

Sustainable Investing - Tracking Alpha and Beta

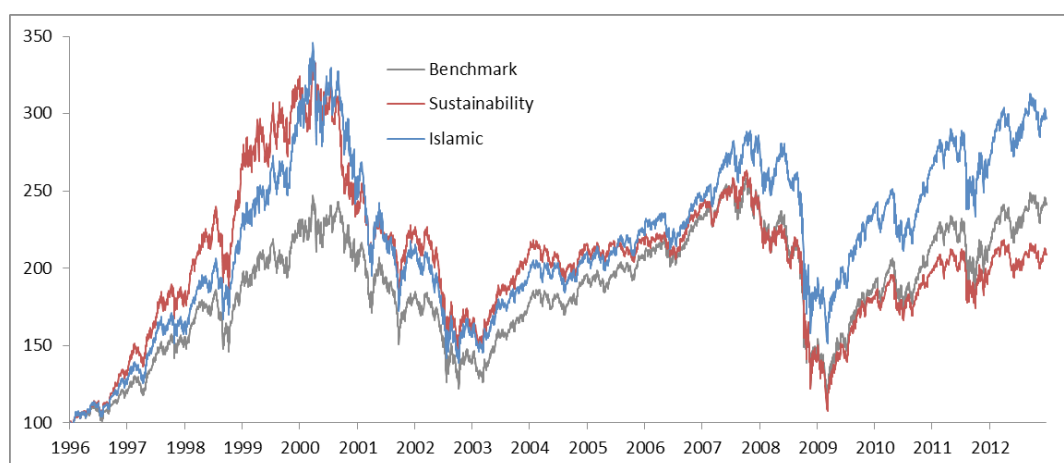
A case study with Dynamic Regression Models on the Dow Jones US Sustainability and Islamic Market Indices

Topic of the month January 2013

Socially responsible investing (SRI) has experienced phenomenal growth over recent years and is poised to go mainstream thanks to the increasing evidence of the financial materiality of environmental, social and governance issues. Similar to their traditional counterparts, performance validation of SRI funds is centred on the existence of alpha. There are numerous practical and academic studies dedicated to this area but they tend to yield different results. In this article, I highlight some of the potential drawbacks of existing performance validation methods and illustrate how these methods can be complemented by the use of dynamic regression analysis.

Line Chart

For the purpose of illustration, I employ two SRI themed indices from the Dow Jones Index family, namely, the *Dow Jones Sustainability™ US Index* and the *Dow Jones Islamic Market™ US Index*. The daily prices of the two indices are extracted for the period from 01/01/1996 to 30/11/2012 and depicted against the benchmark Dow Jones US Index on a line chart (prices are rebased to 100 on 01/01/1996). Plotting the graph is perhaps the simplest way of analysing performance yet it gives direct visual impression of how the index has fared over the chosen sample period.



At first glance, all three indices had similar ups and downs throughout the 17-year period - the first peak in 2000 corresponds to the climax of dot com bubble boom, the second peak in 2007 heralds the outbreak of the global financial crisis thereafter, and the recent upturn signals the recovery from the economic recession. The Islamic index is a clear winner of the 17-year long race as it consistently lies above the benchmark index. The Sustainability index on the other hand got off to a good start but saw its advantage evaporate following the dot com bubble bust and lagged behind the market on the road to economic recovery.



On surface, the graphical presentation seems to favour the Islamic index as an outperformer. Such reading of performance is somewhat superficial and savvy investors would be cautious to conclude about the superiority of the Islamic index. For example, it is easy to note that the Islamic index rises as much as it falls, particularly during the period of dot com bubble boom and bust. Is this pattern indicative of greater beta risk?

The primary drawback of visualising price movement as means of measuring performance is that it gives no consideration to the sources of return, i.e. the risk factors, so one is refrained to make any claim about alpha generation.

