Performance of Smart Beta ETFs in US stocks market

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ประสิทธิภาพของกองทุนรวมดัชนีในตลาดอเมริกาโดยกลยุทธสมาร์ทเบต้า

น.ส.อังควิภา กังสนารักษ์

สารนิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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By	Miss Angkawipa Kangsanarak
Field of Study	Finance
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อังควิภา กังสนารักษ์ : ประสิทธิภาพของกองทุนรวมดัชนีในตลาดอเมริกาโดยกลยุทธสมาร์ทเบต้า. (Performance of Smart Beta ETFs in US stocks market) อ.ที่ปรึกษาหลัก : ผศ. ดร.ธนากร ลิขิตาภิวัฒน์

This project empirically analyses the performance of Smart Beta ETFs through absolute return, relative return and the risk-adjusted return basis over the last decade as well as examine the components of the risk factors exposure in Smart Beta strategy. The samples data that provide in this paper consists of Smart Beta Exchanged Traded Funds (ETFs) in US stocks market. The results show that Smart Beta strategy does not be able to keep up with its persistent performance through time as shown during 2009-2019 period. Moreover, there is no such year that Smart Beta ETFs could generate an abnormal return that statistically significant. The evidence also illustrates that the return of Smart Beta ETFs is not sufficient statistical significance that could beat the market benchmark (S&P 500) in all absolute, relative and risk-adjusted return basis.

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Angkawipa Kangsanarak : Performance of Smart Beta ETFs in US stocks market. Advisor: Asst. Prof. Dr. TANAKORN LIKITAPIWAT, Ph.D.

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Field of Study:	Finance	Student's Signature .....
Academic Year:	2019	Advisor's Signature .....

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Angkawipa Kangsanarak

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Background and Objectives

Since 2000, ETFs products have become more and more popular among investors in the financial markets. The first Exchange Traded Funds (ETFs) was introduced in 1993 and from that it became an alternative investment to investors (ICI.org 2015). The original purpose of ETFs is to get the return same as an index such as Standard and Poors Top 500 Index (Rose, 2012). Ten years later, Smart Beta ETFs have developed under the aim of generating abnormal return. Smart Beta ETFs or Strategic Beta ETFs used a rule-based system to select stocks into portfolio through assigning the weight on the basis of a factor. It offers investors to expose many factors compared to the normal index weighted by market capitalization. Smart Beta strategy is considering as the combination strategy between passive and active strategy under the aim to exploit the factor that could generate the positive return.

Figure 1: Strategic Beta Strategy

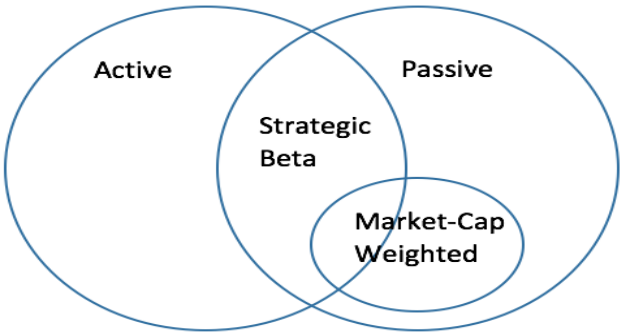

Figure 1: represents the new strategic beta strategy (Smart Beta) that combines between both active and passive strategy and also deviates from the traditional Market-Capitalisation weighted index.

ETFs has gained more and more popularity over the past 20 years as the matter of facts that investors could trade ETFs directly on stock exchange and could be able to manage its real-time price development (SEC.gov 2013). Moreover, ETFs also gives an opportunity for investors to be able to expose easier into not only fund but also other commodities, currencies and bonds, however, in this paper, we will only focus on the ETFs that has equities as its underlying assets. Under US Exchange-Traded Funds (ETFs), US Smart Beta ETFs contain more than seventy percent in

global market of Smart Beta ETFs. There is also at least 25% of Smart Beta ETFs that has a strong significant performance over the traditional ETFs. Practitioners like Morningstar also claimed that such strategy could generate the highest return.

On the other hand, there are several criticisms on investing in Smart Beta Exchanged Traded Funds for investors as the factors that they exposed tend to be fading. These factors may not create the potential value and could involve with data mining bias as when using the algorithms to screen the factors, there are up to 82 factors that statistics significant involve with data-mining bias (Stevenson, 2019). This coherent with practitioner like Blackrock through using Aladdin risk platform to screen the factors, resulting in up to 1000 of factors that could not generate any real value to portfolios. Moreover, their reports also review the results of back testing of Smart Beta ETFs stated that over ten years, more than 50% of factors that been used have loss significant. According to Ang(2013), Smart Beta ETFs strategy could be viewed an overly exposure to various unsystematic risks and depending too much on asset allocation. Without understanding of the complex in constituents of index, investors might find it difficult to fully apply such strategy to generate the return. Hence, it is essential to examine Smart Beta strategy whether it could be able to generate the return that beats the market, given a circumstance with more complicated of indexation and the exposure of various unique factors.

Finally, with the various perspectives from academia and practitioners in Smart Beta strategy, hence, such a strategy must be studied comprehensively to be understood. Since Smart Beta ETFs is considered as a new alternative investment tools to tradition ETFs strategies for investors, assessing whether Smart Beta ETFs have a potential to generate the value to investors is necessary. The value in this analysis will be defined as an ability to generate an abnormal return that outperform relative to the market benchmark. The main purpose of this paper is to compare the performance between Smart Beta ETFs and the market in order to answer whether the abnormal return that Smart Beta ETFs generate is statistically significant and persistence through time or not as well as to investigate into the characteristics of Smart Beta ETFs in order to be able to understand the risk compositions that involve with generating that extra return.

Literature Review

Since this paper is focusing on Smart Beta ETFs in US market, therefore, a background of US Smart Beta ETFs is essential to make the reader understand the trend and situation. Currently, US is the largest market for Smart Beta ETFs, especially during the past 10 years, there is a big jump in the growth of Smart Beta Exchange Traded Products (ETPs) by 45% or 797 billion US Dollars.

Figure 2: Smart Beta Exchange Traded Products' net AUM of US market

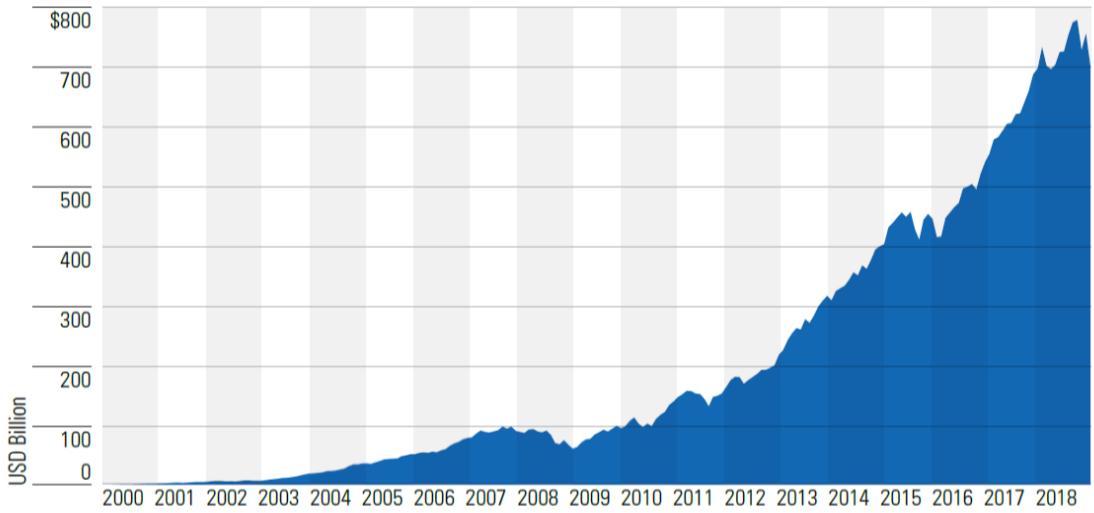

Figure 2: represents the size of asset under management of US Smart Beta ETFs in US Dollar from 2000 until 2018, following Morningstar report in 2019.

