

Article

Sector Portfolio Performance Comparison between Islamic and Conventional Stock Markets

María de la O González , Francisco Jareño *  and Camalea El Haddouti

Department of Economics and Finance, University of Castilla-La Mancha, Faculty of Economic and Business Sciences, Plaza de la Universidad, 1, 02071 Albacete, Spain

* Correspondence: Francisco.Jareno@uclm.es; Tel.: +34-96-759-9200; Fax: +34-96-759-9216

Received: 25 July 2019; Accepted: 22 August 2019; Published: 25 August 2019



Abstract: This study compares the performance of sector portfolios from Islamic and conventional stock markets, using standard as well as current performance measures for a recent sample period between January 1996 and December 2015. Furthermore, to test the robustness of our analysis and to determine which type of portfolios offer better performance depending on the economic cycle, the full sample period is divided into three sub-sample periods: Before, during and after the recent global financial crisis. The three main outcomes of this research confirm that, first, the sector with the best performance results is Health Care, while the sector with the worst performance results is Financials for the Islamic as well as the conventional stock market. Second, the post-crisis sub-period exhibits the best performance not only in conventional but also in Islamic markets, confirming that portfolio performance depends on the economic stage and highlighting emerging signs of economic recovery. Third, Islamic sector portfolios, as a whole, show better performance than conventional sector portfolios for all performance measures—not just for the full period but also for the three sub-sample periods. The superior risk-adjusted returns of the Islamic sector portfolios, even during the recent global financial crisis, can be justified, among other reasons, by the moderated uncertainty and speculation, as well as the fact that Islamic finance prevents interest rates that have a negative impact on the economy. Thus, *Sharia*-compliant assets can contribute to improving the sustainability of unattractive performance portfolios during financial crises.

Keywords: Islamic sector portfolios; conventional sector portfolios; Islamic and conventional stock markets; performance measures

JEL Classification: G11; G15; G21; O57

1. Introduction and Literature Review

There is a huge amount of research that focuses on Islamic portfolios, aimed mainly at *Sharia*-compliant investors related to finance limitations [1]. Thus, recent papers compare Islamic and conventional indices to analyze the peculiarities of the Islamic indices. For example, reference [2] compared nine Islamic and conventional indices and found that the Islamic indices showed a better performance than the conventional indices during the last financial crisis period. In this line, reference [3] examined twelve Islamic and conventional stock markets and they found that the efficiency of the Islamic stock markets is higher than the conventional stock markets due to their peculiarities and *Sharia*-compliant laws, among other reasons. Furthermore, other studies show the advantages of portfolio diversification in Islamic stocks and the desirability of using Islamic finance instruments for hedging, as safe havens. One such example is the study by [4], who researched the connectedness between stocks from Islamic and conventional markets in five countries. Accordingly, reference [5] found that Islamic as well as conventional indices emulate an analogous cyclical pattern

and, additionally, Islamic equities provide portfolio diversification benefits because of their reduced systematic risk.

Moreover, some other papers found different performances in the short, medium and long term. Thus, for instance, [6] found higher efficiency in Islamic stocks in comparison with conventional stocks in the medium term but a lower efficiency in the short term. Furthermore, these outcomes imply that Islamic portfolios reduce the financial risk in investments and allow for diversification and hedging. Similarly, [7] compared ten sectoral Islamic and conventional indices. They found that Islamic sectoral indices usually show higher efficiency than conventional ones in the last ten years. Furthermore, both indices present an analogous efficiency in the shorter horizon. Finally, [8] found that Islamic stocks are more attractive for risk-seeker investors and, contrarily, conventional stocks are more suitable for risk-averters.

On the other hand, another branch of papers is focused on dynamic interdependencies among conventional and Islamic portfolios. Thus, [9] analyzed the financial performance and the directional interdependence of Islamic and conventional stock indices. These authors found that there is an appreciable level of directional interdependence between both types of stock indices. Moreover, they highlighted that the *Sharia*-screened Islamic equity index is an efficient hedging instrument during economic meltdowns (in line with [5]). [10] examined the dynamic interdependence structure between conventional and Islamic stock markets, and conventional and *Sharia*-compliant bonds in Malaysia. They found that conventional markets transmit spillovers to Islamic markets. Furthermore, the *Sharia*-compliant bond market receives shocks from the rest of the markets. They add that some explanatory factors of those results might be economic meltdowns, legal issues and political uncertainties. In addition, [11] focused on uncertainty, comparing Islamic and socially responsible assets with conventional ones in the US. They found that all assets show the same level of uncertainty, although the recent global financial crisis and political and economic news increase uncertainty in both indices. Lastly, they confirmed that these outcomes would help to rebalance investor portfolios according to uncertainty. Finally, [12] explored the causality in the mean and variance for Islamic and conventional stock markets. The author affirms that the conventional stock market transmits spillovers to the Islamic stock market.

A recent and relevant research line about *Sharia*-compliant stocks uses standard performance measures, emphasizing the convenience of using these measures for comparing stock portfolios. Following this research line, [13] used monthly observations of both conventional and Islamic Dow Jones indices covering the US, emerging markets and some developed countries from January 1996 to April 2015 using classical performance measures, specifically, the Sharpe ratio. He concluded that *Sharia*-compliant stocks perform better in the short term, while conventional ones are better in the long term due to the coverage they offer. These outcomes are applicable for risk-averse as well as risk-tolerant investors. [14,15] used classical performance ratios such as the Sharpe, Treynor and Jensen measures and they showed that the Islamic indices outperformed the conventional ones in the recent global financial crisis. [2,16], among others, confirmed the same results. Specifically, [2] analyzed nine Islamic and conventional indices by applying stochastic dominance and they also confirmed a superior performance of Islamic indices in the recent financial crisis. Similarly, [17] used various risk-adjustment performance measures and they found that *Sharia*-compliant funds show a better risk–return tradeoff than the market (in line with [18]). Additionally, [19] measured the performance of twelve Islamic and conventional indices in extreme market conditions by implementing a recent methodology (logistic smooth transition model, LSTAR), and they showed the better performance of Islamic indices during economic meltdowns. So, much of the literature concludes that Islamic indices outperform conventional indices during financial crisis periods, although there is some other research that finds similar performance in Islamic and conventional portfolios according to different risk-adjusted return measurements (e.g., [20–22], among others).

Our paper aimed to study the performance of sector portfolios from the Islamic and conventional stock markets and to compare whether the conventional indices perform better or worse than the Islamic

indices depending on the economic cycle, contributing to the last branch of research. In particular, our empirical study analyses the behavior of conventional compared to Islamic sector portfolios to find the main differences between both stock markets using different performance measures of portfolio management. Specifically, this paper uses classical performance measures based on profitability and risk, that is, the capital asset pricing model (CAPM), such as the alpha ratio, the reward to volatility ratio, and the reward to variability ratio, developed by [23–25], respectively. Moreover, this paper proposes the inclusion of the Sortino ratio [26] and the Conditional Sharpe ratio as modifications of the Sharpe's ratio to solve some of its drawbacks. Furthermore, this research also includes the Omega ratio [27], because it takes into account the four moments of the probability distribution function (mean, variance, skewness and kurtosis) instead of only the first and the second moments (mean and variance), like the five previous measures do. Finally, for robustness, the manipulation proof performance measure (MPPM) developed by [28] is also analyzed to dynamically measure the conventional and Islamic sector portfolio's premium return for a relative risk aversion. The MPPM is the most recent and reliable performance measure for avoiding the possibility of manipulation from portfolio managers. Furthermore, this measure also takes into account all the aforementioned statistical moments of the distribution.

A second robustness test is proposed, dividing the full period into three sub-sample periods to study potential impacts on performance measures of some notable financial and economic episodes, such as the credit crunch of 2007. Thus, we distinguish the following sub-periods: (1) The pre-crisis sub-period—before the US subprime mortgage market crisis (January 1996–June 2007), (2) the financial crisis sub-period (July 2007–December 2010), and, finally, (3) the post-crisis sub-period (January 2011–December 2015).

Therefore, our paper will contribute to previous literature comparing conventional and Islamic sector portfolios using standard ratios (the Jensen, Treynor, Sharpe, Sortino and Conditional Sharpe ratios) as well as current performance measures like the Omega ratio and the MPPM [29,30]. Moreover, this paper confirms that the stage of the economy may be a crucial factor to analyze the performance of sector portfolios. So, the whole sample period is divided into three different sub-sample periods of analysis—pre-crisis, crisis and post-crisis—to identify the best performance portfolios according to the economic trend.

It is mainly interesting to note that this research will contribute to the sustainable development in the context of portfolio management by investigating the impact of the recent global financial crisis [31] as well as by diversifying investments in Islamic stocks. Specifically, this study performs a comparison of the potential different performances of conventional and Islamic stocks. So, this paper analyses the possibility for portfolio managers to include *Sharia*-compliant assets in portfolios to diversify them and to reduce their systematic risk, primarily in certain economic meltdowns. Therefore, Islamic stocks can be used as hedging assets to improve the sustainability of unattractive investments.

Thus, the main results of our study show that Islamic sector portfolios, as a whole, outperform conventional sector portfolios for all performance measures and periods. Furthermore, the post-crisis sub-period exhibits the best performance for both conventional and Islamic stock markets, showing that sector portfolio performance depends on the stage of the economy and reflecting emerging signs of economic recovery. Finally, Health Care is the best performing sector and Financials is the worst performing sector—not only in conventional but also in Islamic stock markets.

