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Downside Beta Modelling for Shariah Compliant, Conventional and Bitcoin Indices as A Proxy for Malaysia

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Abstract

The study focuses on establishing the downside beta for Shariah compliant index, conventional index and bitcoin index (a cryptocurrency) in Malaysia. The indices for the Shariah compliant is the FTSE Bursa Malaysia EMAS Shariah (FTFBMS), the conventional index used is the FTSE Bursa Malaysia EMAS (FTFBMEMAS) and the proxy index for the cryptocurrency is the bitcoin. Given the weak track record of cryptocurrencies in Malaysia, the bitcoin is used as a proxy to simulate cryptocurrency behavior in Malaysia. Downside beta for the three portfolios is calculated through the use of historical volatility (HV) and the Exponentially Weighted Moving Average (EWMA) methods. The findings indicate there is a statistically significant difference in downside beta for each of the portfolios, although the difference is very minimal between Shariah compliant index and the conventional index. However, bitcoin poses to be a riskier portfolio with significant difference over both other indices. The low beta for Shariah complaint indices and its conventional counterparts suggests the large market volume the two indices share, still maintaining them as the mainstream financial models. While bitcoin is vastly riskier, it is surely making promising strides as far as financial trading methods are concerned. Moreover, there is great optimism in cryptocurrency models that assimilate moral Islamic trading principles as research has shown Shariah compliant stocks to be more efficient.

Keywords: Downside beta; Shariah; Conventional; Bitcoin

1. Introduction

1.1 Background

The section covers the background of the study. The concept of safety-first introduced by Roy (1952) is the backbone of downside beta. It made the pronounce distinction of an investor's appetite to differentiate between

higher and lower co-moments. Essentially, it reaffirms that investors generally have asymmetric value functions which motivates them to pay keen attention to the distribution of positive and negative returns. The profoundness of downside beta, also synonymous to downside risk, is that investors are more concerned with avoiding losses over having potential gains. The formula below captures downside beta's influence in the return of an investor.

$$R_i = R_f + \beta_{im}^{-}(R_M - R_f) + \varepsilon_i \quad (1)$$

where,
R_i: Expected return on i^{th} Asset,
R_f : Risk free rate,
β_i^- : Downside beta,
R_M : Return on the market,
$(R_M - R_f)$: Market risk premium.
$\varepsilon_i \sim (0, \sigma^2)$: *Residual*

As such, Stuart & Markowitz (1959) recognized this important distinction in his portfolio maximization model. Other early contributors in the modelling of risk return trade-offs included Hogan & Warren (1974) and Arzac & Bawa (1977). Shortly after, Bawa & Lindenberg (1977), Harlow & Rao (1989) and Estrada (2002) also made improvements to the Lower Partial Moment-CAPM or downside beta. The general CAPM beta is given as:

$$\beta_{im} = \quad (2)$$

The innovation with Harlow & Rao (1989) involves setting a defined target instead of the risk free rate. This target is generally set at the equity market mean return. The estimation of downside beta using this method still proves to be efficient in demonstrating that investors who manage downside beta will enjoy better premiums as indicated by Rashid & Mehmood (2018). The equation for downside beta as given by Harlow & Rao (1989) is:

$$\beta_{im}^{(HRM)} = \quad (3)$$

Where,
R_i : Return on the i^{th} asset,
u_i : *Mean asset return,*
u_m : *Mean market return,*
R_m : Return on the market.

Generally, the Greek letter beta (β=1) is introduced for the wave movement of beta exhibited by the general market. Thus, security betas are measured in relation to the market beta. Any aggressive security will have a $\beta > 1$ and defensive securities will have a $\beta < 1$. In lieu of a security's position in that spectrum, if the market returns are negative (Downside Beta), portfolios will react in retrospect. The study focuses on computing the downside volatility of Shariah compliant index, cconventional and a cryptocurrency index proxy (Bitcoin) of firms in Malaysia. The market indices for Shariah compliant index is the FTSE Bursa Malaysia EMAS Shariah (FTFBMS) and the conventional index is the FTSE Bursa Malaysia EMAS (FTFBMEMAS). The study uses the bitcoin currency as a good model proxy given the weak existence of cryptocurrency in Malaysia. The track record of the bitcoin and its wide acceptance globally makes it a strong contender and a good proxy to use for the purposes of this research. The computation of downside beta is achieved through the modelling of strictly negative index returns for the period 1st January 2015 to the 1st of January 2020, using the HV and EWMA methods.

1.2 Objective

The objective of the study is to:

1. Establish the comparative downside beta for Shariah compliant, conventional and bitcoin indices using EWMA and HV methods.

2. Literature review

2.1 Background

Malaysia is recognized to be a huge player in the Islamic Capital Market with a leading market size of over RM 1.7 trillion according to Securities Commission Malaysia (2016). Authors that focused on beta and return relationship between Shariah compliant indices and their conventional counterparts includes Ben Rejeb & Arfaoui (2019), with the proposal that Islamic stock indices are more volatile than their conventional counterparts although Islamic stock indices are more information efficient. However, Mwamba et al. (2017) indicates that Islamic stocks are less risky when compared to their conventional counterparts during "extreme events". Other publications with similar findings includes the research of Dewandaru et al. (2015), suggesting that Shariah compliant stocks are less risky as compared to their conventional counterparts.

While the existence of both Shariah compliant financial models as well as their conventional counterparts has been long practised, the birth of cryptocurrencies is relatively new. The operations of cryptocurrencies in Malaysia indicates that Luno Malaysia Sdn. Bhd., SINEGY Technologies (M) Sdn. Bhd. and Tokenize Technology (M) Sdn. Bhd. are the only approved cryptocurrency exchange operators listed by the Securities Commission (SC) as of 1st June 2019, as indicated by Fong (2019). Moreover, Bank Negara has rolled out policy document which stipulates the minimum requirements and standards that guides the crypto currency institutions on their continual reporting to the bank so as to effectively deal with potential acts of Anti-Money Laundering (AML) and Counter Financing of Terrorism (CFT).

