Global Equity Delta-One Cost Monitor

Cost Comparison of Futures, ETFs, & Swaps on Equity Indices

Bank of America Merrill Lynch

23 February 2017

Futures
Global

Chintan Kotecha
Equity-Linked Analyst
MLPF&S
+1 646 855 5478
chintan.kotecha@baml.com

Clovis Couasnon >>
Equity-Linked Analyst
MLI (UK)
+44 20 7995 0303
clovis.couasnon@baml.com

Jason Galazidis >>
Equity-Linked Analyst
MLI (UK)
+44 20 7996 5713
jason.galazidis@baml.com

Cost is focal point when comparing delta-one investments

Synthetic equity index exposure (delta-one exposure) can be attained through futures, ETFs, total return swaps, or option combos. Each product differs in operational efficiency, associated risks, and costs. Traditionally, investors have used costs as the primary focal point when comparing each of these instruments. This report compares the all-in cost of replicating delta-one exposure to the S&P500, Russell 2000, NASDAQ-100, MSCI EAFE, EURO STOXX 50, and MSCI Emerging Markets via futures, ETFs, total return swaps, and option combos. Aggregated estimates for fully-funded (non-levered) $100mn long delta-1 exposure for a holding ***period of the prior 12 months through Q4-16*** are shown in Table 1.

Fully-funded and levered exposure have varying costs

ETFs, by construction, are intended to be fully-funded. On the other hand, futures (or swaps and option combos) are inherently levered products because only a fraction of the investment notional is posted as margin. Therefore, it's relevant to compare costs for each assuming both fully-funded and leveraged exposure. To this end, we provide a framework to estimate costs when applying leverage. Generalizing the framework, we then show the spread (in bps) between fully-funded futures minus ETF costs that would make the costs of a leveraged futures position equal to that of a leveraged ETF position for (i) a desired leverage amount and (ii) a given spread between the rate at which an investor can borrow cash versus the rate at which they can earn interest.

Table 1: Cost of holding $100 million in futures, ETFs, swaps, and option combos on a fully-funded basis (no leverage) over the last 12 months ending this past quarter (all costs are indicative)

**MSCI EAFE, EURO STOXX 50, and MSCI Emerging Markets costs are benchmarked to their respective net total return indices, all other indices are benchmarked to their total return versions.

Instrument	Cost	SPX	RTY	NDX	MXEA**	SX5E**	MXEF**
Futures	Transaction	2.5 bps	22.0 bps	5.2 bps	12.1 bps	10.6 bps	13.8 bps
	Carry	-8.3 bps	-86.3 bps	3.7 bps	12.1 bps	-74.1 bps	46.2 bps
	Total	-5.8 bps	-64.3 bps	8.9 bps	24.2 bps	-63.5 bps	60.0 bps
ETFs	Transaction	4.6 bps	25.6 bps	9.3 bps	21.4 bps	20.0 bps	28.2 bps
	Carry	9.5 bps	-5.6 bps	20.0 bps	4.7 bps	-46.0 bps	58.7 bps
	Total	14.1 bps	20.0 bps	29.3 bps	26.1 bps	-26.0 bps	86.9 bps
Swaps	Transaction	2.1 bps	21.3 bps	4.7 bps	11.5 bps	10.0 bps	12.8 bps
	Carry	17.0 bps	-66.0 bps	23.5 bps	10.0 bps	-55.5 bps	10.0 bps
	Total	19.1 bps	-44.7 bps	28.2 bps	21.5 bps	-45.5 bps	22.8 bps
Option Combos	Transaction	2.3 bps	21.7 bps	4.8 bps	--	--	--
	Carry	-11.6 bps	-90.5 bps	3.1 bps	--	--	--
	Total	-9.3 bps	-68.9 bps	7.9 bps	--	--	--

Source: BofA Merrill Lynch Global Research. Importantly, the costs are under the assumption that investor opens a **new** long delta-one position and closes it after one year. This assumption is stylized for simplicity but is not necessarily representative of what all investors accessing delta-one exposure could be subject to. For example, some investors may not close their positions after one year in which case the costs on trade exit listed can be excluded. Likewise, investors looking to switch delta-one exposure between products (versus opening new positions) may not be subject to the same set of transaction costs.

Refer to important disclosures on page 16 to 17. Analyst Certification on page 15.

11714753

Timestamp: 23 February 2017 06:03PM EST

Cost Comparison of Futures, ETFs, Swaps on Equity Indices

Cost is a focal point when comparing delta-one investments

Synthetic equity index exposure (delta-one exposure) can be attained through futures, ETFs, total return swaps, or option combos[1]. Each product differs in operational efficiency, associated risks, and costs. Traditionally, investors have used costs as the primary focal point when comparing each of these instruments. Despite the focus on costs, ultimately, an investor's choice between futures, ETFs, and swaps will also depend largely on their own requirements, preferences, and constraints. The Appendix at the end of this report provides a table listing various characteristics of futures, ETFs, swaps, and option combos.

This report compares the all-in cost of replicating delta-one exposure to the S&P500, Russell 2000, NASDAQ-100, MSCI EAFE, EURO STOXX 50, and MSCI Emerging Markets via futures, ETFs, total return swaps, and option combos. The listed delta-one products compared for each equity index are presented in Table 2 and were chosen on the basis of liquidity and tradability.

Table 2: Listed delta-one product tickers used for cost comparison analysis

	Bloomberg Ticker	
Index	Future	ETF
S&P 500	ES	SPY US
Russell 2000	RTA	IWM US
NASDAQ-100	NQ	QQQ US
MSCI EAFE	MFS	EFA US
EURO STOXX 50	VG	XESC GY
MSCI Emerging Markets	MES	EEM US

Source: BofA Merrill Lynch Global Research

The report is divided into the following sections:

1. A description of the associated costs of holding a long position in equity index futures, ETFs, total return swaps, and option combos
2. Aggregated estimates for fully-funded (non-levered) $100 million long delta-one exposure for a holding period of the prior 12 months
3. A framework to compare the costs for leveraged long exposure using futures & ETFs
4. The decomposition of cost estimates from Section 2 and with varying investment notionals of $25mn, $50mn, $100mn, and $250mn[2]

I) Description of costs for futures, ETFs, swaps, and combos

The costs for delta-one exposure via futures, ETFs, swaps, and option combos can be separated into two categories:

- **Transaction costs:** Transaction costs can be broken into two parts. First is the trade's *commission* which is an explicit fee charged for opening/closing a position. The second is the trade's *market impact* which is a less explicit cost that measures adverse price movement caused by executing the order
- **Carry costs:** Carry costs are expected expenses that the position is subject to as a consequence of maintaining exposure for a period of time

[1] Costs of synthetic option combos estimated on US indices only (S&P500, Russell 2000, and NASDAQ-100)

[2] Where applicable, $500 million notional is used in place of $250 million

Commission costs are more observable and distinctive for each delta-one product. Market impact costs, on the other hand, can be difficult to measure. Market impact costs are a function of a variety of factors, for example, trade size, combined product liquidity, and/or execution timing and methodology. For the collection of indices in our report, we assume the market impact costs are the same for each delta-one product but that the costs can vary based on trade size.