The rest of this paper is structured as follows. Section 2 describes the most important principles of Islamic Finance. Section 3 explains the data and the performance measures used in this paper. Section 4 shows the main results of this research and, finally, Section 5 summarizes the concluding remarks of this study.

2. Islamic Banking: Principles

Islamic banking stemmed from the need for the banking system to serve the increasingly large group of Muslim clients who wanted to obtain financing for their economic activities (agriculture,

manufacturing, and mining, among others) without having to break the principles established by Islam, and, so be faithful to their religious beliefs. In this way, believers can reconcile the religious and financial spheres.

Islamic banking is based on *Sharia*, which is the Islamic law that regulates human behavior. The *Sharia* is formed on the one hand by the Koran and by the *Sunnah* which contains the sayings and actions of the Prophet Muhammad. On the other hand, we find *fiqh* or Islamic jurisprudence that encompasses *Ijmaa*, which refers to the agreements reached by a group of Muslim scholars about a specific matter based on the Koran and the *Sunnah*, and *Qiyas*, or deductive reasoning from the Koran and *Hadith*.

Thus, the first Islamic bank emerged in Egypt in 1963: Mit Ghamr's savings bank. Its main function was to channel the savings of the rural population and to invest in commerce or industry, under the principle of the distribution of profits and losses. Therefore, the savings bank was a first attempt to formalize the bank according to Islamic principles. However, it soon had to close its doors to the public, mainly due to the scarcity of financial resources.

Since then, Islamic finance has undergone a great development due to the enormous impetus that the economy exported oil in the Middle East. Therefore, the need arose to mark the common guidelines to be followed by Islamic banks.

With the establishment of Islamic institutions that regulate banking activity, numerous Islamic banks have appeared in different countries. The main drawback for the Islamic financial system is a non-homogeneous legislation due to the different interpretations that each *Sharia* scholar makes. Once this problem is solved, Islamic banking may show greater transparency and more homogenous financial management, which would attract investors.

The principles governing Islamic banking are as follows:

- The prohibition of interest or utilization: The interest rate or *Riba* is considered the key factor of Islamic finance and is defined as the price of money at a certain point in time, which would be a benefit for the lender.
- *Gharar* and *maysir* prohibition: The concept *gharar* refers to the realization of contracts in which excessive risks are taken, due to asymmetric information between parties and the assumption of high uncertainty. On the other hand, we have the *maysir* concept that refers to speculation and gambling—that is, to those activities that allow us to make profits without making any fruitful efforts (short sale of shares, derivatives, and lottery between others) [32].
- The distribution of losses and benefits: With the aim of equality between the lender and borrower.
- *Zakat*: The *azaque* or *zakat* is the third of the five pillars of Islam. It literally translates to “increase” or “purify”, and it is an economic obligation that Muslims have to help the poor or fund charities.
- The prohibition of economic activities that are *haram*: Islam establishes a ban on financing *haram* or illicit activities such as pornography and gambling, as well as those related to alcohol, tobacco, drugs, weapons, and food products derived from pork.

Islamic banking is expected to adapt to new demands with the creation of new financial instruments that will meet the needs of both investors and Muslim savers anywhere in the world.

These peculiarities of the Islamic stock market show relevant differences between the performance measures of Islamic and conventional stock markets and, also, depending on the stage of the economy.

3. Data and Performance

3.1. Data

The Dow Jones Islamic Stock Market Index (DJIM), which was created to meet the investment needs of the Muslim population, is used in this paper because it does not include companies whose activities are *haram* (illicit) or companies that apply interest rates. Therefore, this index measures the profitability of stocks that comply with the *Sharia* and collects more than 12,000 companies from

77 different countries. In addition, the Dow Jones Global (conventional) Stock Market Index (DJGM or DJCM) has been used to make comparisons with the Islamic stock market.

Other data used are the Islamic and conventional sector equity indices related to DJIM and DJGM (DJCM), respectively. This will allow us to appreciate differences between both stock markets. The analyzed sectors—extracted from the Industry Classification Benchmark (ICB) (Table 1)—are Basic Materials (BM), Consumer Goods (CG), Consumer Services (CS), Oil and Gas (OG), Financials (FIN), Health Care (HC), Industrials (I), Technology (TEC), Telecommunications (TEL) and Utilities (UT) (Dow Jones and Financial Times Stock Exchange (FTSE) proposed the Industry Classification Benchmark (ICB) (Table 1) in 2005).

Table 1. Sectors, according to the Industry Classification Benchmark (ICB) classification.

Code	Sector
BM	BASIC MATERIALS
CG	CONSUMER GOODS
CS	CONSUMER SERVICES
OG	OIL AND GAS
FIN	FINANCIALS
HC	HEALTH CARE
I	INDUSTRIALS
TEC	TECHNOLOGY
TEL	TELECOMMUNICATIONS
UT	UTILITIES

Source: Compiled by authors from ICB.

All stock indexes have been downloaded from Thomson Reuters DataStream and data on US Treasury bond yields with a maturity of three months have been extracted from the website of the Federal Reserve Bank of St. Louis.

The sample period selected for this study is from January 1996 to December 2015, with a weekly frequency (every Friday), in line with [33–36], among others. All data are expressed in US dollars to prevent data being affected by the exchange rate. In addition, we use weekly instead of daily or monthly data, because weekly data are less contaminated by noise and trading bias, as well as the fact that this frequency offers a number of observations large enough to obtain more consistent results [36].

Thus, Table 2 collects the main descriptive statistics, and stationarity and unit root tests. The mean weekly returns of the Islamic and global indices (DJIM and DJGM or DJCM) are quite similar, close to zero but positive. In addition, Islamic sector portfolios show a higher standard deviation than their conventional counterparts. Most sector portfolio returns exhibit negative asymmetry and excess kurtosis (As suggested by a referee, the kurtosis values of Islamic and conventional sector portfolio returns are very high, so this may undermine the whole analysis. Thus, a simple visual inspection allows us to detect and remove potential outliers). The Jarque–Bera statistic rejects the null hypothesis of a normal distribution for all series at the 1% level. Standard stationarity and unit root tests show that all series of Islamic and conventional sector portfolio returns are stationary.

After analyzing the main descriptive statistics of the returns obtained by Islamic and conventional sector portfolios over the period analyzed, the behavior of both sector portfolios might be different.

Table 2. Main descriptive statistics of Islamic and conventional sector portfolio returns.

Sector Portfolio Returns	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	JB Stat.	ADF Stat.	PP Stat.	KPSS Stat.
DJIM index	0.0011	0.0035	0.1076	−0.2121	0.0246	−0.9950 ***	10.4872 ***	2608.3 ***	−33.245 ***	−33.233 ***	0.1122
Islamic Basic Materials	0.0008	0.0031	0.1852	−0.2274	0.0334	−0.6294 ***	8.9561 ***	1610.6 ***	−32.625 ***	−32.656 ***	0.1061
Islamic Consumer Goods	0.0011	0.0025	0.0866	−0.1773	0.0195	−1.0084 ***	11.2922 ***	3165.0 ***	−32.111 ***	−32.120 ***	0.0582
Islamic Consumer Services	0.0017	0.0033	0.1143	−0.1602	0.0252	−0.6102 ***	7.3553 ***	889.1 ***	−32.775 ***	−32.772 ***	0.1327
Islamic Oil & Gas	0.0009	0.0026	0.1401	−0.2999	0.0328	−1.0172 ***	11.2150 ***	3112.7 ***	−34.826 ***	−34.872 ***	0.2029
Islamic Financials	0.0005	0.0019	0.1682	−0.2163	0.0335	−0.4140 ***	7.5213 ***	918.2 ***	−31.446 ***	−31.518 ***	0.0326
Islamic Health Care	0.0015	0.0019	0.0957	−0.2097	0.0223	−1.0539 ***	12.5492 ***	4155.9 ***	−35.508 ***	−35.670 ***	0.1775
Islamic Industrials	0.0010	0.0032	0.1222	−0.1815	0.0275	−0.7021 ***	7.5584 ***	988.7 ***	−31.952 ***	−32.038 ***	0.0514
Islamic Technology	0.0013	0.0032	0.1606	−0.2559	0.0372	−0.6485 ***	6.8442 ***	715.3 ***	−33.213 ***	−33.207 ***	0.1515
Islamic Telecommunications	0.0007	0.0024	0.1246	−0.1888	0.0260	−0.5095 ***	7.7364 ***	1020.0 ***	−32.455 ***	−32.477 ***	0.1930
Islamic Utilities	0.0002	0.0023	0.1135	−0.3137	0.0254	−2.2008 ***	27.5053 ***	26,939.0 ***	−33.464 ***	−33.538 ***	0.2090
DJCM index	0.0008	0.0029	0.1151	−0.2211	0.0239	−1.1158 ***	12.2095 ***	3902.4 ***	−32.602 ***	−32.615 ***	0.0541
Conventional Basic Materials	0.0005	0.0029	0.1584	−0.2349	0.0321	−0.7404 ***	9.3359 ***	1839.9 ***	−31.769 ***	−31.912 ***	0.0965
Conventional Consumer Goods	0.0011	0.0028	0.1014	−0.1806	0.0194	−1.1715 ***	12.5361 ***	4190.5 ***	−32.091 ***	−32.117 ***	0.0527
Conventional Consumer Services	0.0012	0.0030	0.1034	−0.2005	0.0233	−0.9201 ***	10.2772 ***	2448.6 ***	−32.231 ***	−32.248 ***	0.0848
Conventional Oil & Gas	0.0009	0.0030	0.1456	−0.3031	0.0325	−1.0856 ***	12.0716 ***	3781.2 ***	−34.345 ***	−34.330 ***	0.1965
Conventional Financials	0.0004	0.0022	0.1884	−0.2601	0.0299	−0.9494 ***	14.0898 ***	5501.4 ***	−32.462 ***	−32.482 ***	0.0682
Conventional Health Care	0.0015	0.0024	0.0933	−0.2121	0.0218	−1.1882 ***	13.6496 ***	5174.2 ***	−35.327 ***	−35.392 ***	0.1395
Conventional Industrials	0.0008	0.0030	0.1233	−0.1735	0.0261	−0.7472 ***	7.7983 ***	1097.6 ***	−31.550 ***	−31.645 ***	0.0414
Conventional Technology	0.0012	0.0032	0.1583	−0.2429	0.0359	−0.6331 ***	6.6441 ***	646.8 ***	−32.655 ***	−32.694 ***	0.1064
Conventional Telecommunications	0.0005	0.0023	0.1178	−0.2169	0.0253	−0.8476 ***	9.9721 ***	2237.4 ***	−32.204 ***	−32.284 ***	0.1204
Conventional Utilities	0.0004	0.0014	0.1026	−0.2537	0.0198	−2.2501 ***	30.3285 ***	33,336.8 ***	−32.698 ***	−32.696 ***	0.0925