The beginning of Smart Beta ETFs in US starts since 2000 after the introduction of ishares Russell 100 Value IWD and ishares Russell 1000 Growth IWF. The total aggregate growth of these assets come from the net inflow (78%) and appreciation of asset (22%). US and Europe are the primary (88.5%) and secondary (7.2%) leading market, respectively. Noticing that the size of market share of Smart Beta ETPs in US is significantly larger than the secondary market in Europe by 81.3%. However, there is a slightly decline in growth rate of Smart Beta ETPs in those two regions by 0.6% and -4.8% year over year, respectively which shown in Table 3 below. After 2015, the growth rate starts to decline and remain around 21.5% even though Smart Beta ETPs' market share has grown in a faster pace than the traditional ETPs. This is mainly due to a decrease in net inflow, causing by a

difficulty in different providers to differentiate its strategy and products as well as a lack of new strategic factor, represented in the figure 4 below. While in Asia pacific market, the market share is only 3.0% but there is a significantly increase in Smart Beta ETPs by 12.1% year over year based on the increase in their size of assets under management.

Table 3: Asset under management of Smart Beta ETPs in each region.

	Assets 2018 (USD Bil)	Global Market Share (%)	Assets 2017 (USD Bil)	One-Year % Change	2018 Flows (USD Bil)	As a % of Beginning AUM	# of ETPs 12/2018	# of ETPs 12/2017	One-Year % Change
U.S.	705.1	88.5	700.6	0.6	74.4	10.6	693	634	9.3
Canada	10.1	1.3	10.61	-4.5	1.3	11.9	182	162	12.3
Europe	57.4	7.2	60.3	-4.8	5.0	8.2	409	389	5.1
Asia-Pacific	23.7	3.0	21.1	12.1	6.3	29.8	190	157	21.0
Emerging Mkts	0.8	0.1	0.9	-9.1	0.1	10.5	19	19	0.0
Total	**797.1**	**100**	**793.5**	**0.5**	**87.0**	**10.9**	**1,493**	**1,361**	**9.7**

Table 3: reports the size of asset under management of Smart Beta Exchange Traded Products (ETPs) and the fund flows in US, Canada, Europe, Asia-Pacific and Emerging market in US Dollar during 2017 and 2018. It also reports the number of Exchange Traded Products at the end of 2017 and 2018. The percentage change in both the size of Asset under management and the number of Exchange Traded Products over one year are also provided, following Morningstar report in 2019.

Figure 4: The growth of Smart Beta ETPs in US

Figure 4: represents the growth in percentage of US Smart Beta Exchange Traded Products from 2000 to 2018, following Morningstar report in 2019.

Even though there is a decline in growth of Smart Beta ETPs, yet, the number of Smart Beta ETPs that success still increases and becomes quite significant, especially during the past 5 years, depicting in the figure 5.

Figure 5: The number of surviving US Smart Beta ETPs

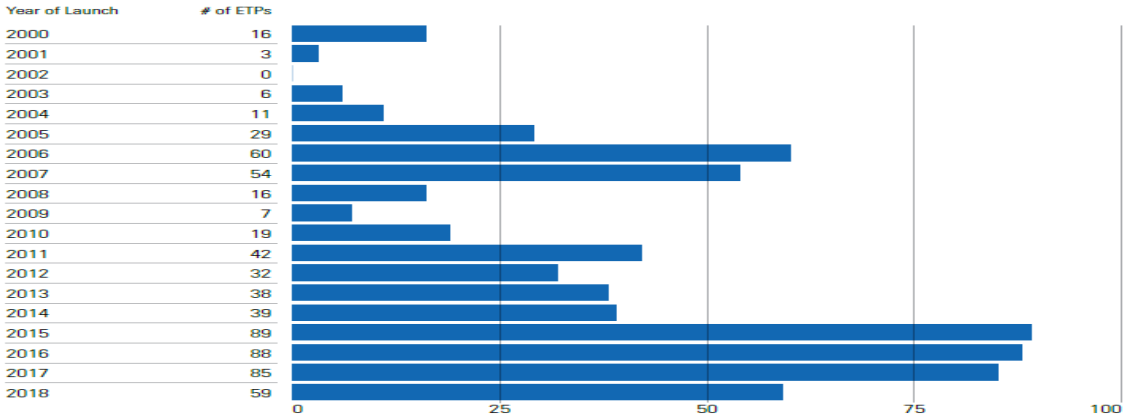

Figure 5: represents the number of US Smart Beta Exchange Traded Products that survive in each year starting from 2000 until 2018, following Morningstar report in 2019.

With a current high volatility environment, the Smart Beta ETPs still gain popularity as it helps one to be able to fit their exposure in equity based on each individual risk preference. There are three popular factors under Smart Beta ETPs investing strategy which are value, growth and dividend which accounts for 25.1%, 23.9% and 6.4% of total market shares of all Smart Beta ETPs in US.

Table 6: The style of Smart Beta ETPs strategies

Strategic-Beta Group	# of ETPs	Assets (USD Bil)	% of Assets	2018 Flows (USD Bil)	% of 2018 Gross Flows
Value	53	176.9	25.1	23.9	31.4
Growth	40	168.8	23.9	13.8	18.2
Dividend	141	166.6	23.6	6.4	8.4
Risk-Oriented	57	55.1	7.8	9.9	12.9
Multifactor	171	42.8	6.1	9.8	12.9
Fundamentals	32	29.1	4.1	4.6	6.1
Other	66	23.7	3.4	0.3	0.4
Momentum	41	15.4	2.2	2.9	3.9
Quality	17	11.5	1.6	4.4	5.8
Fixed Income	42	9.5	1.3	-1.1	—
Commodity	33	5.8	0.8	-0.6	—

Table 6: reports the number of US Exchange Traded Products (ETPs) that characterize in different styles under Smart Beta strategy. It also reports the fund flow and the size of Asset under management in each style in US Dollar. The percentage change in both assets and gross flows during 2018 also provided, following Morningstar report 2019.

Relevant Theory and Contribution

Smart Beta ETFs started from the evolution of indexing fund strategy that used to diversify investors' portfolio. According to Gsam.com (2017), Smart Beta ETFs is still an unclear line strategy between passive and active strategy, its passive strategy in the sense that its tracks the index. However, at the same time, it still tries to deviate by weighting their asset differently from market capitalization indices, in the hope to make a higher return, that could be described as an active strategy. Moreover, the goal of tradition ETFs and Smart Beta ETFs is different. The former aims to follow the development of the index while the latter aims to generate risk-adjusted excess return relative to a benchmark index with the lower costs compared to the normal active strategy.

Due to such purpose, many papers investigate in the cost side of Smart Beta strategy as it claimed that the cost of such strategy is lower than the active strategy. Jacob (2014) found that Smart Beta strategy rebalances the portfolio periodically which causes a negative impact towards Smart Beta's return. Johnson (2016) found that the fees that occur from the replication costs, trading costs varies across region and tend to increase remarkably through time which would be considered as a thread to fund managers who aim to make the return beat the market. Miranda (2017) also supported that through her transaction cost model, the cost of Smart Beta could cut off its own premium. However, in this paper, we will mainly focus on the return side of Smart Beta strategy as their purpose leads to many controversial issues that claimed on the return that generates from such strategy. Kahn (2014) believed that smart beta strategy comes from those investors who do not believe that market is efficient. This kind of strategy is suitable for investors who are able to identify the factors that could generate risk-adjusted return over the benchmark. Many investors could be able to take advantage of the more return with diversify portfolio through investing in a range of factors. Moreover, Jason (2012) replicates Smart Beta Strategy under risk-aware or minimum-variance portfolio and the portfolio that does not involve with the risk or volatility control for 1,000 large stocks. He found that Smart Beta strategy could generate an outperform in both Sharpe ratio and Information ratio.

In addition to this, in 2015, Jean has further applied Smart Beta strategy into 4 different models which consists of Equal Risk Contribution (ERC), Risk-Based portfolios (Global Minimum Variance (GMV)), Most Diversified portfolio (MDP) and Equally Weighted portfolio (EW), in order to compare its excess return in different model from 2001 to 2014. They found that Smart Beta could provide a better performance, especially during the economic downturn in all portfolios. Smart Beta strategy also aims to ensure that its strategy is transparent by providing investors with factors that they are weighting. In correspond to this, Practitioner like Morningstar (2014) tested this by heavily weighting them with different single factors such as volatility and value through various alternative portfolios, revealing that Smart Beta strategy would be able to generate a higher return with lower risk.

