Nasdaq

Measuring AlphaDEX Index Performance: Nasdaq's Assessment

We compare the performance of 12 broad U.S. AlphaDEX indexes with their traditionally-weighted index benchmarks. Backtest data from 2001 through 2016 are used. We find that during this period AlphaDEX indexes generated higher returns compared with the benchmarks. These return premia are shown to be mostly associated with exposure to size, value and momentum factors. We also find that the premia were high earlier in the backtest timeframe but have declined since then.

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 available ETFs are those offered under its 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 products track, as well as the designated benchmark indexes. Because of the rules-based index construction, Nasdaq was able to generate historical backtest index data going back to 2001. Using this information, we can analyze how AlphaDEX indexes compare—on paper—with their benchmarks. This white paper presents the results of this analysis.

This study looks at 12 US AlphaDEX indexes that Nasdaq currently computes, categorized by market capitalization of the components (Large, Mid, Small, Mega, and Multicap) and style (growth, value). Additionally, Nasdaq is responsible for 11 country indexes and 8 non-US regional indexes. The complete list of Nasdaq-computed AlphaDEX indexes is shown in Appendix Table 1.

The AlphaDEX Methodology

As mentioned, the AlphaDEX method as designed by First Trust is an example of the so-called "smart beta" approach to indexing. These indexes use a weighting scheme different than traditional market capitalization weighting. The specific details for a given AlphaDEX index vary across indexes, but the following describes the general approach.[1] An AlphaDEX index starts with a specific traditionally-weighted benchmark. The components of the AlphaDEX index are drawn from this benchmark. Components must meet certain minimum market capitalization and liquidity standards to be eligible for further consideration. Each eligible component is then analyzed with respect to six fundamental factors, which are subdivided into two categories: value and growth.

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.

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

Each eligible stock is given an ordinal ranking on each factor, where higher values of the factor are associated with 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 stock receives the higher of its value rank or growth rank as its final score, and the final score determines the final rank in the universe. An exception concerns the case of style benchmarks. For growth indexes, only the growth scores are used; for value indexes, only the value scores are used.

The final rankings are used to assign weights to the AlphaDEX indexes. Only those stocks ranked above a pre-set threshold receive a positive weight, this threshold determins the final number of index components. These remaining stocks are divided into rank-based quintiles. The highest-ranked quintile has an aggregate weight of 5/15 (33%), shared equally among all stocks in the quintile. The remaining quintiles have aggregate weights of 4/15, 3/15, 2/15, and 1/15. Again, all stocks within a quintile have the same weight. Re-ranking and associated rebalancing is done quarterly.

The Impact of AlphaDEX Weighting

The Nasdaq benchmark indexes tracked by AlphaDEX use float-adjusted shares outstanding in pricing the index. This implies that the benchmark is (float-adjusted) market capitalization weighted—the importance of a given component in the index is proportional to its market cap. The impact of this weighting can be seen by comparing weighted averages of component characteristics. The following table presents weighted averages for a set of component characteristics for the U.S. Large Cap Core AlphaDEX index and its benchmark analog.

Weighted Averages of Stock Characteristics for Components of the U.S. Large Cap Core Index: 2001 - 2016

AlphaDEX Criteria	Factor	WEIGHT USED IN AVERAGE	
		Float-Adj. Mkt Cap	AlphaDEX
Not Used	Mkt Cap ($blns)	$98.3	$24.3
Growth	12-Month Momentum	13.0%	19.9%
	Sales-to-Price	0.643	0.920
	Sales Growth	8.8%	10.9%
Value	Book-to-Price	0.375	0.447
	Cash Flow-to-Price	0.084	0.104
	Return on Assets	7.76%	6.95%

The difference in weighted average market cap is remarkable, though not surprising. By design, traditional market benchmark index weight larger stocks more heavily. AlphaDEX does not, however. As such the AlphaDEX index provides greater exposure to smaller components.

With the exception of Return on Assets, we see that the AlphaDEX weights lead to higher average values of both the growth and value criteria. This is generally true for all the non-style AlphaDEX indexes we analyzed. For the US style indexes, the situation was a bit different. For the growth indexes, the AlphaDEX-weighted averages of the three growth factors are much higher than the market cap-weighted averages, though the value averages tend to be lower. For value indexes, the reverse obtains—the AlphaDEX weights for the value factors are higher, the growth factors lower.