Notes: This table shows the main descriptive statistics of weekly Islamic and conventional sector portfolio returns during the sample period: January 1996–December 2015. The statistics are mean, median, minimum (Min.) and maximum (Max.) values, standard deviation (Std. Dev.), Skewness and Kurtosis measures and the Jarque–Bera test for normality (JB). Finally, the last three columns present the results of the augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests and the Kwiatkowski et al. (KPSS) stationarity test. As usual, *** indicates statistical significance at the 1% levels.

3.2. Performance

In order to determine how Islamic and conventional sector portfolios have performed against the market index, diverse performance measures are proposed in this paper. Generally, the higher their risk-adjusted return, the better the sector portfolios will perform.

First, classical performance measures of sector portfolios are proposed. They are based on a two-dimensional analysis—profitability and risk measured with the standard deviation or the beta coefficient. So, all of them are based on the standard form of the CAPM.

Specifically, the first three standard performance measures used in this research are Jensen's alpha ratio, Treynor's reward to volatility ratio and Sharpe's reward to variability ratio:

The Jensen's alpha ratio measures the ability to achieve a higher return than expected based on the risk it supports [23]. This ratio indicates the breadth of the portfolio and it is based on the CAPM.

Mathematically:

$$J_p = E(r_p) - [r_f + \beta_p \cdot (E(r_m) - r_f)] \quad (1)$$

where $E(r_p)$ is the return of the selected portfolio/fund, r_f is the risk-free interest rate, $E(r_m)$ is the stock market return and β_p is the beta factor of the selected portfolio.

Treynor's reward to volatility ratio measures the excess return or the risk premium per unit of systematic risk (β) [24]. This ratio focuses on the depth of the portfolio and it is also based on the CAPM.

Mathematically:

$$T_p = [E(r_p) - r_f] / \beta_p \quad (2)$$

To interpret the result obtained, it is necessary to calculate the Treynor index of the market portfolio (T_m):

$$T_m = [E(r_m) - r_f] / \beta_m \quad (3)$$

where $E(r_m)$ is the expected market portfolio return and β_p is the beta factor of the market portfolio.

The Sharpe's reward to variability ratio measures the excess of returns per unit of the total risk assumed unlike Jensen's and Treynor's ratios that only take into account the systematic risk [25]. Therefore, this ratio takes into consideration both the breadth and the depth of the portfolio. Thus, the Sharpe index relies on the capital market line (CML) of the CAPM.

Mathematically:

$$S_p = [E(r_p) - r_f] / \sigma_p \quad (4)$$

where σ_p is the standard deviation of the selected portfolio/fund.

To interpret the result obtained, it is necessary to calculate the Sharpe ratio of the market portfolio (S_m):

$$S_m = [E(r_m) - r_f] / \sigma_m \quad (5)$$

where σ_m is the standard deviation of the market portfolio.

This paper also proposes the Sortino ratio as the fourth performance measure [26] to solve the following drawbacks of the Sharpe ratio: (1) Normally distributed returns and (2) no distinction between the upside risk and the downside risk, although rational investors are only afraid of the downside risk. Therefore, [26] only considered the downside risk, focusing their ratio on returns that fall below a specified required rate of return (called threshold).

The Sortino ratio measures the excess in returns per unit of risk, calculated by a dispersion measure of negative returns. This ratio modifies the Sharpe ratio since it only penalizes those returns that fall below the investor-specified required return that is the threshold return.

Mathematically:

$$SOR_p = [E(r_p) - \tau] / \sqrt{LPM(\tau)} \quad (6)$$

where τ is the minimum acceptable return (or minimum threshold) and LPM is the lower partial moment of the selected portfolio/fund. Specifically, the denominator, $\sqrt{LPM(\tau)}$, is the downside deviation-, which measures the downside risk of returns that fall below a minimum threshold, τ .

The higher the Sortino ratio, the better the management performed based on the assumed risk.

Additionally, this paper proposes the conditional Sharpe ratio as the fifth performance measure to solve another weak point of the Sharpe ratio: This ratio adopts standard deviation as a proxy of the latent variability; furthermore, the volatility is time varying [37,38]. Therefore, the conditional Sharpe ratio will show time variation according to the business cycle.

The conditional Sharpe ratio of a portfolio/fund, CS_t , is defined by [37] as the ratio of the conditional mean excess return to the conditional standard deviation of this return. These authors also show that this ratio can be written in terms of the volatility of the pricing kernel and the correlation between the pricing kernel and the return.

Mathematically:

$$CS_t \equiv E_t [r_{t+1} - r_{ft}] / \sigma_t [r_{t+1} - r_{ft}] = -r_{ft} \cdot \sigma_t [M_{t+1}] \cdot \text{corr}_t [M_{t+1} \cdot r_{t+1}] \quad (7)$$

where r_{ft} is the risk-free interest rate, σ_t is the standard deviation and corr_t is the correlation, conditional on information at time t , respectively, while r_{t+1} is the return of the selected portfolio/fund and M_{t+1} is the stochastic discount factor, or the pricing kernel, conditional on information at time $t+1$, respectively.

On the other hand, the conditional Sharpe ratio of the market portfolio is:

$$CS_{mt} \equiv E_t [r_{mt+1} - r_{ft}] / \sigma_t [r_{mt+1} - r_{ft}] = -r_{ft} \cdot \sigma_t [M_{t+1}] \cdot \text{corr}_t [M_{t+1} \cdot r_{mt+1}] \quad (8)$$

The conditional Sharpe ratio of the market portfolio is also proportional to the volatility of the pricing kernel and the correlation between the pricing kernel and the return on the market at time $t+1$, r_{mt+1} .

According to Equations (7) and (8), if this ratio varies considerably over time, it will be due to the variation in the conditional volatility or conditional correlation.

This research also proposes the Omega ratio as the sixth performance measure [27] because it takes into account the four statistical moments of the probability distribution function (mean, variance, skewness and kurtosis), solving the main drawback of all previous performance measures; that is, they only take into consideration the first and second moments of the distribution (mean and variance). So, this new ratio, Omega ratio, has been shown to be a trusty risk indicator.

The Omega ratio measures the relationship between the probability of making a profit and that of making a loss. This ratio can improve previous standard performance measures because all higher moments of the distribution are considered

Mathematically:

$$O_p = E[\text{Max}(E(r_p) - \tau, 0)] / E[\text{Max}(\tau - E(r_p), 0)] \quad (9)$$

where τ is the threshold of the expected return.

The higher the Omega ratio, the better the portfolio performance due to a higher probability of obtaining profits, and vice versa.

To properly test the robustness of these performance measures for the Islamic and conventional sector portfolios, this paper proposes calculating one of the most recent and sophisticated performance measures, the manipulation proof performance measure (MPPM) [28]. These authors pointed out that common and static performance measures such as the Jensen, Treynor, Sharpe and Sortino ratios, among others, can be subject to manipulation, deliberate or not, and these measures can thus obtain misleading conclusions. Additionally, [39] affirmed that the MPPM is more accurate than other performance measures, including measures designed to include tail risk such as the Sortino ratio, because it is resistant to manipulation, contrarily to static measures.

The main strength of the MPPM is based on the fact that it is a dynamic performance measure that prevents the manipulation of performance scores by adjusting the return distribution through dynamic trading [29,30]. So, it will also show time variation according to the business cycle like the conditional Sharpe ratio does.

The MPPM assesses the portfolio's premium return after adjusting per risk. That is, the MPPM(A) represents the certainty equivalent excess (over the risk-free interest rate) return for an investor with a risk aversion of A employing a utility function similar to the power utility function. Moreover, the MPPM does not assume any distribution function and, therefore, this performance measure takes into consideration all higher moments of the distribution (mean, variance, skewness and kurtosis).

Mathematically:

$$MPPM(A) \equiv \left[\frac{1}{(1-A)\Delta t} \ln \left(\frac{1}{T} \sum_{t=1}^T [(1+r_t)/(1+r_{ft})]^{(1-A)} \right) \right] \quad (10)$$

where parameter A is the measure of the relative risk aversion that, according to [28], historically varies between two and four. Later, we find that there is no difference in our results whether we use two, three or four. Therefore, like [28], we report our results using an A value of three. In addition, Δt is the time length between observations, T is the number of observations, r_t is the return of the selected portfolio and r_{ft} is the risk-free interest rate at time t .

