Measuring the Performance of non-US AlphaDEX Indexes: Nasdaq's Assessment

Introduction

First Trust Advisors, LP, is an asset management firm offering a variety of investment products, including Mutual Funds, Exchange-traded Funds (ETFs), and Structured Products. Among the ETFs offered are those under the AlphaDEX brand. The AlphaDEX products are designed to produce enhanced returns over a given benchmark.

First Trust introduced AlphaDEX in 2007, making it one of the earliest creators of factor-based, "smart-beta" investment products. Since 2014, Nasdaq has computed the indexes that many of the AlphaDEX ETFs track, as well as the designated benchmark indexes. In this role, Nasdaq has generated historical backtest index data going back to 2001. Using this information, we can analyze how the Nasdaq AlphaDEX indexes compare—on paper— with their benchmarks during this time frame. This white paper presents the results of that analysis.

This study looks at six non-US AlphaDEX indexes that Nasdaq currently computes. Four are based on country indexes: Germany, Switzerland, Japan, and the United Kingdom. The other two are based on regional indexes: Eurozone and Emerging Markets.

The AlphaDEX Methodology

As mentioned, the AlphaDEX methodology is an example of the so-called "smart beta" approach to indexing. These indexes use a different weighting scheme than traditional market capitalization weighting. The specific details for a given AlphaDEX index vary across indexes, but the general approach is as follows.[1] An AlphaDEX index starts with a specific traditionally-weighted benchmark. The benchmark may be based on geography, style (value vs growth), or component size (e.g. Large- vs Mid-Cap). The benchmark indexes serve as the starting universe for the AlphaDEX indexes. In other words, AlphaDEX indexes select components exclusively from their respective benchmarks. Beyond this initial benchmark membership criterion, eligible components must meet certain minimum market capitalization and liquidity standards to be eligible for further consideration. The remaining eligible components are then analyzed with respect to six fundamental factors, which are subdivided into two categories: value and growth.

Summary

We compare the performance of six broad non-US AlphaDEX indexes with their traditionally-weighted index benchmarks. Backtest data from 2001 through 2017 are used. We find that during this period the AlphaDEX indexes under consideration generated higher returns compared with their respective benchmarks. These return premia are shown to be associated with exposure to size, value and momentum factors.

1 Further details on the construction of AlphaDEX indexes are at indexes.nasdaqomx.com/Index/Directory/AlphaDEX. See also http://business.nasdaq.com/intel/indexes/smart-beta/alphadex-indexes.

The growth factors are:

- 3-, 6-, and 12-month price appreciation,
- Sales-to-Price ratio,
- 1-year Sales growth.

The value factors are:

- Book Value-to-Price ratio,
- Cash Flow-to-Price ratio,
- Return on Assets.

Each eligible component is given an ordinal ranking on each factor, where higher values of the factor result in a higher ranking. An overall growth score is obtained by first summing the ranks of the individual factors, then creating a rank based on this sum. The same procedure is used to create an overall value rank. For most indexes, the component receives as its final score the higher of its value rank or growth rank, and the final rank is based on this composite score.

The final rankings are used to assign weights to the AlphaDEX indexes. Only those components ranked above a pre-set threshold receive a positive weight, with this threshold determining the final number of index components. These remaining components are divided into rank-based quintiles. The highest-ranked quintile is assigned 5/15 (33%) of the overall index weight, shared equally among all components in the quintile. The remaining quintiles are assigned 4/15, 3/15, 2/15, and 1/15 of the overall index weight. Again, all components within a quintile have the same weight. The indexes under consideration are rebalanced semi-annually.

The Impact of AlphaDEX Weighting

The Nasdaq benchmark indexes used by AlphaDEX employ float-adjusted shares outstanding in pricing the index. This method implies that the benchmark is (float-adjusted) market capitalization weighted. In short, the importance of a given component in the index is proportional to its market cap. This traditional weighting can be contrasted with that used by AlphaDEX. The following table presents weighted averages for a set of component characteristics using two sets of weights: float-adjusted market capitalization weights and AlphaDEX weights. The table is based on the AlphaDEX Eurozone index. Results for this index are similar for the other five indexes, details for which are presented in the Appendix, Table 1.

