The Usage of Futures by Pension Plan Sponsors:

--Using Stock Index and Treasury futures
--Allocating to Managed Futures/CTAs

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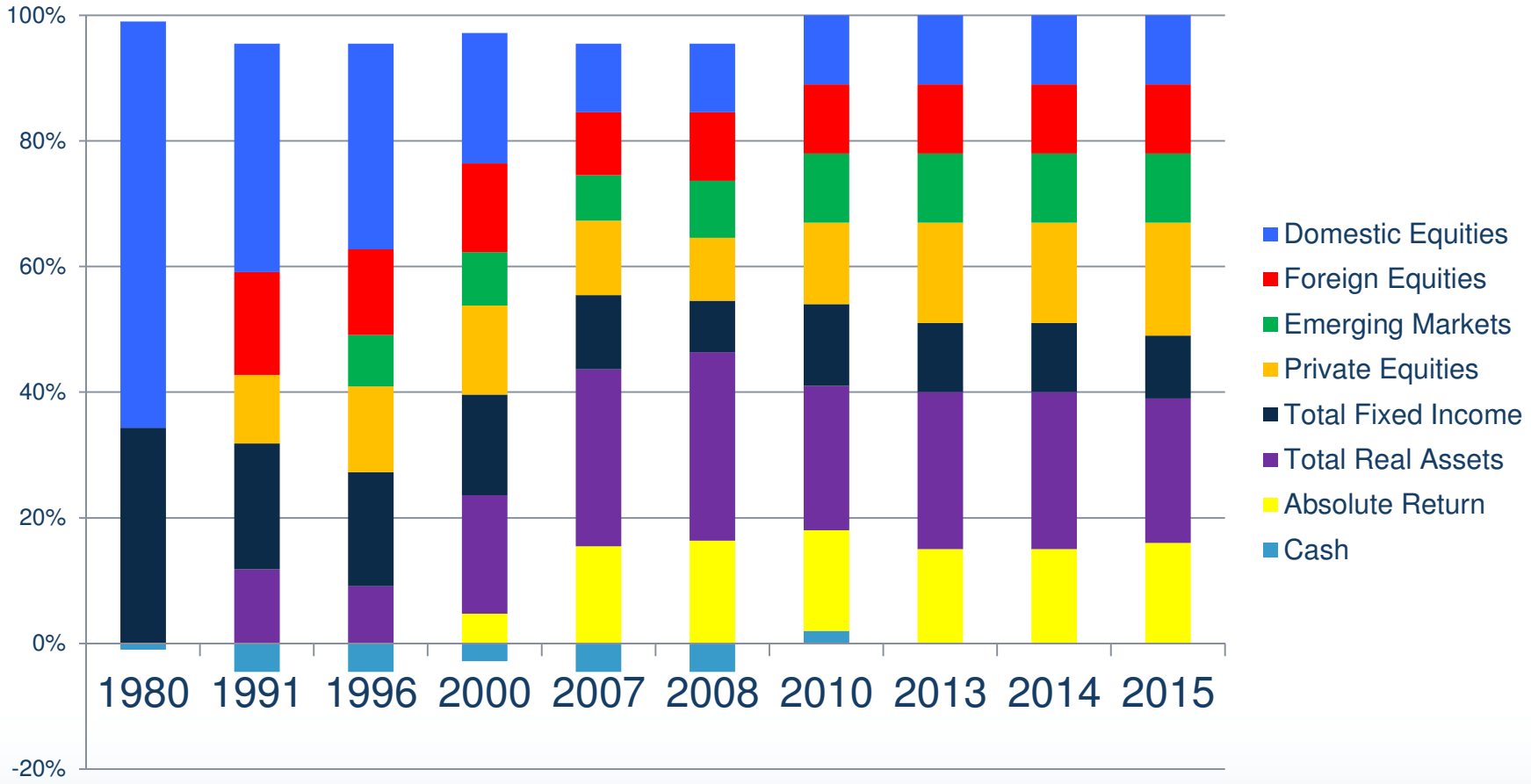
Harvard Management Company: Portfolio Evolution (1980-2013)



Source: Michael O'Phelan of RJO Futures and Harvard Management Co

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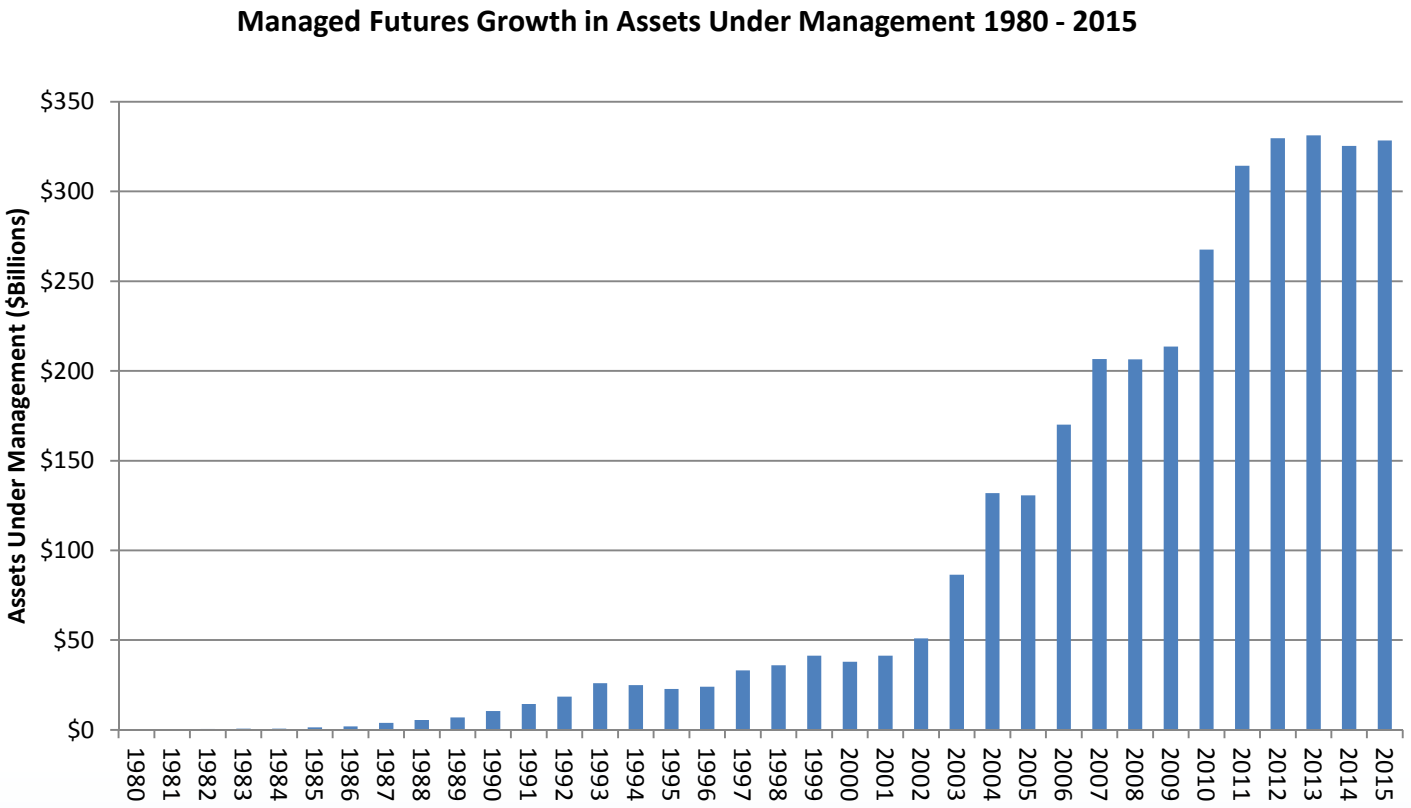
Managed Futures: Growth in Assets Under Management (billions USD) 1980-2015*



