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The Performance of Stock Portfolios: Evidence from Analysing Malaysia Case, and Implication for Open Innovation

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Abstract: This research examines the performance of the Islamic stock portfolio (ISP) and conventional stock portfolio (CSP) for the five industrial sectors and market in Malaysia. The capital asset pricing model statistics indicate that the ISP provides a higher return with a lower systematic risk compared to the CSP in different sectors; however, the ISP and CSP perform equally in the market. The non-parametric stochastic dominance approach reveals that the ISP is better than the CSP for portfolio return without considering the riskiness for all sectors except properties; further, the ISP outperforms the CSP under the market condition. Economic significance analysis identifies that the expected financial loss of the ISP is lower than that of the CSP in all sectors other than properties; the anticipated financial loss of the ISP is significantly less than that of the CSP in the market situation. The overall findings imply that the risk-sharing ISP is superior to the risk-bearing CSP for better returns at the sector as well as the market level.

Keywords: Islamic portfolio; stochastic dominance; historical VaR

1. Introduction

The Islamic financial system (IFS) was first introduced in Malaysia in the 1970s and has been growing significantly along with its 100-year-old existing conventional financial system (CFS). The IFS has emerged as an alternative to the CFS in the last 35 years due to its market booming and broad recognition, as well as its significant growth. Kassim [1] suggested that Islamic finance contributed to the economic growth of Malaysia by effectively performing as a financial intermediary for pooling and channelling funds to investment activities. The Islamic stock market accounts for a sizable portion of the Malaysian securities exchange, resulting in the ongoing development of Malaysia's Islamic financial service sector. The world's first exchange platform for Islamic securities was established in Malaysia, bringing investors a wide range of options to select investments and traded Shariah-compliant Islamic stocks, along with traditional securities in the Malaysia Stock Exchange (MYX). Conventional stock is a risk-bearing asset. However, Islamic stock is a risk-sharing asset because Shariah compliancy prohibits speculation (Gharar) and enforces profit–loss sharing on investments.

We first reviewed the literature related to the performance of Shariah-compliant and traditional stocks. Majid and Kassim [2] investigated the nature of market integration among Malaysia, Indonesia, Japan, the United Kingdom and the United States for Islamic stocks, classified into different economic groups, such as developed and developing countries, using weekly data between January 1999 and August 2006. Their findings indicated that investors could benefit from diversifying into Islamic stock markets. For the risk, return and mean-variance efficiency, Akhtar and Jahromi [3] examined Islamic

and conventional stocks in Malaysia using the compiled monthly data obtained from DataStream between 31 January 1986 and 31 March 2012. Their results revealed that conventional stocks were less mean-variance efficient compared to the Islamic securities as they minimised unfavourable uncertainty at a similar level of earnings. The authors also reported that mean returns between Islamic and traditional equity indices are not distinct, while the conventional stock portfolios had dramatically higher variance than the Islamic stock portfolios.

Umar [4] analysed the outcomes between Shariah-compliant securities and non-Islamic counterparts using a strategic asset allocation system, by taking into account both Islamic investors and traditional investors, employing a monthly dataset for the period between January 1996 and April 2015. The findings indicated that while Shariah investors were exclusively attracted by Islamic securities, traditional investors' portfolios consisted of selected Islamic and conventional equities. Cheema and Nartea [5] scrutinised the disparities between Islamic and conventional stock with regard to unconditional and conditional momentum outcomes for the Malaysian security exchange between January 1990 and December 2014. The findings revealed that there were no major variations in cross-sectional and time series momentum returns between Shariah-compliant and conventional shares. Earlier research showed a better performance of Islamic financial equities relative to the conventional assets. Nevertheless, several studies also reported the comparatively lower profits of Shariah-compliant assets compared to their traditional counterparts.

Next, we studied the literature focusing on the performance of Islamic and conventional indices. Ahmad and Ibrahim [6] examined the performance of the Islamic Index and the Kuala Lumpur Composite Index using the raw and risk-adjusted daily closing data for the period between April 1999 and January 2002. They found no evidence of a major difference in index performances, signifying that Islamic shares did not provide any superior outcomes compared to other shares. Al-Zoubi and Maghyereh [7] applied the value at risk (VaR) method to examine the comparative risk performances between Dow Jones Islamic Indices and the Down Jones Global World Indices based on the assumption of a one-day holding period for the dataset between 1996 and 2005. They showed that the Dow Jones Islamic Index had a lower VaR than that of the Dow Jones Global Index. Their findings concluded that the Shariah-compliant shares were not as volatile as the traditional share market and the Islamic stock index offered a special risk-sharing characteristic. Similarly, Sukmana and Kolid [8] tested the risk performances of the Shariah-compliant security indices compared to a non-Islamic index, using the daily closing prices of the Jakarta Composite Index for the period between 3 January 2001 and 30 December 2009. They revealed the less risky characteristic of the Islamic stock index relative to the conventional index.