We find justification in these assumptions as the goal of the analysis is to (1) quantify the all-in cost for replicating exposure to each equity index for a period of 12 months and (2) allow for a side-by-side comparison of the costs between each delta-one product for both a fully-funded and leveraged investor. Since product providers can access the entire pool of liquidity to hedge each delta-one product, the differential in market impact costs by product is greatly reduced (though not eliminated as it is not costless to transform one asset into another). However, the impact is generally small enough to not be material for our analysis and for purposes of a side-by-side comparison between products, the market impact cost estimates are equal. Importantly, market impact cost can increase with trade size and we account for this in our estimates for varying trade notionals.

Table 3: Summary of carry costs for Futures, ETFs, Swaps, and Option Combos

Instrument	Carry Costs
Futures	* Spread between futures implied financing rate and interest earned on cash * Transaction costs for futures rolls
ETFs	* ETF management fee * Total Adjustment from Securities Lending and Tax Advantage
Swaps	* Financing spread
Option Combos	* Spread between combo implied * Transaction costs for option rolls

Source: BofA Merrill Lynch Global Research

Carry costs vary for each delta-one product. We estimate carry costs for a fully-funded (non-levered) position. Futures carry cost consists of the spread between the futures implied financing rate and an interest rate earned on the investment notional by the long holder of the future. Additionally, futures carry costs include the transaction cost of rolling futures to maintain exposure for 12 months. ETF carry costs consist of the ETF management fee, any income generated from ETF securities lending and/or other enhancements, and tracking error (however, in our analysis, we exclude ETF tracking error). Total return swaps have a carry cost that is measured via their financing spread.[3] Carry costs of option combos, which are synthetic futures positions, can be estimated via the spread between implied financing rates in the options versus an interest rate earned by the investor and as well the transaction costs from rolling quarterly options four times. In Table 3 is a summary of fully-funded (non-levered) carry costs for each delta-one product.

II) Costs for a fully-funded investor

The cost for holding futures, ETFs, swaps, and option combos on a $100 million fully-funded notional (no leverage) over the last 12 months are shown in Table 4. Costs are separated into both the transaction and carry costs described in the prior section. For standardization, the notional in cash that is fully funding the futures, swap, or option combo position is assumed to earn interest at 3M USD LIBOR.[4] In practice, investors' cash may earn interest that is different from 3M USD LIBOR. However, to adjust for varying interest rates, the spread at which an investor's cash is actually earning interest versus 3M USD LIBOR can be subtracted from the respective futures, swaps, and combos estimates below.

[3] Swaps financing spreads sourced from Bank of America Merrill Lynch

[4] For the non-USD products we use EURO 3M deposit rate (for Euros) and 3M JPY LIBOR (for Japanese Yen)

Table 4: Cost of holding $100 million in futures, ETFs, swaps, & option combos on a fully-funded basis (no leverage) over the last 12 months ending this past quarter (all costs are indicative)

**MSCI EAFE, EURO STOXX 50, and MSCI Emerging Markets costs are benchmarked to their respective net total return indices, all other indices are benchmarked to their total return versions.

Instrument	Cost	S&P 500	Russell 2000	NASDAQ-100	MSCI EAFE**	EURO STOXX 50**	MSCI EM**
Futures	Transaction	2.5 bps	22.0 bps	5.2 bps	12.1 bps	10.6 bps	13.8 bps
	Carry	-8.3 bps	-86.3 bps	3.7 bps	12.1 bps	-74.1 bps	46.2 bps
	Total	-5.8 bps	-64.3 bps	8.9 bps	24.2 bps	-63.5 bps	60.0 bps
ETFs	Transaction	4.6 bps	25.6 bps	9.3 bps	21.4 bps	20.0 bps	28.2 bps
	Carry	9.5 bps	-5.6 bps	20.0 bps	4.7 bps	-46.0 bps	58.7 bps
	Total	14.1 bps	20.0 bps	29.3 bps	26.1 bps	-26.0 bps	86.9 bps
Swaps	Transaction	2.1 bps	21.3 bps	4.7 bps	11.5 bps	10.0 bps	12.8 bps
	Carry	17.0 bps	-66.0 bps	23.5 bps	10.0 bps	-55.5 bps	10.0 bps
	Total	19.1 bps	-44.7 bps	28.2 bps	21.5 bps	-45.5 bps	22.8 bps
Option Combos	Transaction	2.3 bps	21.7 bps	4.8 bps	--	--	--
	Carry	-11.6 bps	-90.5 bps	3.1 bps	--	--	--
	Total	-9.3 bps	-68.9 bps	7.9 bps	--	--	--

Source: BofA Merrill Lynch Global Research. Importantly, the costs are under the assumption that investor opens a new long delta-one position and closes it after one year. This assumption is stylized for simplicity but is not necessarily representative of what all investors accessing delta-one exposure could be subject to. For example, some investors may not close their positions after one year in which case the costs on trade exit listed can be excluded. Likewise, investors looking to switch delta-one exposure between products (versus opening new positions) may not be subject to the same set of transaction costs.

MSCI EAFE, **EURO STOXX 50**, and **MSCI Emerging Markets** costs are benchmarked to their respective **net total return** indices, all other indices are benchmarked to their total return versions.

III) Comparing the costs for leveraged long exposure using futures & ETFs

The analysis that follows is an example of how to conceptualize the costs for a leveraged long investor accessing equity delta-one exposure via ETFs and futures.[5] The example assumes that the fully funded cost of ETFs is cheaper than that of futures. ETFs, by construction, are intended to be fully-funded and therefore we assume ETF leverage is attained via a margin account that charges interest on the leveraged notional. On the other hand, futures are inherently levered products and therefore the pricing of futures is in part accounts for the cost of leverage. Futures require only a fraction of the investment notional to be posted as margin. For example, if the minimum margin requirement for an equity index future was 12.5% of notional, that would imply a leverage of 8x (each $12.5 would give $100 exposure).

Let's begin with a 2x leveraged notional of $100 million to a hypothetical ETF (the investor therefore has $50mn in their margin account). The entire leveraged notional of $100mn is still subject to the fully-funded ETF costs which as an example is 25bps. However, now the borrowed $50 million is also subject to cost of financing. The total cost of this levered position becomes 25bps plus the cost of financing multiplied by 50% (50% is the %-age of the portfolio that is levered). Using this example, **in the limit, the cost of an infinitely leveraged ETF position would equate to the cost of a fully-funded ETF position plus the cost of financing.**

Next, we apply this same example to futures. Again we begin with a 2x leveraged notional of $100 million (the investor has $50mn in their margin account). The entire leveraged notional of $100mn is again still subject to the fully-funded futures cost which for example is 50bps. Recall, however, that the cost of 50bps assumes the entire notional was earning interest at cash rate. In this case, only $50mn (the amount in the margin account) is earning interest at the cash rate. Therefore an adjustment is required for the leveraged portion of notional that is not earning cash interest. The total cost of this levered position becomes 50bps plus the cash rate multiplied by 50% (50% is the %-age of the portfolio that is levered and not earning interest). **In the limit, the cost of an infinitely leveraged futures position would equate to the cost of a fully-funded futures position plus the rate at which an investor's margin account is earning interest.**

[5] Swaps would be treated similarly as futures and hence not shown in its own example

Typically, the cost of borrowing money will be greater than the rate at which an investor's margin account earns interest. Therefore, if a fully-funded futures position is already cheaper than a fully-funded ETF position, then leverage will also be cheaper for the futures position. This is because the levered futures notional will forego margin account interest while the levered ETF notional pays a typically higher financing rate.