Static Regression Analysis

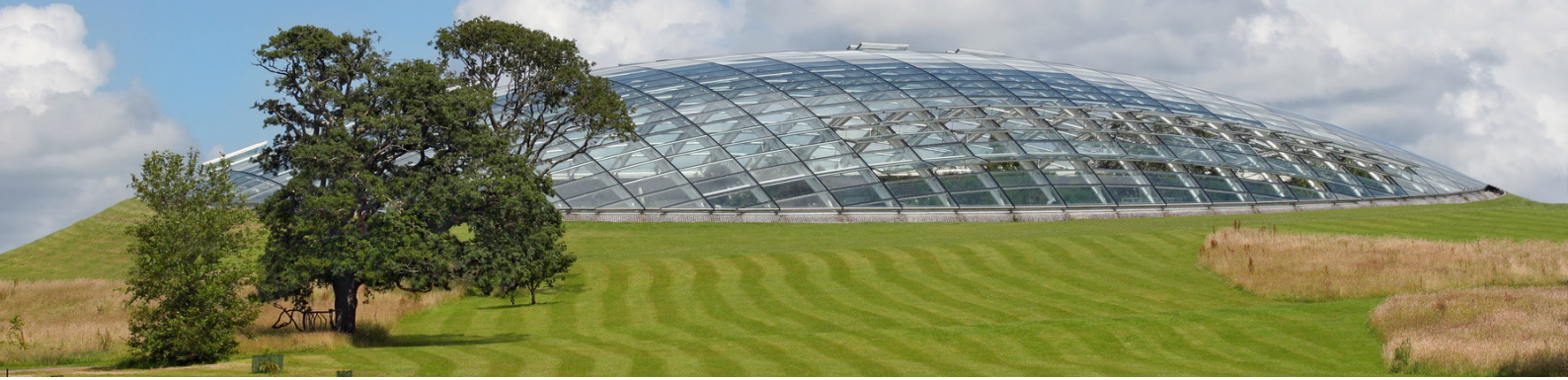
On this front, regression analysis by its design lets itself conveniently into the picture. With style benchmarks become easily accessible nowadays, the Fama-French three-factor and Carhart four-factor models have gradually replaced the traditional CAPM model as the prominent tools to analyse returns and to assert outperformance. In line with these practices and with the help of Dow Jones style benchmark indices, I conduct the regression analysis on the excess returns of the Sustainability and Islamic indices base on the Fama-French three-factor framework, which explicitly controls for any portion of excess returns due to size and value premiums, in addition to the market premium. The risk-free rate is the 3-month US T-bill rate at daily frequency. The market premium is the excess return of the Dow Jones US index over the risk-free rate. The size premium (denoted SMB) is proxied by the return difference between the Dow Jones US Small-Cap index and the Dow Jones US Large-Cap index. The value premium (denoted HML) is proxied by the return difference between the Dow Jones US Value index and the Dow Jones US Growth index. The parameter estimates are displayed in the table below.

Index	Alpha	Beta	SMB	HML	Adj. R ²
Sustainability	-0.000005	0.958***	-0.170***	-0.084***	0.911
Islamic	0.00007**	0.947***	-0.074***	-0.263***	0.975

Note: ** and *** indicate statistical significance at 5% and 1% levels, respectively.

The daily returns of both indices are slightly less exposed to the broad market, as suggested by betas that are less than one. Both SMB and HML register negative signs and are highly significant, which suggest the two indices tilt towards large-cap stocks and growth stocks. This finding nicely explains why the index prices trended up more strongly before the bust of the dot com bubble and fell steeper thereafter compared to the benchmark index. Without digging further to the constituents of the index at the time, we may conjecture that the two indices were loaded with high-tech companies characterised low book-to-market ratios. These companies suffered the most following the dot com bubble bust. However, the results do not shed much light on the price movements in the second leg of the sample period. More importantly, the alpha is positive and statistically significant for the Islamic index return.