2.1.1 Shariah Compliant Index

The Shariah Advisory Council (SAC) of the Securities Commission Malaysia (SC) is responsible for approving securities to the list of formally acknowledged Shariah Compliant securities. The Security Commission was established under the Securities Commission Act of 1993 as a regulatory body and to aid in the capital market development. Also, part of the Security Commission's mandate is to issue licensing to deserving entities and further ensuring that due processes are strictly adhered to. The SC is also tasked with protecting the investor Securities Commission Malaysia (2012).

There are evidently fundamental pillars through which Islamic indices differentiate themselves from Conventional indices. Some of these principles involve the reluctance to participate in practices involving uncertainty (Gharar) and speculation (Maysir), unwillingness in trading haram goods and not involving in taking interests after transactions. However, it is argued by most researchers that the parameters that bound Shariah-compliant stocks makes it less appealing from a portfolio diversification standpoint. This consequently results in slightly more volatile returns for Shariah-compliant indices over their conventional counterparts as specified by Hussein & Omran (2003).

For firms to qualify as a Shariah compliant business, they are required to undergo a screening process. The total number of Shariah compliant securities in Malaysia as at 29th May 2020 is cumulated at 697, according to the Securities Commission Malaysia (2020). There continuous to be a growing interest in Shariah compliant

investments by virtue of its progressive governance structure. There are a few fundamental pillars that distinguishes between Shariah compliant investments over conventional and bitcoin investments.

While the feud between Shariah compliant index and conventional index continues to grow interest, the relatively new financial system (cryptocurrency) is gradually making its mark. However, there has been sceptics questioning the legality of cryptocurrency with respect to its conformity to Shariah compliant principles. To its effect, the Securities Commission Malaysia (2019) acknowledges the permissibility of trading in digital currency so long as it is "backed by gold, silver and currency". The commission further indicates that both trading in digital currency without any underlying and digital currencies backed by "ribawi items other than gold, silver and currency" is not accepted under the rules that govern Shariah principles.

While Shariah compliant principles have a few objections, other factors enable a high engagement with cryptocurrencies. Research done by Ku-Mahamud Et al (2019) informs that the level of education, age or industry sector does not affect the use of the cryptocurrency. Moreover, while Bitcoin seems to be the dominator in the global market, users also have other cryptocurrencies alternatives such as the Ethereum.

2.1.2 Conventional Index

The conventional financial system has long been accepted as the universally practiced model without the limitations of the highlighted Shariah compliant prohibitions. Therefore, conventional firms are better positioned to involve in a wider array of portfolios. Whereas there is growing controversy over the volatile nature of conventional indices, different views continue to surface. Conventional indices do show remarkable similarities with their Shariah compliant counterparts to the point of indistinguishable volatility amongst the two portfolios, as researched by Kholifatul & Fauzan (2016) and Bayram & Abdullah Othman (2019).

Treating the general market as a pie, both conventional and Shariah compliant securities are now compelled to cater a share for the new financial trading model (Cryptocurrency). The use of cryptocurrencies, besides being low maintenance cost, is fast to transact and easy to use unlike traditional banking. This is a key reason why it has been greatly but cautiously considered. However, the main reason the market has seen a dramatic increase of usage is due to the global pandemic which has restricted residents in their homes. This trend is not expected to decline until a vaccine is developed, with researchers such as Cortez (2020) estimating a viable vaccine in 2021. The globe is still in a partial lockdown, with some nations easing restriction of movement but still implementing regulations such as social distancing, wearing of masks and washing of hands as guided by the World Health Organization (2020). This shows that the agenda is minimal physical interaction or touching which is inevitable in exchange of hand-to-hand physical cash hence reinforcing the point that there is potential for the crypto market to grow and continue ahead.

2.1.3 Bitcoin Index

First introduced by Satoshi Nakamoto, cryptocurrency was founded on the basis of performing peer to peer financial services, as published by Wright (2019). The crypto part of the name represents a secured method used to make the currency, that is also commonly known as cryptography. The unique features about cryptography is that it makes it nearly impossible to counterfeit the currency nor double spend. In a sense it can be compared to be having a unique ID which is unchangeable and very secure. Furthermore, it uses encryption techniques, algorithms that give secure keys to the users involved which gives the entire system a solid protection. Amongst some key features of the virtual currency, it uses a new technology called Block chain. It is a distributed type of ledger that is managed by a system of computers in a given network. Furthermore, one of the most distinguishing feature of cryptocurrency which makes it a very widely debated topic is that it is not centrally governed by any government or organization which makes any sort of manipulation very difficult, if not impossible. Following this line of thought, the currency is also not issued by any particular authority who will then be controlling it.

Also, shifting attention to Malaysia, there is realization of increased interest in cryptocurrency, especially during the ongoing pandemic where citizens have resorted to use virtual currency as the medium of exchange. It is

likely that this among other reasons has compelled the government to allow the currency to operate legally in the country. The revolution of virtual currency which includes both cryptocurrencies and fiat money via mobile apps or e-wallets, has recently got a lot of attention. Now that people are restricted to their homes, the use of virtual cash is becoming prevalent. There are many types of cryptocurrencies floating, however the most notable ones are Bitcoin, Ethereum, Litecoin, Tether and XRP as evidenced by Chez (2018).

Flow of funds

There are two parts the mining of the unit currency and storage of the transactions. Similar to mining gold from underground mines and then representing the amount versus physical money, how the modern world is operating, cryptocurrency also uses a similar analogy except that it is virtual.