In contrast, Glushkov (2015) found that Smart Beta ETFs would not be able to outperform its benchmark on a risk-adjusted basis due to the unintended-expose factor which outweigh its positive return. He had run a test on many factors in Smart Beta strategy in order to justify its claimed based on 164 samples during 2003-2014 and he found that the negative effects of unintended factor could partially or fully offsets any advantages of the return that generated by desired exposures factors. Furthermore, he also found that Smart Beta strategy should not be expected to perform well throughout all market environment as Smart Beta strategy does not provide a well-diversified portfolio compared to the traditional ETFs (passive strategy). Jacob (2015) also support Glushkov that following Smart Beta strategy, there is no way to control the increase in the number of factors-trying and also inability to limit the investments. This could lead to factor crashes from one popular to underperforming factors. Bender (2013) found that the factors that Smart beta ETFs strategy weights such as value, growth, momentum and size factors could be treated as a group of shares which have an impact on explaining both risks and return. From his analysis of MSCI factor indices, from 1996-2012, weighting these factors could outperform the market that weighted equally. Fama and French (1992) also used size and value factors to generate the excess returns between 1962-1989. However, Ang (2013) claimed that during financial crisis in 2008, the return of these factors is lower than MSCI market

index, explaining that these factors could disappear through market cycle which coherent with Jacob (2015).

Even though these factors perform well in a long period, it is only because investors compensated from bearing the risk during the recession. This criticism is argued by Green (2014) that the reason that Smart Beta strategy could not outperform risk-adjusted return is due to a fault in factors that were used to examine. He claimed that over 100 factors jointly test, only 24 factors could be able to provide a significant result. Moreover, from Russell (2014), claimed that Smart Beta strategy could not be a good alternative to active investment strategy as in active portfolio, multiples factors were taken under a unite-approach which could generate a more diversification benefits to investors. Or another words active portfolio could adapt better to economic conditions and underlying market than Smart Beta strategy because of the less exposure to unsystematic risk.

Since Smart Beta strategy is an alternative investment tool to investors, by considering the Efficient Market hypothesis, many classify this strategy to be able to generate a more risk-adjusted return to their portfolios. Therefore, with the various of different perspectives among academician and practitioners, in this paper, I will examine into absolute return, relative return and risk-adjusted return basis of US Smart Beta ETFs compared with the benchmark in order to justify whether the return that generated under Smart Beta strategy is statistically significance higher than market as it claimed. Although there is still a controversial in which benchmark should be applied for this Smart Beta ETFs as the fund itself aims to focus on the factor that offer an opportunity to exploit in the market. According to Lixin (2018), stock index is normally used to apply as their claimed benchmark since the fundamental purpose of Smart Beta strategy is to try to get a higher return than a capitalization-weighted index. Hence, the benchmark that in this paper will apply would be S&P 500.

In addition to this, based on Fong (2005) claimed that the size and value factors are not significant in index but if the portfolio weights these factors, it will generate an abnormal return as an evidence in 1962-1989. Black (1993) also

support that value strategies could be able to generate excess return which support to Fama-French model. Also, Strauts (2013) found that by including the momentum factor into the portfolio, could be able to generate the excess return. Barberis (1998) has shown that investors tend to either overreact or under-react to the news that can lead to a momentum effect. To illustrate, under-reaction is when investors do not react quickly enough to news about market shares, causing the price to deviate from the real value. Edwards (1964) found that the perception is updated in the right direction, but that the speed of the change is not as rapid as in rational events. Such a delay in the price increase can cause one momentum strategy yields positive returns. They also show that under-reaction will be only in the short term and then overreact in the longer term. On the other hand, over-reaction, investors will be overwhelmed when there is an excess of positive and continuous growth of the company over a long time period which could make investors less aware of negative news.

Therefore, in this paper, we will apply Carhart (1997) extended from Fama French 3-factors model to be 4-factor model, including market risk premium, size, value and momentum factors, in order to be able to explain and capture the pattern of investor behavior in this Smart Beta strategy. By applying Carhart model, into the analysis of US Smart Beta ETFs, it would be able to explain the risk components that involve with generating the return and also be able to justify that the abnormal return of Smart Beta strategy is statistically significant compared to the market and consistent in a long period horizontal which would help investors to classify whether Smart Beta is truly a good investment tool for them.

Hypothesis

Based on Jason (2012) and Jean (2015), they claim that Smart Beta could provide a higher excess return even in downturn economic period while Jacob (2015) claim that the return that generates from Smart Beta would not be consistent outperform the market in all time. Therefore, in order to be able to justify those arguments, this paper will examine into both absolute return and relative return basis of Smart Beta ETFs compared with the benchmark S&P 500, by forming the pair T-test. Firstly, in the absolute return basis, the actual return of Smart Beta ETFs will be used to apply in T-test and secondly, the excess return of Smart Beta ETFs over the benchmark for relative return basis will be applied in the test. The Sharpe ratio of both Smart Beta ETFs and the benchmark S&P 500 will also be applied to analyse the risk-adjusted return of Smart Beta ETFs for comparison, represented in the hypothesis tests below.

Hypothesis 1: Return of Smart Beta ETFs > Return of Benchmark

Hypothesis 2: Sharpe ratio Smart Beta ETFs > Sharpe ratio of Benchmark

Based on Fong (2005) and Strauts (2013) claimed that by investing in size (SMB), value (HML) and momentum (UMD) factors, it could generate an abnormal return. Even in the market downturn, it still came out with a good performance of risk-adjusted return. Hence, in this paper, I will hypothesize that the factors in the Carhart 4 factors model would be positively significant, represented in the hypothesis tests below.

Hypothesis 3: Alpha of Smart Beta ETFs > 0

Hypothesis 4: Market premium Beta (MKT) of Smart Beta ETFs > 0

Hypothesis 5: Size factor Beta (SMB) of Smart Beta ETFs > 0

Hypothesis 6: Value factor Beta (HML) of Smart Beta ETFs >0

Hypothesis 7: Momentum factor Beta (UMD) of Smart Beta ETFs >0

Data

Annual and monthly return from 2009 to 2019 would be required for both Smart Beta ETFs and the benchmark S&P 500 in order to test the hypothesis above which can be accessed via Morningstar Direct. 9 selected Smart Beta ETFs will be chosen for this analysis as those funds has the largest size in asset under management (AUM) represent around 60% of the total Smart Beta ETFs in US market which is predominant to apply to see the trend of overall US Smart Beta ETFs. These 9 funds consist of Vanguard Growth ETF, Invesco S&P 500 Revenue ETF, Vanguard Value ETF, Vanguard Mid-Cap Growth ETF, Invesco S&P Mid-Cap 400 Revenue ETF, Vanguard Small-Cap Growth ETF, Invesco S&P SmallCap 600 Revenue ETF, Vanguard Small-Cap Value ETF and Invesco Defensive Equity ETF, described in table 7.

Table 7: Asset Under Management (AUM) of samples Smart Beta ETFs

AUM size of Smart Beta ETFs samples	
Name	AUM In US Dollar
Vanguard Growth ETF	52,040,902,638.96
Vanguard Mid-Cap Growth ETF	7,500,521,352.13
Invesco S&P 500 Revenue ETF	1,012,186,154.28
Vanguard Value ETF	56,707,759,726.46
Invesco S&P Mid-Cap 400 Revenue ETF	335,894,448.72
Vanguard Small-Cap Growth ETF	10,400,387,515.39
Invesco S&P Small-Cap 600 Revenue ETF	314,375,787.06
Vanguard Small-Cap Value ETF	10,400,387,515.39
Invesco Defensive Equity ETF	314,180,825.86
Sum	143,581,485,716.99
Total	244,315,044,510.60
Covered	58.8%

Table 7: reports the size of asset under management in US Dollar of both the samples and the overall US Smart Beta ETFs, collecting from Morningstar Direct. It also represents the percentage coverage of the summation in asset undermanagement of the samples to the overall US Smart Beta ETFs.

These 9 Smart Beta ETFs must have at least 90% of its assets invested in US equities where underlying is stocks and must be full-physical (the funds that structure with no return-swap agreement or any derivative instruments that could have an impact on the fund return). These funds also tracked under the same S&P umbrella, shown in table 8 below. Since S&P 500 is one of the most following equity indices and typically used to represent US stock market index, hence, S&P 500 would be a suitable benchmark to apply for this performance of US Smart Beta ETFs' analysis. Moreover, these funds also need to have inception date minimum 10 years before 2019 which is a typical investment horizon that could be able to examine the persistent trend.