We see, then, that AlphaDEX weighting can deviate substantially from market cap 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 $E(R_B)$	Avg of historical Returns
Expected Risk Premium	$E(R_A - R_{rf})$ or $E(R_B - R_{rf})$	Avg of returns over T-bill rate (risk-free rate)

For measuring the risk-free rate, we use the 3-month T-bill rate, a common practice. Historical backtest values of the indexes are computed on a daily basis, but returns can be computed for returns of any length. For the US indexes, we analyze quarterly returns, corresponding with the quarterly rebalancing dates of the indexes. Index backtest data extend back to the spring of 2001. We base our analysis using the Total Return version of the indexes, which takes into account re-invested dividends.

A generic formulation for alpha can be expressed as follows:

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

That is, alpha is the increment to returns beyond what would be expected. Measures of alpha depend, then, on the specific 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 dictated by 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:

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).

- **Firm Size.** Smaller stocks (as measured by market capitalization) tend to have higher average returns than larger stocks. 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 stocks and biggest stocks in a portfolio (as defined by the benchmark).
- **Book-to-Price Ratio.** Stocks whose book-to-price ratios are high 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 stocks minus the low book-to-price stocks.
- **Momentum.** There is often a tendency for stocks 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 compares the returns of stocks 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, as it uses factor-based weights instead of market-cap 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 quarterly 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 63 quarterly returns (almost 16 years).
2. Using component-level data, the SMB, HML, and WML factors were computed for the same quarterly rebalance periods. The stocks used for each quarter were those components of the benchmark index that were present at both the start and end of the quarter. 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.

Complete results are provided in Appendix Table 2.

For illustration we will discuss in detail results from the US Large Cap Core index. Results for the other AlphaDEX indexes are broadly similar. Sample averages for the main variables are as follows:

Average Quarterly Returns for U.S. Large Cap Core Index:

$E(R_A)$	$E(R_B)$	Size (SMB)	Value (HML)	Momentum (WML)
2.14%	1.61%	1.28%	0.67%	-0.53%

Since these values are quarterly, they would be multiplied by four to create annualized values. We see that the average AlphaDEX quarterly return is higher than the benchmark by about a half percent, implying an annual return more than 200 basis points higher than the benchmark. Both size and book-to-price factors are positive for this sample of stocks, in line with the empirical regularities discussed above. In this particular sample, however, there was no evidence of a positive momentum effect, as the estimated mean is negative.

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. Recall 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.

U.S. Large Cap Core: Estimated AlphaDEX Alphas

	MODEL OF EXPECTED RETURN		
	Simple	One-Factor	Four-Factor
Alpha	0.53%	0.48%	-0.03%
t-stat.	1.98	1.78	-0.15
Beta	1.000	1.038	1.093
SMB	--	--	0.374
HML	--	--	0.041
WML	--	--	0.111

The simple model indicates that the quarterly return for the AlphaDEX index averaged 53 bps more than the benchmark. This difference is on the edge of being deemed statistically significant by usual standards. When the beta is allowed to be different from one, we obtain an estimate of 1.038. This implies that the AlphaDEX index is a bit riskier than the benchmark. This added risk reduces the alpha somewhat, to 48 bps.

When the additional three factors are added, the estimated alpha becomes statistically indistinguishable from zero. In conjunction with the previous results, it may be inferred therefore that the return differential of the previous models can be 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 the source of its outperformance of the benchmark.

Pooled Results

The foregoing looked in detail at the US Large Cap Core 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 simple average of the estimated (quarterly) alphas for the indicated group of indexes.

Average Quarterly Alphas for US AlphaDEX Indexes:

Index Group	Simple Alpha	Single-Factor Alpha	Four-Factor Alpha
All US 12 Indexes	0.27%	0.30%	0.02%
Large/Mid/Small Core (3 indexes)	0.29%	0.38%	0.05%
Large/Mid/Small Growth (3 indexes)	0.11%	0.15%	0.08%
Large/Mid/Small Value (3 indexes)	0.34%	0.29%	0.02%