Walkshäusl and Lobe [9] collected a broad international dataset of 35 markets (21 developed and 14 emerging markets) from Morgan Stanley Capital International (MSCI) to examine the performance of Islamic indices in comparison with the conventional benchmarks during the period from 2002 to 2011. The results showed that investors could pursue passive stock investment strategies without compromising financial output in compliance with their religious beliefs. This happens because selecting stocks of index-based Islamic investments did not decrease profits as opposed to choosing a traditional index. Arouri et al. [10] examined the hypothesis of Islamic finance innovation, and moral standards were able to offer superior diversification advantages to European, American and global investors from 14 August 2006 to 30 June 2008. The best portfolio strategies and investment proportions for Islamic and traditional funds were created to assure the optimal resource allocation. The empirical findings showed that conventional finance was affected more severely by the recent crises than Islamic finance, and investing in Islamic equities provided better earnings as it lowered the systemic risk while producing substantial benefits through diversification.

Al-Khazali et al. [11] compared the performance of Islamic stock indices with their conventional counterparts using daily data for nine Dow Jones Islamic and conventional indices. They included the Asia Pacific, Canadian, Developed Markets, Emerging Countries, European, Global, Japanese, United Kingdom and United States indices in the study. The majority of traditional indices showed

stochastic dominance (SD) at the second and third orders except for the European market from 1996 to 2012 and from 2001 to 2006. However, the Islamic indices outperformed traditional indices in the period of the global financial crisis. Ho et al. [12] studied 12 global Islamic as opposed to conventional stock indices of eight countries (USA, UK, Hong Kong, Malaysia, Indonesia, Switzerland, India and France) between 2000 and 2011 that covered both non-crisis and crisis periods. For the crisis period, the findings showed that the Islamic indices provided superior outcomes compared to the conventional index; however, non-crisis periods did not give a precise result.

Hammoudeh et al. [13] concluded that the conventional market indices dynamically relied on the global Islamic indices using the daily data of three major regions (Asia, Europe and the US) for the period from 4 January 1999 to 22 July 2013. They indicated that Shariah compliance laws were not sufficiently stringent to significantly differentiate the global Islamic stock market indices from a conventional one. Bahloul et al. [14] compared the diversification capability of international Shariah-compliant and traditional portfolios among various financial market systems. They introduced an optimum alternative based on the US investors' perspective from 2002 to 2014, using the monthly MSCI prices of both Islamic and conventional security indices covering 38 nations from the Europe, North and Latin America and the Asia Pacific regions. The SD bootstrap method was employed to provide systematic changes in SD association between Islamic and conventional portfolios by investment areas and market regimes. The study showed that the conservative nature of Shariah-compliant led to an efficient hedge method by diversifying the portfolio among Islamic market indices, bringing investors better investment options during any financial collapse or economic recession periods.

The previous literature focused mainly on the performance of individual Islamic and conventional stocks and indices in countries other than Malaysia. Our study explores the capability of the Islamic stock portfolio (ISP) and conventional stock portfolio (CSP) in Malaysia, where Shariah-compliant and traditional shares are traded in parallel in the MYX. Most previous research studies have considered low-frequency weekly or monthly share prices and indices as sample data. Morse [15] suggested that daily return data are more appropriate when there is uncertainty about the announcement date of the information. Therefore, this study uses the daily stock price to estimate the performances of the ISP and CSP. Moreover, earlier studies have investigated the risk and return of Shariah and traditional stocks and indices for only the market condition. We analyse the different groups of the industry and market to draw a better overall picture of the capability of the ISP and CSP at the sector and market levels.

The paper is organised as follows. The next section describes the research materials and methods used in this study. Section 3 provides the results of the empirical analysis. Section 4 discusses the results and implications of the findings.

2. Materials and Methods

We consider the Islamic stock and conventional stock traded in the MYX from 1 January 2010 to 31 December 2017 in this study. MYX consists of two markets, the Main Market and the Access, Certainty and Efficiency (ACE) Market. A company can be registered with the Main Market based on the following criteria: market capitalisation of more than MYR 500 million; minimum of one thousand shareholders and at least one year of working capital; and the primary business activities are not classified in a group of financial companies that invest in other publicly listed firms. We initially select 14 different sectors: closed-end fund, construction, consumer products, finance, hotels, industrial products, IPC, mining, plantations, properties, real estate, SPAC, technology and trading services. However, no Shariah-compliant stock is traded under the closed-end funds, mining and SPAC sectors.