Table 8: Tracking Index of Smart Beta ETFs samples

Tracking Index of choosing Smart Beta ETFs		
Name	*Ticker*	*Track Index*
Vanguard Growth ETF	VUG	S&P 500 Growth Index
Vanguard Mid-Cap Growth ETF	VOT	S&P Midcap 400 Growth Index
Invesco S&P 500 Revenue ETF	RWL	S&P 500 Revenue-Weighted Index
Vanguard Value ETF	VTV	S&P 500 Value Index
Invesco S&P Mid-Cap 400 Revenue ETF	RWK	S&P Midcap 400 Revenue-Weighted Index
Vanguard Small-Cap Growth ETF	VBK	S&P Small-Cap 600 Growth Index
Invesco S&P Small-Cap 600 Revenue ETF	RWJ	S&P Small-Cap 600 Revenue-Weighted Index
Vanguard Small-Cap Value ETF	VOE	S&P Small-Cap 600 Value Index
Invesco Defensive Equity ETF	DEF	S&P 500

Table 8: represents the tracking index and the ticker in each Smart Beta ETFs sample, collecting from Morningstar Direct.

Apart from that, to define the words "Size", "Value", "Momentum"; Size factor (SMB) is the spread of the return between the small and big firm. Small and big firm, in here, will be measured by the value of market capitalization in US dollar. Value factor (HML) will account for the spread in returns between value stocks and growth stocks. For value stocks, it will be with the high book-to-market ratio and vice versa for growth stocks. Lastly, for momentum factor (UMD), according to Carhart,

1997, A stock is showing (winning) momentum if its prior 12-month average of returns is positive and vice versa. Hence, momentum factor will be the spread of the return between the winning momentum and losing momentum.

To calculate, the size factor, SMB (Small Minus Big) is the average return on the three small portfolios minus the average return on the three big portfolios which shown in the equation (1) below:

SMB = 1/3 (Small Value + Small Neutral + Small Growth) (1)
- 1/3 (Big Value + Big Neutral + Big Growth)

While, HML (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios which shown in the equation (2) below:

HML = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth) (2)

Lastly, UMD (Up Minus Down) is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios, shown in the equation (3) below:

UMD =1/2(Small High + Big High) - 1/2(Small Low + Big Low) (3)

Methodology

An absolute and a relative return will be used to analyse the performance of Smart Beta ETFs through comparing historical performance from 2009-2019 period. To define, absolute return basis is the average return of Smart Beta ETFs compared with the average return of benchmark (S&P 500) under 2 samples T-test. While, the relative return is the excess return of Smart Beta ETFs over the benchmark (S&P 500), directly applied in one sample T-test. The risk-adjusted return will be examined under the Sharpe ratio which computed by the formula in equation (4) below.

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p} \quad (4)$$

where the Sharpe ratio is US Smart Beta Exchanged traded funds' annual return over the risk-free rate (3 months US-Treasury bill), divided by the Standard Deviation of US Smart Beta ETFs Monthly return. After that we will conduct the pair t-test to test the results of Sharpe ratio to justify its statistics significant, compared with the Sharpe ratio of the benchmark S&P 500.

Furthermore, in this paper, we will use a monthly return of Smart Beta ETFs samples during 2009-2019 to examine the risk factor compositions in Carhart Four-factor model that could be used to explain the return of Smart Beta ETFs. The monthly return of stock components in each selected 9 Smart Beta ETFs will be collected to conduct the size factor (SMB), the value factor (HML) and the momentum factor (UMD) in each fund, following equation (1)-(3), in order to correspond with Carhart Four-factor model, conducting in equation (5) below:

$$E(r_{i,t}) = r_f + \beta_{i,t}\left[E(r_{m,t}) - r_f\right] + \beta_{SMB,t}SMB_{j,t} + \beta_{HML,t}HML_{j,t} + \beta_{UMD,t}UMD_{j,t} \quad (5)$$

Where:

$E(r_{i,t})$ is the expected return of Smart Beta ETF (fund) i during period t

r_f is US 3-months treasury bill

$E(r_m, t)$is the expectation of the return in market during period t

$\beta_{i,t}$ measures the risk exposure of the market contribute to the fund i during period t

$\beta_{SMB,t}$ measures the size factor risk of holding stocks in fund i during period t

$\beta_{HML,t}$ measures the value factor risks of holding stocks in fund i during period t

$\beta_{UMD,t}$ measures the momentum factor risks of holding stocks in fund i during period t

$SMB_{j,t}$ measures the premium between holding small and large stocks in each fund i (small minus big) during period t

HML_j, t measures the premium between holding low and high B/M ratio stocks in each fund i (high minus low) during period t

$UMD_{j,t}$ measures the premium between the losing and winning stocks j in each fund i over the last prior 12 months, during period t

After that, we will run the regression in each month starting from 2009 to 2019 to examine the persistence of the performance of Smart Beta ETFs and risk characteristics of them through time in order to be able to classify such strategy to be a long-term investment tool for investors.

Data Descriptive Statistics

A sample of 9 Smart Beta ETFs that have the asset under management size covered majority of US Smart Beta ETFs will be analysed and compared with the return of benchmark S&P 500 benchmark through each investment horizontal periods; 3 years, 5 years and 10 years, provided in table 9-11 below, in order to be able to depict the overall performance of US Smart Beta ETFs over time. One may notice that the correlation between the Smart Beta ETFs and the index in each period is nearly one, yet, the excess return of the Smart Beta ETFs over the market decline significantly. Moreover, the value of Sharpe ratio declines largely when the investment horizon gets longer, compared to the Sharpe ratio of benchmark S&P 500. Given the volatility of Smart Beta ETFs is getting larger and larger through time, one might expect with the greater risk, the higher return would be produced for compensation which contradicts with a fall down in the Sharpe ratio value.

Table 9: The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) over 3 years

The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) Over 3 years		
During Period 3 years (2009-2012)	Smart Beta ETFs	Benchmark S&P 500
Average Geometric Return (%)	14.21	10.23
Standard Deviation (%)	11.05	7.47
Correlation	0.97	
Sharpe Ratio	0.92	0.81

Table 9: presents the summary statistics of the samples Smart Beta ETFs (SB ETFs) and S&P 500 in percentage return that calculated based on average geometric annually return, the standard deviation, the correlation between samples Smart Beta ETFs and S&P 500 and the Sharpe ratio over 3 years period starting from 2009-2012.

Table 10: The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) over 6 years

The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) Over 5 years		
During Period 5 years (2009-2015)	Smart Beta ETFs	Benchmark S&P 500
Average Geometric Return (%)	14.99	14.63
Standard Deviation (%)	18.57	12.71
Correlation	0.94	
Sharpe Ratio	0.91	0.95

Table 10: presents the summary statistics of the samples Smart Beta ETFs (SB ETFs) and S&P 500 in percentage return that calculated based on average geometric annually return, the standard deviation, the correlation between samples Smart Beta ETFs and S&P 500 and the Sharpe ratio over 6 years period starting from 2009-2015.

Table 11: The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) over 10 years

The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) Over 10 years		
During Period 10 years (2009-2019)	Smart Beta ETFs	Benchmark S&P 500
Average Geometric Return (%)	13.10	12.42
Standard Deviation (%)	19.51	11.81
Correlation	0.92	
Sharpe Ratio	0.72	0.88

Table 11: presents the summary statistics of the samples Smart Beta ETFs (SB ETFs) and S&P 500 in percentage return that calculated based on average geometric annually return, the standard deviation, the correlation between samples Smart Beta ETFs and S&P 500 and the Sharpe ratio over 10 years period starting from 2009-2019.

In addition, the table 12 below, presents the average geometric percentage return, standard deviation, correlation and Sharpe ratio for each year from 2009-2019 period. It can be noted that after 2014, the average geometric return of Smart Beta ETFs is lower than the benchmark, given that the standard deviation of Smart beta ETFs is higher than S&P 500, implying a logical incompatibility Smart Beta ETFs strategy concept. Also, Smart Beta ETFs performs poorly during economic downturn, especially 2018, as it achieved a significant negative return compared to the market.