The higher the MPPM, the better the portfolio performance.

4. Main Results

The performance measures of conventional and Islamic sector portfolios are compiled in this section, which is divided into four headings. In the first heading, all these performance measures have been compared in the full period to analyze the joint effect. In the second heading, aimed to test the robustness of these results, the whole sample period has been divided into three sub-sample periods based on financial and economic events, such as the recent global financial crisis, that may affect the results analyzed in the full sample. Thus, the management behavior in certain sector portfolios may vary depending on the phase of the economic cycle. In the third heading, an extended statistical analysis of the results has been implemented. Finally, in the fourth heading, overall comments about general results have been collected.

4.1. Analysis of the Whole Sample Period

Table 3 reports the performance measures of conventional and Islamic sector portfolios (first and second panels of Table 3, respectively) for the Jensen, Treynor, Sharpe, Sortino, conditional Sharpe, and Omega ratios and the MPPM for the whole sample period. Additionally, this table includes two ranks of all these sector portfolios according to the MPPM and the Omega ratio, as described by (10) and (9), respectively, because they are the newest and the most complete and reliable performance measures which take into consideration the four statistical moments of the distribution.

On the one hand, the performance results of conventional sector portfolios for each ratio, which are shown in the first panel of Table 3, are the following:

According to Jensen's ratio, the values above zero show an excess in returns with respect to the expected performance depending on the characteristic line (breadth). Therefore, the sectors with the best performance are Health Care and Consumer Services. Furthermore, the worst performing sectors are Financials and Basic Materials.

Table 3. Performance measures of conventional and Islamic sector portfolios: Whole sample period.

Whole Sample Period	MPPM Rank	OMEGA Rank	JENSEN	TREYNOR	SHARPE	SORTINO	COND. SHARPE	OMEGA	MPPM
<i>Conventional</i>									
DJCM			0	0.00037	0.01564	0.04554	0.05128	1.10026	−1.19313
BM	10	9	−0.00037	0.00005	0.00201	0.02057	0.01441	1.04485	−1.24357
CG	2	2	0.00039	0.00090	0.03236	0.07689	0.05905	1.16963	−1.16320
CS	3	3	0.00040	0.00081	0.03229	0.06880	0.06613	1.15003	−1.17411
OG	7	6	0.00006	0.00043	0.01835	0.03655	0.04427	1.07893	−1.22593
FIN	9	10	−0.00045	−0.00002	−0.00084	0.01872	0.03742	1.04228	−1.24019
HC	1	1	0.00083	0.00157	0.05469	0.09667	0.08264	1.21696	−1.14824
I	5	5	−0.00006	0.00032	0.01367	0.04009	0.04516	1.08572	−1.20349
TEC	8	4	0.00034	0.00065	0.02997	0.04670	0.06100	1.09978	−1.23274
TEL	6	8	−0.00024	0.00009	0.00365	0.02794	0.04366	1.05816	−1.21100
UT	4	7	−0.00023	0.00001	0.00024	0.02944	0.03290	1.06677	−1.19505
<i>Islamic</i>									
DJIM			0	0.00070	0.02838	0.06261	0.06483	1.13707	−1.18082
BM	8	8	−0.00035	0.00037	0.01568	0.03412	0.02783	1.07473	−1.23536
CG	3	3	0.00026	0.00110	0.03578	0.08036	0.06220	1.17608	−1.16295
CS	2	2	0.00067	0.00148	0.05552	0.09409	0.08317	1.20660	−1.15583
OG	7	6	−0.00019	0.00051	0.02055	0.03871	0.04277	1.08261	−1.22751
FIN	10	9	−0.00054	0.00006	0.00237	0.02036	0.03163	1.04251	−1.26472
HC	1	1	0.00062	0.00163	0.05407	0.09548	0.07832	1.21181	−1.14974
I	4	4	−0.00015	0.00056	0.02321	0.05084	0.05892	1.10867	−1.19627
TEC	9	5	−0.00003	0.00068	0.03132	0.04843	0.05975	1.10376	−1.23791
TEL	5	7	−0.00027	0.00037	0.01353	0.03952	0.04493	1.08048	−1.20106
UT	6	10	−0.00070	−0.00030	−0.01031	0.01153	0.03858	1.02736	−1.22629

To analyze the performance results based on Treynor's ratio, it is necessary to compare each sector portfolio ratio with the conventional or Islamic market portfolio ratio, as appropriate. Sectors with values above the market index value indicate the existence of an excess in returns per unit of systematic risk assumed (beta factor of sector returns) and so, a good performance. Therefore, the conventional sectors with the best performance (depth) are Health Care and Consumer Goods, while the worst performing sectors are Financials and Utilities.

To interpret the Sharpe ratio, it is also necessary to compare the sector portfolio ratio with the market portfolio ratio (conventional or Islamic, as appropriate). Sectors such as Health Care and Consumer Goods with higher values than the market value show an excess in returns per unit of total risk assumed (standard deviation of sector returns) and, as a consequence, good performance (breadth and depth). Contrarily, the worst performance corresponds to the sectors Financials (negative value) and Utilities.

According to the Sortino ratio, based on the assumed risk and focusing attention on the "loss zone", the best performing sectors are, again, Health Care and Consumer Goods. On the opposite side, the worst performing sectors are Financials and Basic Materials.

Regarding the conditional Sharpe ratio, a dynamic performance measure that takes into account that the volatility is time varying, the best and the second best performing sectors are Health Care and Consumer Services and, contrarily, the worst and the second worst performing sectors are Basic Materials and Utilities, respectively.

With regard to the Omega ratio, the sectors with the highest values are Health Care and Consumer Goods, which means that these sector portfolios perform better as the probability of making a profit is higher. In contrast, the sectors with the lowest Omega ratio are Financials and Basic Materials. In addition, the ranking based on the Omega ratio, shown in the third column of Table 3, ranks all conventional sector portfolios and ratifies that the best performing sector is Health Care, followed by Consumer Goods (corroborating the results of Sortino's, Sharpe's and Treynor's ratios and partially the results of Jensen's ratio and the conditional Sharpe, where the second best sector is Consumer Services). Furthermore, the worst performing sector is Financials, followed by Basic Materials (confirming the results of Sortino's and Jensen's ratios and partially Sharpe's and Treynor's ratios where the second worst performing sector is Utilities. Contrarily, the worst performing sector according to the conditional Sharpe ratio is Basic Materials which coincides with the second worst performing sector for Omega, Sortino's and Jensen's ratios).

Finally, to test the robustness of these results, the dynamic MPPM is also analyzed to measure the conventional and Islamic sector portfolio's premium return for a relative risk aversion. Specifically, the conventional sector portfolios with the highest MPPM values are Health Care and Consumer Goods, confirming that they are the best and the second best performing sectors, respectively. Contrarily, the worst performing sector is Basic Materials, followed by Financials. Additionally, the ranking based on the MPPM, reported in the second column of Table 3, which ranks all conventional sector portfolios, confirms that the best performing sector is Health Care, followed by Consumer Goods (corroborating the results of Omega's, Sortino's, Sharpe's and Treynor's ratios and partially the results of Jensen's ratio and conditional Sharpe ratio, where the second best sector is Consumer Services). Furthermore, the worst performing sector is Basic Materials and the second worst is Financials (coinciding with the two worst performing sectors for Omega's, Sortino's and Jensen's ratios and partially for Sharpe's, conditional Sharpe and Treynor's ratios, but in reverse order).

Therefore, as a summary of the main performance results of conventional sector portfolios in the full period according to all the performance ratios and Omega and the MPPM ranks, the best performing sector is Health Care and the second best is Consumer Goods. Contrarily, the worst performing sectors are Basic Materials and Financials, although their order depends on the ranking.

On the other hand, the performance results for the Islamic sector portfolios, shown in the second panel of Table 3, shows that according to Jensen's, Treynor's, Sharpe's, Sortino's, and Omega's ratios and the MPPM, the best performing sectors are Health Care and Consumer Services. Furthermore,

the Omega and the MPPM ranks confirm that the best performing sector is Health Care, followed by Consumer Services, contrarily to the order assigned by Jensen's, Sharpe's and conditional Sharpe ratios. However, the worst performance is not entirely clear because the results of Jensen's, Treynor's, Sharpe's, Sortino's and Omega's ratios show that the worst performing sector is Utilities and the second worst is Financials (the conditional Sharpe ratio only agrees with them in the second worst performing sector), while according to the most realistic and newest measure, the MPPM, the worst performing sector is Financials and the second worst is Technology.

As a conclusion to the full period, conventional and Islamic sector portfolios agree on the fact that the sector that presents excess returns and, therefore, a better performance is Health Care. Furthermore, the sector that contributes the worst behavior and, therefore, the poorest performance is Financials. Therefore, the behavior of conventional and Islamic sector portfolios is quite similar in the whole sample period.

Finally, it is worth pointing out that the Islamic market (DJIM) in particular and most Islamic sector portfolios in general present higher values for all the calculated ratios, indicating a better performance than the conventional market (DJCM) and the conventional sector portfolios. Jensen's ratio shows a superiority of conventional to Islamic sector portfolios only in a few cases.

4.2. Analysis by Sub-Periods

To test the robustness of our analysis, this section divides the whole sample period into sub-sample periods to determine which sector portfolios are the most sensitive to the relevant economic and historical events in the last decade, such as the credit crunch of 2007. For this, according to [36], current financial events have been considered and, consequently, the full sample is divided into the following three sub-periods:

1. Pre-crisis sub-period—before the US subprime mortgage market crisis (from January 1996 to June 2007).
2. Financial crisis sub-period (from July 2007 to December 2010).
3. Post-financial crisis sub-period (from January 2011 to December 2015).

