold	Nominal bonds Corporate IG bonds	Corporate HY bonds Commodities Emerging debt in local currency Equities

Source: data elaboration based on Pola (2013).

2.2. The Risk Parity Model and the Optimisation Problem

According to Allen (2010), traditional portfolio strategies, founded on the mean-variance optimisation, are based on a 60/40 asset allocation, in which stocks explain approximately 70%/90% of the total risk contribution, resulting in an excessive concentration of a subset of assets. The portfolio results are well diversified from the weight perspective, but not regarding the volatility of stocks and bonds. In addition, the mean-variance approach seems to be too sensitive to its input parameters, with significant differences in small changes (Maillard et al. 2010). The literature describes this phenomenon as the concept of *all eggs in one basket*, since the 60/40 portfolio does not offer proper risk diversification. There is much confusion between the concept of volatility optimisation and risk diversification. Most of the contributions apply the same approach to minimise portfolio volatility, and target an expected return. The PMPT attempts to bypass the optimisation methods, preferring heuristic-solution-based risk distribution (Allen 2010; Anderson et al. 2012; Bruder and Roncalli 2012; Choueifaty and Coignard 2008; Foresti and Rush 2010; Levell 2010; Lohre et al. 2012; Maillard et al. 2010; Meucci 2007, 2009). This kind of approach is conceived to create (potentially) higher long-term profits by accepting the tolerance of higher risk (therefore, it is not only about minimizing the volatility) (Bruder and Roncalli 2012; Qian 2005). Following the risk parity in Equal Risk Contribution (ERC), the asset allocation does not consider any returns in the weight distribution but the risk contribution of a single component as the marginal risk contribution (MRC). It is the share of the total portfolio risk contribution (TRC) associated with that specific component. According to Bruder and Roncalli (2012) and Maillard et al. (2010), we considered a portfolio $X = (x_1; x_2; \ldots ; x_n)$ of n risky assets, assuming no possibility of leverage or short selling. The portfolio standard deviation is as follows:

$$\sigma_p(x) = \sqrt{x^T\ \Omega x} \ = \ \sqrt{\sum_i x_i^2\sigma_i^2 + \sum_i \sum_{i\neq j} x_i x_j \sigma_{ij}} \tag{1}$$

where σ_{ij} is the covariance between asset i and j, and Ω is the covariance matrix. The $MRC_i(x) = \frac{(\Omega x)_t}{\sqrt{x^T\ \Omega x}}$ and the $TRC_i(x) = x_i \frac{(\Omega x)_t}{\sqrt{x^T\ \Omega x}}$, so it is easy to show that the portfolio risk can be explained as the sum of the TRCs:

$$\sum_{i=1}^n TRC(x) = \sum_{i=1}^n x_i \frac{(\Omega x)_t}{\sqrt{x^T\ \Omega x}} = \sqrt{x^T\ \Omega x} \ = \ \sigma_p(x) \tag{2}$$

As previously mentioned, the ERC fundamentals aim to build a risk-balanced portfolio considering the asset allocation in terms of risk contribution rather than in terms of portfolio weights (risk budgeting). Thus, we considered a risk budget, b, and the vector of risk in the percentage of the total risk, $b = (b1, b2, \ldots , bn)$, where $bi = bj = 1/n$, the $TRC_i(x) = TRC_j(x)$, and the $x_i \frac{(\Omega x)_t}{\sqrt{x^T\ \Omega x}} = x_j \frac{(\Omega x)_t}{\sqrt{x^T}}$, so it is easy to show that:

$$\sum_{i=1}^n TRC(x) = nTRC_i(x) \tag{3}$$

where the $TRC_i(x) = \frac{\sigma(x)}{n}$. Finally, the risk parity can be formulated as the following optimisation problem:

$$X = arg\ min\ f(x) \tag{4}$$

where

$$f(x) = \sum_{i=1}^n \sum_{j=1}^n \left[\ TRC_i(x) - TRC_j(x)\right]^2 = \sum_{i=1}^n \sum_{j=1}^n \left[x_i\ (\ \Omega x)_i - x_j\ (\ \Omega x)_j\right]^2, \quad \sum_{i=1}^n x_i = 1,\ \sum_{j=1}^n x_j, \text{ and } x \geq 0 \tag{5}$$

Considering the previous Euler decomposition of the portfolio risk measure, the problem can be solved as follows:

$$X = arg\ min\ \sum_{i=1}^n \left[\ x_i\ (\ \Omega x)_i - \frac{\sigma_p(x)}{n}\right]^2 \tag{6}$$

The optimisation problem can be solved using the MATLAB Optimization Toolbox™, which provides functions for finding parameters that minimise or maximise objectives, while satisfying constraints. Notably, the sequential quadratic programming (SQP) demonstrates a solution to nonlinear programming (NLP), generating iterations to solve the optimisation problem by settling a sequence of SQP and approximating the exact solution. The toolbox also includes solvers for NLP, such as the solver-based nonlinear optimization, which finds the minimum constrained nonlinear multivariable function to discuss the existence and uniqueness of the risk parity portfolio. Constrained optimisation aims to convert the problem into an easier subproblem using an iterative process that provides stochastic approximation in generating possible solutions. Specifically, this algorithm uses a heuristic method, since it is used to find acceptable answers not differing too much from the exact solution. The *fmincon* functions of MATLAB provide an SQP-based nonlinear programming solver, finding the minimum of a constrained nonlinear multivariable function of a problem specified by Byrd et al. (2000) and Waltz et al. (2006):

$$min_x\ f(x)\ such\ that \begin{cases} c(x) \leq 0 \\ ceq(x) = 0 \\ A\cdot\ x \leq b \\ Aeq\ \cdot x = beq \\ lb \leq x \leq ub \end{cases}$$

- *b* and *beq* are vectors, *A* and *Aeq* are matrices, $c(x)$ and $ceq(x)$ are functions that return vectors, and $f(x)$ is a function that returns a scalar. $f(x)$, $c(x)$, and $ceq(x)$ can be nonlinear functions.
- *x*, *lb*, and *ub* can be passed as vectors or matrices.