Table 12: The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500) from 2009-2019

The Return Comparison Between Smart Beta ETFs and Benchmark (S&P 500)

	2009		2010		2011		2012		2013		2014		2015		2016		2017		2018		2019	
	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500	SB ETFs	S&P 500
Average Geometric Return (%)	30.4	20.4	10.7	3.41	5.19	6.20	12.5	11.7	45.5	41.3	10.9	13.1	6.25	10.2	15.4	10.7	7.14	10.2	-8.40	-5.03	20.2	18.3
Standard Deviation (%)	23.6	18.8	20.1	18.2	17.7	4.46	9.21	8.1	8.76	7.96	10.8	8.05	12.1	12.7	14.8	11.2	6.84	4.44	16.8	14.7	14.9	11.6
Correlation	0.97		0.99		0.99		0.96		0.95		0.95		0.93		0.94		0.90		0.92		0.93	
Sharpe Ratio	1.29	1.08	1.07	0.77	0.15	0.13	1.28	1.34	3.04	3.26	1.04	1.52	-0.19	0.09	1.09	1.06	2.99	4.69	-0.55	-0.41	1.61	2.00

Table 12: presents the summary statistics of the samples Smart Beta ETFs (SB ETFs) and S&P 500 in percentage return that calculated based on average geometric annually return, the monthly return standard deviation, the correlation between samples Smart Beta ETFs and S&P 500 and the Sharpe ratio in each year starting from 2009-2019.

Results and Discussions

Analysis I: Comparing the performance between Smart Beta ETFs and the Benchmark S&P 500

This section will provide the analysis into the persistence of the performance of Smart Beta ETFs' return over the benchmark since 2009 until 2019 in both annually and monthly return as well as foresee the trend of US Smart Beta ETFs through the samples that represents the majority of Smart Beta ETFs in US market.

Figure 13: The Average Monthly Excess return of Smart Beta ETFs over S&P 500

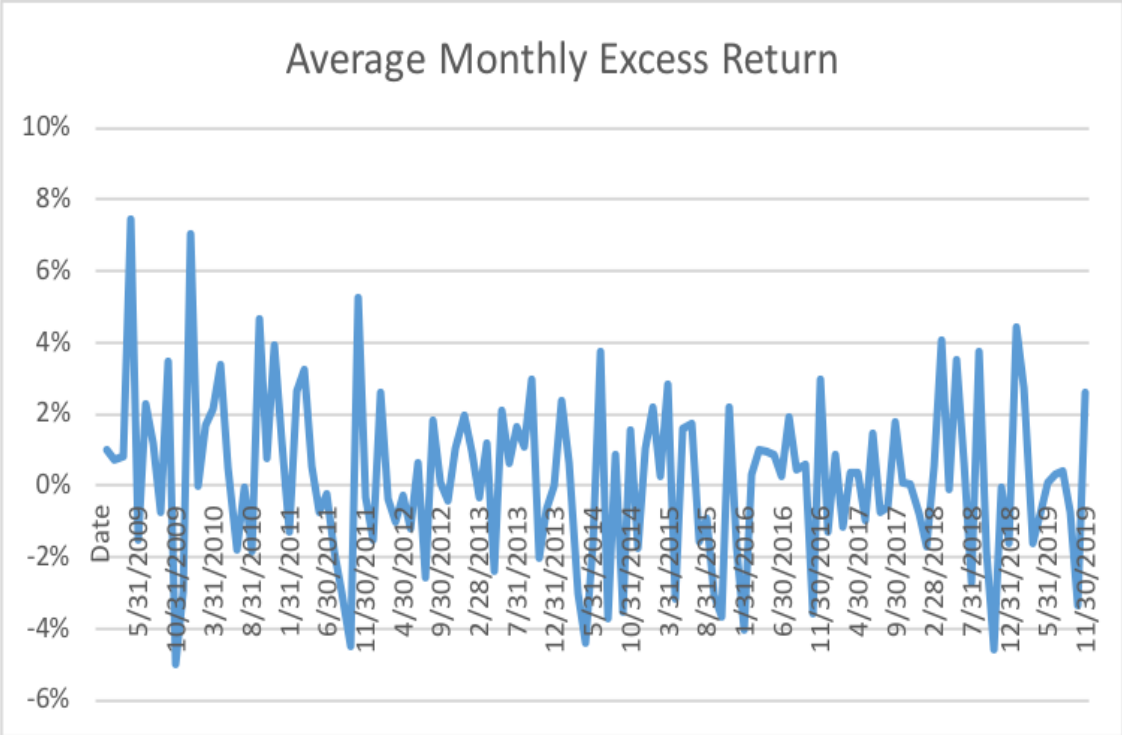

Figure 13: represents the percentage of average excess monthly return of 9 Smart Beta ETFs samples over the monthly return of benchmark S&P 500 from 2009 to 2019.

Figure 14: The Annual Return comparison between Smart Beta ETFs and S&P500

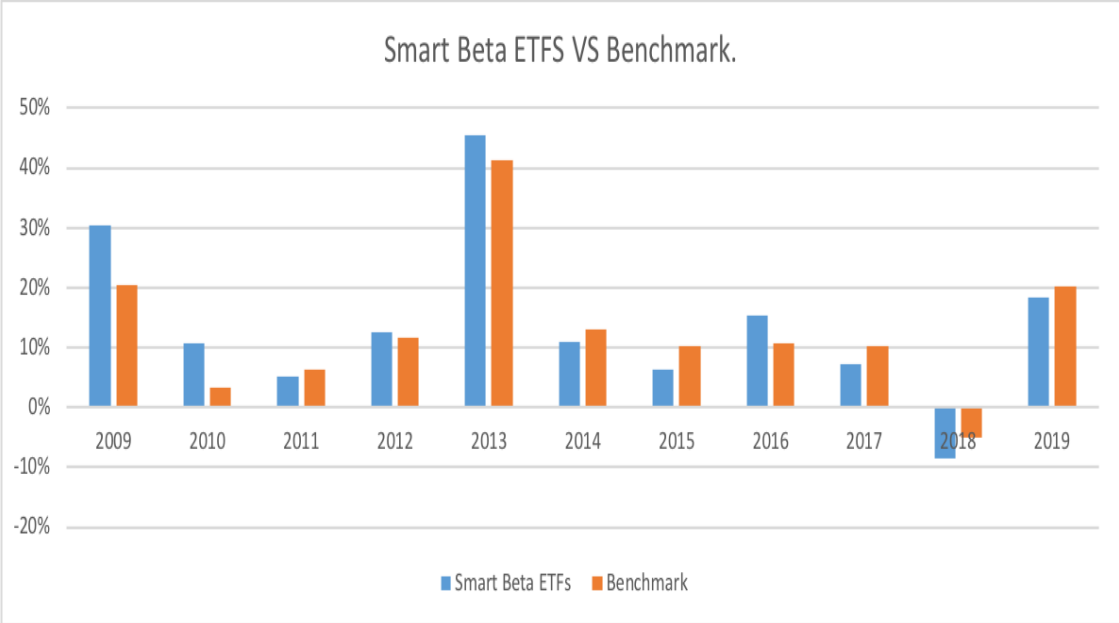

Figure 14: represents the average percentage annually return of 9 Smart Beta ETFs samples and the annually return of benchmark S&P 500 in each year from 2009 to 2019.

From observation on historical performance in the figure 13 and 14 above, it can be observed that the return of Smart Beta ETFs is extreme in both upside and downside. The annually return of Smart Beta ETFs samples over the benchmark S&P 500 between 2009-2019 have return characteristics that similar with the fluctuations in its monthly returns. Since the average excess annually return of Smart Beta ETFs over the market reduces from 10% to 2% from 2009 to 2019, given that the annualized return of Smart Beta ETFs shows a strongly positive correlation with the market, with the max of 0.99 and the min of 0.90 over 10 years period based in table 12, it could imply that the longer the period, the less excess return of Smart Beta ETFs over the market would be. Moreover, based on the higher the standard deviation of annually return of Smart Beta ETFs than the benchmark, the return that Smart Beta ETFs generate neither more than the market nor beat the return of benchmark S&P 500 as shown in table 15 below.

Table 15: The Annual Excess Return of Smart Beta ETFs

The Excess Return of Smart Beta ETFs over the Benchmark											
Excess Return(%)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	10.02	7.28	-1.01	0.83	4.17	-2.21	-3.94	4.72	-3.07	-3.37	1.94

Table 15: reports the percentage average annually excess return of Smart Beta ETFs samples over the benchmark S&P 500 in each year from 2009 to 2019.