Bitcoins are made at a fixed rate which follows the Bitcoin protocol. Accordingly, as represented by Bitcoin.org (2009), there will exist only 21 million coins circulation as they are mined. Presently, the total amount of bitcoins in circulation is 18.444 million according to Block-chain's official website, Blockchain.com (2020). There are generally 4 ways to get bitcoins; as payment for goods or services, exchanging them with fiat money at Bitcoin exchange platforms, exchanging with another user or by mining. Mining is the lingo used to explain what an auditor does in basic sense. Miners get paid for mining, and they work as auditors who verify bitcoin (and other similar cryptocurrencies) transaction security and validation which is done using computers. This auditing is what avoids any issues like double-spending and checking for legitimate coins.

As mentioned earlier, cryptocurrencies work on a technology called blockchain. Which is a public leger that keep records of transfers in a given system. The transactions that occur are anonymous and does not require the physical presence of both parties together. The blockchain serves as the engine of the secure transfers. Any transfer has to go through the system ledger, verified and then stored as an archive. The storage of data or transaction is done in what is called "blocks", each block stores information about transactions like date time and amount spent. Then it also stores the identity of the users involved, however these are not actual names of the persons but detail signatures of the parties involved. Finally, each block is given a unique code called a "hash" which helps to identify it and other millions of blocks as portrayed by Reiff (2020).

Then comes the process of the transaction, for a block to be added to the so called chain, a transaction must take place. The transaction is verified as mentioned above, then it is stored in the block and finally the block is given a hash. Once these steps are done it is added to the chain. Then, the transaction information of the block can be seen on the official website, which updates every time a new block is mined. For example, Bitcoin, can be seen in categories of height, hash (unique code), mined(time), miner and size on simple display, while individually select the hash more information can be seen.

The use of cryptocurrencies is starting to manifest in Malaysia such that there exist at least 5 Bitcoin Automated Teller Machine. One at Petaling Jaya in Selangor, Langkawi, Nilai, Klang in Selangor and Ipoh in Perak as reported by AskTraders (2020).

Issues and challenges

Cryptocurrencies have seen both positive and negative opinions since inception. Amongst the biggest critics are claims that unlawful organizations conduct illegal activities such as money laundering and payment for such activities. Other risks are cyber-related crimes such as hacking of personal user data and malware infected applications which aims to steal information or virtual currency. Although, currencies like Bitcoin claim that it is difficult to hack the currency itself, but the user end can be compromised, as it has been in the past, nonetheless with advancement in the technology more precautions are being taken and security systems such as multi-signature transactions and wallet encryption have been introduced to reduce this risk. Also, part of the main aspects of cryptocurrency is anonymity and ease of operation. However, some companies like Bitcoin have made their currency such that a law enforcement agency can possibly trace and arrest such culprits. Yet still, other currencies like Monero offers almost total user anonymity which allows for all sorts of activities as stipulated by Wilson

(2019).

Other traits are regulation of the currency, unlike traditional fiat money which is regulated by government worldwide, cryptocurrencies don't have any central body to regulate it. And the key aspects are cheap transfer and no heavy charges like traditional banking systems. In Malaysia the government has implemented some regulation towards the use of cryptocurrencies and the central bank with securities commission are doing what they can to enforce the regulations.

There is great potential for Bitcoin to thrive as published by Yussof & Al-Harthy (2018). However, the biggest risk for implementing such a system without detailed regulation by the government can lead to cyber related crimes and other potential crimes.

2.2 Conceptual Framework

The figure below highlights the conceptual framework of the research.

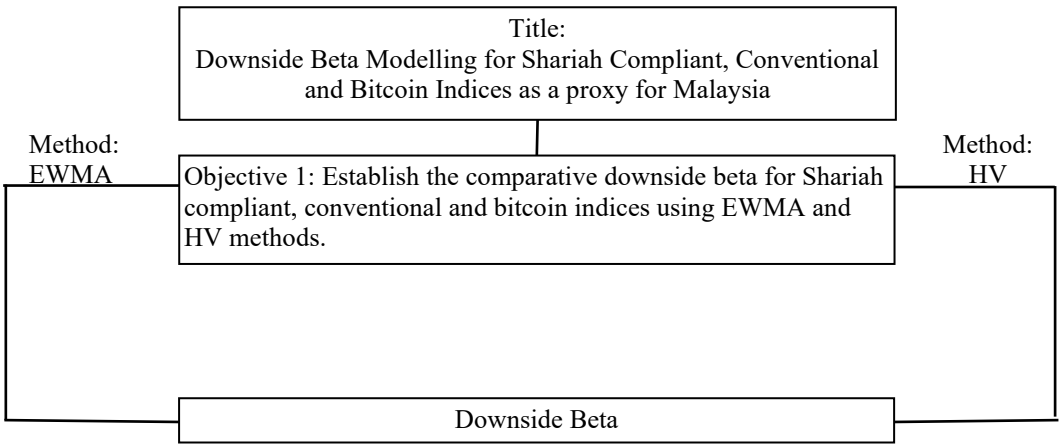

Figure 5. Conceptual framework of the research.

3. Methodology

In order to gain a strategic investment scheme, it is important to be able to predict simulations of market behaviour. This assures a clear qualitative description of how one can make an optimal investment with a sufficiently enough controlled risk and return. The raw data was retrieved from Investing.com (2020). The daily returns were continuously compounded by taking the log return. Thereafter, the data was filtered to capture only days that the indices recorded values below the zero threshold. Finally, the EWMA and HV methods delivers the downside beta scores.

3.1 Data

The data obtained for the daily openings of Shariah-compliant index (FTSE Bursa Malaysia FTFBMEMAS SHARIA), Conventional index (FTSE Bursa Malaysia FTFBMEMAS) and the cryptocurrency proxy (bitcoin) ranged from 1st January 2015 to the 1st of January 2020. This is enticed by the emerging Malaysian market growth over the last few years and its effectiveness in refining this data with better precision and accountability.