Similarly, the real estate sector does not have non-Islamic stock. Finally, we selected ten (10) sectors that have both Islamic stock and conventional stock. Table 1 shows seven non-Islamic stocks of the plantation sector that contains the lowest number of stocks among consumer products (CP), plantations (PL), properties (PR), industrial products (IP) and trading services (TS) sectors. Consequently, the Islamic stock portfolio for the consumer products (ISP-CP), industrial products (ISP-IP), plantations (ISP-PL), properties (ISP-PR) and trading services (ISP-TS) sectors includes the

top seven stocks based on their market capitalisation. Likewise, the conventional stock portfolio for the consumer products (CSP-CP), industrial products (CSP-IP), plantations (CSP-PL), properties (CSP-PR) and trading services (CSP-TS) sectors comprises the top seven stocks based on their market capitalisation. This study also develops the Islamic stock portfolio for the market (ISP-MKT) by including five Shariah-compliant stocks that are the top stocks from each of the five sectors based on market capitalisation. Identically, the conventional stock portfolio for the market (CSP-MKT) is created by comprising the top five conventional stocks.

Table 1. Islamic and conventional stock details.

Sector	Islamic Stock	Conventional Stock
Construction	45	3
Consumer products *	101	23
Finance	2	29
Hotels	1	3
Industrial products *	174	37
IPC	2	2
Plantations *	33	7
Properties *	76	22
Technology	27	3
Trading services *	138	50

Notes: This table provides the number of Islamic and conventional stocks of 10 different sectors. This research excludes the construction, finance, hotels, IPC and technology sectors due to either insufficient Islamic stock (2, 1 and 2 stocks for finance, hotels and IPC, respectively) or insufficient conventional stock (3, 3, 2 and 3 stocks for construction, hotels, IPC and technology, respectively). Finally, this study constructs the Islamic stock portfolio (ISP) and conventional stock portfolio (CSP) based on stocks from the consumer products (PL), industrial products (IP), plantations (PL), properties (PR) and trading services (TS) sectors, denoted by *.

This study uses the capital asset pricing model (CAPM) and the non-parametric stochastic dominance (SD) approach to assess the performances of the ISP and CSP at the market and sector levels. The CAPM statistics of Jensen's alpha measure, the beta measure, the Sharpe ratio [16] and the Treynor ratio [17] have been used in many previous studies to analyse the performance of individual assets [6,12,18–24]. Black et al. [25] suggested that the CAPM statistics explain the correlation between the systematic risk of individual assets and their expected risk premiums.

Jensen's alpha refers to the average portfolio returns, above or below the returns suggested by the CAPM, given the portfolio's volatility relative to the market (beta), the market return and the risk-free rate. The Jensen's alpha is calculated using regression analysis of the portfolio's excess returns over the market's excess returns. The formula for Jensen's alpha is expressed in Equation (1),

$$\left(R_p - R_f\right) = \alpha_P + \beta_P\left(R_m - R_f\right) \quad (1)$$

where

$$\alpha_P = portfolio \text{ Jensen's alpha};$$
$$\beta_P = portfolio\ beta;$$
$$R_p = portfolio\ expected\ return;$$
$$R_f = risk - free\ rate\ (Malaysian\ one - year\ government\ bond\ yield);$$
$$R_m = market\ return.$$

If Jensen's alpha is positive, the portfolio earns more than the market's return. In contrast, if Jensen's alpha is negative, the portfolio performs worse than the market's return [12].

The portfolio beta measures the portfolio's volatility or systematic risk in relation to the overall market. Beta is computed using Equation (1). The security with a beta value of 1 indicates that its price movement is strongly correlated with the market. If a security has a beta higher than 1, its price moves theoretically more than the market. If the security swings less than the market, its beta is lower than 1. Beta estimates the portion of the asset's statistical variance that cannot be eliminated by the diversification obtained from the risky assets portfolio due to its correlation with other portfolio assets' returns [26].

The Sharpe ratio provides information on the returns of an investment compared to its risks without considering a market index [27,28]. The Sharpe ratio measures the excess return received for holding a riskier asset. The higher the value of the Sharpe ratio, the better its risk-adjusted performance, and vice versa [12]. The formula to calculate the portfolio's Sharpe ratio $\left(S_p\right)$ is described in Equation (2):

$$S_p = \frac{R_p - R_f}{\sigma_p}, \tag{2}$$

where

$$R_p = expected\ return\ of\ the\ portfolio;$$
$$R_f = risk-free\ rate\ (Malaysian\ one-year\ government\ bond\ yield);$$
$$\sigma_p = standard\ deviation\ of\ the\ portfolio\ returns.$$