On the other hand, and relevant in recent years, some fully-funded futures positions are instead more costly than fully-funded ETF positions. In this case, it's worthwhile to compare how futures pricing would fare when taking leverage. To this end, we generalized our example and in Table 5 show the spread (in bps) between fully-funded futures minus ETF costs that would make the costs of a leveraged futures position equal to that of a leveraged ETF position for (i) a desired leverage amount and (ii) a given spread between the rate at which an investor can borrow cash versus the rate at which they can earn interest. If the spread between fully-funded futures minus ETF costs is less than the value in Table 5, then futures would be less costly for the desired leverage and financing spread.

So from our example, a fully-funded $100mn position in a hypothetical futures cost approximately 50bps while the same position via ETFs cost about 25bps (a difference of 25bps). Let's assume the spread between the rate at which an investor can borrow cash versus the rate at which they can earn interest is 50bps and that 3.0x leverage was desired. Then Table 5 would imply that if the spread between fully-funded futures minus ETF costs is less than 33.3bps, then futures would be less costly for 3.0x leverage and a 50bps financing spread. In this case, the spread between fully-funded futures minus ETF costs is 25bps so 3.0x leverage is cheaper with futures.

Table 5: For a desired leverage amount and for a given a positive spread between the rate at which an investor can borrow cash versus the rate at which they can earn interest, the table below gives the maximum spread (in bps) between fully-funded futures minus ETF costs that would still make a leveraged futures position cheaper than a leveraged ETF position

Cash Borrow Rate minus Cash Investment Rate (bps)	Leverage									
	1.25x	1.5x	1.75x	2.0x	2.5x	3.0x	3.5x	4.0x	4.5x	5.0x
5	1.0	1.7	2.1	2.5	3.0	3.3	3.6	3.8	3.9	4.0
10	2.0	3.3	4.3	5.0	6.0	6.7	7.1	7.5	7.8	8.0
15	3.0	5.0	6.4	7.5	9.0	10.0	10.7	11.3	11.7	12.0
20	4.0	6.7	8.6	10.0	12.0	13.3	14.3	15.0	15.6	16.0
25	5.0	8.3	10.7	12.5	15.0	16.7	17.9	18.8	19.4	20.0
30	6.0	10.0	12.9	15.0	18.0	20.0	21.4	22.5	23.3	24.0
35	7.0	11.7	15.0	17.5	21.0	23.3	25.0	26.3	27.2	28.0
40	8.0	13.3	17.1	20.0	24.0	26.7	28.6	30.0	31.1	32.0
45	9.0	15.0	19.3	22.5	27.0	30.0	32.1	33.8	35.0	36.0
50	10.0	16.7	21.4	25.0	30.0	33.3	35.7	37.5	38.9	40.0
55	11.0	18.3	23.6	27.5	33.0	36.7	39.3	41.3	42.8	44.0
60	12.0	20.0	25.7	30.0	36.0	40.0	42.9	45.0	46.7	48.0
65	13.0	21.7	27.9	32.5	39.0	43.3	46.4	48.8	50.6	52.0
70	14.0	23.3	30.0	35.0	42.0	46.7	50.0	52.5	54.4	56.0
75	15.0	25.0	32.1	37.5	45.0	50.0	53.6	56.3	58.3	60.0
80	16.0	26.7	34.3	40.0	48.0	53.3	57.1	60.0	62.2	64.0
85	17.0	28.3	36.4	42.5	51.0	56.7	60.7	63.8	66.1	68.0
90	18.0	30.0	38.6	45.0	54.0	60.0	64.3	67.5	70.0	72.0
95	19.0	31.7	40.7	47.5	57.0	63.3	67.9	71.3	73.9	76.0
100	20.0	33.3	42.9	50.0	60.0	66.7	71.4	75.0	77.8	80.0

Source: BofA Merrill Lynch Global Research

IV) Decomposition of holding costs by index

In the pages that follow are full decompositions of the costs on fully-funded delta-one exposure for a 12-month holding period to the S&P500, Russell 2000, NASDAQ-100, MSCI EAFE, EURO STOXX 50, and MSCI Emerging Markets indices using futures, ETFs, swaps, and option combos. Costs are included for varying investment notionals.

S&P500 – Futures vs. ETFs vs. Swaps vs. Combos

Table 6: Cost of holding fully-funded (no leverage) S&P500 futures (ES) for the prior one year

S&P500 futures (ES) 3M median daily notional open interest and volume: 318.0bn and 165.6bn USD

	S&P500 Futures (ES)			
Futures	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	0.9 bps	1.5 bps	2.5 bps	8.9 bps
Commissions at Entry and Exit	*0.4 bps*	*0.4 bps*	*0.4 bps*	*0.4 bps*
Market Impact at Entry and Exit	*0.5 bps*	*1.1 bps*	*2.1 bps*	*8.5 bps*
Total Carry Costs	-8.3 bps	-8.3 bps	-8.3 bps	-8.3 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*-10.0 bps*	*-10.0 bps*	*-10.0 bps*	*-10.0 bps*
Transaction Costs for Futures Rolls	*1.7 bps*	*1.7 bps*	*1.7 bps*	*1.7 bps*
Total Yearly Cost	-7.4 bps	-6.8 bps	-5.8 bps	0.6 bps

Source: BofA Merrill Lynch Global Research

Table 7: Cost of holding fully-funded (no leverage) S&P500 ETF (SPY) for the prior one year

S&P500 ETF (SPY) 3M median daily fund total assets 208.2bn USD and 3M median notional volume 15.4bn USD

	S&P500 ETF (SPY)			
ETFs	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	3.0 bps	3.6 bps	4.6 bps	11.0 bps
Commissions at Entry and Exit	*2.5 bps*	*2.5 bps*	*2.5 bps*	*2.5 bps*
Market Impact at Entry and Exit	*0.5 bps*	*1.1 bps*	*2.1 bps*	*8.5 bps*
Total Carry Costs	9.5 bps	9.5 bps	9.5 bps	9.5 bps
Management Fee per Year	*9.5 bps*	*9.5 bps*	*9.5 bps*	*9.5 bps*
Total Yearly Cost	12.5 bps	13.0 bps	14.1 bps	20.4 bps

Source: BofA Merrill Lynch Global Research

Table 8: Cost of holding fully-funded (no leverage) S&P500 total return swaps for the prior one year

	S&P500 Total Return Swaps			
Swaps	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	0.5 bps	1.1 bps	2.1 bps	8.5 bps
Market Impact at Entry and Exit	*0.5 bps*	*1.1 bps*	*2.1 bps*	*8.5 bps*
Total Carry Costs	17.0 bps	17.0 bps	17.0 bps	17.0 bps
Financing Spread over the past 12 months	*17.0 bps*	*17.0 bps*	*17.0 bps*	*17.0 bps*
Total Yearly Cost	17.5 bps	18.1 bps	19.1 bps	25.5 bps