4.2.1. Pre-Crisis Sub-Period (January 1996–June 2007)

Table 4 depicts the performance measure results of conventional as well as Islamic sector portfolios (first and second panel of Table 4, respectively) in the pre-crisis sub-period, under healthy economic conditions.

The conventional sector portfolios that present an excess in returns, and, as a consequence, a better performance for all the ratios, except for the conditional Sharpe ratio and partially for the Sortino's ratio, are Health Care and Oil and Gas. The ranking position of these two best sectors depends on the portfolio measure. Oil and Gas ranks first and Health Care second for Jensen's, Treynor's, Sharpe's and Omega ratios. However, Health Care is the best performing sector and Oil and Gas is the second best according to the MPPM ranking, determining the final order (In the case of disagreement between performance measures, the MPPM statistic will be chosen to decide between them because it is the most accurate performance measure -it is dynamic, free of manipulation and takes into account the four moments of distribution-). On the contrary, the worst performing sector is Technology, followed by Telecommunications for both Omega and MPPM ranks, apart from most of the remaining ratios, except for the conditional Sharpe ratio that disagrees with these two worst performing sectors.

On the other hand, the performance results of Islamic sector portfolios show that the best performing sectors differ depending on the performance measures. So, this study selects the MPPM rank to determine that Health Care and Consumer Services are the best and the second best performing sectors, respectively. Contrarily, the worst and the second worst performing sectors are Technology and Financials, respectively, according to the MPPM rank. The results of the remaining ratios coincide with these two worst performing sectors but ranked in reverse order.

Table 4. Performance measures of conventional and Islamic sector portfolios: Pre-crisis sub-period.

Pre-Crisis Sub-Period	MPPM Rank	OMEGA Rank	JENSEN	TREYNOR	SHARPE	SORTINO	COND. SHARPE	OMEGA	MPPM
<i>Conventional</i>									
DJM			0	0.00067	0.03338	0.09593	0.05329	1.19643	−1.81720
BM	7	5	0.00031	0.00102	0.04794	0.09188	0.02258	1.18913	−1.83039
CG	4	4	0.00013	0.00086	0.03553	0.10897	0.03948	1.22529	−1.81126
CS	6	7	−0.00004	0.00064	0.03144	0.08585	0.04696	1.17832	−1.82662
OG	2	1	0.00108	0.00209	0.09034	0.11928	0.06753	1.24192	−1.80153
FIN	5	6	0.00006	0.00074	0.03670	0.09250	0.05829	1.18634	−1.81419
HC	1	2	0.00044	0.00130	0.05393	0.11338	0.05926	1.22880	−1.80062
I	8	8	−0.00015	0.00053	0.02692	0.07874	0.03732	1.16307	−1.83733
TEC	10	10	−0.00035	0.00046	0.02895	0.04909	0.04940	1.10258	−1.92190
TEL	9	9	−0.00021	0.00046	0.02233	0.06249	0.05090	1.12471	−1.85078
UT	3	3	0.00024	0.00118	0.03989	0.11458	0.04892	1.22806	−1.80332
<i>Islamic</i>									
DJM			0	0.00095	0.04236	0.10308	0.06528	1.21460	−1.81485
BM	6	2	0.00069	0.00189	0.07204	0.11284	0.04640	1.23606	−1.81467
CG	5	5	0.00015	0.00123	0.04005	0.10903	0.04516	1.22653	−1.81081
CS	2	1	0.00050	0.00149	0.06378	0.11373	0.07465	1.24846	−1.80421
OG	3	4	0.00093	0.00234	0.08529	0.11441	0.06473	1.22985	−1.80757
FIN	9	10	−0.00082	0.00004	0.00177	0.02919	0.03350	1.05960	−1.91799
HC	1	6	0.00034	0.00149	0.05237	0.11086	0.05706	1.22307	−1.80185
I	7	7	−0.00018	0.00078	0.03494	0.08446	0.05413	1.17671	−1.83479
TEC	10	9	−0.00063	0.00057	0.03236	0.05314	0.04993	1.11112	−1.92804
TEL	8	8	0.00010	0.00107	0.04457	0.08627	0.05664	1.17068	−1.83642
UT	4	3	0.00046	0.00202	0.05905	0.10548	0.07629	1.23037	−1.80868

In summary, Health Care presents the best performing results for both the conventional and Islamic market, while Technology shows the worst behavior.

It should be noted that in this pre-crisis sub-period, most Islamic sector portfolios as a whole (including the Islamic market, DJIM) present higher values for all performance measures than conventional sector portfolios (and the conventional market, DJCM, respectively), stating a better performance. So, the results of this first sub-period are consistent with the outcomes of the total sample.

4.2.2. Crisis Sub-Period (July 2007–December 2010)

Table 5 shows the performance analysis using all the previous ratios in the crisis sub-period for conventional as well as Islamic sector portfolios in its first and second panels, respectively. So, this sub-period includes the credit crunch of 2007 as well as its consequences for the economy.

Looking at conventional sector portfolios, Consumer Goods and Health Care present an excess in returns during the economic crisis period and so, they became the best and the second best performing sectors. On the contrary, the worst performance corresponds to Financials, and Oil and Gas. These outcomes correspond to the MPPM ranking. However, other performance measures rank Basic Materials first and Consumer Goods second, while their worst performing sector is Financials, by unanimity, coinciding with the MPPM, but their second worst sector is Utilities.

With regards to the results of Islamic sector portfolios, the best performing sector is Consumer Services and the second best is Health Care. Contrarily, according to the MPPM, the worst performing sector is Utilities and the second worst is Oil and Gas. The remaining measures do not agree with the MPPM, neither on the two best performing sectors (Basic Materials and Consumer Goods in their ranks) nor the second worst sector (Financials). However, all the performance measures were in agreement on the worst performing sector (Utilities).

Finally, after comparing conventional as well as Islamic sector portfolios during the sub-period of the financial crisis, the conclusion is that the best (Consumer Goods for conventional and Consumer Services for Islamic market) and the worst performing sectors (Financials for conventional and Utilities for Islamic market) differ depending on the market. Furthermore, the second best and the second worst performing sectors (Health Care and Oil and Gas, respectively) coincide for both markets.

Moreover, most Islamic sector portfolios, as a whole, show higher values for all the ratios than conventional sector portfolios. So, this implies a better performance management of the Islamic sector portfolios.

4.2.3. Post-Crisis Sub-Period (January 2011–December 2015)

Table 6 provides the performance measures results for all the ratios during the post-crisis sub-period for conventional as well as Islamic sector portfolios (first and second panels, respectively).

Looking at both panels, there is clear evidence that for both conventional and Islamic sector portfolios, Health Care is the best performing sector, followed by Consumer Services, while Basic Materials is the worst performing sector, followed by Oil and Gas throughout the post-crisis sub-period. Therefore, it is important to highlight that there is virtual unanimity on these outcomes for all the performance measures, including the MPPM. Specifically, it is the only period where there is unanimity between all the performance measures and even between conventional and Islamic markets.

Table 5. Performance measures of conventional and Islamic sector portfolios: Crisis sub-period.

Crisis Sub-Period	MPPM Rank	OMEGA Rank	JENSEN	TREYNOR	SHARPE	SORTINO	COND. SHARPE	OMEGA	MPPM
<i>Conventional</i>									
DJM			0	−0.00116	−0.03158	−0.03310	−0.02128	0.92769	−0.60419
BM	8	1	0.00187	0.00026	0.00824	0.01357	0.00742	1.02882	−0.71434
CG	1	2	0.00074	−0.00016	−0.00379	0.00337	0.01690	1.00765	−0.48853
CS	3	6	0.00029	−0.00081	−0.02043	−0.01937	0.01449	0.95813	−0.51952
OG	9	4	0.00073	−0.00054	−0.01624	−0.01214	−0.01955	0.97278	−0.73545
FIN	10	10	−0.00179	−0.00251	−0.07877	−0.07668	−0.05481	0.83773	−0.84422
HC	2	5	0.00019	−0.00086	−0.01918	−0.01602	0.01373	0.95981	−0.49393
I	7	7	0.00022	−0.00094	−0.02634	−0.02605	−0.02036	0.94726	−0.61518
TEC	4	3	0.00087	−0.00019	−0.00494	0.00084	0.01477	1.00180	−0.52474
TEL	5	8	−0.00048	−0.00175	−0.04275	−0.04671	−0.03946	0.89567	−0.59893
UT	6	9	−0.00073	−0.00213	−0.05031	−0.05332	−0.04368	0.86812	−0.60870
<i>Islamic</i>									
DJM			0	−0.00042	−0.01197	−0.00820	−0.00389	0.98181	−0.55780
BM	8	1	0.00119	0.00040	0.01391	0.01907	0.01158	1.04031	−0.72214
CG	3	2	0.00007	−0.00032	−0.00780	−0.00163	0.00754	0.99636	−0.49270
CS	1	6	−0.00028	−0.00078	−0.01970	−0.01739	0.01807	0.96378	−0.48645
OG	9	5	−0.00005	−0.00046	−0.01491	−0.01064	−0.02112	0.97636	−0.72365
FIN	7	8	−0.00121	−0.00177	−0.04797	−0.04258	−0.02272	0.91899	−0.62991
HC	2	7	−0.00026	−0.00080	−0.01882	−0.01494	0.01355	0.96263	−0.48997
I	6	4	0.00007	−0.00035	−0.01056	−0.00627	0.00340	0.98708	−0.58413
TEC	4	3	0.00007	−0.00034	−0.00944	−0.00455	0.00772	0.99028	−0.53487
TEL	5	9	−0.00081	−0.00144	−0.03690	−0.03910	−0.02594	0.91654	−0.56936
UT	10	10	−0.00149	−0.00184	−0.05416	−0.05043	−0.04222	0.87518	−0.74971

Table 6. Performance measures of conventional and Islamic sector portfolios: Post-crisis sub-period.