The Treynor ratio was introduced by Treynor [29] to calculate returns subtracted by the risk-free rate on each market risk unit. Unlike the Sharpe ratio, the Treynor ratio considers only the portfolio beta (β_P), also referred to as systematic risk, instead of the portfolio's standard deviation or total risk (σ_P). Consequently, the Treynor ratio introduces a useful parameter for evaluating the portfolio outcome that only is a part of the investor's assets. A greater value of the Treynor ratio shows the superior performance of the portfolio as more returns are earned per unit of market risk [12]. Equation (3) calculates the Treynor ratio of the portfolio (T_P):

$$T_P = \frac{R_P - R_f}{\beta_P}, \tag{3}$$

where

$$R_p = expected\ return\ of\ the\ portfolio;$$
$$R_f = risk-free\ rate\ (Malaysian\ one-year\ government\ bond\ yield);$$
$$\beta_P = portfolio\ beta.$$

The CAPM statistics test the performance of the portfolio based on the first two moments and the assumption that the underlying return series follows the normal distribution. The stochastic dominance (SD) method, however, is a non-parametric approach which requires no assumption about normality within the data sample. The current research tests first-order, second-order and third-order SD under which the investor's utility function satisfies cumulatively non-satiation, risk aversion and non-increasing absolute risk aversion, respectively [11]. Vinod [30] extended the SD to a fourth order and indicated that the utility function for that order should convey the non-increasing absolute risk aversion, law of diminishing marginal utility and non-increasing prudence (Kimball [31] introduces the term "prudence" to describe "the sensitivity of the optimal choice of a decision variable to risk"), describing the SD orders, respectively, as: $u' \geq 0$, $u'' \leq 0$, $u''' \geq 0$ and $u'''' \leq 0$ (u', u'', u''' and u'''' represent the first-, second-, third- and fourth-order utility functions, respectively). Moreover, SD orders from one to four are, respectively, described in terms of local mean, variance, skewness and kurtosis.

In the SD test, $f_a(x)$ and $f_b(x)$ are probability density functions (PDFs) of the return series for two assets, A and B, respectively, and they compute their cumulative distribution functions (CDFs) as $F_a(x)$ and $F_b(x)$, respectively. The negative difference between CDFs of asset A and asset B indicates the first-order dominance of asset A over asset B, expressed as $F_a(x) - F_b \leq 0$. This implies that the expected utility of asset A is equal or more than that of asset B, or in other words, asset A is more preferred than asset B.

In second-order SD, the integrals of the PDFs of the return series are employed to satisfy $\int F_a(x) - \int F_b(x) \leq 0$, meaning the dominance of asset A over asset B. All investors who are non-satiable and risk-averse would choose asset A over asset B. In the third order, if $\int \int F_a(x) - \int \int F_b(x) \leq 0$, this indicates asset A over asset B, or that investors who prefer non-satiation and risk aversion and positive skewness would choose asset A over asset B. Extending from the work of [30], the dominance of asset A over asset B in the fourth order, when $\int \int \int F_a(x) - \int \int \int F_b(x) \leq 0$, indicates that

investors interested in non-satiation and risk aversion and positive skewness would choose asset A and reject asset B. The SD's first- to fourth-order computation procedures are described by Vinod [30,32].

3. Results

This study examines the performances of the ISP and CSP at the sector level and the market level. This study started with an investigation of the normal distribution of Islamic and conventional stock prices with descriptive statistics. The skewness and kurtosis statistics and Jarque–Bera (JB) test results are given in Table 2. In column 3, the twenty (20) and fifteen (15) Islamic stocks confirm the positive skewness and negative skewness, respectively. Similarly, column 8 presents the twenty-four (24) and eleven (11) conventional stocks with positive skewness and negative skewness, respectively. Positive skewness suggests that the share prices are skewed to the right, while negative skewness indicates that stock prices are skewed to the left in comparison with a normal distribution. Consequently, the skewness statistics imply that the prices of both Islamic and conventional stocks do not have the characteristic of a normal distribution. In column 4, the kurtosis statistics of twenty-two (22) Islamic stock prices are lower than three (3), and the kurtosis statistics are higher than three (3) for the remaining thirteen (13) Islamic stock prices. Similarly, column 9 confirms that the kurtosis statistics of twenty-four (24) conventional stock prices are less than three (3), and the kurtosis statistics are more than three (3) for the other eleven (11) conventional stock prices. The kurtosis analysis suggests that the prices of Shariah-compliant and traditional shares do not show normal distributions; either they have lower and broader peaks or higher and sharper peaks. Finally, the higher-value JB statistics, which are far from zero, in columns 5 and 10 for the Islamic prices and non-Islamic stock prices, respectively, provided evidence of non-normality at the 99 percent confidence level.