Source: BofA Merrill Lynch Global Research

Table 9: Cost of holding fully-funded (no leverage) S&P500 option combinations for the prior one year

	S&P500 Option Combinations			
Option Combinations	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	0.7 bps	1.2 bps	2.3 bps	8.6 bps
Commissions at Entry and Exit	*0.2 bps*	*0.2 bps*	*0.2 bps*	*0.2 bps*
Market Impact at Entry and Exit	*0.5 bps*	*1.1 bps*	*2.1 bps*	*8.5 bps*
Total Carry Costs	-11.6 bps	-11.6 bps	-11.6 bps	-11.6 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*-12.2 bps*	*-12.2 bps*	*-12.2 bps*	*-12.2 bps*
Transaction Costs for Option Rolls	*0.6 bps*	*0.6 bps*	*0.6 bps*	*0.6 bps*
Total Yearly Cost	-10.9 bps	-10.4 bps	-9.3 bps	-3.0 bps

Source: BofA Merrill Lynch Global Research

Russell 2000 – Futures vs. ETFs vs. Swaps vs. Combos

Table 10: Cost of holding fully-funded (no leverage) Russell 2000 futures (RTA) for the prior one year

Russell 2000 futures (RTA) 3M median daily notional open interest and volume: 41.2bn and 9.0bn USD

	Russell 2000 Futures (RTA)			
Futures	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	4.3 bps	11.4 bps	22.0 bps	36.3 bps
Commissions at Entry and Exit	*0.7 bps*	*0.7 bps*	*0.7 bps*	*0.7 bps*
Market Impact at Entry and Exit	*3.6 bps*	*10.7 bps*	*21.3 bps*	*35.6 bps*
Total Carry Costs	-86.3 bps	-86.3 bps	-86.3 bps	-86.3 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*-89.1 bps*	*-89.1 bps*	*-89.1 bps*	*-89.1 bps*
Transaction Costs for Futures Rolls	*2.8 bps*	*2.8 bps*	*2.8 bps*	*2.8 bps*
Total Yearly Cost	-82.0 bps	-74.9 bps	-64.3 bps	-50.0 bps

Source: BofA Merrill Lynch Global Research

Table 11: Cost of holding fully-funded (no leverage) Russell 2000 ETF (IWM) for the prior one year

Russell 2000 ETF (IWM) 3M median daily fund total assets 35.2bn USD and 3M median notional volume 3.0bn USD

	Russell 2000 ETF (IWM)			
ETFs	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	7.9 bps	15.0 bps	25.6 bps	39.9 bps
Commissions at Entry and Exit	*4.3 bps*	*4.3 bps*	*4.3 bps*	*4.3 bps*
Market Impact at Entry and Exit	*3.6 bps*	*10.7 bps*	*21.3 bps*	*35.6 bps*
Total Carry Costs	-5.6 bps	-5.6 bps	-5.6 bps	-5.6 bps
Management Fee per Year	*20.0 bps*	*20.0 bps*	*20.0 bps*	*20.0 bps*
Total Adjustment from Securities Lending	*-25.6 bps*	*-25.6 bps*	*-25.6 bps*	*-25.6 bps*
Total Yearly Cost	2.3 bps	9.4 bps	20.0 bps	34.3 bps

Source: BofA Merrill Lynch Global Research

Table 12: Cost of holding fully-funded (no leverage) Russell 2000 total return swaps for the prior one year

	Russell 2000 Total Return Swaps			
Swaps	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	3.6 bps	10.7 bps	21.3 bps	35.6 bps
Market Impact at Entry and Exit	*3.6 bps*	*10.7 bps*	*21.3 bps*	*35.6 bps*
Total Carry Costs	-66.0 bps	-66.0 bps	-66.0 bps	-66.0 bps
Financing Spread over the past 12 months	*-66.0 bps*	*-66.0 bps*	*-66.0 bps*	*-66.0 bps*
Total Yearly Cost	-62.4 bps	-55.3 bps	-44.7 bps	-30.4 bps

Source: BofA Merrill Lynch Global Research

Table 13: Cost of holding fully-funded (no leverage) Russell 2000 option combinations for the prior one year

	Russell 2000 Option Combinations			
Option Combinations	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	3.9 bps	11.0 bps	21.7 bps	35.9 bps
Commissions at Entry and Exit	*0.3 bps*	*0.3 bps*	*0.3 bps*	*0.3 bps*
Market Impact at Entry and Exit	*3.6 bps*	*10.7 bps*	*21.3 bps*	*35.6 bps*
Total Carry Costs	-90.5 bps	-90.5 bps	-90.5 bps	-90.5 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*-91.5 bps*	*-91.5 bps*	*-91.5 bps*	*-91.5 bps*
Transaction Costs for Option Rolls	*1.0 bps*	*1.0 bps*	*1.0 bps*	*1.0 bps*
Total Yearly Cost	-86.7 bps	-79.6 bps	-68.9 bps	-54.7 bps

Source: BofA Merrill Lynch Global Research

NASDAQ-100 – Futures vs. ETFs vs. Swaps vs. Combos

Table 14: Cost of holding fully-funded (no leverage) NASDAQ-100 futures (NQ) for the prior one year

NASDAQ-100 futures (NQ) 3M median daily notional open interest and volume: 28.0bn and 20.1bn USD

	NASDAQ-100 Futures (NQ)			
Futures	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	1.0 bps	2.4 bps	5.2 bps	8.0 bps
Commissions at Entry and Exit	*0.5 bps*	*0.5 bps*	*0.5 bps*	*0.5 bps*
Market Impact at Entry and Exit	*0.5 bps*	*1.9 bps*	*4.7 bps*	*7.5 bps*
Total Carry Costs	3.7 bps	3.7 bps	3.7 bps	3.7 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*1.8 bps*	*1.8 bps*	*1.8 bps*	*1.8 bps*
Transaction Costs for Futures Rolls	*1.9 bps*	*1.9 bps*	*1.9 bps*	*1.9 bps*
Total Yearly Cost	4.7 bps	6.1 bps	8.9 bps	11.7 bps

Source: BofA Merrill Lynch Global Research

Table 15: Cost of holding fully-funded (no leverage) NASDAQ-100 ETF (QQQ) for the prior one year

NASDAQ-100 ETF (QQQ) 3M median daily fund total assets 39.7bn USD and 3M median notional volume 2.2bn USD

	NASDAQ-100 ETF (QQQ)			
ETFs	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	5.1 bps	6.5 bps	9.3 bps	12.1 bps
Commissions at Entry and Exit	*4.6 bps*	*4.6 bps*	*4.6 bps*	*4.6 bps*
Market Impact at Entry and Exit	*0.5 bps*	*1.9 bps*	*4.7 bps*	*7.5 bps*
Total Carry Costs	20.0 bps	20.0 bps	20.0 bps	20.0 bps
Management Fee per Year	*20.0 bps*	*20.0 bps*	*20.0 bps*	*20.0 bps*
Total Yearly Cost	25.1 bps	26.5 bps	29.3 bps	32.1 bps

Source: BofA Merrill Lynch Global Research

Table 16: Cost of holding fully-funded (no leverage) NASDAQ-100 total return swaps for the prior one year