3.2 Model Development

The listings for the daily openings is extracted from the dataset. In calculating the downside beta, the daily log returns are computed. Furthermore, the returns are subtracted from a target return (set at 0). This is the by-line that differentiates upside from downside betas. The standard deviation, which represents the volatility is then computed for the three portfolios over the 5-year period. The proposed null hypothesis is that there is no difference in downside mean values between the three portfolios (FTFBMEMAS, FTFBMS and Bitcoin).
The first hypothesis proposes that there is no statistical difference in the mean downside beta values of FTFBMS and Bitcoin indices. The alternative hypothesis suggests that there is a difference. Therefore:
$H_0 : \mu_d = 0$
$H_A : \mu_d \neq 0$
Where,
H_0: The null hypothesis
H_A: The alternative hypothesis
μ_d : The difference between mean downside values of Shariah compliant index and bitcoin index.

The second hypothesis seeks to establish whether there is any statistically significant difference between Bitcoin and FTFBMS. Other than this innovation, both null and alternate hypothesis statements remain the same.

The third hypothesis is set similar to the above mentioned hypothesis with the only difference in the replacing of Bitcoin with FTFBMEMAS. This seeks to establish whether there is statistically significant difference between the selected Shariah compliant index with its conventional counterpart. Both null and alternate hypothesis remain the same.

3.3 Method

The index return is simply a measure of how much money an investor gains or losses on an investment. It is a fundamental index in our computation of downside beta, which ultimately discloses the level of volatility/Beta. The daily index returns (u_{n-i}) will be generated by:

$$Return_t = u_{n-i} = Ln\left(\frac{Price_t}{Price_{t-1}}\right) \quad (4)$$

where,
$Return_t$: u_{n-i} : Index Return at time t,
Ln: Natural Logarithm,
$Price_t$: Index price at time t,
$Price_{t-1}$: Index price at time t – 1.

The target return is set at 0. This becomes the mean ($\bar{u}$) return to differentiate the downside returns from the upside. It is denoted by:

$$\bar{u}_i = 0 \quad (5)$$

3.3.1 HV Method

Standard deviation is a measure of volatility. It is obtained through computing the squared downward deviation from a benchmark (FTSE KLCI). In more analytical terms, it is expressed by (Post, van Vliet, & Lansdorp, 2012):

$$\beta_{sv,i} \equiv \frac{\quad}{\quad} \quad (6)$$

The numerator details the covariance between the market and the index returns while the denominator highlights the variance of the market returns.

After sorting the returns for shariah-compliant indices and Conventional indices, the next step is to find the variance of each portfolio. Firstly, the daily returns are each subtracted from the target return (0). Then, the values obtained are each squared and summed up. Finally, the result is divided by the total number of trading days in the sample size. In a statistical form, it is denoted by:

$$\sigma_n^2 = \frac{}{} \sum (u_{n-i} - \bar{u})^2 \quad (7)$$

where,
σ^2 : Variance,
m : Number of trading days,
u_{n-i} : Return on i^{th} asset,
$\bar{u}$: Return threshold that separates losses from gains.
The standard deviation is then given by taking the square root of the variance.

$$\sigma = \sqrt{\sigma^2} = \sqrt{\frac{}{} \sum (u_{n-i} - \bar{u})^2} \quad (8)$$

Where,
M= 59 days

NB: The volatility for the 60th day was calculated by using the opening index returns of the first 59 days. Therefore, there is no recorded daily volatility for the first 59 days because the returns were used as statistics to inform on the volatility for the 38th working day. This is not necessary for the HV but for the EWMA. Therefore, to maintain consistency, the HV was computed for the whole 5-year period, except the first 2 months of 2015.

3.3.2 EWMA Method

The EWMA is an instrument that detects smaller fluctuations in the mean of data points constrained by time. By way of assumption, the EWMA is significant only when observations are normally distributed. In our computation of volatility, the EWMA allows for flexibility in more recent weights having a higher influence on the volatility as opposed to previous periods. The only innovation for the EWMA is the addition of weighted averages. The innovation for the EWMA is the addition of weights which assign higher magnitude to more recent returns. Therefore, the 59 days' variance are such that the 59th day carries 94% of the total weight. This is called the smoothing parameter. The 59th day is assigned a weight of (94% of the weight of day 59). The 59th day is assigned a weight of (94% of the weight the 59th day), and so on. This implies that yesterday's return has a much higher influence in predicting today's returns as compared to the long run history. It is noteworthy to recognize that the introduced weights are allocated in an exponentially declining order.

The EWMA introduces a controlling/smoothing parameter lambda (λ) which is levered on each squared periodic return. λ is a decay factor that lies between 0 and 1. It is typically assigned a value between 85% to96%? The decay factor's effects on the model is such that lower λ values will suppress the influence of more distant squared returns.

A lambda of 94% is chosen in this research as it is mainstream in most financial risk management companies MSCI (n.d). The weight for the most recent return will be (1-94%), the subsequent weight will be (94% of the (1-94%)) and so on. This is represented as:

$$\sigma_{t-1}^2 = \lambda\sigma_t^2 + (1-\lambda)r_{t-1}^2 \quad (9)$$

Where:
λ : smoothing parameter
σ : Variance
r : index return

The EWMA uses a refined method of calculating the variance as defined by Wahab (2009)

$$\sigma^2 = \qquad (10)$$

where,
$(\lambda \mid 0 < \lambda < 1)$,
λ : Smoothing parameter.
In summary:

1. We first obtain the daily log returns for the different portfolios in our study.
2. Next, we find the return threshold that separates loses from gains. This is subtracted from the monthly log returns.
3. Then, the log returns subtracted from the return threshold is squared. This is the variance of the portfolio and it is represented by:

$$\sigma_n^2 = \qquad \sum (u_{n-i} - \bar{u} \mid (u_{n-i} < \bar{u})^2 \qquad (11)$$

where,
σ^2 : Variance,
u_{n-i} : Portfolio Return,
m : Number of days,
$\bar{u}$: Return threshold that separates losses from gains.