Mainly, the Optimization Toolbox™ solvers accept vectors for many arguments (*x*0 as initial point, lower bounds *lb*, and upper bounds *ub*) and matrices, where the matrix is an array of any size. Solvers handle matrix arguments as follows:

- Internally, solvers convert matrix arguments into vectors before processing. For example, *x*0 becomes *x*0(:);
- For output, solvers reshape the solution, x, to the same size as the input, *x*0;
- When *x*0 is a matrix, solvers pass x as a matrix of the same size as *x*0 to both the objective function and to any nonlinear constraint function;
- Linear constraints, however, take *x* in vector form, *x*(:). In other words, a linear constraint of the form:

  *A*x* $\leq$ *b or Aeq*x = beq*, takes *x* as a vector, not a matrix (MathWorks Inc. 2021).

Thus, recalling Equation (4), the appropriate syntax for the risk-parity optimisation problem's solution is as follows:

$$X = fmincon\ (fun, x0, A, b, Aeq, beq, lb, ub) \tag{7}$$

which defines a set of lower and upper bounds on the design variables in *x*, so that the solution is always in the range $lb \leq x \leq ub$ (Giuzio 2017; Mussafi and Ismail 2021). By default, the *fmincon* function solves the interior-point algorithm approach to constrained minimisation problems. Following, the RP optimisation problem is solved by computing MATLAB *fmincon*. First, Function (1) was designed to solve the optimisation problem in Equation (4). Function (1) represents the MATLAB function computed to solve the optimisation problem showed in Equation (4):

fun = @ {(EW_Shares) *Aeq* * (((*VarCovar* (:,:,*i*) * (EW_Shares)/(*sqrt* ((EW_Shares') * *VarCovar* (:,:,1) * EW_Shares))). * EW_Shares − (*sqrt* ((EW_Shares') * *VarCovar* (:,:,1) * EW_Shares))/*nc*).^2}

where *VarCovar* is the variance–covariance matrix, and *nc* is the number of the asset classes composing the portfolio. Second, the fmincon was applied to Function (1) to solve the optimisation problem, writing a string to find the RP portfolio weights. (To improve the computing, we set the optimisation algorithm, changing the termination tolerance of the function value (set as 1×10^{-6}) and setting the maximum number of function evaluations, a positive integer, as 500,000.)

RPShares (:,*i*) = *fmincon* (*fun*, EW_Shares, [ ], [ ], *Aeq*, *beq*, *lb*, *ub*, [ ], *options*)

Finally, to improve the optimisation problem's solution, we set the maximum function evaluations to 500,000 and set the optimality tolerance to 1×10^{-6}.

2.3. *Data and Sample Selection*

As previously mentioned, the sample selection was designed following the GMA and the AW strategy to identify an asset allocation that may perform across all different economic macroscenarios. Notably, since major global indexes are quoted in USD, we also considered the geographical and currency exposure suitable for European-based investors, adding a EUR (Euro)-based bond component. Thus, following Figure 1 and Table 1, the asset allocation was designed while assuming the equal probability that each of the four scenarios occurs over time (25% of the investor's risk premium). However, to facilitate the operation of the risk-parity model, we chose not to consider both assets affected by too much and too little volatility, respectively, as commodities and cash. Thus, each asset class is included in the portfolio designed, considering its specific role to react differently when the economic environment varies. Considering the possibility for investors to use index-tracking instruments, the conventional asset allocation includes 10 indexes with 506 weekly observations (505 weekly returns) from 29 April 2011 to 31 December 2020 (9.7 years), extracted from Reuters Refinitiv Eikon. According to the strategy, the data span covers different macroeconomic cycles, including crisis and postcrisis periods, deflation, and economic growth, including COVID-19 pandemic market shock. Figure 2 summarises different global business cycles corresponding to the different levels of inflation and annual GDP growth. For the second stage of the analysis, we added four stock indexes to the *Combined Portfolio* corresponding to the Shariah-compliant counterparts previously selected. A Bloomberg Terminal was used to extract Shariah stock index time series. Table 2 summarises each macroasset class and the corresponding index selected for the asset allocation.