Source: BarclayHedge Alternative Investment Database

*2015 data as of 6/30/15

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Managed Futures Overview

Making sense of managed futures industry…

- 1st managed account attributed to noted technician Dick Donchian who secured power of attorney to trade retail customer accounts in 1948
- Commodity Trading Advisors (CTAs)
  - Professional commodity traders registered with National Futures Association (NFA) for purposes of trading decisions on behalf of customers
  - They may trade on behalf of separately managed accounts or pooled funds
- Commodity Pool Operators (CPOs)
  - Registered with NFA to create and administer managed futures funds, commodity funds, commodity pools
  - CPOs usually retain services of CTAs to trade all or part of fund
  - CPOs concentrate on fund raising, accounting, evaluation and monitoring of CTA performance
- Originally a retail product, managed futures are widely accepted as institutional investment tool ... often classified as a type of hedge fund
- ***And now we have 40 Act mutual funds and ETFs that allow one to allocate to managed futures strategies with the click of a mouse on various platforms***

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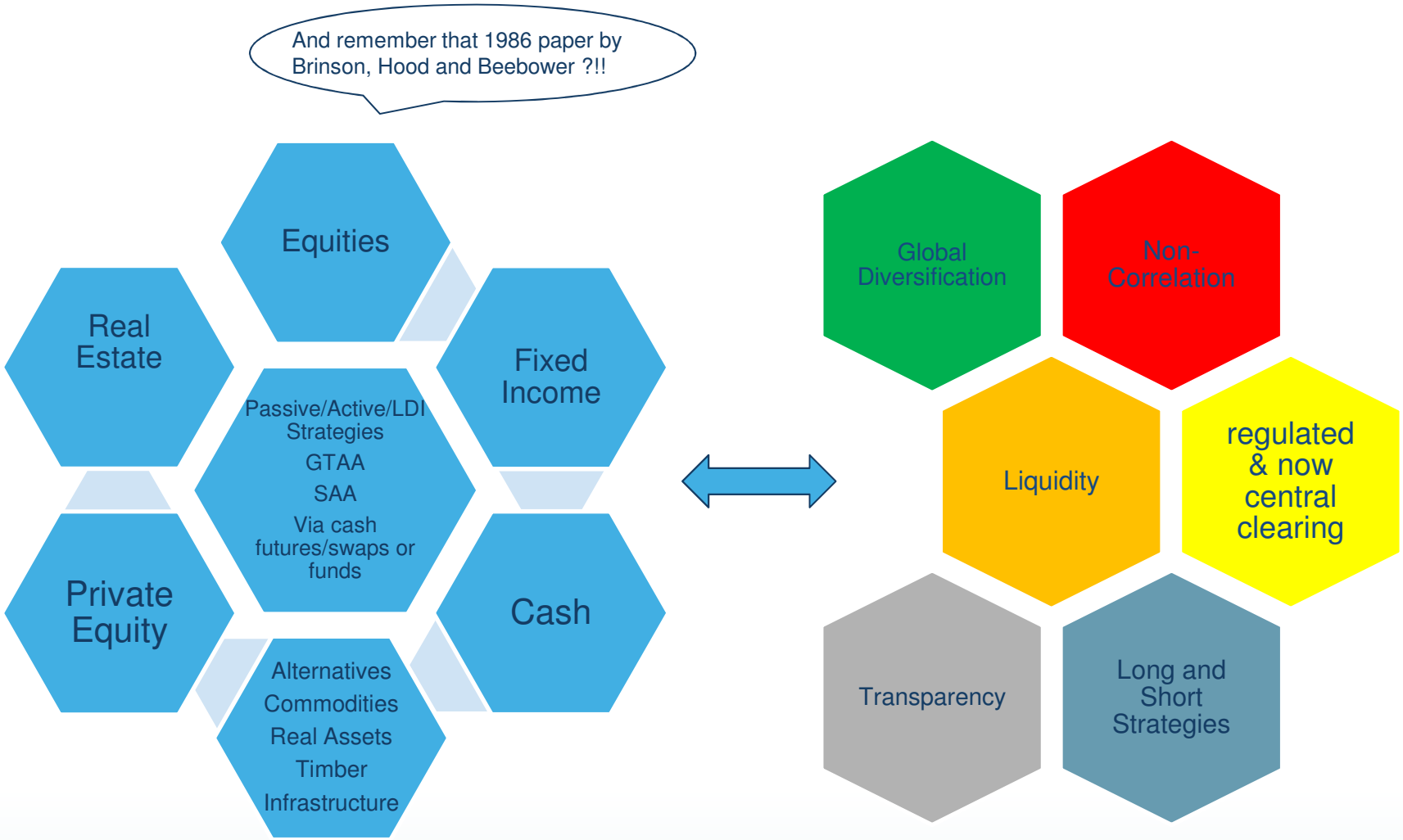
The Investor's Dilemma….



Is there an investment Strategy that incorporates many of the elements above?

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A sampling of Plan Sponsors/Endowments/SWFs that allocate to managed futures

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The Two Major Trading Styles of CTAs:

There are generally two styles of trading in the managed futures industry.

Discretionary CTAs are traders who use their own decision-making skills to determine whether to enter or exit a trade. For example, a discretionary CTA might focus on economic reports and technical analysis to determine if they will Treasury or Stock index futures.

Systematic CTAs, on the other hand, do not transact trades and are conducted based on a trading signal that is generated by a computer program or algorithm.

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Major CTA Strategies

- Trend Following/Countertrend Strategies
- Arbitrage
- Options Writing
- Fundamental Global Macro
- Intermarket/Intramarket Spreading

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Commodities/Commodity Trading Advisors and some Myths:

CTA'S USE MORE THAN JUST COMMODITIES [38]