To further analysis, based on the T-test results from table 16 and 17 below that construct based on the assumption of equally weighted portfolio, it can be concluded that the evidence of both annually and monthly return of Smart Beta ETFs that beat S&P 500 benchmark is statistically insignificant at 95% confidence level which contrasts with the claim of such a new style of Smart Beta strategy. This means that performance of Smart Beta ETFs may not be persistence outperform the market over time. In addition to this, Smart Beta ETFs are prone to have a slightly higher standard deviation than S&P 500 which should be expected to have a higher return than the market, but such result is out of our expectation. This may due to the US stocks market are big and efficient enough that makes it difficult for fund managers to search for an alpha or abnormal return.

Table 16: Statistical Results of Annually Return of Smart Beta ETFs and S&P 500

	Smart Beta	*Benchmark*
Mean	13.9903	12.9476
Hypothesized Mean Difference	0	
t Stat	0.18802	
P(T<=t) one-tail		
At 95 % confidence level	0.42643	
t Critical one-tail	1.72913	

Table 16: shows the results for a paired of two samples (independent) mean t-test between the average annually return of sample Smart Beta ETFs and the benchmark S&P 500 over 10 years periods starting from 2009 until 2019. The annual return in each year of samples Smart Beta ETFs will be computed through forming an equally weighted portfolio of total 9 Smart Beta ETFs samples.

Table 17: Statistical Results of Monthly Excess Return of Smart Beta ETFs

	Excess Return
Mean	0.008333
Hypothesized Mean Difference	0
t Stat	0.790435
P(T<=t) one-tail	
at 95% confidence level	0.215357
t Critical one-tail	1.656659

Table 17: shows the results for one sample mean t-test of the average monthly excess return of sample Smart Beta ETFs over the return of benchmark S&P 500 for 10 years periods from 2009 to 2019.The monthly excess return in each year of samples Smart Beta ETFs will be computed through forming an equally weighted portfolio of total 9 Smart Beta ETFs samples which consists of 132 observations.

Table 18: Statistical Results of Sharpe Ratio of Smart Beta ETFs

	Smart Beta	*Benchmark*
Mean	1.165558	1.413932
Hypothesized Mean Difference	0	
t Stat	-0.441460	
P(T<=t) one-tail		
at 95% confidence level	0.331932	
t Critical one-tail	1.729133	

Table 18: shows the results for a paired of two samples (independent) mean t-test of the average annually Sharpe ratio of sample Smart Beta ETFs and the benchmark S&P 500 over 10 years periods from 2009 to 2019, conducting from equation (4) $Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$.

For Sharpe ratio perspective, in the table 18 above, the average of annually sharp ratio is 1.17 which is lower than the market S&P 500 which is 1.4. It implies that with a higher of historical volatility of Smart Beta ETFs compared to Benchmark, Smart Beta ETFs fail to generate a higher risk-adjusted return than benchmark, especially after 2012 where the value of Sharpe ratio declines over time, represents in table 12. This indicates that with the extra risk that investors take in investing in such strategy, the generated return from Smart Beta is significantly lower than it should be. It can also be concluded that investing in Smart Beta ETFs may not be as 'Smart' as it claimed.

This could suggest that the expectation of future return of Smart Beta ETFs would become less and less significant based on historical performance over the past 10 years as only few Smart Beta ETFs would be able to beat the market after the long time. Smart Beta ETFs may not be considered as a good investment strategy since investing in Smart Beta ETFs lately would suggest a less return for investors and only specific Smart Beta ETFs that could be able to generate the persistence performance over time. In addition to this, Smart Beta ETFs also have similar characteristics as stocks as it follows a negative skewed, according to French (2007), implying that Smart Beta ETFs may proses only a small gain but significant chance of getting loss or negative returns which we will provide the insight of risk-returns characteristics that involve with Smart Beta ETFs in the next section.

Analysis II: Risk Factors Exposure of Smart Beta ETFs

In this section, we apply Carhart Four Factors model to analyze the risk factors that involve with generating the return of Smart Beta ETFs. After running regression analysis, it indicates that under goodness of fit statistic: The R-squared are more than 74% for Smart Beta ETFs samples in all year and there is also no evidence for auto-correlation problem; its mean is stationary, and the variance is stable, which assure that Carhart Four Factors model is some extent affirmed.

The abnormal risk-adjusted return or Alpha that generates from Smart Beta ETFs is insignificant at 95%, statistically for all periods, starting from 2009 until 2019 which means that this strategy may not be suitable for active investors who looking to achieve active return over time. Apart from the market risk factor, the other risk factors may show some significant in statistics at 99%, yet it does not seem to be consistent through time either, indicating they do not contribute to generate return of Smart Beta ETFs which shows in the table 19 below. This may also align with the Sharpe ratio results in table 18, where the risk-adjusted return may not remain persistence and outperform the market through time.

Table 19: Statistical Results of Risk factors components in Smart Beta ETFs

Risk Factors Exposure of Smart Beta ETFs from 2009 to 2019												
Variables	SB ETFs 2009	SB ETFs 2010	SB ETFs 2011	SB ETFs 2012	SB ETFs 2013	SB ETFs 2014	SB ETFs 2015	SB ETFs 2016	SB ETFs 2017	SB ETFs 2018	SB ETFs 2019	SB ETFs 2009-2019
MKT	0.969***	1.036***	0.943***	1.083***	0.922***	0.909***	0.956***	0.660***	0.768***	0.958***	0.815***	0.912***
	(0.0201)	(0.0177)	(0.0202)	(0.0237)	(0.0257)	(0.0282)	(0.0263)	(0.0141)	(0.0466)	(0.0190)	(0.0502)	(0.00935)
SMB	-0.234***	-0.125***	-0.109***	-0.129***	-0.149***	-0.278***	-0.213***	-0.0763***	-0.0281	-0.166***	-0.117	-0.123***
	(0.0312)	(0.0275)	(0.0313)	(0.0367)	(0.0398)	(0.0436)	(0.0409)	(0.0219)	(0.0722)	(0.0304)	(0.0723)	(0.0129)
HML	0.265***	-0.237***	0.252***	-0.255***	-0.00630	0.205***	0.268***	0.176****	0.170**	0.106***	0.0668	0.105***
	(0.0302)	(0.0266)	(0.0303)	(0.0355)	(0.0385)	(0.0423)	(0.0382)	(0.0212)	(0.0699)	(0.0285)	(0.0750)	(0.0140)
UMD	-0.0433	0.0726*	-0.0794*	0.0597	0.269***	0.181***	-0.0283	-0.278*	0.419***	0.139***	0.04525	0.108***
	(0.0476)	(0.042)	(0.0478)	(0.0560)	(0.0608)	(0.0666)	(0.0623)	(0.167)	(0.110)	(0.0443)	(0.553)	(0.0235)
Constant	-0.00112	0.00023	-0.000765	-0.000592	-0.00138	-0.000416	-0.000432	0.000491	-0.000144	-0.00215	-0.00419	-0.0010***
	(0.000724)	(0.00063)	(0.000715)	(0.00084)	(0.000915)	(0.00102)	(0.00104)	(0.000534)	(0.00170)	(0.00134)	(0.0057)	(0.000384)
#Observations	108	108	108	108	108	108	108	108	108	108	108	1188
R-Squared	0.965	0.973	0.965	0.957	0.930	0.919	0.942	0.965	0.751	0.966	0.741	0.900

Table 19: reports coefficients of the regression from equation (5): $E(r_{i,t}) = r_f + \beta_{i,t}\left[E(r_{m,t}) - r_f\right] + \beta_{SMB,t}SMB_{j,t} + \beta_{HML,t}HML_{j,t} + \beta_{UMD,t}UMD_{j,t}$. where the dependent variable is the monthly return of Smart Beta ETFs (SB ETFs); $r_{i,t}$. r_f is the 3 months US treasury bill, MKT is the market risk factor computed based on the return of US market (S&P500) subtracted by r_f, SMB is the size factor, HML is the value factor and UMD is the momentum factor. All these variables will be computed based on the return of stocks components in Smart Beta ETFs, following the criteria in equation (1)-(3): SMB = 1/3 (Small Value + Small Neutral + Small Growth) - 1/3 (Big Value + Big Neutral + Big Growth), HML = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth) and UMD = 1/2 (Small High + Big High)- 1/2(Small Low + Big Low). The number in the parenthesis are the standard errors. ***, **, * indicate that the coefficient is statistically significant at 1%, 5% and 10% level, respectively.