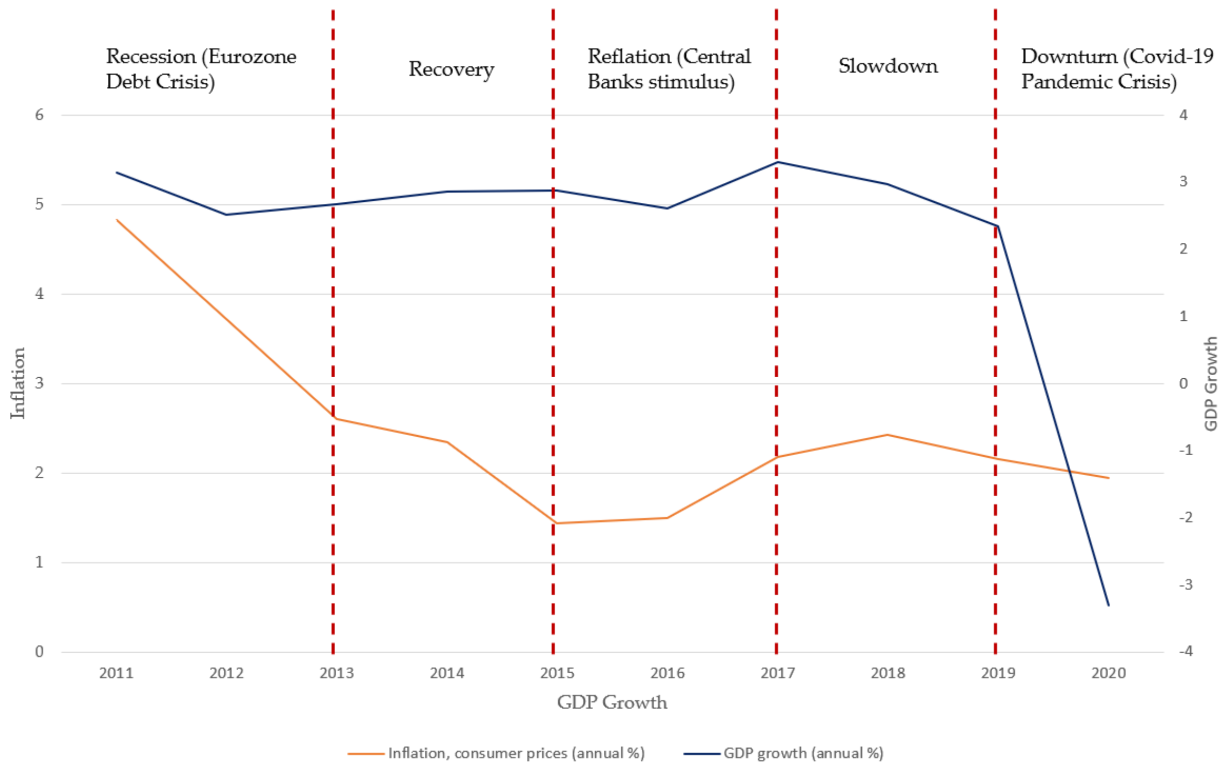

Figure 2. Business cycles in 2011–2020. Source: authors' elaboration based on World Bank Data. Notes: The inflation and GDP growth world data are year-on-year. The red dotted lines delimit the end of the business cycle.

Table 2. Sample composition.

Macroasset Class	**Index**	**Code**
Equities	S&P 500 Index—CBOE	SP500
	MSCI World Price Index USD	MSCIW
	MSCI Emerging Markets Price Index USD	MSCIEM
	MSCI AC Asia-Pacific Price Index USD	MSCIAP
Islamic Equities	S&P 500 Shariah Index	SPS500
	MSCI World Islamic Index	MSCIWI
	MSCI Emerging Market Islamic Index	MSCIEMI
	MSCI AC Asia-Pacific Islamic Index	MSCIAPI
Short Term Nominal Bonds	ICE BofA US 1–3-Year US Treasury Index	USTREAS
All-Maturity Nominal Bonds		
Government Bonds	Markit IBoxx EUR Eurozone Index	EUROGOV
Corporate Bonds	IBoxx EUR Corporate Index	EUROCORP
Inflation-Linked Bonds	IBoxx Euro Inflation-Linked Index	EUROIL
Convertible Bonds	Refinitiv Qualified Global Convertible Index	CONVBOND
Gold	COMEX Gold Composite Commodity Future Continuation 1	GOLD

Source: authors' compilation.

3. Empirical Results

3.1. Descriptive Statistics and Correlation

Table 3 summarises the descriptive statistics of the weekly asset returns. The correlations between the asset returns (Table 4) confirm the financial trend of recent years: for more than 20 years, stocks and bonds were negatively correlated, and precious metals, such as gold, played the role of a safe-haven asset, being negatively correlated with stocks and neutral to bonds. After the GFC and the sovereign debt crisis in Europe, the global central banks began to launch accommodative monetary policies to stimulate the global economy and achieve long-term economic growth. However, according to the literature in this field, the negative stock–bond correlation seems to be related to low and stable risk-free interest rates and inflation, and the comovement between economic growth and rates, equity risk premiums and bond risk premiums. Changes in macroeconomic conditions may modify the stock–bond correlation from negative/neutral to positive, as occurred after the second wave of COVID-19 when inflation and interest rate growth expectations began to develop (Anderson et al. 2012; Shen and Weisberger 2021; Yang et al. 2009).

Similarly, precious metals such as gold have always been considered by investors as safe-haven assets, since they are not correlated with stocks and bonds, contributing to portfolio-diversification benefits and the downside risk reduction (Baur and Lucey 2010; Baur and McDermott 2010; Reboredo 2013). During market distress and recession, investors tend to move to safe-haven assets such as gold and cash (as the US dollar). As for the stock and bond market, gold evaluation has also changed fundamentals. While economic stimulus measures in recent years have supported economic growth, regional and global economic and political issues have retained the background of a climate of uncertainty, which explains the lack of correlation with other assets.

Table 3. Descriptive statistics of asset returns.

	Mean (%)	Std. Dev. (%)	Kurt	Skew	Sharpe	Min	Max	JB (*p*-Value) (%)	Weekly Returns	Weekly Obs.
SP500	12.51	16.39	7.87	−0.74	0.76	−0.15	0.12	0.00	505	506
MSCIW	8.45	16.07	7.23	−0.70	0.53	−0.12	0.11	0.00	505	506
MSCIEM	2.41	18.15	3.06	−0.39	0.13	−0.12	0.10	0.00	505	506
MSCIAP	5.03	15.43	4.49	−0.42	0.33	−0.13	0.09	0.00	505	506
CONVBOND	8.24	9.23	7.38	−0.97	0.89	−0.09	0.06	0.00	505	506
USTREAS	1.31	0.81	12.06	1.85	1.61	0.00	0.01	0.00	505	506
EUROIL	3.87	5.77	18.22	0.47	0.67	−0.05	0.07	0.00	505	506
EUROGOV	4.98	4.17	9.43	−0.70	1.19	−0.04	0.04	0.00	505	506
GOLD	3.67	16.07	1.58	−0.04	0.23	−0.09	0.09	0.00	505	506
EUROCORP	3.97	3.17	16.62	−2.04	1.25	−0.03	0.02	0.00	505	506
MSCIWI	5.53	16.05	7.32	−0.87	0.34	−0.15	0.11	0.00	505	506
SPS500	13.29	16.28	7.12	−0.77	0.82	−0.15	0.11	0.00	505	506
MSCIEMI	1.18	18.37	2.84	−0.38	0.06	−0.12	0.11	0.00	505	506
MSCIAPI	4.69	15.59	4.32	−0.50	0.30	−0.13	0.09	0.00	505	506

Notes: This table provides sample moments, Sharpe ratios, and minimum and maximum statistics of all asset classes used in the asset allocation. The evaluation period covered 506 weeks, from 29 April 2011 to 31 December 2020 (505 weekly returns). "*Mean*" denotes annualised time-series mean of weekly returns, while "*Std.Dev.*" is the associated annualised standards deviation. "*Skew*" and "*Kurt*" represent the third and fourth moments, respectively, of the return distribution. "*Sharpe*" denotes the annualised Sharpe ratios of the respective asset classes, considering 0.125% as risk-free according to EU zero interest rates policy in recent years. "*JB* (*p*-value)" is the *p*-value of the Jarque–Bera statistic for testing the normality of returns.