4. Assign weights to the returns in descending order of proportions with the most recent return carrying the most weight. The weights are assigned as $(1-\lambda)\lambda^{i=0}$ to the i^{th} return.
5. The squared returns are multiplied with their corresponding weights and summed up.
6. Finally, the value is divided by the total number of trading days to give the total downside variance of the portfolio. The square root of the variance yields the standard deviation.

4. Results and analysis

4.1 Results

The descriptive analysis using the EWMA method indicates a higher mean downside value for Bitcoin, at 36.94%, followed by Shariah compliant and Conventional index respectively. The same sequence is observed for the standard error as well as the median values. However, Shariah compliant index records a higher kurtosis value at 3.05, followed by Conventional and Bitcoin index respectively. Moreover, Shariah compliant index is more skewed to the left, followed by Conventional index and then bitcoin being the least skewed at 0.78.

Table XI: Downside volatility scores of the indices using EWMA and HV methods.

	PANEL A EWMA			PANEL B HV		
Descriptive	FTFBMS	FTFBMEMAS	BITCOIN	FTFBMS	FTFBMEMAS	BITCOIN
Mean	6.31%	5.84%	36.94%	5.78%	5.33%	34.64%
Standard Error	0.10%	0.09%	0.55%	0.09%	0.08%	0.43%
Median	5.54%	5.06%	34.80%	5.22%	4.46%	35.41%
Mode	#N/A	#N/A	#N/A	0.05	0.07	0.31

Standard Deviation	3.45%	3.15%	18.89%	3.04%	2.73%	14.71%
Sample Variance	0.12%	0.10%	3.57%	0.09%	0.07%	2.16%
Kurtosis	3.05	2.63	0.57	2.18	1.60	0.34
Skewness	1.53	1.54	0.78	1.38	1.34	0.46
Range	22.28%	18.26%	108.37%	14.77%	12.12%	73.03%
Minimum	1.53%	1.70%	5.97%	1.47%	1.67%	7.90%
Maximum	23.81%	19.96%	114.35%	16.24%	13.79%	80.93%
Sum	74.73	69.18	437.72	68.47	63.13	410.08
Count	1185	1185	1185	1184	1184	1184

The HV method records a higher value for all the measured quantities relative to the EWMA method. This is as a consequence of having to parameterize the HV method into assigning more weights to more recent returns. Similarly, the Mean downside value for bitcoin equals 37.10%, followed by Shariah compliant index at 6.31% and Conventional index at 5.84%. The kurtosis for Shariah compliant index follows a normal distribution at 3, while kurtosis for conventional index and bitcoin are relatively lower at 2.63 and 0.45 respectively. The figure below captures the downside volatility for the three indices used in this study through the EWMA method.

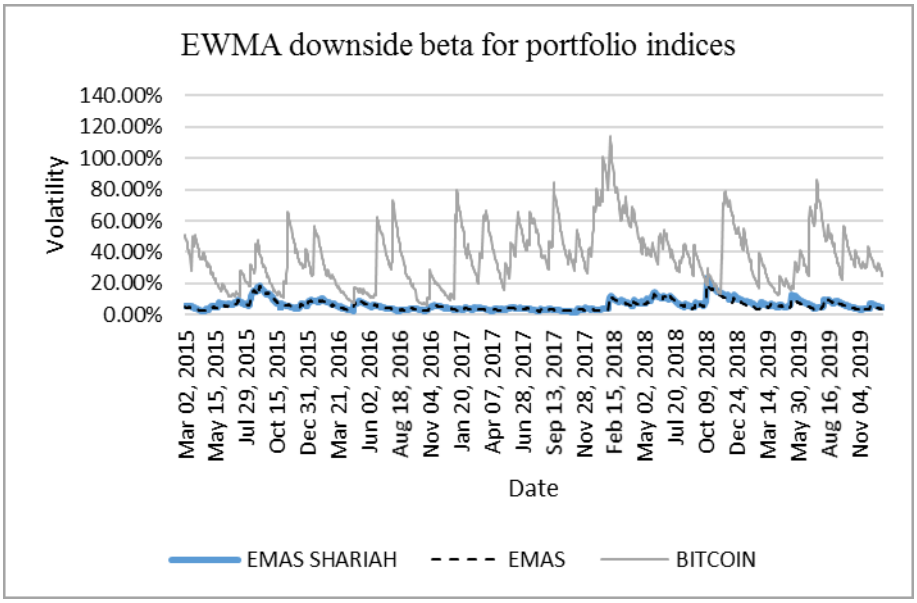

Figure 6: EWMA downside volatility for FTFBMS, FTFBMEMAS and Bitcoin indices

The downside volatility registered by bitcoin is certainly higher than both the Shariah compliant index as well as the conventional index. There is high correlation between FTFBMS and FTFBMEMAS while downside volatility for Bitcoin is significantly higher.