Index Weighted Averages of Characteristics for Components of the Nasdaq Eurozone Index: 2001 - 2017

		Weight used in Average	
AlphaDEX Criteria	**Factor**	**Float-Adjusted Market Capitalization**	**AlphaDEX**
	Mkt Capitalization (Billions USD)	$45	$11
Growth	12-Month Momentum	11%	20%
	Sales-to-Price	1.22	1.81
	Sales Growth	4.2%	9.2%
Value	Book-to-Price	0.64	0.72
	Cash Flow-to-Price	0.12	0.17
	Return on Assets	4.1%	4.9%

The difference in weighted average market capitalization is remarkable, though not surprising. By design, traditional market benchmark index weight larger components more heavily. AlphaDEX utilizes factors other than market capitalization to derive index weights. As such the AlphaDEX index provides greater exposure to smaller components. The table shows that the AlphaDEX weights lead to higher average levels of both the growth and value criteria. This is generally true for all the AlphaDEX indexes we analyzed.

AlphaDEX weighting deviates, therefore, substantially from market-capitalization weights. The impact of this deviation on index performance will now be addressed.

Assessing the "alpha" of an index

The central empirical question to be addressed is whether and to what degree AlphaDEX indexes generate "alpha" relative to their benchmarks. The following statistical inputs form the basis of the analysis:

Statistical Inputs:

Metric	Written as	Definition
Index Return	R_A (AlphaDEX), R_B (benchmark)	log (I_t/I_{t-1}) for Index Value *I*
Expected Return	$E(R_A)$ or $E(R_B)$	Average of historical returns
Expected Risk Premium	$E(R_A - R_{rf})$ or $E(R_B - R_{rf})$	Average of returns over T-bill rate (risk-free rate)

For measuring the risk-free rate, we follow common practice in using the 3-month T-bill rate. Historical backtest values of the indexes are computed on a daily basis, but returns can be computed for returns of any length. For the non-US indexes, we analyze semi-annual returns corresponding to the rebalancing dates of the indexes. Index backtest data extend back to the spring of 2001, with the exception of the Switzerland index, whose backtest data start in July 2005. Our analysis uses the Total Return version of the indexes, which assumes reinvestment of cash dividends on the ex-dividend date.

A generic formulation for alpha can be expressed as follows:

$E(R_A - R_{rf}) = \alpha$+Model of Expected Returns.

That is, alpha is the addition to expected return above what would be expected given market conditions. Specific measures of alpha depend, then, on the particular model of expected returns. This white paper employs three such models:

Alternative Models of Expected Returns:

Evaluation Metric	Model of Expected Returns
Simple Market Adjustment	$(R_B - R_{rf})$
Beta-Adjusted Market	$\beta(R_B - R_{rf})$
Market Plus Three Additional Factors	$\beta_1 (R_B - R_{rf}) + \beta_2 \cdot$Size Factor$+\beta_3 \cdot$Value Factor + $\beta_4 \cdot$Momentum Factor

The first approach is a simple comparison of the historical returns of the AlphaDEX index against its benchmark. No account is made of differences in risk, the approach implicitly using a beta of one. The second recognizes that the index may have a beta different than one. From the perspective of the widely-used Capital Asset Pricing Model (CAPM), beta is viewed as the measure of risk, with values of beta greater than one indicating greater risk than the benchmark. To achieve a positive alpha, the index would have to outperform the market by an amount greater than the level of beta. The alpha obtained using this metric is often termed "Jensen's alpha."

The third metric involves factors in addition to the market, reflecting extensive research done by finance academics during the last two decades.[2] This approach is based on the empirical finding that certain characteristics of stocks have been consistently associated with higher expected returns, even after taking the market beta into account. Three of the most prominent of these factors are used in this study:

- **Firm Size**. Smaller securities (as measured by market capitalization) tend to have higher average returns than larger securities. A common way to implement this finding is creating a factor termed "Small minus Big" (SMB). The SMB factor is the average difference in returns between the smallest securities and biggest securities in a portfolio (as defined by the benchmark).
- **Book-to-Price Ratio**. Securities with relatively high book-to-price ratios tend to have higher returns. The measure used here, consistent to the academic literature, is termed "High minus Low" (HML). The HML factor is based on the difference in returns from the high book-to-price securities minus the low book-to-price securities.
- **Momentum**. Though the literature is less definitive, there is often a tendency for securities whose prices have been rising more than average in the past to continue to have higher than average returns in the future. The measure used here is termed "Winners minus Losers" (WML), which is the difference in returns of securities whose prior returns were in the highest decile with those whose prior returns were in the lowest decile.