Table 4. Correlation matrix of asset returns (April 2011–December 2020).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
SP500	1.00													
MSCIW	0.97 **	1.00												
MSCIEM	0.70 **	0.79 **	1.00											
MSCIAP	0.73 **	0.84 **	0.91 **	1.00										
CONVBOND	0.15 **	0.17 **	0.23	0.24	1.00									
USTREAS	−0.08	−0.11 *	−0.12 **	−0.16 **	−0.22	1.00								
EUROIL	0.09	0.09 *	0.06	0.09	0.38 **	0.02	1.00							
EUROGOV	0.09 *	0.07	0.02	0.02	0.09	0.28	0.76 **	1.00						
GOLD	0.01	−0.03	−0.02	−0.07	0.18	0.33	0.13 **	0.17 **	1.00					
EURCORP	0.03	−0.01	0.03 *	0.00	0.37 **	0.06	0.51 **	0.52 **	0.21	1.00				
MSCIWI	0.93 **	0.98	0.80 **	0.83 **	0.15 **	−0.10 *	0.08	0.07	−0.03	−0.02	1.00			
SPS500	0.99	0.95 **	0.70 **	0.72 **	0.15 **	−0.05	0.09 *	0.11 *	0.03 *	0.0 *	0.92 **	1.00		
MSCIEMI	0.70 **	0.78 **	0.98	0.89 **	0.22	−0.10 *	0.05	0.01	−0.01	0.04 *	0.80 **	0.70 **	1.00	
MSCIAPI	0.73 **	0.83 **	0.90 **	0.98	0.24	−0.15 **	0.09	0.03	−0.07	0.01	0.84 **	0.72 **	0.90 **	1.00

Notes: This table provides the correlation matrix for all asset classes used in asset allocation from 29 April 2011 to 31 December 2020. * and ** indicate values significantly different from 0 at the 1% and 5% level, respectively.

3.2. Conventional Portfolio ERC Optimisation

The portfolio optimisation process began by considering the Conventional Portfolios. As mentioned in previous paragraphs, the asset selection considered the AW and the GMA strategy, including equities, bonds, and gold, for a total of 10 asset classes. The first observation period considered all available data (506 weeks). We created a rolling time window with an in-sample period of 244 weeks (29 April 2011 to 31 December 2015) and an out-of-sample period of 262 weeks (1 January 2016 to 31 December 2020). As mentioned before, to implement the strategy objectively, we applied the ERC risk-parity model starting from an equally weighted (EW) portfolio, which was the function objective, comparable with the RP. The EW is an investors' basis asset allocation applied in MATLAB *fmincon* (Function (1)). To consider the weaknesses and benefits of the ERC approach, Table 5 and Figure 3 report and chart the most relevant statistics, risk-adjusted indicators, and the performance of the Conventional Portfolios in the first out-of-sample windows (w = 262).

The second observation period considered the last five years of available data, which, in frequencies, corresponded to 260 weekly data. The rolling window consisted of an in-sample period of 130 weeks (1 January 2016 to 15 June 2018) and an out-of-sample of 132 weeks (16 June 2018 to 31 December 2020). We reported different rolling windows to show the differences in ERC optimisation by varying the in-sample data, since the rolling window approach was very sensitive to input data changes (Zivot and Wang 2006). This rolling window focused on the effects of the slowdown and downturn macroeconomic scenarios that characterised the last five years.

The optimisation problem of ERC was solved by applying Function (1). As seen in Table 5 and Figure 4, we noted that, in the second out-of-sample window (w = 132), a smaller number of observations finely caught the asset class volatility, but neglected performance in the long term. According to the GMA, different asset classes (with specific diversification power) in the portfolio asset allocation protected the portfolio against any macroeconomic and market shocks. In addition, the RP asset allocation confirmed this trend by recording a low level of volatility and downside volatility, maintaining proper annualised returns and reducing the maximum drawdown (MDD) in both out-of-sample windows. Table 6 confirms that in both rolling windows, the ERC approach allocated only 23.14% to 34.68% and 11.97% to 35.28 of the total portfolio amount into higher volatility instruments, such as equity convertible bonds (which recorded a max of 12.67% and 12.96%). The MRCs in Table 7 confirmed this trend. Indeed, considering the period selected (characterised by a long period of economic growth, monetary stimulus, and low inflation), the asset allocation took risk benefits from the high component of nominal bonds, convertible bonds, and gold. These asset classes have been positively correlated for years and helped the portfolio's resilience during the pandemic shock of 2020, a good stress test for the model. The RP model tended to allocate a lower weight to high-volatility instruments (at the expense of stocks, which are the best return generator in the long term). In this context, the RP exploited the positive return of fixed-income and hybrid instruments as convertible bonds. In particular, convertible bonds were confirmed as an asset class halfway between stocks and bonds, setting up a good instrument that performed across different market conditions. The level of volatility was lower than equities and higher than bonds, generating lower exposition to the portfolio interest rate sensitivity and duration (Table 7). It represented the optimal asset class to be used in those models (as the RP) more responsive to the portfolio volatility, contributing to low downside risk and MDD. The combination of RP and GMA seemed to fit well with designing a portfolio *performing well across all environments.* We used a global balanced mutual fund as a benchmark to improve the readability and ensure that results were realistic.

Table 5. The performance of the Conventional Portfolios.