Post-Crisis Sub-Period	MPPM Rank	OMEGA Rank	JENSEN	TREYNOR	SHARPE	SORTINO	COND. SHARPE	OMEGA	MPPM
<i>Conventional</i>									
DJM			0	0.00076	0.03746	0.05214	0.11169	1.10831	0.00855
BM	10	10	−0.00311	−0.00170	−0.09505	−0.09938	−0.04931	0.80660	−0.16724
CG	4	3	0.00075	0.00170	0.07536	0.11346	0.12319	1.23440	0.04018
CS	2	2	0.00133	0.00232	0.10614	0.15819	0.18125	1.33822	0.07963
OG	9	9	−0.00242	−0.00111	−0.06283	−0.06290	−0.01349	0.87452	−0.14582
FIN	6	6	−0.00033	0.00046	0.02444	0.03135	0.09246	1.06371	−0.00348
HC	1	1	0.00210	0.00359	0.15324	0.22117	0.23748	1.49683	0.11578
I	5	5	−0.00007	0.00069	0.03569	0.04665	0.11270	1.09566	0.00583
TEC	3	4	0.00080	0.00155	0.07735	0.10056	0.16674	1.20089	0.04195
TEL	7	7	−0.00029	0.00037	0.01611	0.02325	0.05503	1.04381	−0.01943
UT	8	8	−0.00065	−0.00019	−0.00782	−0.00943	0.05601	0.98205	−0.03700
<i>Islamic</i>									
DJM			0	0.00089	0.04413	0.06139	0.12149	1.13006	0.01109
BM	10	9	−0.00315	−0.00161	−0.08938	−0.09298	−0.05546	0.81814	−0.16698
CG	3	3	0.00078	0.00194	0.08278	0.12614	0.14347	1.26684	0.04619
CS	2	2	0.00158	0.00292	0.12766	0.19042	0.18241	1.40207	0.09375
OG	9	8	−0.00237	−0.00093	−0.05261	−0.05288	−0.00719	0.89376	−0.14340
FIN	5	4	0.00064	0.00185	0.07494	0.10324	0.08337	1.20680	0.03587
HC	1	1	0.00192	0.00352	0.14884	0.21512	0.21382	1.47469	0.11033
I	6	6	−0.00017	0.00073	0.03765	0.04884	0.11333	1.09949	0.00981
TEC	4	5	0.00066	0.00152	0.07695	0.09975	0.16407	1.20104	0.04192
TEL	7	7	−0.00076	−0.00024	−0.00980	−0.01195	0.01849	0.97759	−0.03006
UT	8	10	−0.00217	−0.00203	−0.08673	−0.09824	−0.06315	0.81269	−0.10478

In addition, most Islamic sector portfolios, in general, present higher values for all the ratios than conventional sector portfolios, implying a better performance.

4.3. Extended Statistical Analysis of the Results

To corroborate the results, an extended statistical analysis of the results has been implemented. Specifically, this section includes a threefold analysis: First, the differences in the mean, median and variance between Islamic and conventional sector portfolio performance measures in the full sample period as well as the three sub-sample periods have been examined. Second, the value-at-risk (VaR) has been calculated to test the riskiness of Islamic and conventional sector portfolios. Third, the economic loss function of the Islamic and conventional stock markets has been analyzed.

Thus, it would be interesting to test whether these differences between Islamic and conventional performance measures are statistically significant [40] by using standard statistics for the analysis of the mean (Anova F Test), median (Kruskal–Wallis test) and variance (Levene test). These differences are shown in Table 7, distinguishing between the MPPM test in Panel A and the Omega ratio in Panel B.

Table 7. Differences in the mean, median and variance between Islamic and conventional sector portfolios performance.

Panel A: MPPM Statistic				
	Full Sample	Pre-Crisis	Crisis	Post-Crisis
Mean (μ): Anova F—test ($H_0: \mu_M = \mu_F$)	0.0023	0.1172	0.1754	0.0013
Median (M): Kruskal–Wallis (tie-adj.) test ($H_0: M_M = M_F$)	0.0011	0.0011	0.1822	0.1304
Variance (σ^2): Levene’s test ($H_0: \sigma^2_M = \sigma^2_F$)	0.6707	0.6844	0.0035	0.3187
Panel B: Omega Ratio				
	Full Sample	Pre-Crisis	Crisis	Post-Crisis
Mean (μ): Anova F—test ($H_0: \mu_M = \mu_F$)	0.2491	0.0642	0.6721	0.0015
Median (M): Kruskal–Wallis (tie-adj.) test ($H_0: M_M = M_F$)	0.3115	0.3892	0.6737	0.0528
Variance (σ^2): Levene’s test ($H_0: \sigma^2_M = \sigma^2_F$)	0.3076	0.9819	0.8661	0.3249

Notes: The null-hypothesis for the Anova F-test, Kruskal–Wallis (tie-adj.) test, and Levene’s test is that the difference in the mean, median and variance between Islamic and conventional sector portfolios performance is equal to zero.

As can be seen, the differences in the mean, median and variance do not show statistical significance, although the highest values are in the crisis period, confirming our results.

On the other hand, in order to evaluate the riskiness of Islamic and conventional sector portfolios, we also obtained the time-varying value-at-risk (VaR), which is a predominant risk measure after that the conditional volatility has been estimated by a stochastic model (please see the conditional Sharpe shown in Equations (7) and (8)).

The VaR is calculated at the 99% confidence level by filtered historical simulation, according to the following expression:

$$VaR_{t+1} = \mu_{t+1} + \sigma_{t+1} \text{Quantiler}_{t=1}^n \quad (11)$$

where μ_{t+1} and σ_{t+1} are the conditional forecasts of the mean and the standard deviation.

Thus, once we obtained the VaR measures for each index, we evaluated the riskiness of the portfolio through some economic loss function [41,42], among others. According to [41], the economic

loss function examines the distance between the observed returns and the forecasted VaR when the losses are uncovered. Specifically, we estimated the loss function proposed by [43] as follows:

$$\begin{cases} |VaR - r_t| \text{ if } r_t < VaR \\ 0 \text{ if } r_t \geq VaR \end{cases} \quad (12)$$

Table 8 collects the filtered historical simulation estimates of the VaR for conventional as well as Islamic sector portfolios, confirming the better performance of the Islamic stock market and some sector portfolios—mainly during the global financial crisis.

Table 8. Estimates of the value-at-risk (VaR) at the 99% confidence level by filtered historical simulation.

Panel A: Conventional Sector Portfolios				
	Full Sample	Pre-Crisis	Crisis	Post-Crisis
DJCM	−0.001	0	−0.005	0
BM	−0.002	0	−0.006	−0.003
CG	0	0	−0.002	0.001
CS	0	0	−0.004	0.002
OG	−0.002	0	−0.007	−0.003
FIN	−0.002	0	−0.010	−0.001
HC	0	0.001	−0.003	0.002
I	−0.001	0	−0.004	0
TEC	−0.002	−0.003	−0.003	0.001
TEL	−0.001	−0.001	−0.004	0
UT	−0.001	0.001	−0.004	−0.001
Panel B: Islamic Sector Portfolios				
	Full Sample	Pre-Crisis	Crisis	Post-Crisis
DJIM	0	0	−0.004	0
BM	−0.002	0	−0.006	−0.003
CG	0	0	−0.002	0.001
CS	0	0	−0.003	0.002
OG	−0.002	0	−0.007	−0.003
FIN	−0.002	−0.002	−0.006	0.001
HC	0	0.001	−0.003	0.002
I	−0.001	0	−0.004	0
TEC	−0.002	−0.003	−0.003	0.001
TEL	−0.001	0	−0.003	0
UT	−0.001	0	−0.006	−0.002

Finally, Figure 1 exhibits the time-varying economic loss function of the Islamic and conventional stock markets. The shaded area confirms that losses in conventional sector portfolios are higher than those in their Islamic counterparts during the global financial crisis.