Note that the AlphaDEX weighting scheme uses these same factors (in addition to some others). Both book-to-price and momentum are explicitly taken into account in the AlphaDEX weighting methodology. The size factor is implicitly used by AlphaDEX through its use of factor-based weights instead of market-capitalization weights, as discussed above.

The question often arises as to why these factors are associated with higher average returns. They may be indicative, for instance, with risk not adequately captured by the beta. Alternatively, they may be associated with various market anomalies. This study maintains an agnostic stance with regard to this question, focusing only on the observed results.

Empirical Results

We estimated alphas for each index under consideration using the following steps:

1. The dates of the semi-annual index rebalance were obtained. Levels of the AlphaDEX index and the benchmark were identified for these dates, and converted to (logarithmic) returns. The sample consisted of 33 semi-annual returns (25 returns for Switzerland).
2. Using component-level data, the SMB, HML, and WML factors were computed for the same semi-annual rebalance periods. The securities used for each quarter were those components of the benchmark index that were present at both the start and end of the half-year. The method attempted to mimic that used in academic research.
3. Estimated alphas were obtained as the intercepts from least squares regressions based on the three models shown above.

For illustration we will again use results from the Nasdaq Eurozone index. Results for the other AlphaDEX indexes are broadly similar, and are shown in the Appendix.

Sample averages for the main variables are as follows:

Average Semi-Annual Returns for Nasdaq Eurozone Index:

AlphaDEX(R_A)	BenchmarkE(R_B)	Size (SMB)	Value (HML)	Momentum (WML)
4.69%	2.85%	-0.47%	0.90%	10.57%

2 Among the earliest important academic papers are Fama and French (1992, 1993 and 1996) in which the size and book-to-price factors are introduced. Carhart (1997) and Jagadeesh and Titman (1993) analyzed momentum. An example of recent research illustrating the ongoing search for significant factors is Fama and French (2015).

Since these values are semi-annual, they would be multiplied by two to create annualized values. We see that the average AlphaDEX return is higher than the benchmark by more than two percentage points, implying an annual return more than 400 basis points higher than the benchmark. In this particular sample, the Size effect is actually negative, which is somewhat atypical. The book-to-price and momentum factors are positive for this sample of stocks, the latter especially so, which is somewhat atypical.

The regression results are shown as follows. The table provides the estimated coefficients of the model, as well as the t-statistic of the estimated alpha. Note that the t-statistic is used to determine whether the estimate meets the standard of statistical significance, with values exceeding approximately 2 in magnitude being deemed statistically significant.

Nasdaq Eurozone Index: Estimated AlphaDEX Alphas

	Model of Expected Return		
	Simple	**One-Factor**	**Four-Factor**
Alpha	1.84%	1.79%	0.44%
t-statistic	2.49	2.38	0.63
Beta	1	1.02	1.04
SMB	--	--	0.463
HML	--	--	0.202
WML	--	--	0.127

The simple model indicates that the semi-annual return for the AlphaDEX index averaged 184 bps more than the benchmark. This difference meets the usual standard for statistical significance. When the beta is allowed to be different from one, we obtain an estimate of 1.02. This implies that the AlphaDEX index is a bit riskier than the benchmark. This added risk reduces the estimated alpha a small amount, to 1.79%

When the additional three factors are added, the estimated alpha becomes much smaller, and falls below the level needed for statistical significance. It may be inferred, therefore, that the AlphaDEX return differential of the previous models can be partially "explained" by the three additional factors. Note that the estimated coefficients of the three factors are all positive—consistent with the idea that AlphaDEX returns are correlated with those of smaller stocks, high book-to-price stocks, and high momentum stocks. In essence, then, it appears that the AlphaDEX index creates exposure to factors associated with higher returns, and this is a large part of the source of its outperformance of the benchmark.