	NASDAQ-100 Total Return Swaps			
Swaps	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	0.5 bps	1.9 bps	4.7 bps	7.5 bps
Market Impact at Entry and Exit	*0.5 bps*	*1.9 bps*	*4.7 bps*	*7.5 bps*
Total Carry Costs	23.5 bps	23.5 bps	23.5 bps	23.5 bps
Financing Spread over the past 12 months	*23.5 bps*	*23.5 bps*	*23.5 bps*	*23.5 bps*
Total Yearly Cost	24.0 bps	25.4 bps	28.2 bps	31.0 bps

Source: BofA Merrill Lynch Global Research

Table 17: Cost of holding fully-funded (no leverage) NASDAQ-100 option combinations for the prior one year

	NASDAQ-100 Option Combinations			
Option Combinations	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	0.6 bps	2.0 bps	4.8 bps	7.6 bps
Commissions at Entry and Exit	*0.1 bps*	*0.1 bps*	*0.1 bps*	*0.1 bps*
Market Impact at Entry and Exit	*0.5 bps*	*1.9 bps*	*4.7 bps*	*7.5 bps*
Total Carry Costs	3.1 bps	3.1 bps	3.1 bps	3.1 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*2.9 bps*	*2.9 bps*	*2.9 bps*	*2.9 bps*
Transaction Costs for Option Rolls	*0.3 bps*	*0.3 bps*	*0.3 bps*	*0.3 bps*
Total Yearly Cost	3.7 bps	5.1 bps	7.9 bps	10.7 bps

Source: BofA Merrill Lynch Global Research

MSCI EAFE – Futures vs. ETFs vs. Swaps

MSCI EAFE delta-one cost comparisons are calculated versus the **net total return** version of the MSCI EAFE index. Tracking error is relatively more of a consideration with ETFs and futures on MSCI EAFE as taxation on reinvested dividends will have a greater impact. Among other risks, tracking error will in part be a function of the respective tax treatment on the replication portfolio that the counterparty offering the delta-one product is subject to.

We estimate the following quarterly roll premiums over the last year: Q4-15/Q1-16: 38bps, Q1-16/Q2-16: -31bps, Q2-16/Q3-16: 13bps, and Q3-16/Q4-16: 19bps for an average of 10bps.

MSCI EAFE roll cost calculation includes an adjustment to calculate fair value using net (instead of gross) dividends

Table 18: Cost of holding fully-funded (no leverage) MSCI EAFE futures (MFS) for the prior one year

MSCI EAFE futures (MFS) 3M median daily notional open interest and volume: 18.4bn and 0.9bn USD

	MSCI EAFE Futures (MFS)			
Futures	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	5.5 bps	8.8 bps	12.1 bps	41.8 bps
Commissions at Entry and Exit	*0.6 bps*	*0.6 bps*	*0.6 bps*	*0.6 bps*
Market Impact at Entry and Exit	*4.9 bps*	*8.2 bps*	*11.5 bps*	*41.2 bps*
Total Carry Costs	12.1 bps	12.1 bps	12.1 bps	12.1 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*9.8 bps*	*9.8 bps*	*9.8 bps*	*9.8 bps*
Transaction Costs for Futures Rolls	*2.3 bps*	*2.3 bps*	*2.3 bps*	*2.3 bps*
Total Yearly Cost	17.5 bps	20.8 bps	24.2 bps	53.8 bps

Source: BofA Merrill Lynch Global Research

Table 19: Cost of holding fully-funded (no leverage) MSCI EAFE ETF (EFA) for the prior one e year

MSCI EAFE ETF (EFA) 3M median daily fund total assets 58.3bn USD and 3M median notional volume 864mn USD

	MSCI EAFE ETF (EFA)			
ETFs	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	14.8 bps	18.1 bps	21.4 bps	51.1 bps
Commissions at Entry and Exit	*9.9 bps*	*9.9 bps*	*9.9 bps*	*9.9 bps*
Market Impact at Entry and Exit	*4.9 bps*	*8.2 bps*	*11.5 bps*	*41.2 bps*
Total Carry Costs	4.7 bps	4.7 bps	4.7 bps	4.7 bps
Management Fee per Year	*33.0 bps*	*33.0 bps*	*33.0 bps*	*33.0 bps*
Total Adjustment from Securities Lending and Other Enhancements	*-28.3 bps*	*-28.3 bps*	*-28.3 bps*	*-28.3 bps*
Total Yearly Cost	19.5 bps	22.8 bps	26.1 bps	55.8 bps

Source: BofA Merrill Lynch Global Research

Table 20: Cost of holding fully-funded (no leverage) MSCI EAFE net total return swaps for the prior one year

	MSCI EAFE Net Total Return Swaps			
Swaps	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	4.9 bps	8.2 bps	11.5 bps	41.2 bps
Market Impact at Entry and Exit	*4.9 bps*	*8.2 bps*	*11.5 bps*	*41.2 bps*
Total Carry Costs	10.0 bps	10.0 bps	10.0 bps	10.0 bps
Financing Spread over the past 12 months	*10.0 bps*	*10.0 bps*	*10.0 bps*	*10.0 bps*
Total Yearly Cost	14.9 bps	18.2 bps	21.5 bps	51.2 bps

Source: BofA Merrill Lynch Global Research

EURO STOXX 50 – Futures vs. ETFs vs. Swaps

EURO STOXX 50 delta-one cost comparisons are calculated versus the **net total return** version of the EURO STOXX 50 index. Tracking error is relatively more of a consideration with ETFs and futures on EURO STOXX 50 as taxation on reinvested dividends will have a greater impact. Among other risks, tracking error will in part be a function of the respective tax treatment on the replication portfolio that the counterparty offering the delta-one product is subject to.

EURO STOXX 50 roll cost calculation includes an adjustment to calculate fair value using net (instead of gross) dividends. Fully-funded notional assumed to earn interest at EURO 3M deposit rate.

Table 21: Cost of holding fully-funded (no leverage) EURO STOXX 50 futures (VG) for the prior one year

EURO STOXX 50 futures (VG) 3M median daily notional open interest and volume: 122.5bn and 33.9bn USD

	EURO STOXX 50 Futures (VG)			
Futures	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	3.6 bps	5.6 bps	10.6 bps	25.6 bps
Commissions at Entry and Exit	*0.6 bps*	*0.6 bps*	*0.6 bps*	*0.6 bps*
Market Impact at Entry and Exit	*3.0 bps*	*5.0 bps*	*10.0 bps*	*25.0 bps*
Total Carry Costs	-74.1 bps	-74.1 bps	-74.1 bps	-74.1 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*-76.5 bps*	*-76.5 bps*	*-76.5 bps*	*-76.5 bps*
Transaction Costs for Futures Rolls	*2.4 bps*	*2.4 bps*	*2.4 bps*	*2.4 bps*
Total Yearly Cost (bps)	-70.5 bps	-68.5 bps	-63.5 bps	-48.5 bps

Source: BofA Merrill Lynch Global Research

Table 22: Cost of holding fully-funded (no leverage) EURO STOXX 50 ETF (XESC GY) for the prior one year

EURO STOXX 50 ETF (XESC GY) fund total assets as of 22-Feb-17 4.7bn USD and 3M median notional volume 4.8mn USD