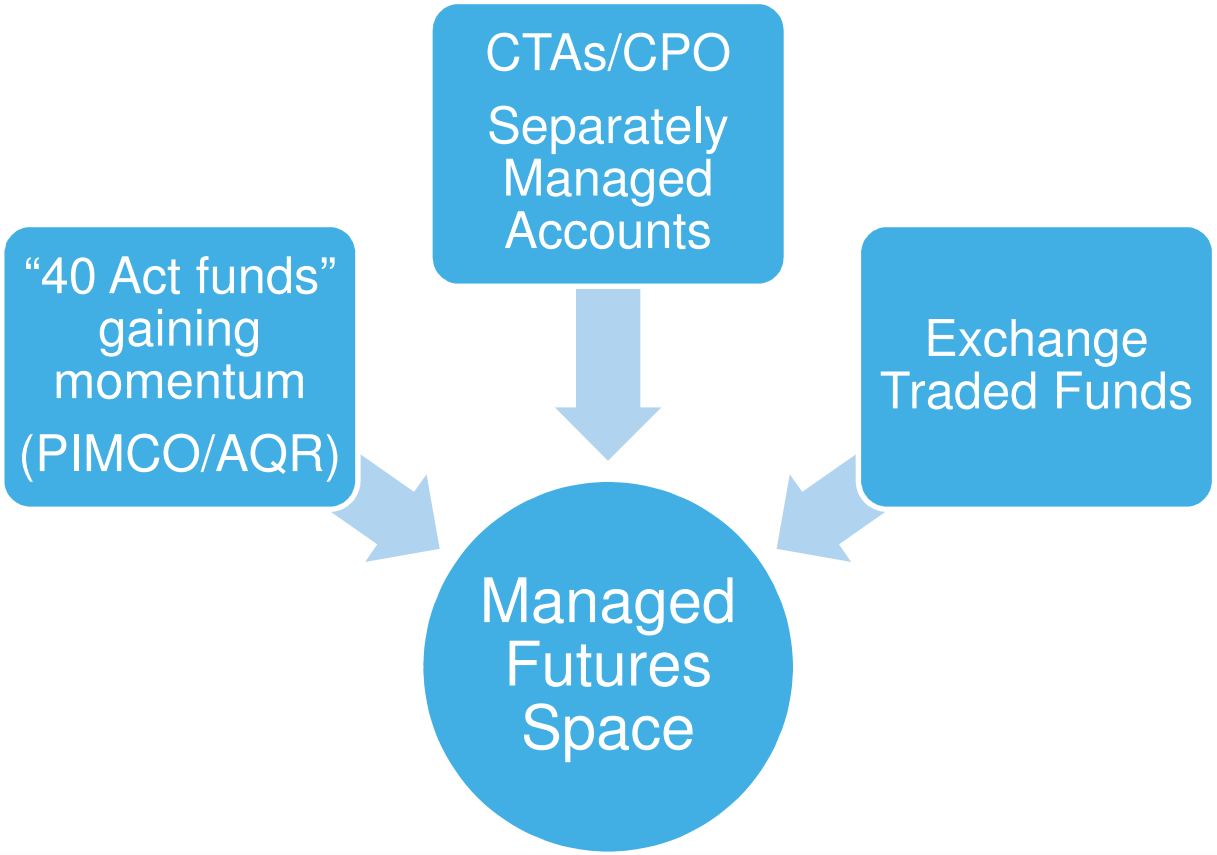
A Commodity Trading Advisor (CTA) is an individual or organization which, for compensation or profit, advises others as to the value of or the advisability of buying or selling futures contracts, options on futures, or retail off-exchange forex contracts.[1]

What does this mean?

A CTA registers with the National Futures Association (NFA) so that it is regulated by the U.S. Commodity Futures Trading Commission.

WHY IS THIS SO CONFUSING?!
The word "commodity" in CTA doesn't reflect what the strategies are trading! The CTA's are trading any futures contracts including ones on stocks, currencies, interest rates, fixed income, and commodities.

The Product mix is changing rapidly…



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DIVERSIFICATION OF FUTURES MARKETS

FX (22%)

Australian Dollar
British Pound
Canadian Dollar
Euro FX
Indian Rupee
Japanese Yen
Russian Ruble
Swiss Franc

Metals (6%)

Copper
Gold
Silver
Steel
Zinc

Energy (6%)

Brent Crude Oil
Heating Oil
Henry Hub Swap
Futures
Light Sweet Crude Oil
Natural Gas

Commodities (7%)

Corn
Cotton
Lean Hogs
Live Cattle
Palm Oil
Rubber
Soy Oil
Soy Meal
Soybeans
Wheat
White Sugar

Interest Rates (22%)

2-Year Treasury Note
5-Year Treasury Note
10-Year Treasury Note
30-Year Treasury Bond
Euribor

Individual Equity (15%)

Deutsche Telekom
Allianz
SAP
Deutsche Bank
Munchener Ruckversicherung
Banco Comercial Portugues Stock Futures
Brisa Autoestradas de Portugal Stock Futures

Equities (21%)

E-mini Nasdaq 100
E-mini S&P 500
Euro Stoxx 50
Kospi 200
Nikkei 225 Mini
RTS Index
S&P CNX Nifty Index

The above list is only a partial list of the futures products currently available around the world. "Other" represents the remaining 1 percent. Source: FIA 2012

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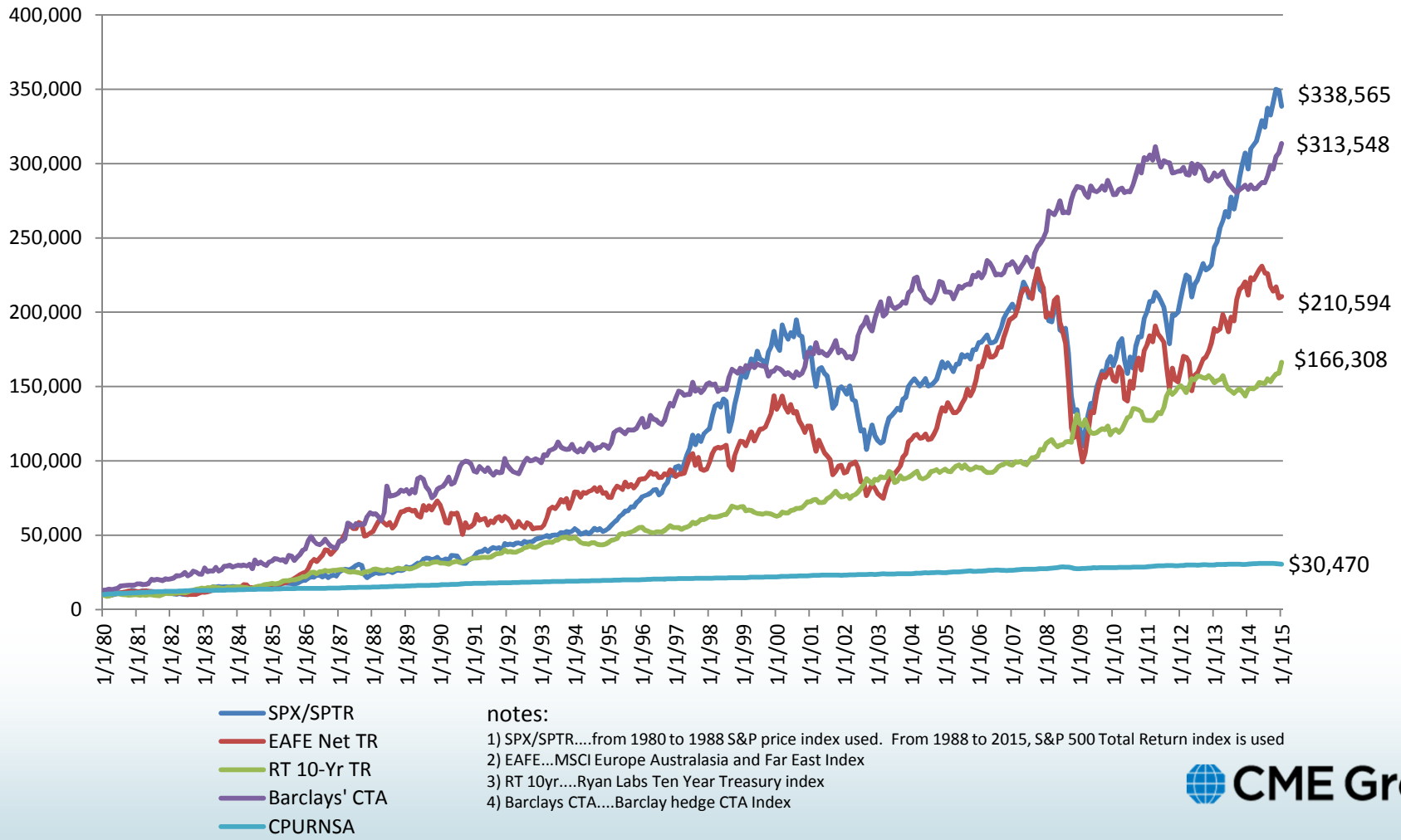
Managed futures vs. some common benchmarks

Comparison of Performance (01/1980- 01/2015)



notes:

1) SPX/SPTR....from 1980 to 1988 S&P price index used. From 1988 to 2015, S&P 500 Total Return index is used
2) EAFE...MSCI Europe Australasia and Far East Index
3) RT 10yr....Ryan Labs Ten Year Treasury index
4) Barclays CTA....Barclay hedge CTA Index

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10 Compelling Reasons to Invest in Managed futures

1. **Diversify beyond the traditional asset classes.**
Managed Futures are an alternative asset class that has achieved strong performance in both up and down markets, exhibiting low correlation to traditional asset classes, such as stocks, bonds, cash and real estate.