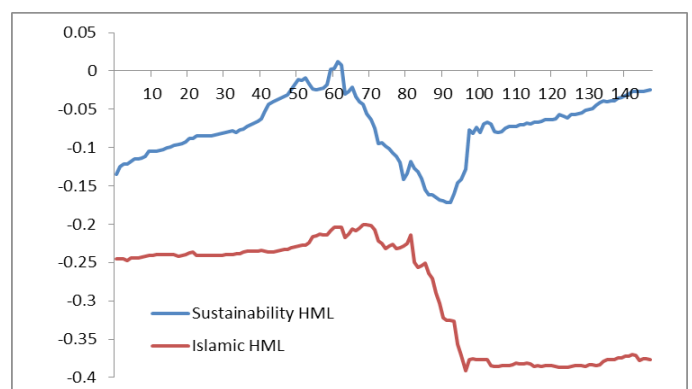
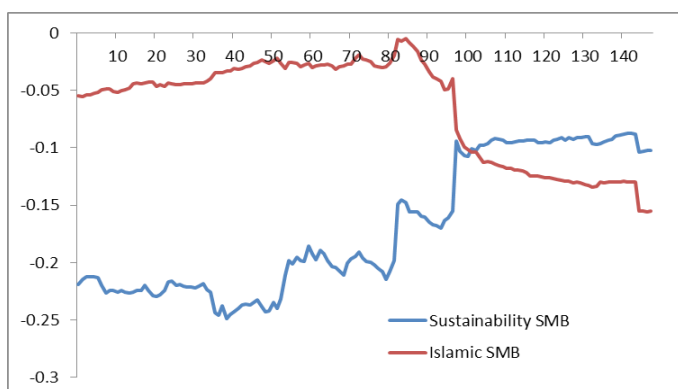
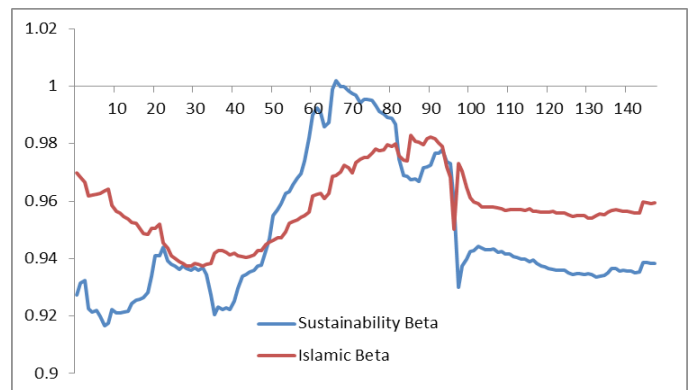
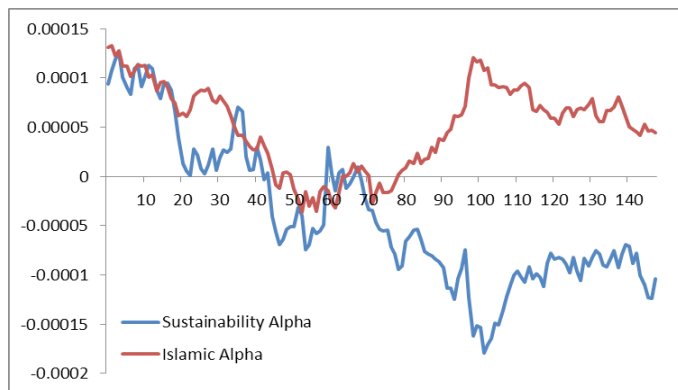
Although the magnitude of the alpha is relatively small, bear in mind this is the abnormal return at daily frequency which is quite impressive for a passively managed index. If the Fama-French model adequately accounts for all other sources of returns, a statistically significant alpha would come from the Dow Jones' selection of Shari'ah compliant stocks. Unsurprisingly, the outperformance is not evident for the Sustainability index, largely due to the sluggish performance after the global financial crisis of 2007. Lastly, the Fama-French three-factor model explains the return variation to a very satisfactory level as suggested by an adjusted R² of more than 90% .



The regression analysis demonstrated above is certainly insightful - not only it helps us to attribute returns to certain investment styles but also dig out the true risk-adjusted alpha. This powerful tool is not without problems. One of which is that it fails to take into account of the parameter instability in the estimated relationship - which is exactly how users of such information may be misguided. The alpha found in the Islamic index return may be only pertain to the 17-year sample period and may well disappear if we alter the sample length of 17 years to any other time interval. In other words, the alpha observed may be specific to the sample selection. In light of a statistically significant alpha, the essential question to ask is whether it is persistent, if not, when it is exploitable. Unfortunately, this question is left answered by the traditional regression analysis. Furthermore, asset managers may encounter difficulties to communicate the statistical results to their clients who would prefer the straightforwardness of a line chart due to their modest statistical background.