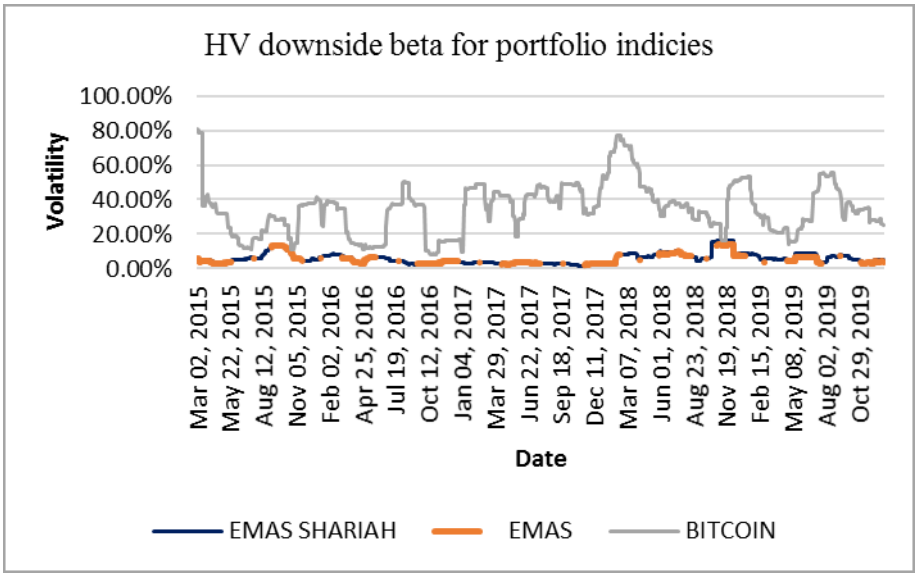

Figure 7: HV downside volatility for FTFBMS, FTFBMEMAS and Bitcoin

The HV method for the portfolios is computed. The HV method outlined a similar trend with the EWMA method. The figure above captures the downside volatility scores for the three indices using the HV method. The t-test is done to establish whether there is statistical difference between the average downside values for the three indices. The tests are conducted using a confidence interval of 95%.
The table below highlights the result.

Table XII: t-Test: Two-Sample Assuming Unequal Variances for Bitcoin and FTFBMS

	BITCOIN	FTFBMS
Mean	0.369	0.063
Variance	0.036	0.001
Observations	1184	1184
Hypothesized Mean Difference	0	
df	1262	
t Stat	54.856	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.646	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.962	

The downside Shariah values (M=0.063, SD = 3.45%, n = 1184) was hypothesized to have equal mean with Bitcoin downside values (M = 0.0369, SD = 18.89%, n = 1184). This difference was significant, *t* (1262), p = 0.00 (2 tails).

Table XIII: t-Test: Two-Sample Assuming Unequal Variances for Bitcoin and FTFBMEMAS

	BITCOIN	FTFBMEMAS
Mean	0.369	0.058
Variance	0.036	0.001
Observations	1184	1184
Hypothesized Mean Difference	0	
df	1249	
t Stat	55.846	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.646	
P(T<=t) two-tail	0.000	
t Critical two-tail	1.962	

The average downside beta values between FTFBMS and FTFBMEMAS is tested to establish whether there is any statistical difference between the two. The FTFBMEMAS average downside beta values (M=0.058, SD = 3.15%%, n = 1184) was hypothesized to have equal mean with Bitcoin's average downside beta values (M = 0.369, SD = 18.89%, n = 1184). This difference was significant, t (55.85), p = 0.00 (2 tails).

Table XIV: t-Test: Two-Sample Assuming Unequal Variances for FTFBMEMAS and FTFBMS

	FTFBMEMAS	FTFBMS
Mean	0.058	0.063
Variance	0.001	0.001
Observations	1184	1184
Hypothesized Mean Difference	0	
df	2346	
t Stat	-3.443	
P(T<=t) one-tail	0.000	
t Critical one-tail	1.646	
P(T<=t) two-tail	0.001	
t Critical two-tail	1.961	

The FTFBMS average downside beta values (M=0.063, SD = 3.45%, n = 1184) was hypothesized to have equal mean with FTFBMEMAS downside values (M = 0.058, SD = 3.15%, n = 1184). This difference was significant, t (1262), p = 0.00 (2 tails).

Table XV: correlation matrix between FTFBMS, FTFBMEMAS and Bitcoin

	FTFBMS	FTFBMEMAS	BITCOIN
FTFBMS	1		

FTFBMEMAS	0.978	1	
BITCOIN	-0.020	-0.028	1

There is strong positive correlation between Shariah FTFBMEMAS and FTFBMEMAS of (97.8%). However, Bitcoin is negatively correlated with both FTFBMS index and FTFBMEMAS index.

The mean values between all three portfolios are statistically significant and different from each other. Conventional portfolio is slightly less volatile than Shariah compliant portfolio (Ling et al., 2020). The graph below highlights the similar correlation in downside beta between Shariah compliant index as well as conventional index.

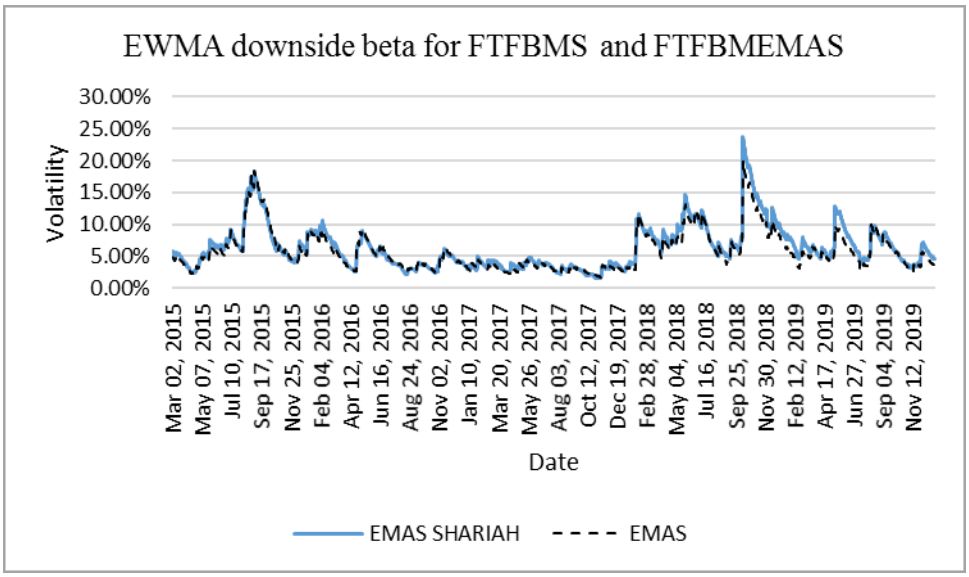

Figure 8: EWMA downside volatility for FTFBMS and FTFBMEMAS

4.2 Robustness Test

The beta of Shariah compliant indices with respect to the movements of Bitcoin index (-0.004) indicates a beta less than 1. Therefore, it is evident that Shariah compliant index is less risky compared to the bitcoin index.