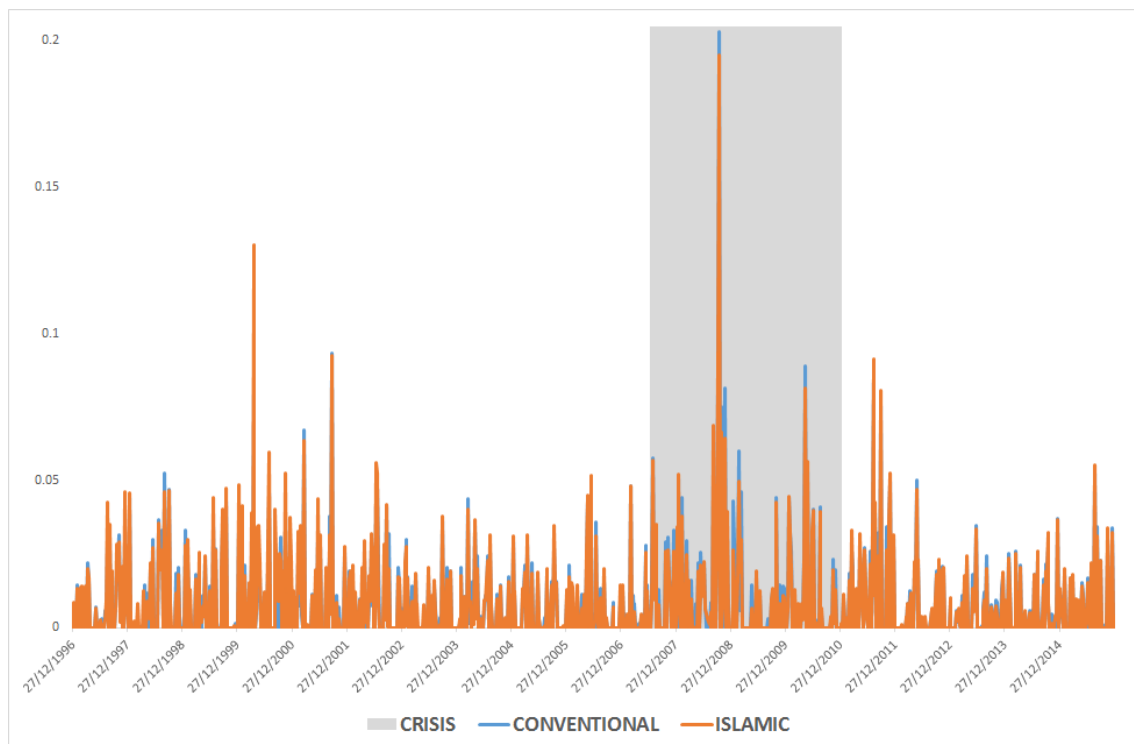


Figure 1. Time-varying economic loss function suggested by Caporin [43].

4.4. Overall Comments

In conclusion, Islamic sector portfolios outperform conventional sector portfolios in the full period as well as in the three sub-sample periods analyzed in this paper (pre-crisis, crisis and post-crisis sub-periods) for all performance measures (Jensen's ratio shows a superior performance of conventional sector portfolios only in a few cases).

Moreover, in general and according to the most elaborated performance measure—the MPPM statistic (The MPPM statistic has been chosen to draw general conclusions because it is the only dynamic performance measure of this research that takes into account the four moments of the probability distribution function and, moreover, it is resistant to the manipulation of performance scores unlike the other static measures that can be subject to manipulation and so, they can obtain misleading conclusions. Therefore, the MPPM is the most reliable and accurate performance measure)—, Health Care is the sector with the best performance results, while Financials is the sector with the worst performance results for the Islamic as well as the conventional stock market. In detail, the comparison between the best and the worst performing sectors provides the following concluding results. On the one hand, the MPPM value of Health Care (the best performing sector) is -1.14824 and -1.14974 for conventional and Islamic stock markets, respectively, in the whole sample period; -1.80062 and -1.80185 in the pre-crisis sub-period; -0.49393 and -0.48997 in the crisis sub-period (although in this second sub-period, Health Care is the second best sector); and, finally, 0.11578 and 0.11033 in the post-crisis sub-period. According to these results, the value of the MPPM varies from -1.8 in the pre-crisis sub-period to 0.1 in the post-crisis sub-period. So, the best performance with regard to the MPPM correspond to the post-crisis sub-period, where these values are remarkably positive for both conventional and Islamic sector portfolios. On the other hand, the MPPM values of this measure for Financials (the worst performing sector) is -1.24019 and -1.26472 for conventional and Islamic stock markets in the total period; -1.81419 and -1.91799 in the pre-crisis sub-period (although the worst sector is Technology for both markets, with a MPPM value of -1.92190 and -1.92804 , respectively); -0.84422 and -0.6299 in the crisis sub-period (although Utilities is the worst performing sector in the Islamic market, with a value of -0.74971); and, finally, -0.00348 and 0.03587 in the post-crisis sub-period.

(where the worst sector portfolio is Basic Materials, -0.16724 and -0.16698 , for the conventional and the Islamic market, respectively). Based on these results, the highest values of the MPPM and so, the best performance, also correspond to the post-crisis sub-period for both conventional and Islamic sector portfolios.

Therefore, in summary, the best performance according to the MPPM—both for the best performing sector, Health Care, and for the worst performing sector, Financials—corresponds to the post-crisis sub-period, not only in conventional but also in Islamic stock markets.

5. Conclusions

The aim of this paper was to study the performance of Islamic and conventional sector portfolios and to compare whether conventional indices perform better or worse than their Islamic counterparts depending on the stage of the economy for the period between January 1996 and December 2015.

Thus, this research compared Islamic and conventional sector portfolios using different types of performance measures. Specifically, this paper applied standard performance measures such as Jensen's, Treynor's and Sharpe's ratios, as well as two further ratios, the Sortino ratio and the conditional Sharpe ratio, to solve different drawbacks of the well-known Sharpe's ratio and, additionally, two more recent and precise performance measures that take into consideration the four moments of the probability distribution function (mean, variance, skewness and kurtosis), the Omega ratio and the MPPM. Moreover, the MPPM is a dynamic performance measure which prevents the manipulation of performance scores by adjusting the return distribution through dynamic trading and so, it is the most accurate and sophisticated performance measure. In this way, it was possible to obtain evidence about which are the best and the worst performing sectors in both conventional and Islamic stock markets.

In addition, for robustness, since the performance can also depend on the stage of the economy, in this study, three different sub-periods of analysis have been distinguished: Before, during and after the recent global financial crisis. So, this paper defined which type of sector portfolios perform better according to the stage of the economy. Moreover, to test the robustness of our results, we implemented an extended statistical analysis. It consisted of studying the differences in the mean, median and variance between Islamic and conventional sector portfolio performance measures in all the periods, the value-at-risk (VaR) to test the riskiness of Islamic and conventional sector portfolios, and, finally, the economic loss function of the Islamic and conventional stock markets.

In this sense, with the analysis of the total sample, we can conclude that Health Care is the best performing sector, whereas Financials is the worst performing sector for most performance measures in conventional as well as Islamic stock markets. For robustness, the second part of the analysis split the whole sample period into three different subsamples, and diverse conclusions were drawn depending on the sub-period analyzed. Specifically, in the pre-crisis sub-sample period, Health Care is the best performing sector, while Technology is the worst performing sector for both conventional and Islamic stock markets. Subsequently, during the recent global financial crisis sub-period, the sector that presented a significant excess in returns was Consumer Goods for the conventional index and Consumer Services for the Islamic counterpart. On the contrary, the worst performance corresponds to the sector Financials in the conventional market and Utilities in the Islamic market. So, the results are not consistent for both markets in this second sub-period that includes the financial crisis. Finally, during the post-crisis sub-period, Health Care is the sector with the best performance behavior, while Basic Materials is the sector that performs worse in both conventional and Islamic markets. In general, and according to the most recent and completed performance measure, the MPPM, Health Care is the best performing sector, whereas Financials is the worst performing sector for the Islamic as well as the conventional stock market.

Additionally, the period after the recent global financial crisis exhibits the best performance according to the MPPM not only for the best performing sector, Health Care, but also for the worst performing sector, Financials, in both conventional and Islamic markets. This result shows the emerging

signs of economic recovery, as well as confirming that the sector portfolio performance actually depends on the stage of the economy.

Moreover, Islamic sector portfolios, as a whole, perform better than their conventional counterparts for all performance measures during the whole sample period, as well as in the three sub-sample periods (before, during and after the recent crisis). Our extended statistical analysis confirms this relevant result, which might be due to the limitations established by Islam, mainly concerning the ban of interest rates as well as of *gharar* and *maysir*. That is to say, the higher risk-adjusted returns of the Islamic sector portfolios, even during the recent global financial crisis, can be justified, among other reasons, by the diluted uncertainty and speculation, as well as the fact that Islamic finance prevents interest rates that have a negative impact on the economy.

It is of great interest to highlight the main contribution of this paper to sustainable development, since *Sharia*-compliant assets can be used as hedging assets to improve the sustainability of unattractive performance portfolios by offering portfolio managers the possibility to diversify stock portfolios in these assets and, consequently, to reduce their systematic risk, primarily in financial crises.

To conclude, the results obtained with the calculation of the performance measures (Jensen's, Treynor's, Sharpe's, Sortino's, conditional Sharpe, Omega's ratios and the MPPM) used in this paper further ratify the importance of the subject at present, which is advancement in the financial sphere. As the Islamic banking system tries to meet the needs of Muslim believers, this allows them to reconcile the financial sphere with the religious one.

Author Contributions: Conceptualization, F.J.; Data curation, C.E.H.; Formal analysis, M.d.l.O.G., F.J., and C.E.H.; Funding acquisition, F.J.; Investigation, M.d.l.O.G., F.J., and C.E.H.; Methodology, M.d.l.O.G.; Project administration, F.J.; Software, M.d.l.O.G. and F.J.; Supervision, F.J.; Validation, M.d.l.O.G. and F.J.; Visualization, M.d.l.O.G., F.J., and C.E.H.; Writing—original draft, C.E.H.; Writing—review and editing, M.d.l.O.G. and F.J.