Dynamic Regression Analysis

To alleviate the problems noted above, I propose the use of dynamic regression analysis to complement the performance validation process. The dynamic regression analysis can be conducted using either rolling or recursive sample. For the rolling regression, I adopt a five-year period and move this fixed window forward by 21 daily observations (the number of trading days in a month) at a time until we reach the end of 2012. The choice of five years as the window length is somewhat arbitrary. Analysts could tailor the window length to match investors' desired holding period. The five-year setting generates approximately 150 sets of estimates for alpha, beta, SMB and HML. The estimates for each parameter are plotted in a line chart, in similar fashion as how we treated the index prices, as shown below.





The main analytical interest is the path of alphas over different sub-samples. The path is constituted by the alpha (if any) could be earned by holding the index for five years at different point in time. For simplicity, the statistical significance is not indicated but it is safe to assume any alpha whose magnitude is within ± 0.00005 should be deemed insignificant (i.e. alpha is most likely to be zero).

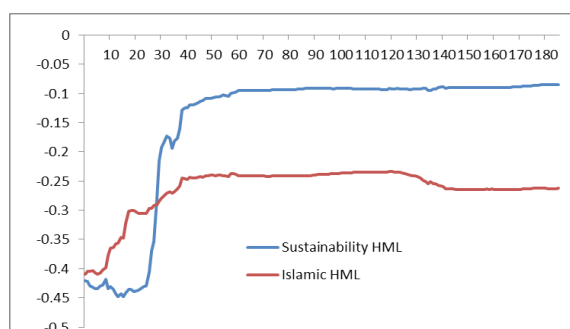
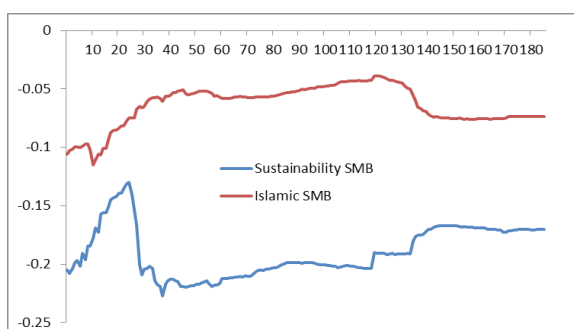
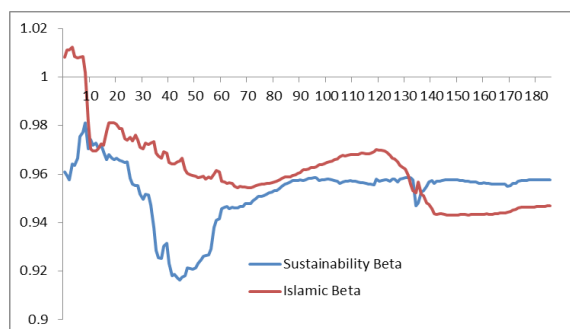
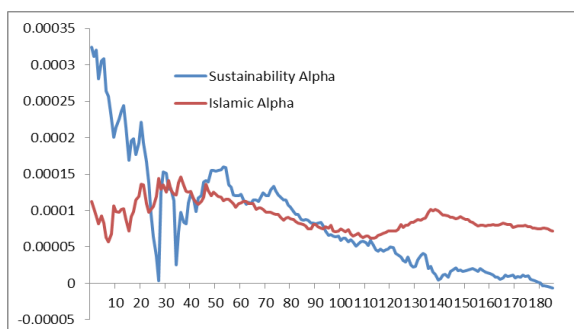
Ideally, we would like to see an upward trending alpha but this rarely happens with any passively managed investment. Nevertheless, we should look out for any downward trend or abrupt jumps. The former is indicative of deteriorating performance while the latter may, in hindsight, signal entry or exit points under the specific circumstances.