Alpha

From all the Smart Beta ETFs studied shown that in each Smart Beta ETF, there is no positive risk-adjusted return that statistically significant at any significance level. Moreover, most of the time, the alpha shows the negative sign, yet it is still not significant at any level either. This could be described that Smart Beta strategy fails to provide the extra return for the investors. Such property is coherent with the traditional ETFs; although, for Smart Beta ETFs that considered as a part in active strategy, it aims for beating the traditional ones. Hence, such results indicate that Smart Beta strategy may not be able to achieve the purpose of its own and may not be able to fulfil the investors who invest in this Smart Beta strategy.

Market risk Factor (Mkt – RF)

The result shows that the Market risk is the important factor in generating the return of Smart Beta ETFs. Since such risk factors could generate result at least at 99% confidence level statistics significantly and it is the only factor that could be able to provide the result statistically significant consistent in each single year from 2009-2019. It can also be implied that investing in such strategy makes the investors contain the similar risk profile as the market. This also corresponds with a high level of correlation value, almost one, that Smart Beta ETFs poses with the S&P 500 index, described in table 12. Even though there is a significant in correlation between Smart Beta ETFs and S&P 500, there is no evidence confirm that Smart Beta ETFs could generate a return beat the benchmark consistence over time based on its return historical performance and the statistically insignificant of the alpha result.

Size Factor (SMB)

It can be seen that from 2009 to 2019, the size factor shows a negative coefficient through time, which implies that the small-size firms do not provide a reward to Smart Beta ETFs return. In addition to this, during 2009-2016, the coefficient of size factor provides a statistic significantly at 99% consistently which assure that there is a discount in holding small companies. Based on the result in table 19, Size factors seem to not be statistics significant consistent through time either. It can also be suggested that size factor effect start to become less significant lately, implying that investors does not get compensations for holding in small companies. Moreover, there still no single year shows that size factor generates a positive reward to Smart Beta ETFs. It could be suggested that Smart Beta ETFs should shift their strategy to invest less in small companies.

Value Factor (HML)

Smart Beta ETFs shows no value effect statistically significant persistence through time, yet based on the historical performance in table 19, there is a premium for holding the value stocks and it even provides the result that statistically significant at 99% confidence level in some years. However, only for those 3 years; 2010, 2012 and 2013 that the value effect shows a discount towards the return for Smart Beta ETFs. After that there is no evidence of negative impact in Value factors. Therefore, holding value stocks in Smart Beta strategy would be considered as a plus even though its result does not remain consistence through time.

Momentum Factor (UMD)

Momentum effect seems to be fluctuated over time, however based on the results, there are some evidences showing that there is a discount effect from momentum factor during 2009, 2011, 2015 and 2016. But only in 2011 and 2016 that shows negative statistically significant at 90% confidence level. Even though their

premium shows a statistically significant at 99% confidence level in some year, yet, it does not remain consistence over time. One of the reasons may due to the inefficient of US market that arises from the change in investment perspectives from different investors that various across time.

Overall Consistency

All the risk factors in Carhart four factor model shows a statistic significant at 99% confidence level, including the alpha over 2009-2019 period. This implies that the risk factors in the model could be used to explain the return of the Smart Beta ETFs comprehensively. Although, the alpha in each year provide a negative result yet, it is not statistically significant at any confidence level. However, over 10 years, it shows the negative result significantly at 99% confidence level, meaning that Smart Beta strategy does not only fail to generate the excess positive return but even worse, it generates the return statistic significantly lower than the market. Apart from that, the size factor is the only factor that provide a discount effect towards the return of Smart Beta ETFs. This is coherent with our suggestion above that Smart Beta strategy should change their investment style from size factor which is consistent well with its historical performance in each individual period.

Under the purpose of Smart Beta strategy that aims to be the new investment tools for the investors who searching for the extra return above market, such results would be an unsatisfactory. Smart Beta strategy could not be able to provide the positive abnormal return but rather provides a negative return that statistics significant. As a consequence, Smart Beta strategy should not be considered as an effective strategy since such strategy is incapable of reaching the investors' expectation.

Conclusion

This paper provides the empirical analysis of the performance of Smart Beta ETFs in US market in the aspects of the absolute return, relative return and the risk-adjusted return as well as the risk factors that expose in Smart Beta ETFs from 2009 to 2019 period. In a nutshell, Smart Beta may not be a smart strategy as it claimed. Under the logic that Smart Beta aims to be a new investment tool for active investors who searching for alpha, yet the result is disappointing. There is no evidence in our samples of US Smart Beta ETFs that could generate the positive risk-adjusted return statistics significantly based on their historical performance over 10 years.

From absolute and relative return side, the return that Smart Beta ETFs generate still not statistics significantly enough to satisfy its claimed, even though its standard deviation is higher than the market. This implies that Smart Beta strategy does not follow the idea of a higher risk, a higher return. Moreover, this is coherent with the Sharpe ratio result where the performance of Smart Beta does not worth for investors to invest, given the unit extra risk that investors may need to take. Furthermore, after analyzing into the exposure in risk factors of Smart Beta ETFs, Smart Beta failed to generate the abnormal return (alpha) that statistics significant over time. Efficient Market Hypothesis theory (EMH) would be one of the potential explanations to explain this displeasing result. The US market may be large and efficient enough to be left no room for Smart Beta to generate an abnormal return. Furthermore, fund managers would have no market timing ability to add the value in the Smart Beta ETFs. Due to a lack of liquidity timing skills in fund manager, Smart Beta performance is failed to beat the market S&P 500.

Overall, the financial industry always keeps growing, given the improvement in technology and the development of various investment products. Smart Beta strategy still has some rooms for future improvement, at least have provided in this project. But for now, Smart Beta strategy would not be a good prospect for active investors based on their past performance.

Appendix

The Auto-correlation test shows that there is no issue with our samples Smart Beta ETFs based on the consistent in mean represents in figure A and constant volatility represents in figure B, computed from R programme, which is suitable to apply in the Carhart Four-factor model.

Figure A: Consistent in Mean of Smart Beta ETFs

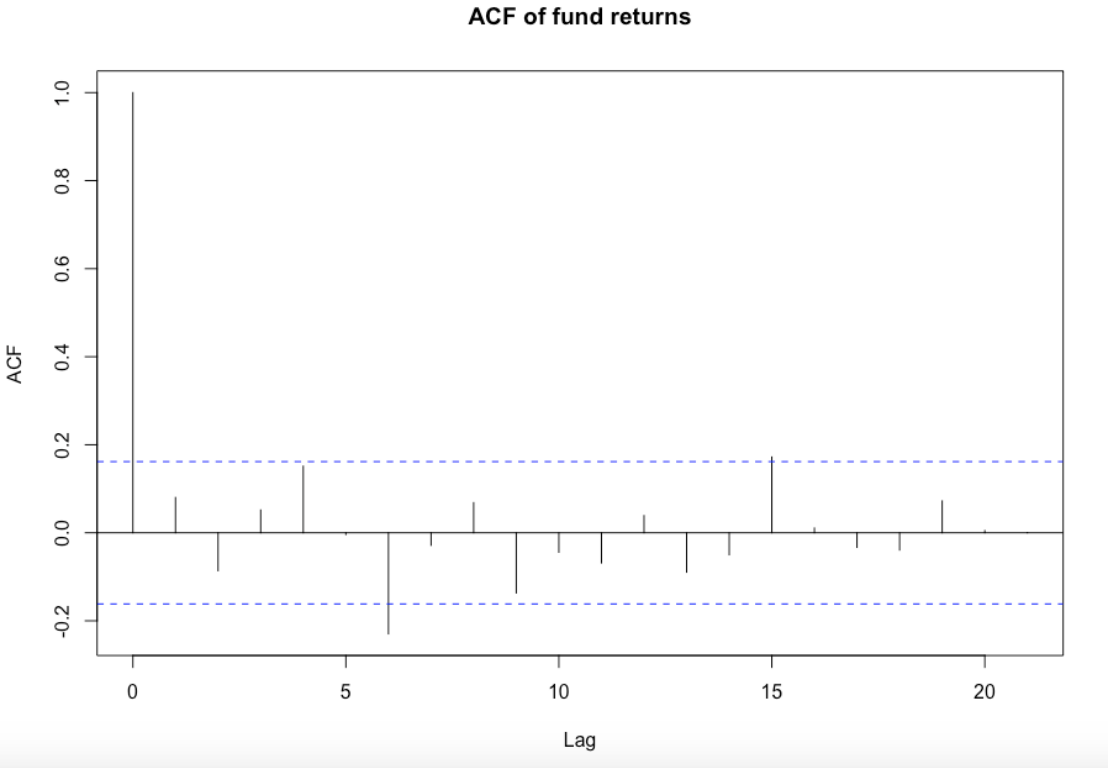

Figure A: reports the result of running Auto correlation function on the monthly return of Smart Beta ETFs in R-programme