2. **Reduce overall portfolio volatility.**
In general, as one asset class goes up, some other asset class goes down. Managed Futures invest across a broad spectrum of asset classes with the goal of achieving solid long-term returns.

3. **Increase returns and reduce volatility.**
Managed Futures, as well as commodities, when used in conjunction with traditional asset classes, may reduce risk, while at the same time potentially increasing returns.

4. **Returns evident in any kind of economic environment.**
Managed Futures may generate returns in bull and bear markets, boasting solid long-term track records despite economic downturns. Moreover, they often do so with less volatility and smaller drawdowns than other asset classes (see chart above).

5. **Strong performance during stock market declines.**
Managed Futures may do well in down markets because they employ short-selling and options strategies that allow them to profit in such markets.

6. **Successful institutions use them.**
Pension Plan Sponsors, Endowments and Foundations have long used Managed Futures to generate returns in excess of the S&P 500.

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10 Compelling Reasons to Invest in Managed futures

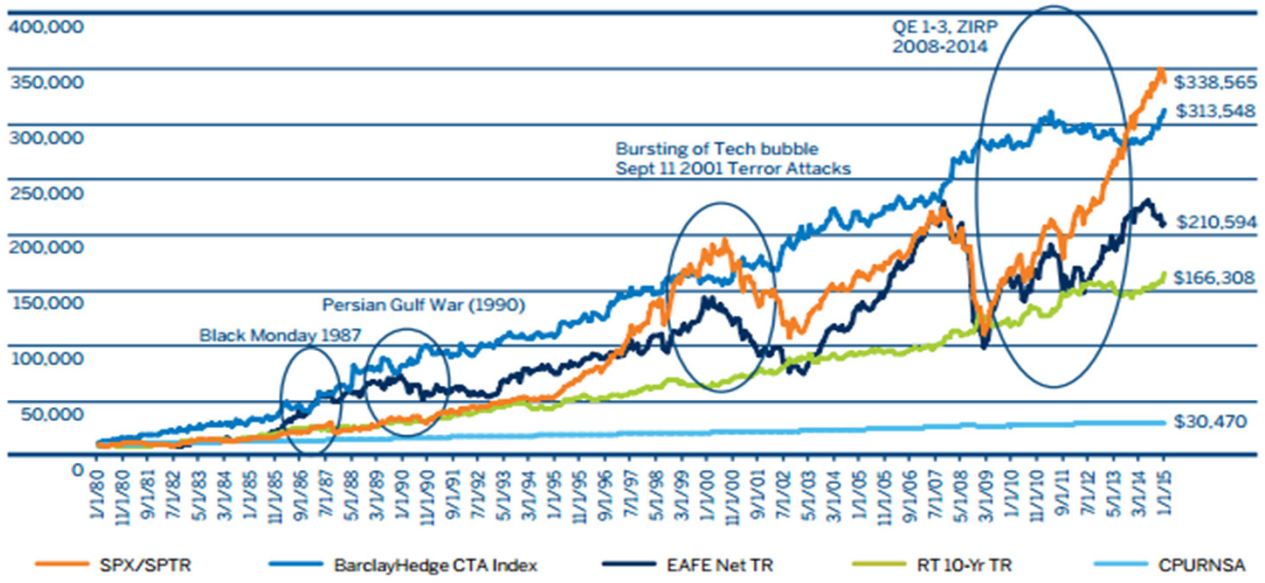
7. Commodity Trading Advisors (CTAs), Pool Operators (CPOs), and Managed Futures Mutual Funds have access to a wide variety of global futures products that are liquid and transparent.
There are more than 150 liquid futures products across the globe, including stock indexes, fixed income, energies, metals, and agricultural products.

8. The CTA/CPO/Managed Futures Mutual Fund community is regulated.
Trading in a regulated marketplace builds the credibility and trustworthiness of the CTA/CPO/Managed Futures Mutual Fund community.

9. Risk Management and Clearing
CME Clearing institutes some of the most sophisticated risk management practices in the financial world. For more than 100 years, CME Clearing has provided services that substantially mitigate the risk of clearing member failure. CME Clearing has provided the resources to ensure the performance of every contract on our exchanges for more than a century.

10. Overall industry growth has been exceptional.
In the last 35 years, assets under management for the Managed Futures industry have grown 1000 fold. Current assets under management stand at over $310 billion.

WHEN CRITICAL EVENTS OCCUR (01/1980 – 01/2015)



Stocks vs. Managed Futures During Critical Events

Period	Event	S&P 500 Total Return Index	Barclay BTOP 50 Index	Difference
Fourth Quarter 1987	Black Monday - Global Stock Markets Crash	-22.53%	16.88%	39.41%
Fourth Quarter 2008	Bear Market in U.S. Equities led by Financials	-21.95%	9.14%	31.08%
Third Quarter 2002	WorldCom Scandal	-17.28%	9.41%	26.69%
Third Quarter 2001	Terrorist Attacks on World Trade Center and Pentagon	-14.68%	4.12%	18.79%
Third Quarter 1990	Iraq Invades Kuwait	-13.75%	11.22%	24.97%
Second Quarter 2002	Continuing Aftermath of Technology Bubble Bursting	-13.39%	8.52%	21.92%
First Quarter 2001	Bear Market in U.S. Equities led by Technology	-11.86%	5.97%	17.83%
Second Quarter 2010	European Sovereign Debt Crisis, "Flash Crash"	-11.42%	-1.94%	9.48%
First Quarter 2009	Credit Crisis Continues	-11.01%	-1.75%	9.26%
Third Quarter 1998	Russia Defaults on Debt, LTCM Crisis	-9.94%	10.54%	20.48%
First Quarter 2008	Credit Crisis, Commodity Prices Rally	-9.45%	6.43%	15.88%
Third Quarter 2011	European Sovereign Debt Crisis	-8.90%	0.44%	9.34%
Third Quarter 2008	Credit Crisis, Government-Sponsored Bailout of Banks	-8.37%	-4.11%	4.26%
Fourth Quarter 2000	DotCom Bubble Bursts	-7.82%	19.78%	27.60%
Third Quarter 1999	Anxiety during Run Up to Y2K	-6.24%	-0.67%	5.57%