The CAPM statistics of Jensen's alpha, beta, Sharpe ratio and Treynor ratio are given in Table 3 and create 20 measures (4 statistics × 5 sectors) and four (4) measures (4 statistics × 1 market) to evaluate the performances at the sector and market levels, respectively. Jensen's alpha of the CSP is lower than that of the ISP for the CP, IP, PR and TS sectors, suggesting that the CSP underperforms the ISP for all sectors except the case of the PL sector and market. It also leads to conclude that the CSP performs better than the ISP for the PL sector and at the market level. The beta of the ISP is smaller than the CSP's beta for all sectors and the market. This suggests that the ISP is less volatile to the market and performs better than the CSP at the sector and market levels. The higher Sharpe ratio of the ISP than the CSP indicates that the ISP outperforms the CSP in the IP and PR sectors and also suggests that the CSP performs better than the ISP for the CP, PL and TS sectors and the market. The Treynor ratio of the CSP is lower than that of the ISP, indicating that the ISP surpasses the CSP in the CP, PR and TS sectors and at the market level, and also revealing that the CSP performs better than the ISP in the IP and PL sectors. Overall, the ISP exceeds the CSP in 14 out of 20 measures at the sector level, denoted by *, signifying that the ISP is superior compared to the CSP for return and risk trade-off. However, the ISP and CSP perform equally (two out of four measures) at the market level, denoted by * and **, respectively.

The well-accepted CAPM is measured by the combination of four ratios: Jensen's alpha, beta, Sharpe ratio and Treynor ratio, which produced mixed performance outcomes for six ISPs and six CSPs. Further, these four ratios are based on the assumption of a normal distribution of the Islamic and conventional stock prices; however, the stock prices have failed to meet this assumption. Therefore, we used non-parametric stochastic dominance (SD) analysis that does not require the normal distribution of stock prices and accommodates the CAPM drawbacks. The results of the JB normality tests in Table 2 for the Islamic and conventional stock prices reveal that if the prior results are driven by a violation of parametric assumptions, the non-parametric SD method can lead to different conclusions [11]. The findings of the SD analysis are given in Table 4. At the sector level, the ISP is found to stochastically outperform the CSP for all sectors. The exception occurs for the PR sector at all orders where the CSP stochastically outperforms the ISP. The ISP stochastically dominates the CSP at the first, second, third and fourth orders for the market level.

Table 2. Descriptive statistics of Islamic and conventional stocks.

Islamic Stock					Conventional Stock				
Portfolio	**Company**	**Skewness**	**Kurtosis**	**JB**	**Portfolio**	**Company**	**Skewness**	**Kurtosis**	**JB**
ISP-CP	Nestle M	−0.62	2.00	201.07	CSP-CP	Britis Am	0.14	1.73	134.85
	PPB Gr	0.12	3.08	5.27		Carlsberg	−0.74	2.28	214.00
	Fraser	1.00	2.53	336.71		Oriental	0.64	2.44	157.13
	QL Res	−0.39	2.53	65.91		Panasonic	0.42	1.76	178.34
	UMW H	−0.87	3.54	265.60		Malaya F	1.54	4.18	868.23
	Dutch La	0.76	3.15	184.65		Guang C	0.42	3.16	57.84
	Hong Le	0.56	2.03	175.93		Lattitude	1.01	3.23	328.70
ISP-IP	Petronus	1.60	6.40	1742.96	CSP-IP	Kech Sen	0.04	2.05	72.75
	Hartalega	−0.06	1.64	149.56		Kian Joo	−0.78	2.33	232.52
	Top Glov	0.36	2.30	81.02		Southern	0.54	2.69	100.17
	Cahya	0.25	1.67	161.92		Rapid Sy	0.28	2.39	54.46
	Kossan R	−0.69	2.08	220.56		Malaysi S	−0.08	1.27	240.12
	DRB Hic	2.34	7.64	3480.78		Tomypac	−0.09	1.93	94.03
	VS Indus	1.60	6.40	1742.96		HIL Indu	1.35	4.10	682.99
ISP-PL	IOI Corpo	−1.76	5.36	1437.23	CSP-PL	Kim Loon	0.03	1.74	127.13
	K. Kepong	−0.67	2.49	164.56		Chin Teck	−0.04	2.64	10.57
	BatuKawa	−0.35	2.19	92.45		TDM	0.98	3.45	320.45
	Genting Pl	0.11	2.16	60.39		Kluang R.	−0.60	2.52	133.51
	United Pla	−1.23	4.03	565.52		Negri Se	0.14	2.37	38.29
	IJIM Plant	0.12	1.83	113.73		Golden La	−0.09	1.58	163.13
	Sarawak	−1.07	2.65	375.40		Malpac H	0.83	2.27	260.38
ISP-PR	S P Setia	0.88	4.02	328.18	CSP-PR	OSK Hold	0.11	4.47	176.80
	Man Sing	2.56	10.61	6726.25		TA Global	0.59	4.62	321.13
	Eastern	0.21	2.34	50.02		Selangor	0.83	3.89	282.85
	KSL Holdi	0.83	3.80	269.19		Berjaya A	2.05	8.54	3798.34
	Paramoun	2.00	5.67	1849.79		YNH Pro	0.32	2.04	106.30
	MKH	2.32	9.07	4670.59		Guocolan	0.62	2.71	127.93
	Yong Tai	0.47	1.91	165.34		Plentude	−0.69	2.67	161.35