	In-Sample w = 244–Out-of-Sample w = 262			In-Sample w = 130–Out-of-Sample w = 132		
	EW	**RP**	**Benchmark Fund**	**EW**	**RP**	**Benchmark Fund**
Return (%)	8.61	6.32	4.26	9.06	4.62	6.93
Volatility (%)	7.34	4.49	4.98	8.88	4.04	9.06
Sharpe Ratio	1.17	1.41	0.86	1.02	1.14	1.11
Max Drawdown (%)	−15.22	−9.41	−9.91	−15.22	−6.70	−9.91
Calmar Ratio	0.57	0.67	0.43	0.59	0.69	0.70
Downside Risk	4.41	4.37	4.84	4.21	4.39	4.39
Sortino Ratio	1.95	1.45	0.85	2.15	1.05	1.58

Notes: This table summarises the portfolio out-of-sample performance. "*Return*" denotes the annualised time-series cumulative return, while "*Volatility*" shows the associated annualised standard deviation, and "*Sharpe Ratio*" represents the annualised Sharpe ratio to measure risk-adjusted performance. The "*Max Drawdown*" (MDD) is the maximum observed loss from a peak to a portfolio trough before a new peak is attained. The "*Calmar Ratio*" is a risk-adjusted indicator that considers MDD as a risk-adjusted risk indicator. Similarly, the "*Downside Risk*" was estimated, annualising the Lower Partial Moment of the time-series return to calculate the "*Sortino Ratio*" as another risk-adjusted indicator. "*Benchmark Fund*" is the Amundi Funds Global Multi-Asset Conservative E2 EUR (C), a global balanced mutual fund and winner of the Morningstar Fund Awards 2021. The cumulative return of the benchmark fund was calculated considering the weekly closing NAV. The ongoing charge of the fund (based on European UCITS IV) amounted to 1.40%. The benchmark fund was not added with a performance comparison purpose, but only to facilitate the reading of the results.

Table 6. Asset marginal weight contribution to the Conventional Portfolios.

	In-Sample w = 244–Out-of-Sample w = 262					In-Sample w = 130–Out-of-Sample w = 132				
	Min	**Max**	**Mean**	**Median**	**Variance**	**Min**	**Max**	**Mean**	**Median**	**Variance**
SP500	3.63%	6.21%	5.23%	5.49%	0.0055%	1.63%	6.12%	3.94%	4.60%	0.0253%
MSCIW	3.88%	5.74%	5.04%	5.14%	0.0024%	1.81%	6.03%	4.10%	4.72%	0.0234%
MSCIEM	3.91%	4.68%	4.32%	4.28%	0.0004%	2.31%	4.82%	3.83%	4.30%	0.0090%
MSCIAP	4.41%	5.38%	4.87%	4.86%	0.0003%	2.82%	5.35%	4.27%	4.73%	0.0083%
CONVBOND	7.30%	12.67%	10.89%	11.25%	0.0221%	3.40%	12.96%	8.79%	10.64%	0.1329%
High-Volatility Assets (Total)	23.14%	34.68%	30.36%	31.03%	0.0306%	11.97%	35.28%	24.94%	29.00%	0.1990%
USTREAS	13.25%	17.02%	14.17%	13.79%	0.0089%	12.78%	55.21%	25.73%	13.24%	3.4703%
EUROIL	12.41%	17.39%	14.92%	14.99%	0.0057%	6.12%	17.38%	13.25%	15.93%	0.2148%
EUROGOV	15.72%	18.83%	16.76%	16.56%	0.0074%	11.10%	18.35%	15.00%	16.02%	0.0517%
GOLD	7.07%	9.48%	7.66%	7.61%	0.0015%	4.40%	11.29%	7.13%	7.85%	0.0241%
EURCORP	14.97%	18.44%	16.13%	15.70%	0.0099%	10.55%	16.19%	13.93%	15.07%	0.0403%

Note: this table summarises the asset weight contribution to the total portfolio resulting after the optimisation process.

Table 7. Assets' marginal risk contributions (MRCs).

	In-Sample w = 244–Out-of-Sample w = 262					In-Sample w = 130–Out-of-Sample w = 132				
	Min	**Max**	**Mean**	**Median**	**Variance**	**Min**	**Max**	**Mean**	**Median**	**Variance**
SP500	0.94%	2.57%	1.44%	1.31%	0.0025%	0.95%	4.68%	2.40%	1.61%	0.0206%
MSCIW	1.02%	2.53%	1.49%	1.33%	0.0022%	0.98%	4.53%	2.31%	1.52%	0.0188%
MSCIEM	1.43%	2.60%	1.83%	1.73%	0.0013%	1.41%	4.11%	2.37%	1.73%	0.0107%
MSCIAP	1.19%	2.34%	1.56%	1.49%	0.0011%	1.19%	3.75%	2.14%	1.53%	0.0097%
CONVBOND	0.23%	0.77%	0.36%	0.29%	0.0003%	0.27%	1.42%	0.68%	0.39%	0.0022%
High-Volatility Assets (Total)	4.80%	10.81%	6.68%	6.15%	0.01%	4.80%	18.49%	9.90%	6.78%	0.0620%
USTREAS	−0.02%	0.02%	0.01%	0.01%	0.0000%	−0.05%	0.01%	−0.01%	0.00%	0.0000%
EUROIL	0.08%	0.36%	0.16%	0.13%	0.0001%	0.09%	0.68%	0.28%	0.14%	0.0006%
EUROGOV	0.10%	0.26%	0.14%	0.13%	0.0000%	0.05%	0.40%	0.19%	0.13%	0.0002%
GOLD	0.25%	0.78%	0.56%	0.54%	0.0001%	0.00%	0.86%	0.58%	0.54%	0.0002%
EURCORP	0.05%	0.20%	0.08%	0.06%	0.0000%	0.03%	0.35%	0.13%	0.05%	0.0002%

Note: this table summarises the assets' MRC to the total portfolio resulting after the optimisation process.