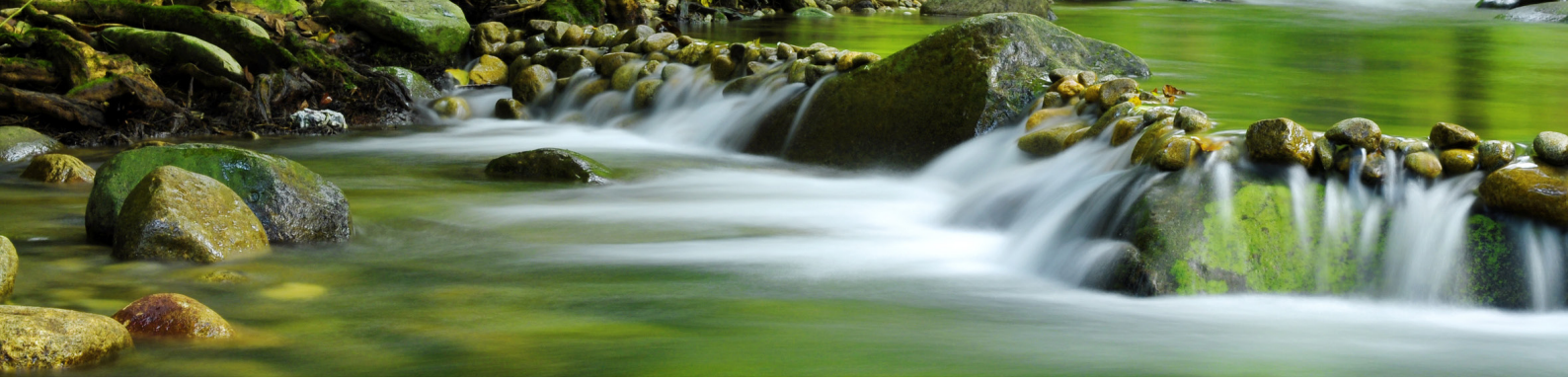
The importance of beta is often overshadowed by alpha. A beta is certainly desirable if it decreases during market downturn while increases during upturn. Unfortunately, such property is not visible in the present dataset.

The paths of other two performance attributes would inform investors about potential style drifts of the index over time so necessary actions can be taken to ensure compliance to investment mandates.

The paths of the parameters may vary with rolling window length. Analysts are advised to experiment with different sample lengths to gain a complete understanding of the time-varying performance of the index under consideration.

Unlike rolling estimation which uses a fixed window, recursive estimation assumes that the estimated parameters are evolving to some final form. In practice, recursive regression analysis should be useful for investors who intend to hold their investment as long as possible, as it informs them about the performance attributes of their investments as time passes. For the recursive estimation, I start with a two-year sample which is added 21 observations at each recursive estimate until the sample reaches its full length of 17 years. The plots of the four parameters are presented below.





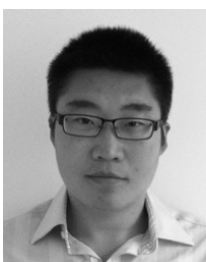
On average, the Islamic index was able to generate a positive alpha that persists over time whereas the margin of out-performance for the Sustainability index was on a gradual decline.

Turning to SMB and HML, for which both indices consistently lie below zero, suggesting their greater exposures to large-cap stocks and growth stocks. Between the two indices, the Islamic index on average exhibited less bias towards large-cap stocks but greater appetite for growth stocks over time. Again, this preference is consistent with the principles of Shari'ah laws that prohibit companies with high leverage ratio – an attribute more commonly found among value stocks.

What is really intriguing is that the steep fall in the alpha of sustainability index seems to coincide with the rise in the index's exposure to HML. Is there a negative correlation between the sustainability alpha and the value premium? This is a speculation that certainly warrants further investigation.

Final Remarks

Dynamic regression analysis overcomes some of the deficiencies inherent from the traditional static regression analysis. It captures the fluid nature of performance attributes and the results drawn from which are less sensitive to sample selection. Rolling regression analysis facilitates us to detect structural changes in key performance drivers. Recursive regression analysis takes a long-term perspective and investigates how performance drivers evolve as time passes. Both methods model returns in a data-determined manner and would serve as complements to traditional regression analysis. Finally, the graphical output of dynamic regressions appeals more to investors who may be less comfortable with statistical information.



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