Figure B: Constant Volatility in Smart Beta ETFs

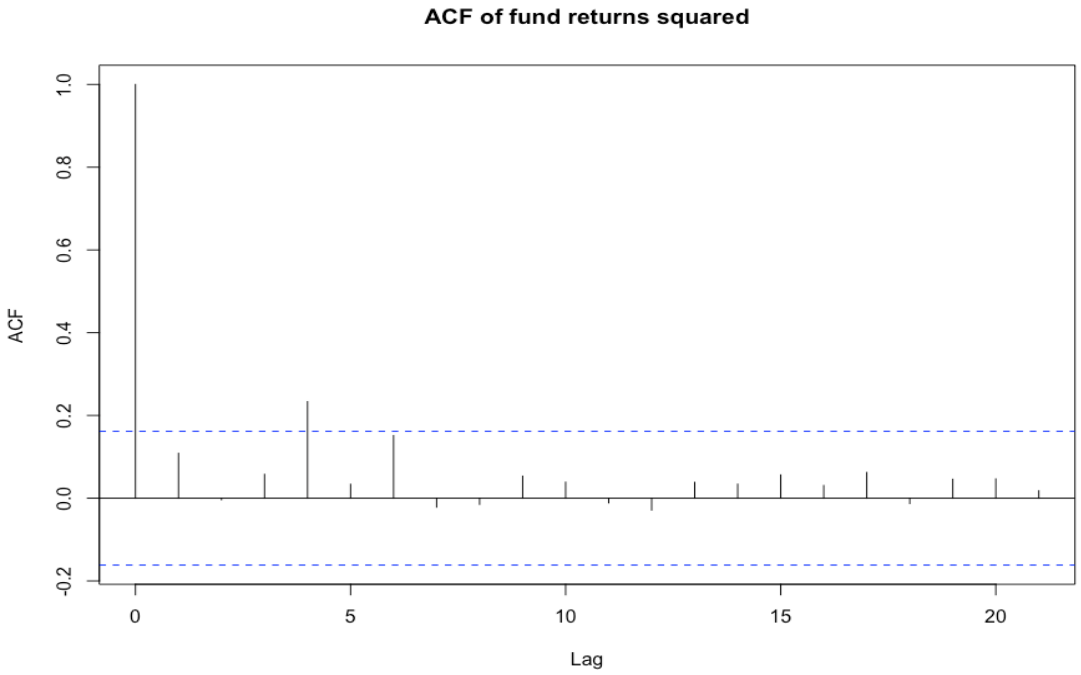

Figure B: reports the result of running Auto correlation function on the monthly return squared of Smart Beta ETFs in R-programme

REFERENCES

Journal

Asness, C. S., Frazzini, A., Israel, R. & Moskowitz, T. J. 2014. "Fact, Fiction and Momentum Investing." *Journal of Portfolio Management*, (40th Anniversary).

Barberis, N., Shleifer, A. & Vishny, R. 1998. "A Model of Investor Sentiment." *Journal of Financial Economics*, 49, 307-43.

Ben Johnson, Hortense Bioy and Dimitar Boyadzhiev. 2016. "Assessing the True Cost of Strategic-Beta Etfs." *The Journal of Index Investing*, 7, 35-48.

Black , F. . 1993. "Beta and Return

" *The Journal of Portfolio Management*, 20, 8-18.

Edwards, W. 1964. "Conservatism in Human Information Processing." *Formal Representation of Human Judgment*, 17-52.

Fama, E. and Kenneth R. French. 2007. "Dissecting Anomalies with a Five-Factor Model." *Journal Of Finance*, LXIII, NO. 4.

Jacob. 2015. "Is Smart Beta State of the Art? ." *Journal of Portfolio Management*.

Jacobs, B., and K. Levy. 1988. "Disentangling Equity Return Regularities: New Insights and Investment Opportunities." *Financial Analysts Journal*, Vol.44, No.3 18-43.

Jacobs, B. I. & Levy, K. N. . 2015. "Smart Beta: Too Good to Be True? ." *The Journal of Financial Perspectives*, 3, 155-61.

Jason Hsu, V. Kalesnik and F. Li 2012. "An Investors' Guide to Smart Beta Strategies." *American Association of Individual Investors Journal*.

Johnson, Bloy and Dimitar 2016. "Assess the Differences in Fees, Replication Costs, Trading Costs for Strategic-Beta Etfs." *Journal of Index Investing*, 7, 35-48.

Lixin Cai, Yong Jin, Qiulin Qi & Xin Xu. 2018. "A Comprehensive Study on Smart Beta Strategies in the a-Share Market." *Applied Economics*, 50:55, 6024-33.

M, Mark. 1997. "On Persistance in Mutual Fund Performance." *Journal Of Finance*, 52, 57-82.

Miranda, Ang, Ratclliffe 2017. "Capacity of Smart Beta Strategies from a Transaction Cost Perspectives." *Journal of Index Investing*, 8, 39-50.

Roncalli, Jean and. "Smart Beta: Managing Diversification of Minimum Variance

Portfolios." *Risk-Based and Factor Investing* 31-62.

Simon G, Frank B. 2016. "Contemporary Issues in Bank Financial Management." 18-35.

sophie, Da zhi and Shive. 2018. "Exchange Traded Funds and Asset Return Correlations." *European Financial Management*, 24, 136-68.

Stevenson, D. . 2014. " Factor Investing –How to Avoid the Smart Beta's Big Sin." *Journal of Portfolio Management*, 40(5), 135-45.

WURGLER, MALCOLM BAKER and JEFFREY. 2006. "Investor Sentiment and the Cross-Section of Stock Returns " *THE JOURNAL OF FINANCE*, LXI, NO. 4

Online

Commissions, US Securities and Exchange. 2013.

direct, Morningstars. 2019. "Morningstars Research "

Rose. 2012. "Morningstars Etf Research,"

Unpublished

A, Ang. 2013. "Factor Investing," National Bureau of Economic Research (NBER): Columbia Business School Research 13-42.

Arnott, R. & Kose, E. . 2014. "What 'Smart Beta' Means to Us," Research Affiliates,

Bender, J., Briand, R., Melas, D. & Subramanian, R. A. . 2013. "Foundations of Factor Investing,"

Fong, Gifford. 2005. "The World of Hedge Funds: Characteristics and Analysis

"

Glushkov, D 2015. "How Smart Are Smart Beta'etfs? Analysis of Relative Performance and Factor Timing," University of Pennsylvania: Wharton Research Data Services,

Green, J., J. Hand, and X. Zhang. 2014. "The Remarkeble Multidimensionality in the Cross-Section of Expected Us Stock Returns," UNC CHapel Hill,

Russell J. Fuller, Raife Giovinazzo and Yining Tung. "The Stable Roe Portfolio: An Alternative Equity Index Strategy Based on Common Sense Security Analysis,"

Web page

DataBase, ETF. https://etfdb.com/2009/size-does-matter-to-a-point-study-of-etf-liquidity/

GoldmanSach. 2017. https://www.gsam.com/content/dam/gsam/pdfs/institutions/en/articles/2017/indexing-and-the-evolution-of-active-management.pdf?sa=n&rd=n

Institute, Investment Company. 2015. "Ici.Org. Frequently Asked Questions About Etf Basics and Structure.," ICI.org. Frequently Asked Questions About ETF Basics and Structure.

Kahn, R. N. & Lemmon, M. 2014. " Making Smart Decisions About Smart Beta " http://www.insurercio.com/images/making-smart-decisions-about-smart-beta.pdf.

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