	EURO STOXX 50 ETF (XESC GY)			
ETFs	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	13.0 bps	15.0 bps	20.0 bps	50.0 bps
Commissions at Entry and Exit	*10.0 bps*	*10.0 bps*	*10.0 bps*	*25.0 bps*
Market Impact at Entry and Exit	*3.0 bps*	*5.0 bps*	*10.0 bps*	*25.0 bps*
Total Carry Costs	-46.0 bps	-46.0 bps	-46.0 bps	-46.0 bps
Management Fee per Year	*9.0 bps*	*9.0 bps*	*9.0 bps*	*9.0 bps*
Total Adjustment from Securities Lending and Other Enhancements	*-55.0 bps*	*-55.0 bps*	*-55.0 bps*	*-55.0 bps*
Total Yearly Cost	-33.0 bps	-31.0 bps	-26.0 bps	4.0 bps

Source: BofA Merrill Lynch Global Research

Table 23: Cost of holding fully-funded (no leverage) EURO STOXX 50 net total return swaps for the prior one year

	EURO STOXX 50 Net Total Return Swaps			
Swaps	25mn USD	50mn USD	100mn USD	500mn USD
Total Transaction Costs	3.0 bps	5.0 bps	10.0 bps	25.0 bps
Market Impact at Entry and Exit	*3.0 bps*	*5.0 bps*	*10.0 bps*	*25.0 bps*
Total Carry Costs	-55.5 bps	-55.5 bps	-55.5 bps	-55.5 bps
Financing Spread over the past 12 months	*-55.5 bps*	*-55.5 bps*	*-55.5 bps*	*-55.5 bps*
Total Yearly Cost	-52.5 bps	-50.5 bps	-45.5 bps	-30.5 bps

Source: BofA Merrill Lynch Global Research

MSCI Emerging Markets – Futures vs. ETFs vs. Swaps

MSCI Emerging Markets delta-one cost comparisons are calculated versus the **net total return** version of the MSCI Emerging Markets index. Tracking error is more considerable with delta-one products linked to MSCI EM as the underlying index is composed of stocks that trade across multiple emerging markets globally with varying rules on taxation. Therefore, replicating MSCI EM can be more complicated for ETF and futures providers which could lead to relatively more unstable tracking errors for MSCI EM ETFs and more volatile calendar roll premiums for MSCI EM futures.

We estimate the following quarterly roll premiums over the last year: Q4-15/Q1-16: 17bps, Q1-16/Q2-16: 24bps, Q2-16/Q3-16: 76bps, and Q3-16/Q4-16: 51bps for an average of 42bps.

MSCI EM roll cost calculation includes an adjustment to calculate fair value using net (instead of gross) dividends

Table 24: Cost of holding fully-funded (no leverage) MSCI Emerging Markets futures (MES) for the prior one year

MSCI EM futures (MES) 3M median daily notional open interest and volume: 38.1bn and 2.3bn USD

	MSCI Emerging Markets Futures (MES)			
Futures	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	6.1 bps	8.7 bps	13.8 bps	44.7 bps
Commissions at Entry and Exit	*1.0 bps*	*1.0 bps*	*1.0 bps*	*1.0 bps*
Market Impact at Entry and Exit	*5.1 bps*	*7.7 bps*	*12.8 bps*	*43.7 bps*
Total Carry Costs	46.2 bps	46.2 bps	46.2 bps	46.2 bps
Adjustment of 4 Rolls due to Richness/Cheapness	*42.0 bps*	*42.0 bps*	*42.0 bps*	*42.0 bps*
Transaction Costs for Futures Rolls	*4.2 bps*	*4.2 bps*	*4.2 bps*	*4.2 bps*
Total Yearly Cost	52.3 bps	54.9 bps	60.0 bps	90.9 bps

Source: BofA Merrill Lynch Global Research

Table 25: Cost of holding fully-funded (no leverage) MSCI Emerging Markets ETF (EEM) for the prior one year

MSCI EM ETF (EEM) 3M median daily fund total assets 26.9bn USD and 3M median notional volume 1.8bn USD

	MSCI Emerging Markets ETF (EEM)			
ETFs	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	20.5 bps	23.1 bps	28.2 bps	59.1 bps
Commissions at Entry and Exit	*15.4 bps*	*15.4 bps*	*15.4 bps*	*15.4 bps*
Market Impact at Entry and Exit	*5.1 bps*	*7.7 bps*	*12.8 bps*	*43.7 bps*
Total Carry Costs	58.7 bps	58.7 bps	58.7 bps	58.7 bps
Management Fee per Year	*72.0 bps*	*72.0 bps*	*72.0 bps*	*72.0 bps*
Total Adjustment from Securities Lending	*-13.3 bps*	*-13.3 bps*	*-13.3 bps*	*-13.3 bps*
Total Yearly Cost	792. bps	81.8 bps	86.9 bps	117.8 bps

Source: BofA Merrill Lynch Global Research

Table 26: Cost of holding fully-funded (no leverage) MSCI Emerging Markets net total return swaps for the prior one year

	MSCI Emerging Markets Net Total Return Swaps			
Swaps	25mn USD	50mn USD	100mn USD	250mn USD
Total Transaction Costs	5.1 bps	7.7 bps	12.8 bps	43.7 bps
Market Impact at Entry and Exit	*5.1 bps*	*7.7 bps*	*12.8 bps*	*43.7 bps*
Total Carry Costs	10.0 bps	10.0 bps	10.0 bps	10.0 bps
Financing Spread over the past 12 months	*10.0 bps*	*10.0 bps*	*10.0 bps*	*10.0 bps*
Total Yearly Cost	15.1 bps	17.7 bps	22.8 bps	53.7 bps

Source: BofA Merrill Lynch Global Research

Appendix

Option combos for delta-one exposure

Synthetic long delta-one exposure to an equity index can be created with options by simultaneously going short a put option and long a call option with the same strike and expiry. These option combinations (combos) offer an alternative way to access delta-one exposure to equity indices. Like futures, ETFs, and swaps, combos can be characterized through their operational efficiency, risk, and cost. Combos are exchange listed like futures and ETFs. However, they offer more maturity options than futures and more leverage than ETFs. Recall swaps also offer flexible maturities and leverage, but unlike combos, are not exchange listed. Combos, however, are generally less traded than futures. The decision to use a combo for delta-one exposure will therefore vary based on an investor's requirements, flexibilities, and constraints.

We estimate costs of synthetic option combos on the US indices only (S&P500, Russell 2000, and NASDAQ-100)

How to measure the cost of an option combo?

We look to quantify the costs of combos when used for synthetic delta-one exposure. Similar to our cost analysis on futures, ETFs, and swaps, we will assume a holding period of 12 months. Listed options are available in a variety of expiries which allow for numerous combinations of structures for a one year holding period. However, to make for a more similar comparison to futures and swaps in our prior analysis, we look at the cost of combos using options with 3-month expiry over the last year.

We use put-call parity to measure the implied interest rate in options which then gives us the funding premium for option combos. Specifically, for each day over the last year we calculated the implied financing rate using put-call parity on the closest to 3-month expiry and nearest-to-the-money listed put and call option strike. Then using the put and call option's volume for that day, we applied a volume weighted average to the sample to determine the average funding rate in options over the last year. The spread of the average funding rate to 3-month USD LIBOR as implied by Eurodollar futures is then the richness or cheapness in option combos.