Source: AlphaMetrix Alternative Investment Advisors, Bloomberg

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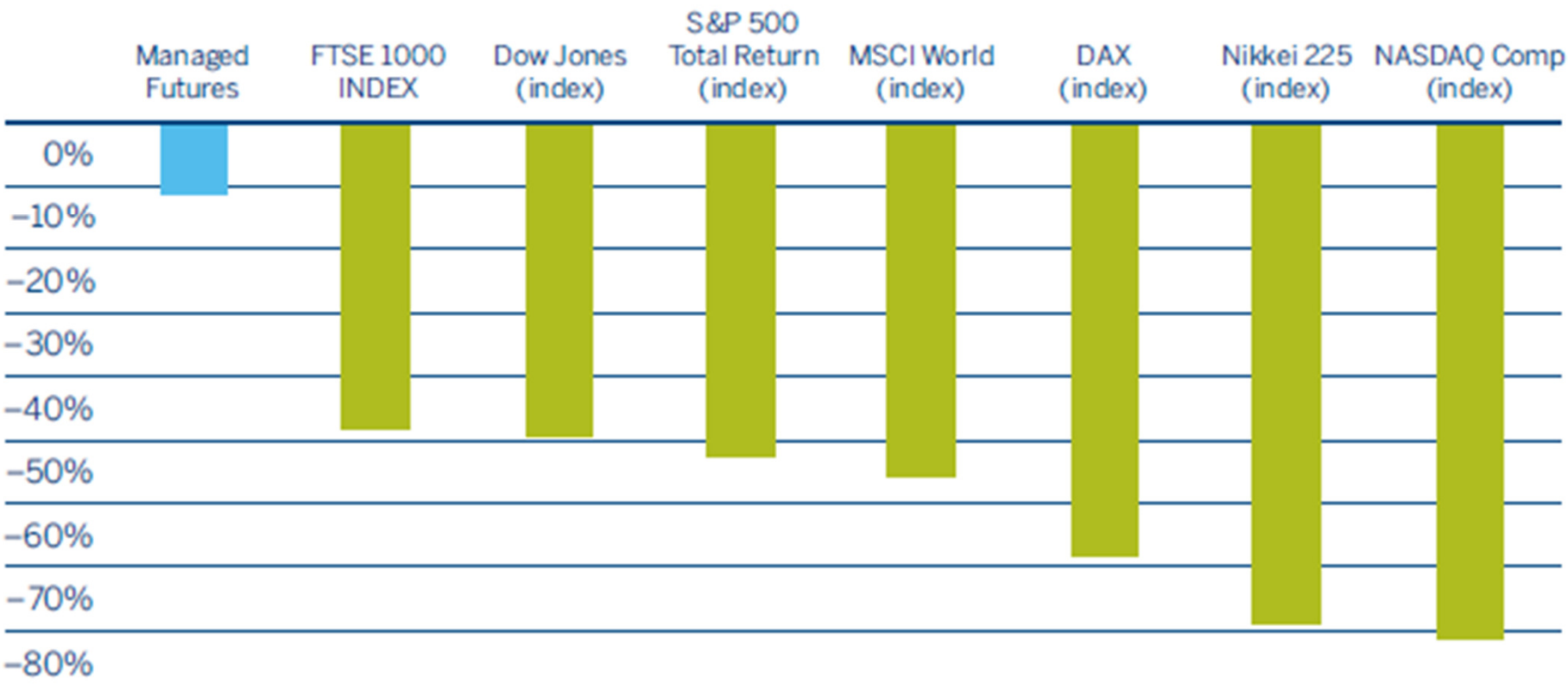
WORST DRAWDOWNS IN COMPARISON



Based on a period from 1/90 to 3/12. *Source: Bloomberg*

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3-Year/5-Year Rolling Returns of Various Indexes S&P 500 vs. Alternatives

	S&P 500 Index	Barclay Capital Bond Composite Global Index	S&P Goldman Sachs Commodity Total Return Index	HFR Equity Hedge Index	HFRI Fund Weighted Index	Barclay CTA Index	Barclay BTOP50 Index
Number of 3-Year Rolling Negative Periods (out of n = 270)	69	0	99	22	5	22	15

	S&P 500 Index	Barclay Capital Bond Composite Global Index	S&P Goldman Sachs Commodity Total Return Index	HFR Equity Hedge Index	HFRI Fund Weighted Index	Barclay CTA Index	Barclay BTOP50 Index
Number of 5-Year Rolling Negative Periods (out of n = 246)	83	0	90	8	0	1	8

Source: Sigma Analysis and Bloomberg

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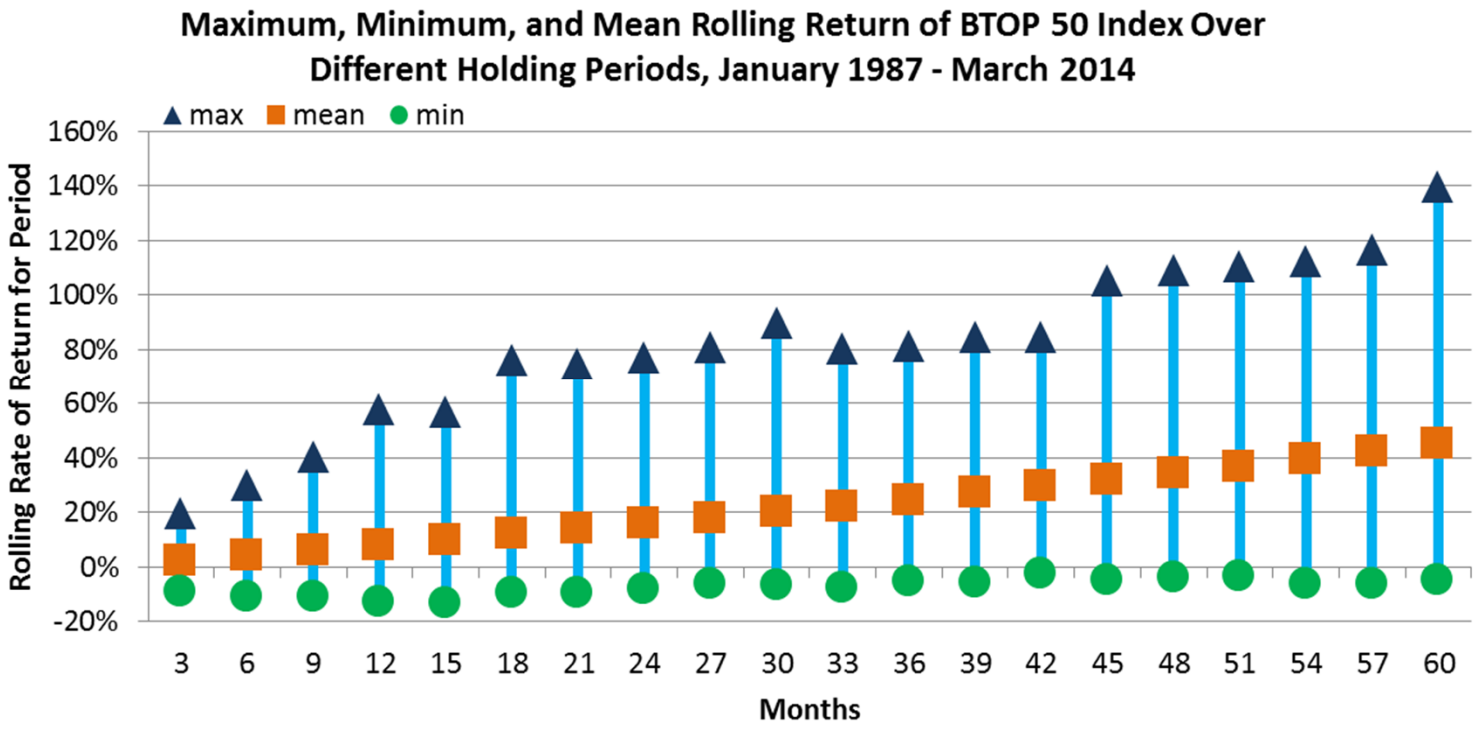
Managed Futures Returns Over Different Holding periods.