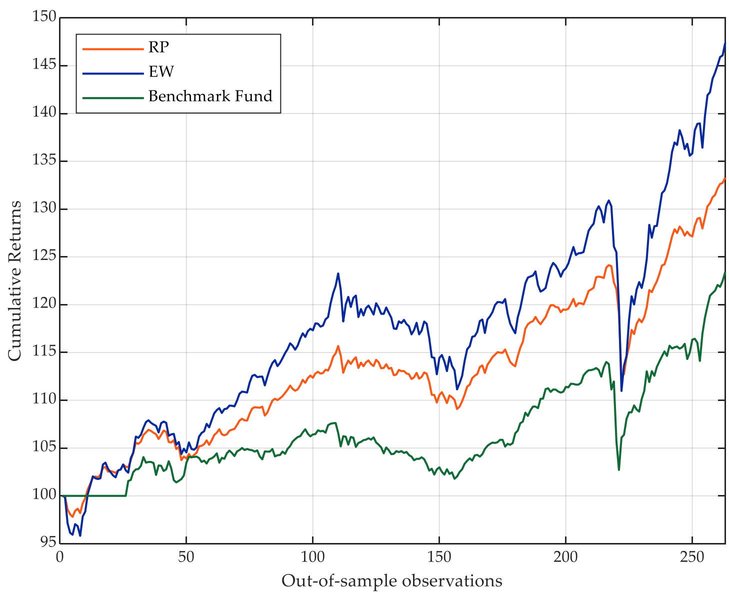

Figure 3. Conventional Portfolio returns (in-sample w = 244; out-of-sample w = 262). Note: to improve table clarity, returns were normalised on a scale of 100.

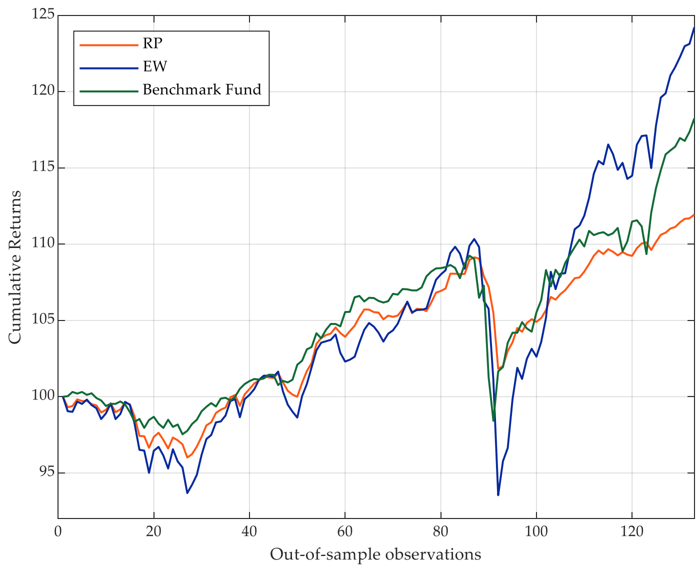

Figure 4. Conventional Portfolio returns (in-sample w = 130; out-of-sample w = 132). Notes to improve table clarity, returns were normalised on a scale of 100.

3.3. Combined Portfolio ERC Optimisation

In the second step, we focused on the *Combined Portfolios*. Following the aim to build and test the performance, diversification benefits, and decoupling effects, we added four Islamic stock indexes corresponding to the Shariah-compliant counterparts of equities components already in the portfolio (*SPS500*, *MSCIWI*, *MSCIEMI*, and *MSCIAPI*—Table 2) to the Conventional Portfolios. Then, the *Combined Portfolios* included 14 indexes. Again, the first observation period consisted of 506 weekly observations. The rolling time window relied on 244 weeks in-sample, and an out-of-sample period of 262 weeks. As previously described, we applied Function (1) used to solve the portfolio optimisation problem, reporting results and charting the cumulative out-of-sample returns into Table 8 and Figure 5. As expected, the performance of the *Combined Portfolios* was better than the conventional ones in both the EW and RP asset allocations due to the highest returns and volatility of the Islamic equities recorded in the period. Notably, the MDD and the Calmar Ratio recorded interesting results. First, regarding the Conventional Portfolios, the RP asset allocation confirmed that the ERC optimisation fundamentals reduced portfolio volatility (4.49% and 4.04%) and drawdown (−19.41 and −12.36). During periods of distress, the MRCs of high volatility assets were significant and larger than other asset classes, and generally, the RP model preferred low-volatility assets. Nevertheless, we noted that during these periods, the total weights of equities and convertible bonds amounted to 29.64–46.19% and 17.84–48.03%. Mainly, we highlighted that the minimum value of the first rolling window (w = 244) was similar to that recorded in the conventional portfolio optimisation (23.14%) (Tables 9 and 10).

Although the EW asset allocation maintained the best performance, the power of Islamic equities arose in the RP model. Investors who add Islamic equities to asset allocation could improve their portfolio risk-adjusted performance whilst maintaining moderate MDD levels. As for the Conventional Portfolios, we tested the ERC optimisation combining Islamic indexes considering 262 weekly observations to capture the differences in asset allocations considering shorter time series. As previously described, the rolling window consisted of an in-sample period of 130 weeks (out-of-sample of 132 weeks) and the ERC optimisation problem. Table 8 and Figure 6 report the results of the second period of observation. The addition of Islamic equities into asset allocations seemed to benefit the global portfolio performance positively. Finally, the *Combined Portfolios* continued to show healthy returns in risk-adjusted performance, despite slightly high volatility associated with the more significant presence of equities, especially Islamic equities. Necessarily, more equities increased the various MRCs, but during high periods of volatility (as in the March 2020 crash). Thus, the *Combined Portfolios* alternative, following a GMA and the RP, seemed to fit well with the need to design asset allocations that were also suitable for risk-averse investors and to perform well across all environments.

Table 8. The performance of the Combined Portfolios.