Combined Results

The foregoing looked in detail at the Nasdaq Eurozone AlphaDEX index. Full results for the other indexes are presented in the Appendix Table 2. We here examine summaries of these results, allowing for identification of a general "AlphaDEX effect." The following table shows the estimated semi-annual alphas for the group of indexes under consideration.

Semi-Annual Alphas for Six non-U.S. AlphaDEX Indexes:

Index	Simple Alpha	Single-Factor Alpha	Four-Factor Alpha
Germany	2.42%	2.32%	0.73%
United Kingdom	1.36%	0.83%	0.45%
Switzerland	1.40%	0.58%	0.41%
Japan	1.07%	0.99%	0.27%
Eurozone	1.84%	1.79%	0.44%
Emerging Markets	2.39%	2.06%	1.69%
Overall Average	1.75%	1.43%	0.67%

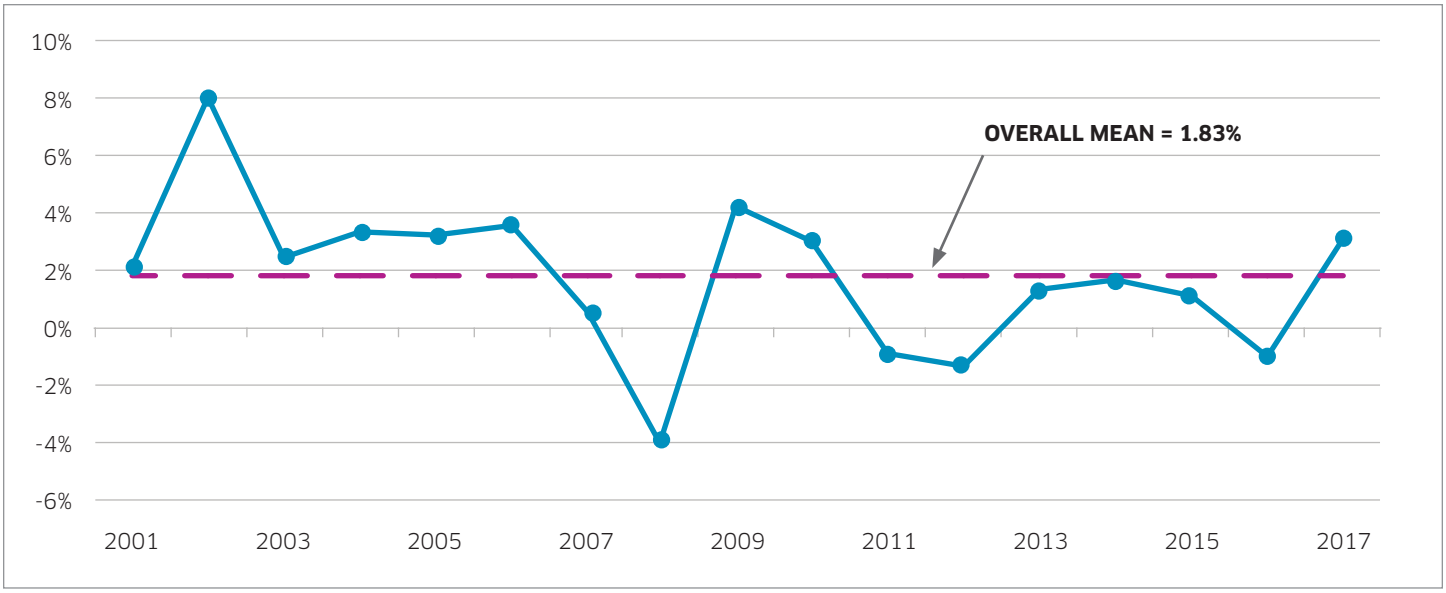
While there are differences, the table shows a fairly consistent story. The AlphaDEX indexes on average yield raw returns higher than their benchmark counterparts. Adjusting for market risk via the estimated beta lowers the alphas somewhat.

When adding the additional three factors, the resulting alphas are smaller, though still positive. Four of the six alphas are not large enough to be deemed statistically significant. Consistent, then, with what was seen with the Germany index, we see that the additional return to AlphaDEX may be partially attributed to exposure to the three factors.