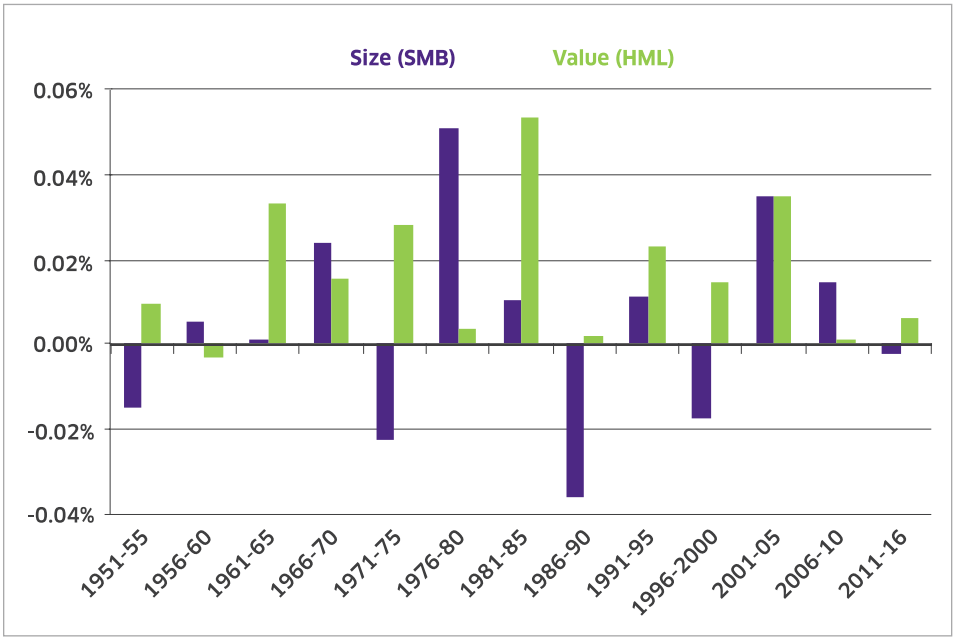
While there are differences, the table shows a fairly consistent story. The U.S. AlphaDEX indexes on average yield raw quarterly returns higher than their benchmark counterparts. Adjusting for market risk via the estimated beta does not consistently change the average alpha.

When adding the additional three factors, the resulting alphas are much smaller, though still positive. The magnitudes of these alphas are not large enough, however, to be deemed statistically significant. Consistent, then, with what was seen with the U.S. Large Cap Core index, we see that the additional return to AlphaDEX may be attributed to exposure to the three factors.

Results Over Time

As was seen above, the enhanced returns obtained by the AlphaDEX indexes may be partially if not largely 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 provided by Prof. Kenneth French, one of the leading academics whose research discovered the importance of these factors.[3] The French data indicate the pattern of return premia as shown in the following graph, which shows the return premium averaged over five-year buckets. The data cover all U.S. equities listed on the major stock exchanges.

Historical Return Premia for US Stocks



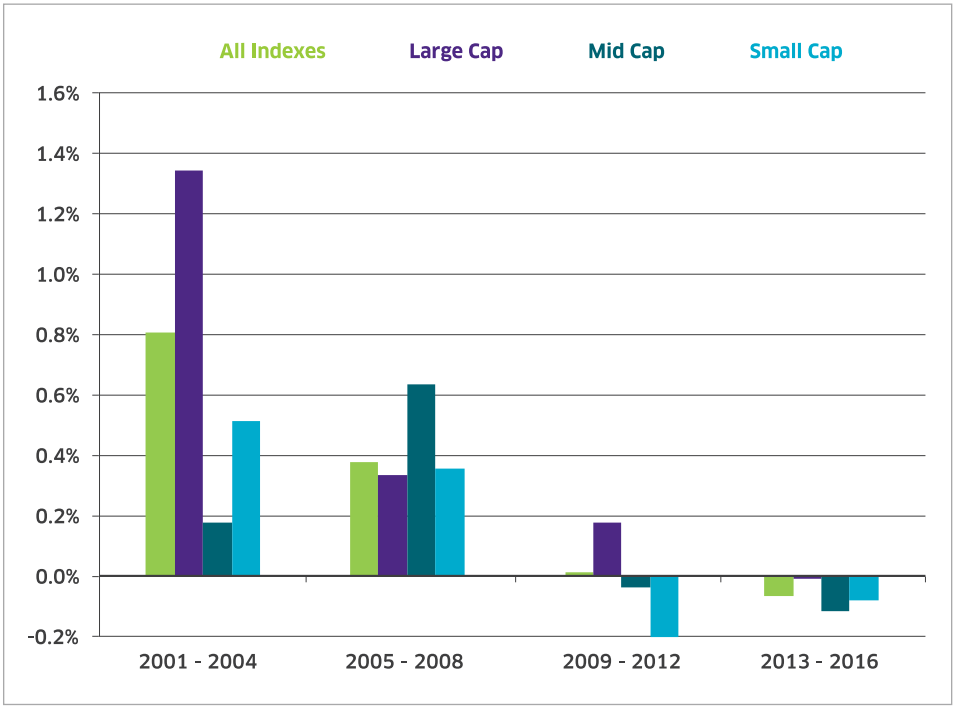
This graph illustrates a number of findings. First, both the Size and Value factor premia have been on average positive during the last 60+ years. On an annualized basis the average Size premium was 1.17% and the Value premium was 4.31%. The graph clearly shows, however, substantial variation when looking at individual five-year periods. The five years from 1986-90, for instance, exhibited a strongly negative size effect, and virtually no value effect.