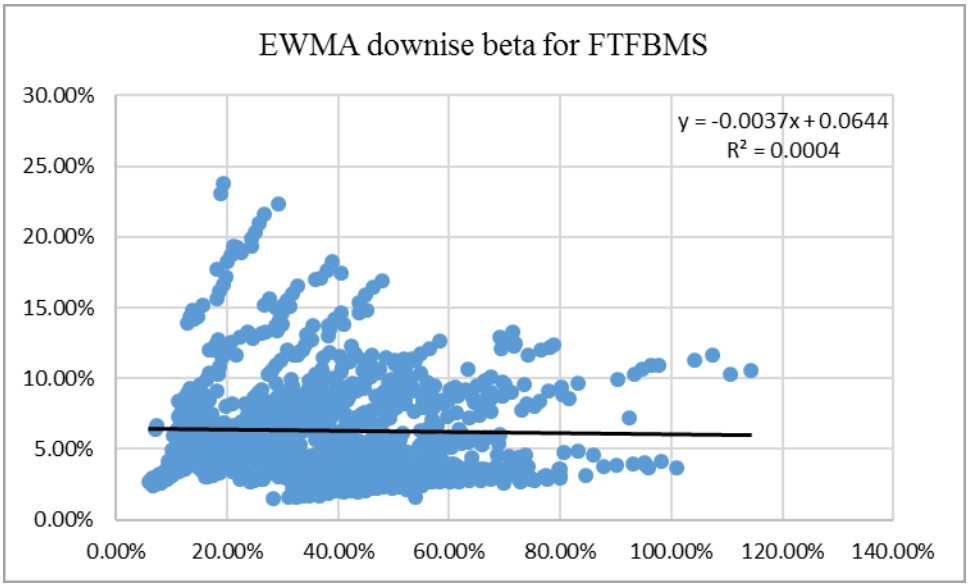

Figure 9: Downside BETA for FTFBMS with respect to Bitcoin using EWMA

Similarly, the beta captures the co-movement of Bitcoin's volatility (beta) scores with respect to FTFBMEMAS beta scores. The graph above illustrates that FTFBMEMAS is less risky compared to bitcoin, with a beta of (-0.005).

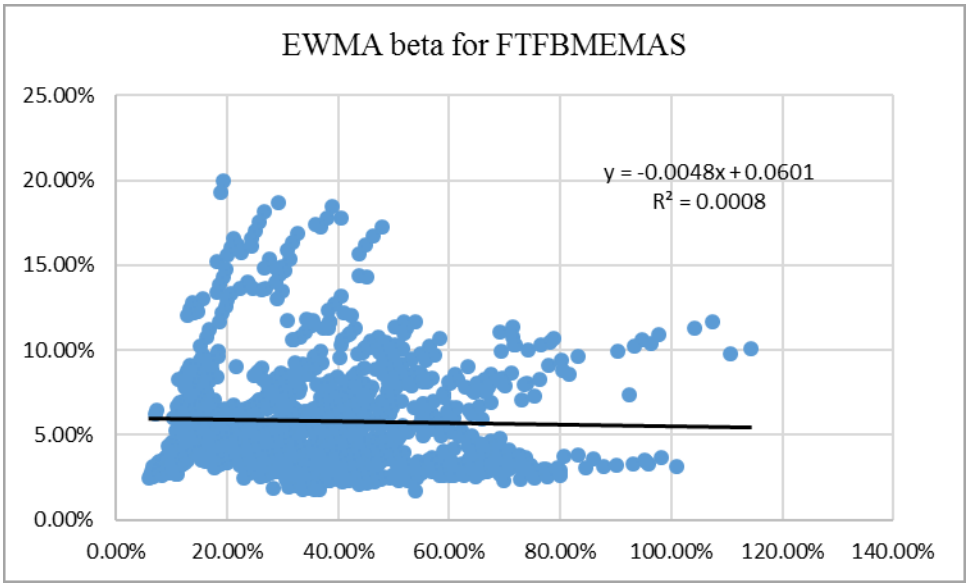

Figure 10: Downside BETA for FTFBMEMAS with respect to Bitcoin using EWMA

The approach is doubled on the HV method. The graph below illustrates that FTFBMEMAS is less risky compared to bitcoin, with a beta of (-0.01) as expected.

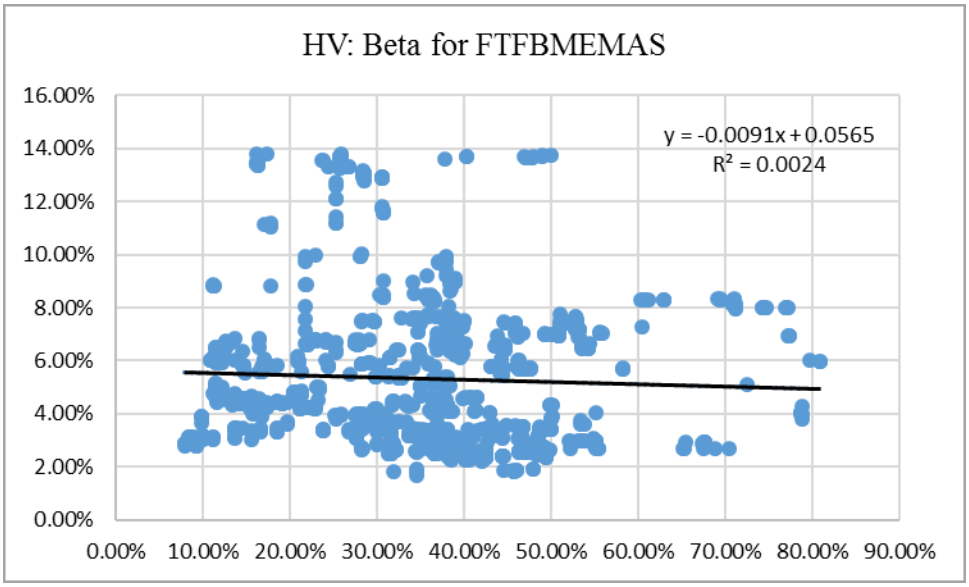

Figure 11: Beta for FTFBMEMAS with respect to Bitcoin using HV

Finally, similar beta computation is done for FTFBMS against Bitcoin. The graph below illustrates that FTFBMS is less risky compared to bitcoin, with an approximately equal beta of (-0.01) as expected.