Results over Time

We now consider how AlphaDEX performance has varied over time. The following graph shows the average of the AlphaDEX semi-annual return premium (i.e., the simple alpha) over time. As noted above, back test data are available from March 2001forward for all indexes except that for Switzerland, whose backtest data starts in July 2005. To provide a consistent perspective, the averages shown in the graph exclude values from the Switzerland index. The graph presents information aggregated by year. The year shown on the axis label refers to the date of the end of the six-month return (for example, a return from Sept 2011 – March 2012 would be counted as 2012).

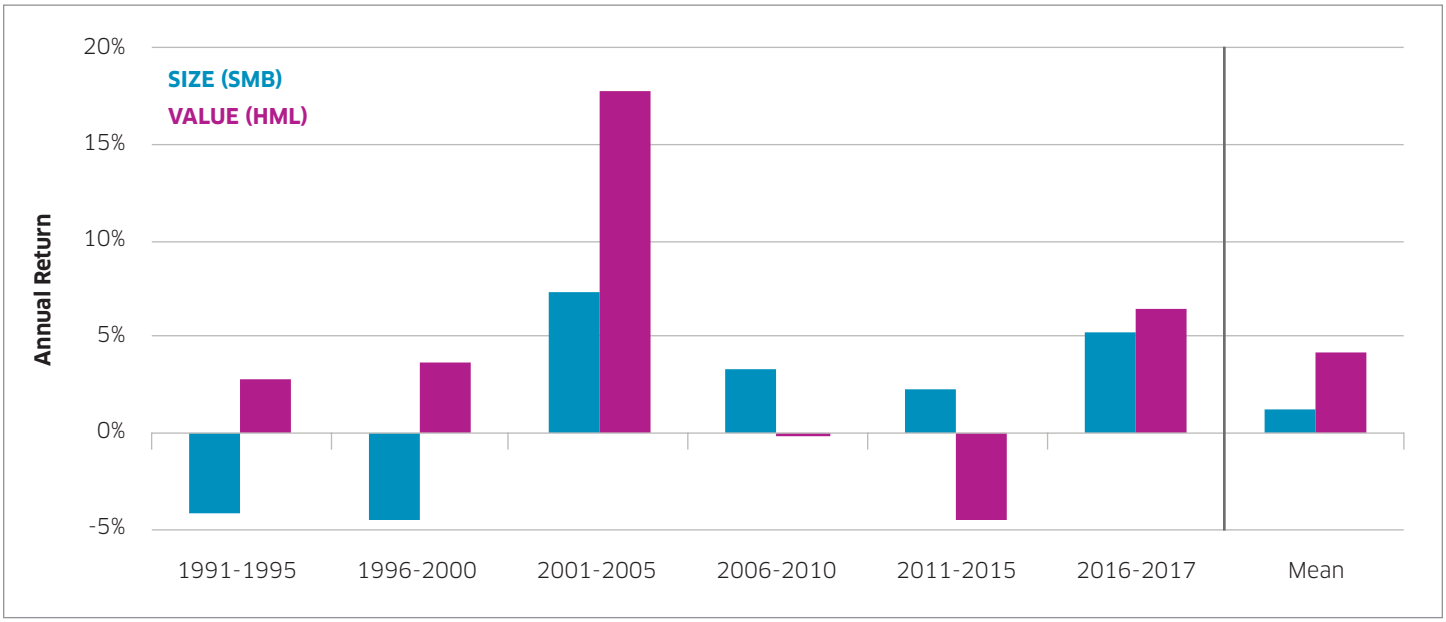
Average Semi-Annual Alpha for 5 AlphaDex Non-U.S. Indexes



The average return premia are greater than zero for all but four years in the sample. AlphaDEX strongly underperformed the benchmark in the crisis year of 2008. There is a general downward trend in the values of alpha.

As was seen above, the enhanced returns obtained by the AlphaDEX indexes may be partially attributed to their exposure to the size and value factors. Long-term historical perspective on the return premia associated with these factors can be seen using historical data independently provided by Prof. Kenneth French, one of the leading academics whose research discovered the importance of these factors.[3] The following graph illustrates the pattern of factor-specific return premia indicated by the French data for European securities.