Table 2. *Cont.*

Islamic Stock					Conventional Stock				
Portfolio	**Company**	**Skewness**	**Kurtosis**	**JB**	**Portfolio**	**Company**	**Skewness**	**Kurtosis**	**JB**
ISP-TS	Tenaga N	−0.21	2.05	85.76	CSP-TS	Genting	−0.39	2.35	82.30
	Axiata Gr	0.65	2.93	134.30		Genting	−0.67	2.26	189.52
	Maxis	−0.11	1.62	154.85		Hap Seng	0.55	3.54	119.97
	Petronus	0.41	2.25	99.99		YTL Corp	−0.43	2.45	82.29
	Telekom	−0.51	2.75	87.91		Malaysia	0.48	1.82	186.48
	Dialogue	−0.07	1.40	207.08		AirAsia	0.65	2.68	141.32
	MYEG Ser	−0.61	2.13	180.17		Berjaya Sp	1.82	4.37	1208.72

Notes: The Islamic stock portfolio for the consumer product, industrial product, plantation, properties and trading services sectors are represented by ISP-CP, ISP-IP, ISP-PL, ISP-PR and ISP-TS, respectively, in column 1. Similarly, the conventional stock portfolio for the consumer product, industrial product, plantation, properties and trading services sectors are represented by CSP-CP, CSP-IP, CSP-PL, CSP-PR and CSP-TS, respectively, in column 6. Descriptive statistics examine the normal distribution of Islamic and conventional stock prices. The skewness and kurtosis statistics and Jarque–Bera (JB) test results in this table determine the normal distribution of Islamic and conventional stock prices. Columns 3 and 8 examine the skewness statistic for Islamic stock prices and conventional stock prices, respectively. Skewness measures the symmetry of distribution, a skewness of zero indicating the normal distribution of a data series. Columns 4 and 9 report the kurtosis statistics for Islamic stock and conventional stock prices, respectively. If a kurtosis is less than 3, the central peak of the distribution is lower and broader. If a kurtosis is more than 3, the central peak of the distribution is higher and sharper. The JB test results in columns 5 and 10 analyse the normality of the Islamic stock price and conventional stock price, respectively, with the null hypothesis being that the stock price is normally distributed at the 1 percent level of significance.

Table 3. ISP and CSP performance evaluation.

Portfolio	Jensen's Alpha		Beta		Sharpe Ratio		Treynor Ratio	
	ISP	CSP	ISP	CSP	ISP	CSP	ISP	CSP
Panel A: Sector Level								
CP	0.0002 *	0.0001	0.0274 *	1.0009	0.0102	0.0266 **	0.0065 *	0.0002
IP	0.0010 *	0.0002	−0.0803 *	0.4280	0.0439 *	0.0273	−0.0124	0.0005 **
PL	−0.0001	0.0001 **	0.0285 *	0.3948	−0.0041	0.0091 **	−0.0025	0.0003 **
PR	0.0009 *	−0.0001	0.0720 *	0.6420	0.0450 *	−0.0003	0.0127 *	0.0001
TS.	0.0004 *	0.0001	−0.0657 *	1.0451	0.0175	0.0240 **	−0.0066 *	−0.0124
Panel A: Market Level								
MKT.	−0.0001	0.0001 **	−0.0324 *	0.6785	−0.0145	0.0007 **	0.0041 *	0.0001

Notes: The capital asset pricing model (CAPM) statistics of Jensen's alpha, beta, Sharpe ratio and Treynor ratio for the sector level (consumer product (CP), industrial product (IP), plantation (PL), properties (PR) and trading services (TS)) and the market level (MKT) are given in panel A and panel B, respectively. Jensen's alpha is the average portfolio returns, above or below the returns suggested by the CAPM, given the portfolio's volatility relative to the market (beta), the market return and the risk-free rate. Equation (1) estimates Jensen's alpha measures for the Islamic stock portfolio (ISP) and conventional stock portfolio (CSP), which are reported in columns 2 and 3, respectively. Equation (1) also estimates the beta (relative volatility or risk) measures for the ISP and CSP, which are presented in columns 4 and 5, respectively. The Sharpe ratio is the excess return of the portfolio per unit of total portfolio risk. Equation (2) calculates the Sharpe ratios for the ISP and CSP, which are shown in columns 6 and 7, respectively. The Treynor ratio is the excess return of the portfolio per unit of systematic risk instead of total portfolio risk, and a higher Treynor ratio indicates the greater ability of a portfolio to diversify the market risk. Equation (3) provides the Treynor ratios for the ISP and CSP, which are presented in columns 8 and 9, respectively. The symbol * indicates that the ISP outperforms the CSP, and ** denotes that the CSP outperforms the ISP.