Source: Bloomberg

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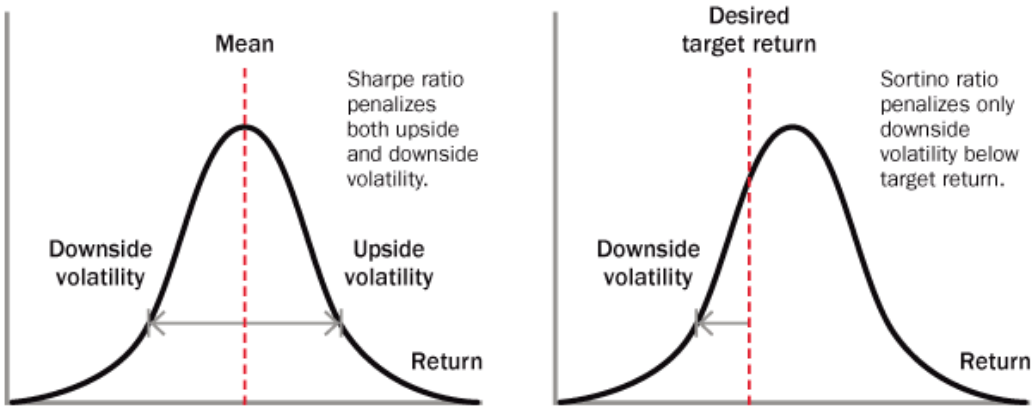
Sharpe and Sortino Ratios

Sharpe Ratio frequently criticized

Large return swings are a sign of volatility and risk, but if a program consistently produces strong up moves with lower down moves, it should not be punished for those strong moves in its favor.



$$Sharpe\ Ratio = \frac{R_p - R_{rf}}{\sigma_p}$$

R_p = Expected portfolio/asset return

R_{rf} = Risk-free rate of return

σ_p = Portfolio/asset standard deviation

$$Sortino\ Ratio = \frac{R_p - R_t}{\sigma_{np}}$$

R_p = Expected portfolio/asset return

R_{rf} = Target rate of return defined by investor

σ_p = Downside of portfolio/asset standard deviation

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Risk Through Several Lenses

Which Manager are you most likely to allocate to.

CTA #1

10 yr ann.Return	17.54%
Std Deviation	13.98%
Sharpe Ratio	0.89
Max mo. Drawdown	9.47%
Max drawdown	12.71%

CTA #2

10 Yr ann. return	17.91%
Std Deviation	31.22%
Sharpe Ratio	.44
Max. Mo Drawdown	19.88%
Max. drawdown	30.07%

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Comparing Performance vs. Risk With Various Managers

Drilling Down on Performance/Risk						
CTA/program	**Manager A**	**Manager B**	**Manager C**	**Manager D**	**Manager E**	**Manager F**
Type of program/strategy	**Diversified**	**Absolute Ret.**	**Mgd. Futures**	**Spread Trading**	**Diversified**	**Gen. Trading**
Time Frame	**Jan 88 to Aug 15**	**Jun 05 to Sep 14**	**Jan 88 to Sep 15**	**Dec 06 to Sep 15**	**Oct 97 to Sep 15**	**Apr 00 to Aug 15**
Cumulative Total Return %	6585.20	-6.95	2321.81	290.41	767.09	8224.48
Annualized Compounded Return %	16.40	-1.86	12.17	16.67	12.75	33.22
Annualized Standard Deviation %	30.40	2.11	15.6	26.11	16.34	43.29
Mon. Correlation to SP500	-0.06	0	0	-0.09	-0.02	0
Annualized Sharpe Ratio	0.64	-0.88	0.82	0.72	0.82	0.85
Monthly maximum loss %	-20.80	-1.6	-11.8	-25.28	-12.97	-34.33
Maximum Drawdown %	-31.96	-8.39	-29.32	-36.21	-25.73	-39.67

Source: CTA Performance

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Calculating the Omega Ratio

Exhibit 1 – Omega Measure Calculation for a 5% Annual Target Return

	Annual	Quarterly
Target	5%	1.2272%

Date	Return	Downside	Upside	LPM	UPM
2002-03	0.9622%	1	0	0.2650%	0.0000%
2002-06	-13.0920%	1	0	14.3192%	0.0000%
2002-09	-17.2373%	1	0	18.4645%	0.0000%
2002-12	8.0228%	0	1	0.0000%	6.7956%
2003-03	-3.0522%	1	0	4.2794%	0.0000%
2003-06	16.2520%	0	1	0.0000%	15.0247%
2003-09	3.4211%	0	1	0.0000%	2.1939%
2003-12	12.4269%	0	1	0.0000%	11.1996%
2004-03	2.2369%	0	1	0.0000%	1.0097%
2004-06	1.3270%	0	1	0.0000%	0.0998%
2004-09	-1.8976%	1	0	3.1249%	0.0000%
2004-12	10.1529%	0	1	0.0000%	8.9257%
			Average	3.3711%	3.7708%
			Omega		1.11855931

Exhibit 2 – Omega Measure Calculation for a 10% Annual Target Return

	Annual	Quarterly
Target	10%	2.4114%

Date	Return	Downside	Upside	LPM	UPM
2002-03	0.9622%	1	0	1.4492%	0.0000%
2002-06	-13.0920%	1	0	15.5033%	0.0000%
2002-09	-17.2373%	1	0	19.6487%	0.0000%
2002-12	8.0228%	0	1	0.0000%	5.6114%
2003-03	-3.0522%	1	0	5.4636%	0.0000%
2003-06	16.2520%	0	1	0.0000%	13.8406%
2003-09	3.4211%	0	1	0.0000%	1.0098%
2003-12	12.4269%	0	1	0.0000%	10.0155%
2004-03	2.2369%	1	0	0.1744%	0.0000%
2004-06	1.3270%	1	0	1.0843%	0.0000%
2004-09	-1.8976%	1	0	4.3090%	0.0000%
2004-12	10.1529%	0	1	0.0000%	7.7415%
			Average	3.9694%	3.1849%
			Omega		0.802368733

LPM =Lower Partial moment
UPM =Upper Partial moment

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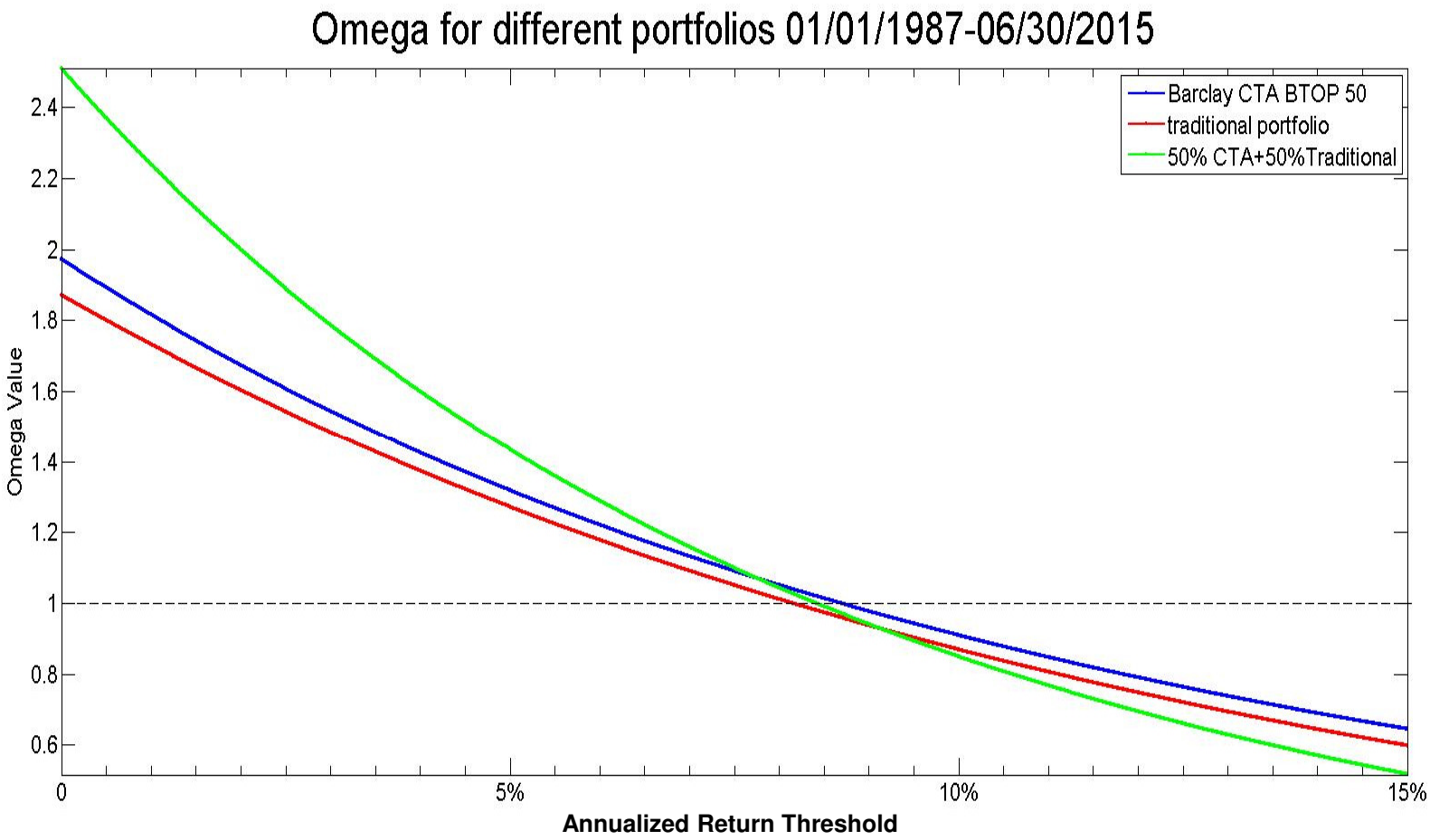
Omega Ratios for different Portfolio Allocations