Trends in European Factor Return Premia



This graph provides a number of findings. First, both the Size and Value factor premia have been on average positive during the last 27 years. The mean Size premium was 1.19% and the Value premium was 4.12%. However, the premia demonstrated substantial variation across individual periods. The five years from 2001-2005, for instance, exhibited much higher than average size and value premia. From 2006-2015 both the Size and Value premia declined, with the Value premium actually negative from 2011-2015. Since 2016, however, both premia have increases. The temporal patterns observed in the Ken French European data generally track AlphaDEX performance.

The implication for AlphaDEX is clear. Over the long term, overweighting small stocks and value stocks, as does AlphaDEX, is likely, but not certainly, to result in a positive return premium. The premium is variable. It was high from 2001-2005, but much less so from 2011-2015. Future performance of AlphaDEX will therefore likely depend on the how factors such as size, value, and momentum perform in the future.

3 See Prof. French's website http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Appendix

Table 1: Comparison of AlphaDEX and Benchmark (float-adjusted market-capitalization) Weighting:

Index Weighted Average Market Capitalization of Components (Billions USD)

	Benchmark	AlphaDEX
Switzerland	111.0	15.6
Germany	52.0	15.5
Emerging Markets	20.7	3.4
Eurozone	44.6	10.7
United Kingdom	76.8	15.8
Japan	19.1	3.8
Average	54.0	10.8

Index Weighted Average of Growth Factors

	12-month Price appreciation		Sales-to-price		Sales Growth	
	Benchmark	AlphaDEX	Benchmark	AlphaDEX	Benchmark	AlphaDEX
Switzerland	9%	18%	0.62	1.00	3%	7%
Germany	13%	19%	1.43	2.11	4%	8%
Emerging Markets	24%	41%	0.84	1.35	18%	24%
Eurozone	11%	20%	1.22	1.81	4%	9%
United Kingdom	10%	22%	0.92	1.08	7%	14%
Japan	6%	23%	1.57	2.16	4%	8%
Average	12%	24%	1.10	1.59	7%	12%

Index Weighted Average of Value Factors

	Book-to-Price		Cash Flow-to-Price		Return on Assets	
	Benchmark	AlphaDEX	Benchmark	AlphaDEX	Benchmark	AlphaDEX
Switzerland	0.41	0.57	0.07	0.10	7.91%	6.54%
Germany	0.62	0.66	0.13	0.16	4.05%	4.87%
Emerging Markets	0.54	0.73	0.11	0.17	7.56%	8.34%
Eurozone	0.64	0.72	0.12	0.17	4.14%	4.90%
United Kingdom	0.50	0.55	0.09	0.12	6.18%	7.95%
Japan	0.72	0.80	0.11	0.16	3.28%	4.08%
Average	0.57	0.67	0.11	0.15	5.52%	6.11%

Table 2: Alpha Estimates: Semi-Annual Returns from 2001:Q1 – 2017:Q4 (N=33)

Index	Simple Alpha	t-Statistic	One-factor Alpha	t-Statistic	One-factor Beta	Four-factor alpha	t-Statistic	Four-factor beta	SMB	HML	WML
Switzerland*	1.40%	1.40	0.58%	0.63	1.22	0.41%	0.35	1.18	0.323	0.106	0.068
Germany	2.42%	2.87	2.32%	2.70	1.04	0.73%	0.84	1.05	0.191	0.191	0.133
Emerging Markets	2.39%	4.27	2.06%	3.90	1.07	1.69%	2.55	1.06	0.192	0.075	0.019
Eurozone	1.84%	2.49	1.79%	2.38	1.02	0.44%	0.63	1.04	0.463	0.202	0.127
United Kingdom	1.36%	1.18	0.83%	0.81	1.23	0.45%	0.48	1.09	0.456	0.200	0.088
Japan	1.07%	1.67	0.99%	1.52	1.04	0.27%	0.31	1.05	-0.150	0.114	-0.001
Average	**1.75%**	**2.31**	**1.43%**	**1.99**	**1.10**	**0.67%**	**0.86**	**1.08**	**0.246**	**0.148**	**0.072**

*Switzerland backtest sample: 2005:Q2 – 2017:Q4 (N = 25)

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