Table 4. ISP and CSP performance evaluation with stochastic dominance.

	SD (1)	SD (2)	SD (3)	SD (4)
Panel A: Sector Level				
CP	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$
IP.	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$
PL.	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$
PR.	$SD_{CSP \to ISP}$	$SD_{CSP \to ISP}$	$SD_{CSP \to ISP}$	$SD_{CSP \to ISP}$
TS.	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$
Panel B: Market Level				
MKT.	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$	$SD_{ISP \to CSP}$

Notes: Non-parametric stochastic dominance (SD) analysis does not require the normal distribution of the stock price. This analysis is conducted for the first through fourth orders in terms of mean, variance, skewness and kurtosis, respectively, to evaluate the performance of the Islamic stock portfolio (ISP) and conventional stock portfolio (CSP). The results of the SD analysis at the sector level (consumer product (CP), industrial product (IP), plantation (PL), properties (PR) and trading services (TS)) and the market level (MKT) are given in panel A and panel B, respectively. $SD_{ISP \to CSP}$ indicates that the ISP dominates the CSP, and $SD_{CSP \to ISP}$ indicates that the CSP dominates the ISP.

Economic significance analysis identifies the possibility of financial loss, which is crucial for an investor's decision making. This study employs the non-parametric historical VaR without assumptions regarding the normal distribution of historical stock prices to examine the expected loss of an investment over a specific period at a specific confidence level. Portfolio VaR is an appropriate measure of financial distress risk for a short-term period that is estimated by portfolio liquidity and the risk of adverse net cash outflows [33]. VaR is a statistical measure of expected portfolio shortfall [34]. The results of the historical VaR analysis are given in Table 5. The forecasted financial loss of ISP-CP and CSP-CP is 12.99 and 19.41 percent, respectively, revealing that an investor expects, per year, not more than a 12.99 and 19.41 percent loss for investments in ISP-CP and CSP-CP, respectively. This expected financial loss also suggests that the anticipated loss of ISP-CP is less than that of CSP-CP. Likewise, for all sectors except the PR sector, the expected shortfall of the ISP is smaller than the expected loss of the CSP. The expected loss of ISP-PR (23.84 percent) is marginally higher than that of CSP-PR (20.55 percent). Further at the

market level, the expected loss of ISP-MKT (13.90 percent) is substantially lower than that of CSP-MKT (26.56 percent).

Table 5. Historical value at risk (VaR) analysis.

Portfolio	Bottom 95th-Day Yearly Return	Bottom 96th-Day Yearly Return	Bottom 95.9th-Day Yearly Return (Expected Loss at 95% Confidence)
ISP-CP	−0.130193	−0.129917	−12.99%
CSP-CP	−0.194387	−0.194015	−19.41%
ISP-IP	−0.179222	−0.176407	−17.66%
CSP-IP	−0.192099	−0.191241	19.13%
ISP-PL	−0.143089	−0.141718	−14.19%
CSP-PL	−0.197628	−0.197603	−19.76%
ISP-PR	−0.239635	−0.238321	−23.84%
CSP-PR	−0.207277	−0.205338	−20.55%
ISP-TS	−0.180733	−0.170699	−17.17%
CSP-TS	−0.202882	−0.200995	−20.12%
ISP-MKT	−0.140939	−0.138838	−13.90%
CSP-MKT	−0.265837	−0.265598	−26.56%

Notes: The total 1919 trading days from 6 January 2010 to 29 December 2017 provide 1918 portfolio return days. For the 5% historical VaR, the bottom 5% of cases determine the 95.9th-day (5% of 1918) return. The 95.9th-day return lies between the 95th-day and 96th-day returns. First, the bottom 95th-day and 96th-day returns are obtained from 1918 portfolio return days, and then, the bottom 95.9th-day return is determined by interpolating the [95th-day return + (96th-day return—95th-day return) × 0.9], which is the 5% historical VaR. The Islamic stock portfolio for the consumer product, industry product, plantation, properties and transportation service sectors is denoted by ISP-CP, ISP-IP, ISP-PL, ISP-PR and ISP-TS, respectively. Similarly, the conventional stock portfolio for the consumer product, industry product, plantation, properties and transportation service sectors is represented by CSP-CP, CSP-IP, CSP-PL, CSP-PR and CSP-TS, respectively. ISP-MKT and CSP-MKT represent the Islamic and conventional stock portfolios, respectively, at the market level.