	In-Sample w = 244–Out-of-Sample w = 262			In-Sample w = 130–Out-of-Sample w = 132		
	EW	**RP**	**Benchmark Fund**	**EW**	**RP**	**Benchmark Fund**
Return (%)	9.58	6.96	6.93	9.26	4.66	6.93
Volatility (%)	9.70	5.60	9.06	11.73	5.17	6.24
Sharpe Ratio	0.99	1.24	1.11	0.79	0.90	1.11
Max Drawdown (%)	−19.41	−12.36	−9.91	−19.41	−9.27	−9.91
Calmar Ratio	0.49	0.56	0.70	0.48	0.50	0.70
Downside Risk	4.57	4.34	4.39	4.53	4.35	4.39
Sortino Ratio	2.10	1.60	1.58	2.05	1.07	1.58

Note: see notes in Table 6.

Table 9. Asset marginal weight contribution to the Combined Portfolios.

	In-Sample w = 244–Out-of-Sample w = 262					In-Sample w = 130–Out-of-Sample w = 132				
	Min	**Max**	**Mean**	**Median**	**Variance**	**Min**	**Max**	**Mean**	**Median**	**Variance**
SP500	3.03%	4.58%	3.62%	3.45%	0.0020%	1.40%	4.95%	2.67%	2.77%	0.0083%
MSCIW	2.89%	4.29%	3.44%	3.28%	0.0019%	1.52%	4.92%	2.81%	3.01%	0.0072%
MSCIEM	2.38%	3.62%	2.99%	2.80%	0.0014%	2.02%	3.68%	2.70%	2.80%	0.0016%
MSCIAP	2.81%	4.17%	3.48%	3.32%	0.0017%	2.32%	4.10%	2.97%	3.05%	0.0017%
CONVBOND	7.51%	12.85%	10.54%	10.90%	0.0230%	3.43%	13.08%	8.06%	8.81%	0.1023%
MSCIWI	2.88%	4.26%	3.45%	3.34%	0.0019%	1.64%	4.82%	2.80%	2.84%	0.0061%
SPS500	2.92%	4.56%	3.62%	3.46%	0.0023%	1.43%	4.89%	2.62%	2.78%	0.0072%
MSCIEMI	2.39%	3.60%	2.96%	2.70%	0.0019%	1.94%	3.60%	2.53%	2.54%	0.0014%
MSCIAPI	2.84%	4.25%	3.47%	3.32%	0.0016%	2.14%	3.99%	2.73%	2.73%	0.0016%
High-Volatility Assets (Total)	29.64%	46.19%	37.57%	36.57%	0.0377%	17.84%	48.03%	29.88%	31.32%	0.1375%
USTREAS	9.44%	14.09%	12.19%	12.80%	0.0184%	9.89%	45.52%	21.91%	12.97%	2.0204%
EUROIL	12.08%	15.64%	14.05%	14.15%	0.0098%	6.25%	16.68%	12.69%	14.90%	0.1775%
EUROGOV	12.10%	16.50%	14.75%	15.18%	0.0186%	11.87%	17.14%	14.89%	15.00%	0.0224%
GOLD	5.90%	10.98%	7.55%	6.71%	0.0165%	5.68%	14.63%	6.93%	6.76%	0.0138%
EURCORP	10.85%	16.09%	13.89%	14.55%	0.0229%	11.08%	16.33%	13.69%	13.98%	0.0203%

Note: see notes in Table 6.

Table 10. Assets' marginal risk contributions (MRCs).

	In-Sample w = 244–Out-of-Sample w = 262					In-Sample w = 130–Out-of-Sample w = 132				
	Min	**Max**	**Mean**	**Median**	**Variance**	**Min**	**Max**	**Mean**	**Median**	**Variance**
SP500	0.97%	2.63%	1.49%	1.37%	0.0026%	0.98%	4.86%	2.50%	1.71%	0.0220%
MSCIW	1.07%	2.62%	1.56%	1.39%	0.0023%	1.03%	4.75%	2.44%	1.63%	0.0205%
MSCIEM	1.51%	2.70%	1.92%	1.82%	0.0013%	1.52%	4.27%	2.51%	1.87%	0.0110%
MSCIAP	1.24%	2.45%	1.63%	1.55%	0.0013%	1.26%	3.96%	2.27%	1.63%	0.0108%
CONVBOND	0.17%	0.64%	0.28%	0.23%	0.0002%	0.19%	1.23%	0.56%	0.33%	0.0015%
MSCIWI	1.08%	2.56%	1.56%	1.41%	0.0021%	1.05%	4.61%	2.41%	1.66%	0.0186%
SPS500	1.00%	2.59%	1.51%	1.40%	0.0024%	1.02%	4.76%	2.51%	1.77%	0.0201%
MSCIEMI	1.49%	2.73%	1.93%	1.85%	0.0014%	1.52%	4.36%	2.59%	1.98%	0.0113%
MSCIAPI	1.18%	2.51%	1.62%	1.57%	0.0016%	1.29%	4.15%	2.39%	1.75%	0.0118%
High-Volatility Assets (Total)	9.73%	21.43%	13.49%	12.57%	0.0152%	9.87%	36.97%	20.17%	14.31%	0.1277%
USTREAS	−0.02%	0.01%	0.00%	0.01%	0.0000%	−0.06%	0.01%	−0.02%	0.00%	0.0000%
EUROIL	0.04%	0.28%	0.10%	0.07%	0.0001%	0.05%	0.54%	0.22%	0.09%	0.0004%
EUROGOV	0.05%	0.19%	0.10%	0.09%	0.0000%	0.01%	0.31%	0.14%	0.09%	0.0001%
GOLD	0.04%	0.47%	0.32%	0.31%	0.0000%	−0.21%	0.43%	0.32%	0.33%	0.0000%
EURCORP	0.05%	0.20%	0.08%	0.06%	0.0000%	0.03%	0.35%	0.13%	0.05%	0.0002%

Note: see notes in Table 7.