The graph shows that during the 2001-2005 timeframe, both the size and value factor premia were high. They have since declined to essentially zero. This decline suggests that AlphaDEX performance may have likewise declined during the 16-year backtest time frame from 2001 to the present.

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

The following chart shows the average difference in quarterly returns for the indicated time frames and indexes.

Trends in AlphaDEX/Benchmark Return Differentials



The graph shows substantial variability, but there is a general downward trend in the differentials. For the most recent period, 2013-16, the return differentials are essentially zero, in contrast from earlier years in the backtest sample. The results for AlphaDEX thus mirror those seen in the French data.

The implication for AlphaDEX is as follows. 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 2011-2016. Future performance of AlphaDEX will therefore likely depend on the how factors such as size, value, and momentum perform in the future.

Appendix

Table 1: List of AlphaDEX indexes computed by Nasdaq:

U.S. Indexes:

Index	Index Symbol	Benchmark
Large Cap Core	NQDXUSLC	NQUS500LC
Large Cap Growth	NQDXUSLCG	NQUS500LCG
Large Cap Value	NQDXUSLCV	NQUS500LCV
Mid Cap Core	NQDXUSMC	NQUS600MC
Mid Cap Growth	NQDXUSMCG	NQUS600MCG
Mid Cap Value	NQDXUSMCV	NQUS600MCV
Small Cap Core	NQDXUSSC	NQUS700SC
Small Cap Growth	NQDXUSSCG	NQUS700SCG
Small Cap Value	NQDXUSSCV	NQUS700SCV
MultiCap Growth	NQDXUSMLTCG	NQUSMLTCG
MultiCap Value	NQDXUSMLTCV	NQUSMLTCV
Mega Cap	NQDXUSMEGA	NQUS500LC

Additional Non-U.S. Geographies for which Nasdaq computes AlphaDEX indexes.

Countries	Regions
Australia	Asia/Pacific, excluding Japan
Brazil	Developed Markets, excluding U.S.
Canada	Developed Markets, ex. U.S., Small Cap
China	Emerging Markets
Germany	Emerging Markets, Small Cap
Hong Kong	Europe
Japan	EURO Zone
Korea	Latin America
Switzerland	
Taiwan	
United Kingdom	

Table 2: Alpha Estimates: Quarterly Returns from 2001:Q1 – 2016:Q4 (N=63)

Index	Simple Alpha	t-stat	One-factor Alpha	t-stat	One-factor Beta	Four-factor alpha	t-stat	Four-factor beta	SMB	HML	WML
Large Cap Core	0.53%	1.98	0.48%	1.78	1.038	-0.03%	-0.15	1.093	0.374	0.041	0.111
Large Cap Growth	0.34%	0.86	0.28%	0.70	1.068	0.06%	0.16	1.091	0.337	-0.096	0.125
Large Cap Value	0.47%	1.66	0.41%	1.43	1.034	0.03%	0.10	1.056	0.302	0.042	0.059
Mid Cap Core	0.22%	1.21	0.36%	2.11	0.940	0.22%	1.32	0.976	0.040	0.109	0.076
Mid Cap Growth	0.08%	0.27	0.23%	0.79	0.918	0.08%	0.27	0.975	0.157	-0.068	0.099
Mid Cap Value	0.19%	1.13	0.21%	1.21	0.993	0.20%	0.91	0.988	0.000	0.006	-0.007
Small Cap Core	0.13%	0.56	0.29%	1.37	0.932	-0.04%	-0.19	0.975	0.064	0.092	0.088
Small Cap Growth	-0.11%	-0.45	-0.07%	-0.28	0.978	0.10%	0.46	1.006	0.062	-0.116	0.061
Small Cap Value	0.36%	1.61	0.26%	1.16	1.036	-0.16%	-0.65	1.057	0.133	0.048	0.053
Multi Cap Growth	1.30%	2.03	1.19%	1.87	1.101	0.36%	0.65	1.005	0.661	0.353	0.035
Multi Cap Value	-0.06%	-0.10	0.11%	0.18	0.914	0.13%	0.25	1.118	0.266	-0.483	0.155
Mega Cap	-0.19%	-0.58	-0.20%	-0.60	1.008	-0.65%	-2.56	1.068	0.296	0.019	0.117

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