4. Discussion: Performance of Islamic Stock Portfolios, and Open Innovation

A traditional innovation model refers to the innovation process that takes place inside the company without any connection to the external environment until the introduction of the product to the marketplace. Due to shorter innovation cycles, increasing research and development costs, as well as growing involvement of technology and consumer tastes, traditional innovation no longer creates superior benefits. The change in market dynamics has resulted in significant attention to the open innovation paradigm, which enhances internal innovation and expands markets for external use of innovation [35]. At the firm level, open innovation provides a powerful tool that consists of generating, identifying and implementing intellectual property [36]. The majority of companies, or even whole industry sectors, compete mainly through innovation. For instance, pharmaceutical firms need to invent new drugs regularly, or advertising companies need a constant update of snappy original taglines. Innovation helps these enterprises sustain a competitive edge in comparison with price competing, convenience or other aspects of a business. Open innovation has a positive relationship with the firm's financial performance [37]. In terms of portfolio management, open innovation provides an effective manner for risks and expenses sharing with external parties [38]. Thus, portfolio management needs to be considered incorporated with open innovation as an overall innovation management system to address risks and probability efficiently and achieve the expected economic returns.

The Islamic finance market has been developing dramatically and quickly. Islamic finance innovations and ethical values can bring new diversification benefits to investors, especially in the context of the global financial crisis. The favour of investors in Islamic funds is significantly strong as Shariah-compliant finance allows them to earn higher returns and lower risks [10]. Digital technology has been transforming the landscape of financial services. Automation, robotic, Shariah-compliant investment platforms are becoming more popular and are continuing to grow in Malaysia [39]. Thus, facilitating access to Islamic

finance innovations plays a vital role in the growth of the financial market. However, Islamic finance innovations must comply with the Shariah law for its products and services. Islamic finance shares some similarities in terms of market and credit risks with its traditional counterpart. However, it is different from non-Islamic finance by a second layer of Sharia risks [40]. Sinclair [41] indicated that legal institutions, which define not only incentives but also rights and obligations in financial contracts, are the core of financial innovations. With many strong Islamic institutions, Malaysia has become the heart of financial innovations parallel with developing the regulatory environments to protect religious rules to minimise Islamic risks [40]. The application of the existing theories in open innovation to the Malaysian Islamic finance industry needs to be investigated cautiously, considering differences in regulatory and law aspects, capital markets, industry structure and cultural components.

5. Conclusions

This paper analyses the performance of the ISP and CSP in the Malaysian stock market, where Islamic stock and conventional stock are traded simultaneously in the MYX. The CAPM statistics of Jensen's alpha, beta, Sharpe ratio and Treynor ratio signify that the ISP is superior compared to the CSP in providing a higher return with lower systematic risk at the sector level. This is consistent with the conclusions of [12,22,42,43], which concluded that Islamic stocks provided a superior outcome than conventional stocks. Similarly, Hayat and Kraeussl [44] also revealed that Islamic funds outweighed their conventional counterparts. However, there is no difference in the performance of the ISP and CSP under the CAPM statistical measures at the market level. This result is supported by the conclusions of Dharani and Natarajan [42]. They studied the performance of Shariah and conventional stock portfolios for the Indian market from 2001 to 2007 and reported that both portfolios performed equally.

The CAPM statistics provide a mixed result for the performances of the ISP and CSP at the sector and market levels. Further, the CAPM statistics of Jensen's alpha, beta, Sharpe ratio and Treynor ratio rely on the assumption that the sample data are normally distributed; however, Islamic and conventional stock prices are not normally distributed. Consequently, this study employs the non-parametric SD approach, which does not require a normal distribution of stock prices, to examine the performances of the ISP and CSP at the sector and market levels. Interestingly, the ISP stochastically dominates the CSP for all sectors and the market except for the PR sector. SD analysis examines the preference based on the return between the ISP and CSP without considering the riskiness of the ISP and CSP; that is, how much risk a decision-maker is willing to take is not an issue. The results of the SD analysis are consistent with the findings of Dharani and Natarajan [42], who showed that Shariah stocks produce better returns than non-Shariah stocks.

The CAPM statistics examine the performance of the ISP and CSP based on their return with an associated risk. The SD approach evaluates the performance of the ISP and CSP from a return perspective without considering the riskiness of the portfolio. The CAPM statistics and SD method do not quantify the probability of loss of the ISP, and CSP economic significance analysis identifies the possibility of financial loss for investing in the SCP and CSP. The expected minimum financial loss of the ISP is lower than that of the CSP for all sectors except for the PR sector. Interestingly, the minimum anticipated financial loss of the ISP is significantly less than that of the CSP at the market level.

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