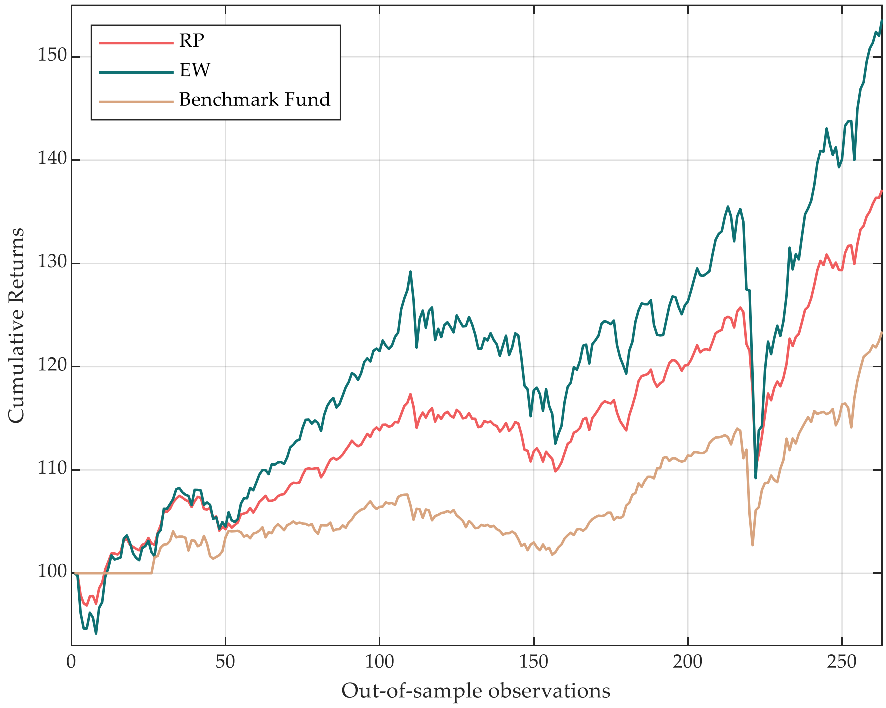

Figure 5. *Combined Portfolio* returns (in-sample w = 244; out-of-sample w = 262). Note: to improve table clarity, returns were normalised on a scale of 100.

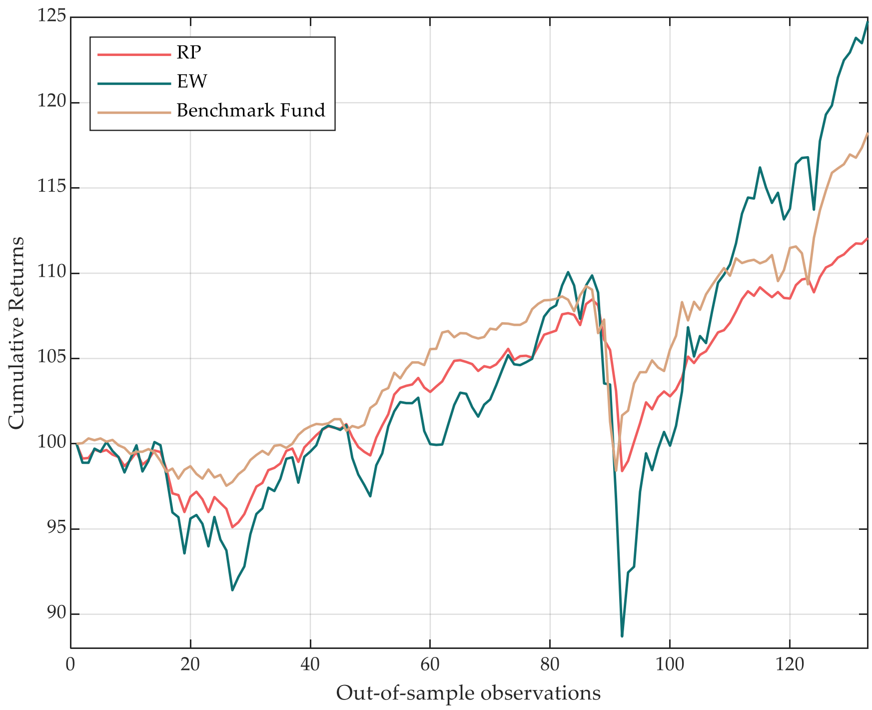

Figure 6. *Combined Portfolio* returns (in-sample w = 130; out-of-sample w = 132). Note: to improve table clarity, returns were normalised on a scale of 100.

4. Conclusions and Further Research

This study aimed to contribute to studies on portfolio-management and asset-allocation strategies, referring to the pursuit of safe-haven assets and to the need to design a portfolio *"based on a fundamental understanding of the environmental sensitivities inherent in the pricing structure of asset classes"*. The COVID-19 shock has increased the need to build portfolio strategies that fit all macroeconomic scenarios facing postcrisis economic and financial uncertainty, recalling the attention of global macrostrategies such as GMA. In this context, the COVID-19 shock has renewed the attention, on the one hand, on the diversification opportunities and potential hedging benefits offered by Islamic equities, and on the other hand, on the rejection of the hypothesis of the ISM from the conventional market, especially during high-volatility and uncertain periods. Although some scholars demonstrated that the Shariah screening process failed to provide immunity during a *short* crash affected by an internal demand shock, we decided to explore the possibility of combining the conventional and Shariah-compliant assets using the GMA strategy. The performances of the *Combined Portfolios* demonstrated the positive effects of combining the GMA strategy, the RP, and Islamic equities. The results also showed that these kinds of portfolios may be appropriate for risk-averse investors who are not interested in beating the market, but in rising stable returns with low volatility, minimising the downside risk and the maximum portfolio drawdown. The RP approach can also be adapted to more risk-taker investors using the leverage to maximise the return. Finally, global macrostrategies such as GMA recorded fewer returns than other, more aggressive strategies, especially in short periods. In these strategies, which considered that asset returns were mainly affected by macroeconomic and stress factors, asset allocation seemed immune to the short market crash. The *Combined Portfolios* represented a different choice in this context, especially for risk-averse and risk-inclined investors (such as young investors). Further research in the portfolio-management industry could continue, separately and together with the behaviour and performance of this kind of strategy and the *Combined Portfolios*, to study single patterns with quantitative methods. Keeping in mind that it is impossible to forecast the next economic or financial shock, it might be better to include each specific asset class with a precise role to allow portfolios to perform across different seasons (macroeconomic scenarios).

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