Like futures, the price of an option is a function of the cost of funding within the market. And as is the case with futures, we can take market traded prices along with a pricing model to imply a funding rate to determine richness or cheapness. However, versus futures prices, the price of an option is much less sensitive to changes in interest rates. Option prices, instead, are primarily a function of the underlying's volatility. Therefore, using put-call parity, a small change in option price has a relatively large impact on the implied interest rate.

Relative to futures, listed option closing prices are not marked to observe a financing arbitrage as much and instead are priced on their implied volatility levels. Therefore, on any given day, a small change in option price may not lead to a meaningfully different implied volatility but can lead to significantly different implied interest rate. As a result, we apply a volume weighted average to our daily implied financing rates from options to smooth out the volatility and arrive at an average cost for option combos. Intuitively, this approach would be accurate if we assume that option closing prices are marked more accurately on high volume days.

Investment Considerations - Overview

Apart from the cost of holding the four products – futures, ETFs, total return swaps, and option combinations differ on several parameters. Table 27 shows the important considerations for investors deciding between the products most suitable for their investment needs.

ETFs are traded on the exchange and require the most collateralization. ETFs require reinvestment of distributions. Futures are also exchange listed but require less collateral. On the other hand, futures require management of a contract rolling process. Swaps are over the counter which then allows for customized contract specifications. However, swaps require monitoring of counterparty risk and have less flexibility for early termination.

ETFs and futures are subject to tracking error. Since futures trade for longer hours than cash markets, there can be differences between theoretical fair value and the actual closing price of the futures from a mark-to-market perspective. But on the other hand, longer trading hours allow futures holders to hedge market events occurring globally during off-market hours. Futures are also subject to dividend forecast errors and interest rate differentials. Swaps are less at risk from tracking error and dividend forecast errors/interest rate differentials but at the tradeoff of increased counterparty risk as they are only traded OTC.

Table 27: Investment Considerations

Features	Futures	ETFs	Swaps	Option Combinations
Investor Access Point	Exchange	Exchange and Over-the Counter	Over-the-Counter	Exchange Listed
Product Classification	Derivative Product	Non-Derivative	Derivative Product	Derivative Product
Daily Investment Management Responsibility	High, Rolling and Daily Margin tracking	Low, done by ETF Manager	Medium, periodic review based on negotiated contract	Medium, periodic review based on negotiated contract
Product Specifications	Standardized	Standardized	Customizable	Standardized
Leverage	Margin requirement usually at 5% of Notional	Zero leverage with 100% of Notional as upfront payment	Negotiated	Varies based on the margin required to go short a put
Dividends	Estimated in the Price	Reinvested or Distributed based on type of ETF	Accounted in basis risk	Estimated in the price
Dividends Impact	Unanticipated dividends will impact the futures price	Reinvestment ETF may have tracking error Distributed ETF will distribute dividends at pre-decided frequency which may differ from actual dividend payout date	None in Total Returns Swap (TRS)	Unanticipated dividends will impact the combo price
Dividend Taxation	N.A.	ETF jurisdiction, investor domicile and other reasons lead to complicated taxation	N.A.	N.A.
Maturity	Quarterly maturity, Investments need to be rolled over	Open ended	Negotiated Maturity	Investments need to be rolled over
Tracking Error	Yes, via calendar roll	Yes, via replication efficiency	No for TRS	Yes, via implied financing
Risks	Dividend Risk, Tracking Error, Interest Rate Risk	Tracking Error, Taxation, Cash Drag	Interest Rate Risk	Dividend Risk, Tracking Error, Interest Rate Risk
Explicit Costs	Commissions, Bid/Ask spreads	Management Fees, Bid/Ask spreads, Commissions	Bid/Ask Cost, Funding cost	Commissions, Bid/Ask spreads
Variable Cost, Revenue	Roll Cost, Unanticipated Dividends	Dividend tax treatment, Dividend payout timing, Cash drag, Lending Activity	N.A. for TRS	Roll Cost, Unanticipated Dividends
Counterparty Risk	Low, Exchange acts as intermediary for all trades	Low, Exchange acts as intermediary for all trades	High, depends on counterparty credit rating	Low, Exchange acts as intermediary for all trades
Other Advantage	Low Commissions, Leverage	Liquidity	Leverage, Confidentiality	Leverage, trading off-quarterly cycles

Source: BofA Merrill Lynch Global Research

Options Risk Statement

Potential Risk at Expiry & Options Limited Duration Risk

Unlike owning or shorting a stock, employing any listed options strategy is by definition governed by a finite duration. The most severe risks associated with general options trading are total loss of capital invested and delivery/assignment risk... all of which can occur in a short period.

Investor suitability

The use of standardized options and other related derivatives instruments are considered unsuitable for many investors. Investors wishing to partake in these strategies are encouraged to become familiar with the "Characteristics and Risks of Standardized Options" (an OCC authored white paper on options risks). U.S. investors should consult with a FINRA Registered Options Principal.

For detailed information regarding the risks involved with investing in listed options: http://www.theocc.com/about/publications/character-risks.jsp

Analyst Certification

I, Chintan Kotecha, hereby certify that the views expressed in this research report about securities and issuers accurately reflect the research model applied in such analysis. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

Disclosures

Important Disclosures

Price charts for the securities referenced in this research report are available at http://pricecharts.baml.com, or call 1-800-MERRILL to have them mailed.
One or more analysts responsible for covering the securities in this report owns stock of the covered issuer: iShares Russell 2000.
MLPF&S or one of its affiliates acts as a market maker for the equity securities recommended in the report: iShare MSCI EAFE, iShares EM ETF, iShares Russell 2000, Powershares QQQ, SPDR S&P 500 ETF.
The issuer is or was, within the last 12 months, an investment banking client of MLPF&S and/or one or more of its affiliates: Powershares QQQ, SPDR S&P 500 ETF.
MLPF&S or an affiliate has received compensation from the issuer for non-investment banking services or products within the past 12 months: Powershares QQQ, SPDR S&P 500 ETF.
The issuer is or was, within the last 12 months, a non-securities business client of MLPF&S and/or one or more of its affiliates: Powershares QQQ, SPDR S&P 500 ETF.
In the US, retail sales and/or distribution of this report may be made only in states where these securities are exempt from registration or have been qualified for sale: EURO STOXX50 ETF.
MLPF&S or an affiliate has received compensation for investment banking services from this issuer within the past 12 months: Powershares QQQ, SPDR S&P 500 ETF.
MLPF&S or an affiliate expects to receive or intends to seek compensation for investment banking services from this issuer or an affiliate of the issuer within the next three months: Powershares QQQ, SPDR S&P 500 ETF.
MLPF&S together with its affiliates beneficially owns one percent or more of the common stock of this issuer. If this report was issued on or after the 9th day of the month, it reflects the ownership position on the last day of the previous month. Reports issued before the 9th day of a month reflect the ownership position at the end of the second month preceding the date of the report: iShare MSCI EAFE, iShares EM ETF, iShares Russell 2000, Powershares QQQ, SPDR S&P 500 ETF.
MLPF&S or one of its affiliates is willing to sell to, or buy from, clients the common equity of the issuer on a principal basis: iShare MSCI EAFE, iShares EM ETF, iShares Russell 2000, Powershares QQQ, SPDR S&P 500 ETF.
The issuer is or was, within the last 12 months, a securities business client (non-investment banking) of MLPF&S and/or one or more of its affiliates: Powershares QQQ, SPDR S&P 500 ETF.
BofA Merrill Lynch Research Personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank's sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.