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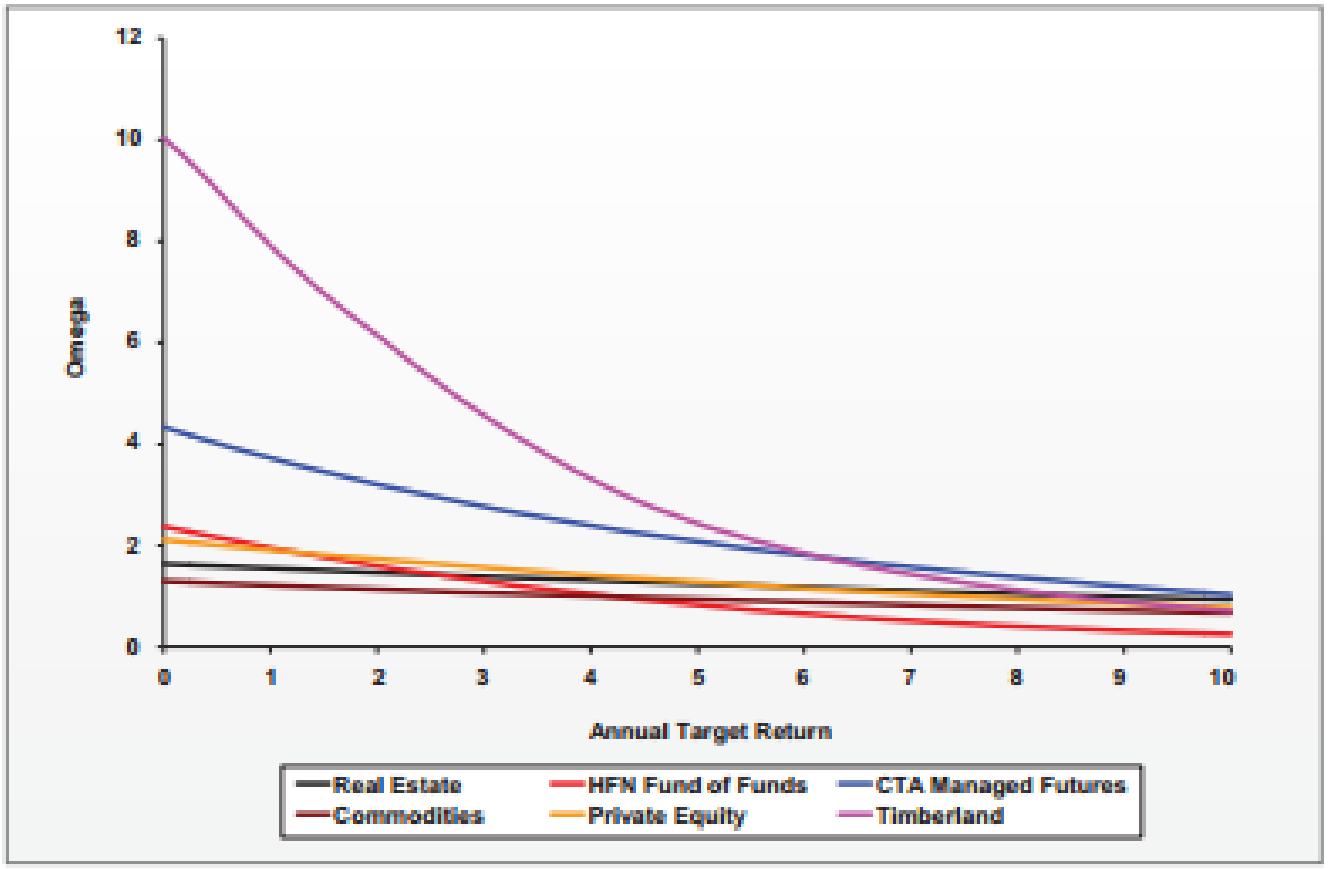
Omega Function for Various Asset Classes

Exhibit 5 – Omega Measure for Alternative Assets



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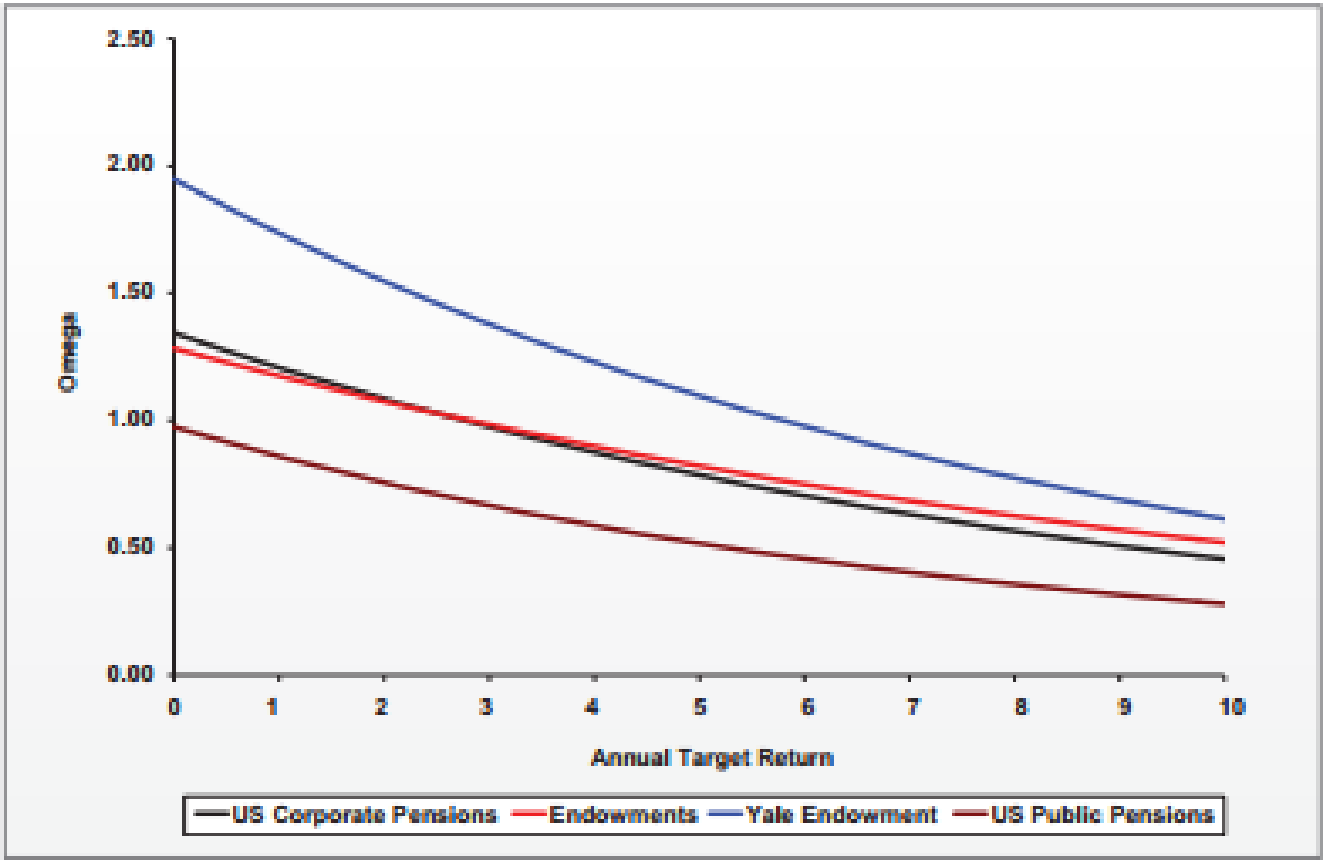
Omega Function Comparison: The Yale Model vs. Pensions and Endowments