Funding: This research was funded by the Ministerio de Economía, Industria y Competitividad, Gobierno de España: Análisis del riesgo en los mercados financieros (ECO2017-89715-P).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Boudt, K.; Raza, M.W.; Ashraf, D. Macro-financial regimes and performance of Shariah-compliant equity portfolios. *J. Int. Financ. Mark. Inst. Money* **2019**, *60*, 252–266. [\[CrossRef\]](#)
2. Al-Khazali, O.; Lean, H.H.; Samet, A. Do Islamic stock indexes outperform conventional stock indexes? A stochastic dominance approach. *Pac. Basin Financ. J.* **2014**, *28*, 29–46. [\[CrossRef\]](#)
3. Ali, S.; Shahzad, S.J.H.; Raza, N.; Al-Yahyaee, K.H. Stock market efficiency: A comparative analysis of Islamic and conventional stock markets. *Phys. A* **2018**, *503*, 139–153. [\[CrossRef\]](#)
4. Usman, M.; Jibran, M.A.Q.; Amir-ud-Din, R.; Akhter, W. Decoupling hypothesis of Islamic stocks: Evidence from copula CoVaR approach. *Borsa Istanbul. Rev.* **2018**, 1–7. [\[CrossRef\]](#)
5. Rizvi, S.A.R.; Arshad, S. Understanding time-varying systematic risks in Islamic and conventional sectoral indices. *Econ. Model.* **2018**, *70*, 561–570. [\[CrossRef\]](#)
6. Uddin, G.S.; Areola, J.; Shahzad, S.J.H.; Yoon, S.-M. Time-varying evidence of efficiency, decoupling, and diversification of conventional and Islamic stocks. *Int. Rev. Financ. Anal.* **2018**, *56*, 167–180. [\[CrossRef\]](#)
7. Alam, N.; Arshad, S.; Rizvi, S.A.R. Do Islamic stock indices perform better than conventional counterparts? An empirical investigation of sectoral efficiency. *Rev. Financ. Econ.* **2016**, *31*, 108–114. [\[CrossRef\]](#)
8. Hoanga, T.-H.-V.; Zhu, Z.; El Khamlichi, A.; Wong, W.-K. Does the Shari'ah screening impact the gold-stock nexus? A sectorial analysis. *Resour. Policy* **2019**, *61*, 617–626. [\[CrossRef\]](#)
9. Ahmad, W.; Rais, S.; Shaik, A.R. Modelling the directional spillovers from DJIM Index to conventional benchmarks: Different this time? *Q. Rev. Econ. Financ.* **2018**, *67*, 14–27. [\[CrossRef\]](#)
10. Ahmed, H.; Elsayed, A.H. Are Islamic and conventional capital markets decoupled? Evidence from stock and bonds/sukuk markets in Malaysia. *Q. Rev. Econ. Financ.* **2018**. [\[CrossRef\]](#)
11. Jawadi, F.; Jawadi, N.; Cheffou, A.I. A statistical analysis of uncertainty for conventional and ethical stock indexes. *Q. Rev. Econ. Financ.* **2018**. [\[CrossRef\]](#)

12. Ahmed, W.M.A. Islamic and conventional equity markets: Two sides of the same coin, or not? *Q. Rev. Econ. Financ.* **2019**, *72*, 191–205. [[CrossRef](#)]
13. Umar, Z. Islamic vs conventional equities in a strategic asset allocation framework. *Pac. Basin Financ. J.* **2015**, *42*, 1–10. [[CrossRef](#)]
14. Jawadi, F.; Jawadi, N.; Louhichi, W. *Does Islamic Finances Outperform Conventional Finance? Further evidence from the Recent Financial Crisis*; Ipag Business School Research Working Paper; Ipag Business School: Paris, France, 2014; p. 279.
15. Ho, C.S.F.; Abd Rahman, N.A.; Yusuf, N.H.M.; Zamzamin, Z. Performance of global Islamic versus conventional share indices: International evidence. *Pac. Basin Financ. J.* **2014**, *43*, 110–121. [[CrossRef](#)]
16. Hkiri, B.; Hammoudeh, S.; Aloui, C.; Yarovaya, L. Are Islamic indexes a safe haven for investors? An analysis of total, directional and net volatility spillovers between conventional and Islamic indexes and importance of crisis periods. *Pac. Basin Financ. J.* **2017**, *43*, 124–150. [[CrossRef](#)]
17. Mumtaz, R.; Usman, M.; Nasir, S.B. An Empirical Study of Risk-Return Profile of Islamic Mutual Funds: A Case from Pakistan. *Eur. J. Bus. Manag.* **2014**, *6*, 156–167.
18. Hakim, S.; Rashidian, M. Risk & Return of Islamic Stock Market Indexes. In Proceedings of the 9th Economic Research Forum Annual Meeting, 26–28 October 2004; Economic Research Forum: Sharjah, UAE.
19. Ashraf, D.; Mohammad, N. Matching perception with the reality—Performance of Islamic equity investments. *Pac. Basin Financ. J.* **2014**, *28*, 175–189. [[CrossRef](#)]
20. Ahmad, Z.; Ibrahim, H. A Study of Performance of the KLSE Syariah Index. *Malays. Manag. J.* **2002**, *6*, 25–34.
21. Elfakhani, S.; Hassan, M.K. *Performance of Islamic Mutual Funds*; Working Paper; American University of Beirut: Beirut, Lebanon, 2005.
22. Albaity, M.; Ahmad, R. Performance of Syariah and Composite Indices: Evidence from Bursa Malaysia. *Asian Acad. Manag. J. Acc. Financ.* **2008**, *4*, 23–43.
23. Jensen, M.C. The Performance of Mutual Funds in the period 1945–1964. *J. Financ.* **1968**, *23*, 389–416. [[CrossRef](#)]
24. Treynor, J.L. How to Rate Management of Investment Funds. *Harv. Bus. Rev.* **1965**, *43*, 63–75.
25. Sharpe, W.F. Mutual Fund Performance. *J. Bus.* **1966**, *39*, 119–138. [[CrossRef](#)]
26. Sortino, F.; van der Meer, R. Downside risk. *J. Portf. Manag.* **1991**, *17*, 27–31. [[CrossRef](#)]
27. Keating, C.; Shadwick, W.F. *A Universal Performance Measure*; The Finance Development Centre Limited: London, UK, 2002.
28. Ingersoll, J.; Spiegel, M.; Goetzmann, W.; Welch, I. Portfolio Performance Manipulation and Manipulation-Proof Performance Measures. *Rev. Financ. Stud.* **2007**, *20*, 1503–1546.
29. González, M.O.; Skinner, F.S.; Agyei-Ampomah, S. Term Structure Information and Bond Investment Strategies. *Rev. Quant. Financ. Acc.* **2013**, *41*, 53–74. [[CrossRef](#)]
30. González, M.O.; Papageorgiou, N.A.; Skinner, F.S. Persistent doubt: An examination of hedge fund performance. *Eur. Financ. Manag.* **2016**, *22*, 613–639. [[CrossRef](#)]
31. Jiang, Y.; Yu, M.; Hashmi, S.M. The Financial Crisis and Co-Movement of Global Stock Markets—A Case of Six Major Economies. *Sustainability* **2017**, *9*, 260. [[CrossRef](#)]
32. Di Mauro, F.; Caristi, P.; Couderc, S.; di Maria, A.; Ho, L.; Grewal, B.K.; Masciantonio, S.; Ongena, S.; Zaher, S. Islamic finance in Europe. *Eur. Cent. Bank. Occas. Pap. Ser.* **2013**, *146*, 29–30.
33. Ferrer, R.; Bolós, V.; Benítez, R. Interest rate changes and stock returns: A European multi-country study with wavelets. *Int. Rev. Econ. Financ.* **2016**, *44*, 1–12. [[CrossRef](#)]
34. Flannery, M.J.; James, C. The effect of interest rate changes on the common stock returns of financial institutions. *J. Financ.* **1984**, *39*, 1141–1153. [[CrossRef](#)]
35. Hirtle, B.J. Derivatives, Portfolio Composition, and Bank Holding Company Interest Rate Risk Exposure. *J. Financ. Serv. Res.* **1997**, *12*, 243–266. [[CrossRef](#)]
36. Umar, Z.; Shahzad, S.J.; Ferrer, R.; Jareño, F. Does Shariah compliance make interest rate sensitivity of Islamic equities lower? An industry level analysis under different market states. *Appl. Econ.* **2018**, *50*, 4500–4521. [[CrossRef](#)]
37. Tang, Y.; Whitelaw, R.F. Time-varying sharpe ratios and market timing. *Q. J. Financ.* **2011**, *1*, 465–493. [[CrossRef](#)]

38. Andersen, T.G.; Bollerslev, T.; Christoffersen, P.F.; Diebold, F.X. Chapter 15 Volatility and Correlation Forecasting. In *Handbook of Economic Forecasting*; Elsevier: Amsterdam, The Netherlands, 2006; Volume 1, pp. 777–878.
39. Brown, S.; Kang, M.S.; In, F.; Lee, G. *Resisting the Manipulation of Performance Metrics: An Empirical Analysis of the Manipulation-Proof Performance Measure*; NYU Working Paper; New York University: New York, NY, USA, 2010.
40. Opdyke, J.D.J. Comparing sharpe ratios: So where are the p -values? *J. Asset Manag.* **2007**, *8*, 308–336. [[CrossRef](#)]
41. Abad, P.; Benito, S.; López, C. The role of the loss function in value-at-risk comparisons. *J. Risk Model Valid.* **2015**, *9*, 1–19. [[CrossRef](#)]
42. Amendola, A.; Candila, V. Evaluation of volatility predictions in a VaR framework. *Quant. Financ.* **2016**, *16*, 695–709. [[CrossRef](#)]
43. Caporin, M. Evaluating Value-at-Risk Measures in the Presence of Long Memory Conditional Volatility. *J. Risk* **2008**, *10*, 79–110. [[CrossRef](#)]



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).