Other Important Disclosures

Prices are indicative and for information purposes only. Except as otherwise stated in the report, for the purpose of any recommendation in relation to: (i) an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report; or (ii) a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including Bank of America Merrill Lynch trading desks.
The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

Officers of MLPF&S or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.
BofA Merrill Lynch Global Research policies relating to conflicts of interest are described at http://go.bofa.com/coi.
"BofA Merrill Lynch" includes Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") and its affiliates. Investors should contact their BofA Merrill Lynch representative or Merrill Lynch Global Wealth Management financial advisor if they have questions concerning this report. "BofA Merrill Lynch" and "Merrill Lynch" are each global brands for BofA Merrill Lynch Global Research.
Information relating to Non-US affiliates of BofA Merrill Lynch and Distribution of Affiliate Research Reports:
MLPF&S distributes, or may in the future distribute, research reports of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by The Financial Service Board; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSFC); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Investment Industry Regulatory Organization of Canada; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; Merrill Lynch (Argentina): Merrill Lynch Argentina SA, regulated by Comisión Nacional de Valores; Merrill Lynch (Japan): Merrill Lynch Japan Securities Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International Incorporated (Seoul Branch) regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; DSP Merrill Lynch (India): DSP Merrill Lynch Limited, regulated by the Securities and Exchange Board of India; PT Merrill Lynch (Indonesia): PT Merrill Lynch Indonesia, regulated by Otoritas Jasa Keuangan (OJK); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (Russia): OOO Merrill Lynch Securities, Moscow, regulated by the Central Bank of the Russian Federation; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Spain): Merrill Lynch Capital Markets Espana, S.A.S.V., regulated by Comisión Nacional del Mercado De Valores; Merrill Lynch (Brazil): Bank of America Merrill Lynch Banco Multiplo S.A., regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company, Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority.
This research report: has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK) and Bank of America Merrill Lynch International Limited, which are authorized by the PRA and regulated by the FCA and the PRA, and is distributed in the UK to retail clients (as defined in the rules of the FCA and the PRA) by Merrill Lynch International Bank Limited, London Branch, which is authorized by the Central Bank of Ireland and subject to limited regulation by the FCA and PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been considered and distributed in Japan by Merrill Lynch (Japan), a registered securities dealer under the Financial Instruments and Exchange Act in Japan; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSFC (research reports containing any information in relation to, or advice on, futures contracts are not intended for issuance or distribution in Hong Kong and are not directed to, or intended for issuance or distribution to, or use by, any person in Hong Kong); is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by DSP Merrill Lynch (India); and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch International Bank Limited (Merchant Bank) (MLIBLMB) and Merrill Lynch (Singapore) (Company Registration Nos F 06872E and 198602883D respectively). MLIBLMB and Merrill Lynch (Singapore) are regulated by MAS. Bank of America N.A., Australian Branch (ARBN 064 874 531), AFS License 412901 (BANA Australia) and Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distribute this report in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of BANA Australia, neither MLEA nor any of its affiliates involved in preparing this research report is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this report in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Research reports prepared and issued by Merrill Lynch (DIFC) are done so in accordance with the requirements of the DFSA conduct of business rules. Bank of America Merrill Lynch International Limited, Frankfurt Branch (BAMLI Frankfurt) distributes this report in Germany and is regulated by BaFin.
This research report has been prepared and issued by MLPF&S and/or one or more of its non-US affiliates. MLPF&S is the distributor of this research report in the US and accepts full responsibility for research reports of its non-US affiliates distributed to MLPF&S clients in the US. Any US person receiving this research report and wishing to effect any transaction in any security discussed in the report should do so through MLPF&S and not such foreign affiliates. Hong Kong recipients of this research report should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities (and not futures contracts) or provision of specific advice on securities (and not futures contracts). Singapore recipients of this research report should contact Merrill Lynch International Bank Limited (Merchant Bank) and/or Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this

research report.

General Investment Related Disclosures:

Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Merrill Lynch.

This research report provides general information only. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This report is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of any specific person. Investors should seek financial advice regarding the appropriateness of investing in financial instruments and implementing investment strategies discussed or recommended in this report and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this report.

Securities and other financial instruments discussed in this report, or recommended, offered or sold by Merrill Lynch, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

This report may contain a short-term trading idea or recommendation, which highlights a specific near-term catalyst or event impacting the issuer or the market that is anticipated to have a short-term price impact on the equity securities of the issuer. Short-term trading ideas and recommendations are different from and do not affect a stock's fundamental equity rating, which reflects both a longer term total return expectation and attractiveness for investment relative to other stocks within its Coverage Cluster. Short-term trading ideas and recommendations may be more or less positive than a stock's fundamental equity rating.

Futures and options are not appropriate for all investors. Such financial instruments may expire worthless. Before investing in futures or options, clients must receive the appropriate risk disclosure documents. Investment strategies explained in this report may not be appropriate at all times. Costs of such strategies do not include commission or margin expenses.

BofA Merrill Lynch is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments, including ADRs, effectively assume currency risk.

UK Readers: The protections provided by the U.K. regulatory regime, including the Financial Services Scheme, do not apply in general to business coordinated by BofA Merrill Lynch entities located outside of the United Kingdom. BofA Merrill Lynch Global Research policies relating to conflicts of interest are described at http://go.bofa.com/coi.

MLPF&S or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. MLPF&S or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Merrill Lynch, through business units other than BofA Merrill Lynch Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented in this report. Such ideas or recommendations reflect the different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Merrill Lynch is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this report.

In the event that the recipient received this report pursuant to a contract between the recipient and MLPF&S for the provision of research services for a separate fee, and in connection therewith MLPF&S may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom MLPF&S has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by MLPF&S). MLPF&S is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities mentioned in this report.

Copyright and General Information regarding Research Reports:

Materials prepared by BofA Merrill Lynch Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Merrill Lynch, including investment banking personnel. BofA Merrill Lynch has established information barriers between BofA Merrill Lynch Global Research and certain business groups. As a result, BofA Merrill Lynch does not disclose certain client relationships with, or compensation received from, such issuers in research reports. To the extent this report discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this report. BofA Merrill Lynch Global Research personnel's knowledge of legal proceedings in which any BofA Merrill Lynch entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this report is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Merrill Lynch in connection with the legal proceedings or matters relevant to such proceedings.

This report has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of MLPF&S, any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Merrill Lynch Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Merrill Lynch and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This report may contain links to third-party websites. BofA Merrill Lynch is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this report and is not incorporated by reference into this report. The inclusion of a link in this report does not imply any endorsement by or any affiliation with BofA Merrill Lynch. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Merrill Lynch is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

Certain outstanding reports may contain discussions and/or investment opinions relating to securities, financial instruments and/or issuers that are no longer current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with MLPF&S or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.

Neither BofA Merrill Lynch nor any officer or employee of BofA Merrill Lynch accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this report or its contents.