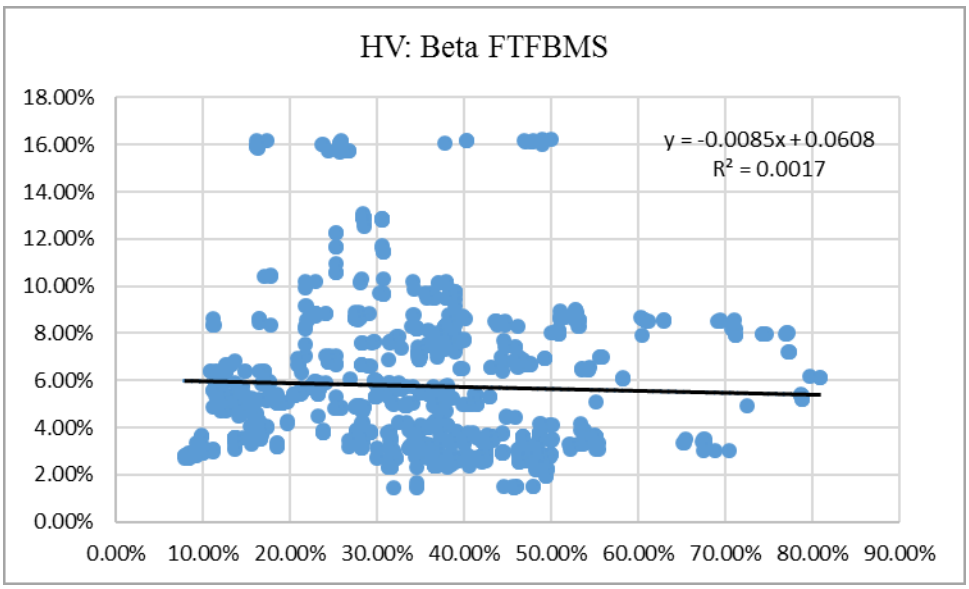

Figure 12: Beta for FTFBMS with respect to Bitcoin using HV

4.3 Analysis

The beta and performance of Shariah compliant and conventional markets has always been a contentious issue with different opinions. In emerging markets, Hashmi (2018) showed that Shariah compliant indices tend to exhibit slightly higher volatility as compared to their conventional counterparts. Additional views suggesting that conventional indices are slightly more efficient in performance over their contemporary has been acknowledged by Sensoy et al. (2015) and Ling et al. (2020). This aligns with the findings of this research, with the classification of present Malaysia as an emerging market. However, opposing views that Islamic indices are more efficient compared to their conventional counterparts, especially during bearish periods, has been researched by Habib & Ul Islam (2014), Al-Khazali et al. (2016) and Ben Rejeb & Arfaoui (2019).

Furthermore, the findings of the research collaborates on the fact that Islamic indices do exhibit similar behavior as their conventional counterparts as also mentioned by Orzano & Welling (2017). While conventional and Shariah compliant indices exhibit low downside beta mean values, bitcoin stands out well under the downside beta spectrum with relatively higher risk exposure. The magnitude of downside beta (100% share) is distributed at 11.9% for conventional indices, 12.8% for Shariah compliant indices and a huge portion of 75.3% for bitcoin indices. The slightly higher downside beta for Shariah compliant index can be attributed to the fact that it is less diversified as opposed to its conventional counterpart (Sherif, 2016). Additionally, the downside beta values exhibited similar directional result patterns with the individual portfolio beta.

5. Conclusion and recommendation

5.1 Conclusion

While conventional indices have been in existence longer than both crypto currency and Islamic indices, they have proved to be the least risky portfolio. However, this does not translate to better performance. In fact, Dow Jones Islamic Market World Index have outperformed their conventional counterparts (Dow Jones Global Market) from 2015 to 2019 as researched by Orzano & Welling (2017). This allows for a possible convincing argument that while Shariah compliant indices are resilient for risk averse investors, they are renounced for providing higher reward, affirming the mantra “the higher the risk, the higher the reward”.

As the debate surrounding crypto currency continues to grow, there are expectations that it will replace the current mainstream trading currencies as it is slowly being embraced across the globe. Focusing on the tech frontier and based on historical experiences of Shariah compliant and conventional financial models, the burst of the dot com agrees to the fact that it is natural to leverage technology in easing the way business and networking are conducted, even at the expense of unclear future consequences. Therefore, it is logical to presume crypto currency will inadvertently continue to get more approval as time unfolds. However, as brilliant as the concept sounds, if it is not guided by proper rule of law and grounded on good social constructs, it is inevitably going to perish at the expense of its competing financial models.

5.2 Recommendation

Based on the findings of this research, investors will not necessarily suffer a penalty for investing in a chosen portfolio if success is determined by downside volatility or downside return performance. Consequently, risk averse investors are at liberty to be guided by environmental, social and governance (ESG) requisites or any proactive value based system to dictate good investments in any of the two portfolios.

In addition, recommendations on the extension of this research can be achieved in different ways. Researchers can

choose to use the risk-free rate as the benchmark for average returns as well as different market portfolios. This can be extended to both within and outside the Malaysian context for a much diverse risk-return analysis. In addition, further researchers can look into publishing more works on downside beta as there are limited papers that focus on it. Moreover, other methods of assessing the level of downside beta can be explored such as the Markov switching GARCH models.

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