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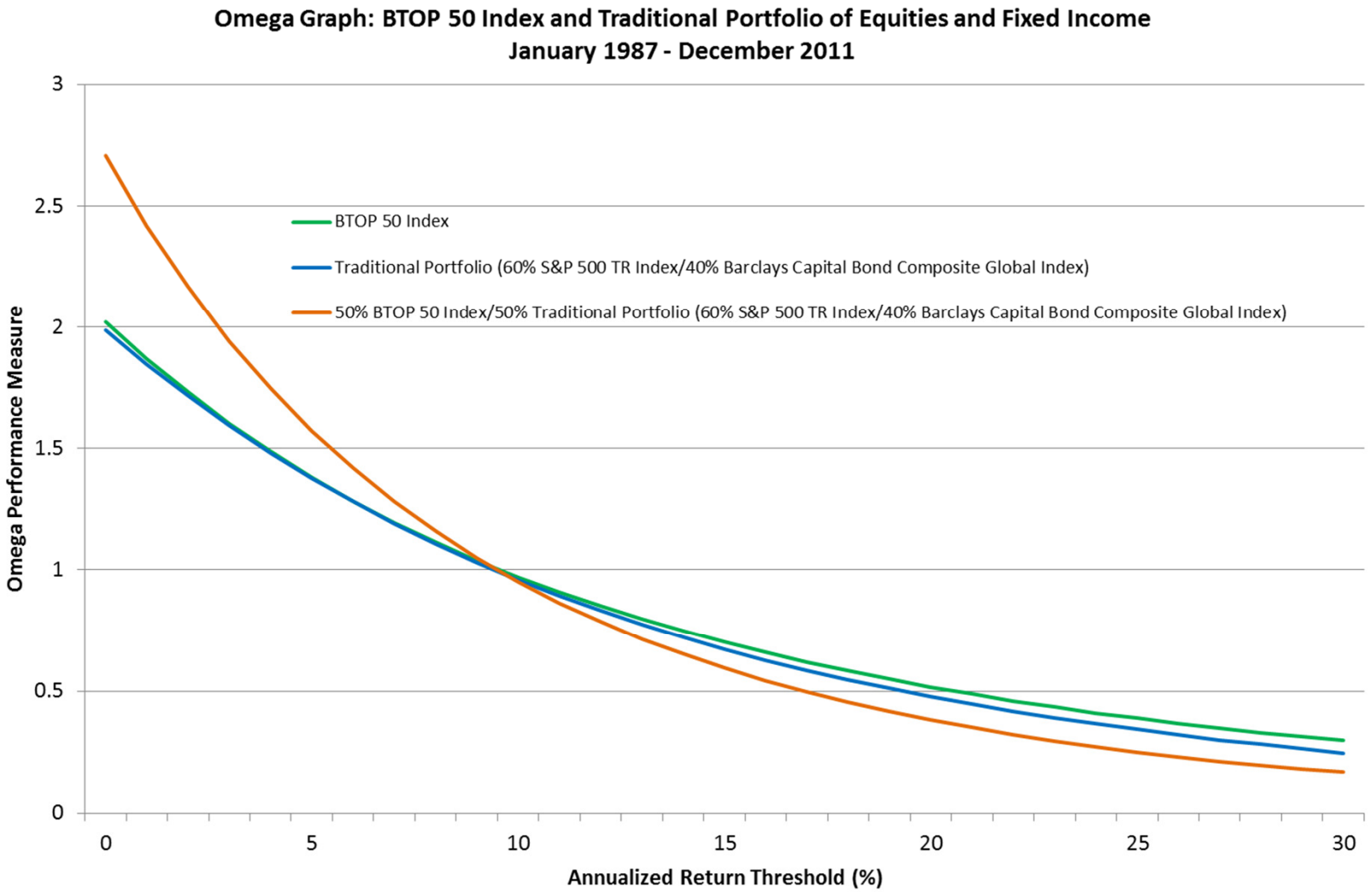
Risk and Return through the Lens of the Omega Function



Source: AlphaMetrix Alternative Investment Advisors, Bloomberg. The Barclays Capital Bond Composite Global Index did not report Sep 2008 and Oct 2008

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So now what? Next Steps

Most institutions…

1) **Will utilize their consultants to help decide allocations in terms of percent and which CTAs to allocate to**
2) **Those with the expertise & resources will perform their own due diligence and contact CTAs directly**
3) **Platforms or intermediaries to consider… DB Select, HFR**
4) **Separately managed accounts vs. 40 Act funds**

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CME Managed Futures Initiatives

Managed Futures Initiative	Institutional	Retail
Investor's Roundtable	√	
Industry Experts Interviews on iPod	√	
Participation at industry conferences	√	√
Written collateral	√	√
Website	√	√
Webinars/Seminars	√	√
Pinnacle Awards	√	√
Phone Campaigns to Endowment, Foundations	√	
Calling programs/Direct mail programs	√	√

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More CME Group Resources for Pension Plan Sponsors

Investor Resource Center

Receive Updates

For Risk Management, Managed Futures & Hedge Fund Strategies

CME Group is a dedicated partner to the investor community and is focused on providing meaningful information and research on a variety of relevant topics, in many different formats.

Contact us at investoredu@cmegroup.com to provide feedback or learn more about our efforts.

Managed Futures Research Digest

An aggregate of abstracts from practitioner and academic resources

Managed Futures Pinnacle Awards

Get the latest details about our annual awards event to honor the top managers in the industry

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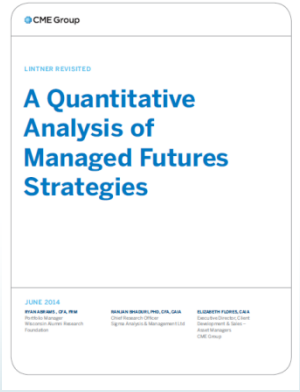
Visit our **Managed Futures Resource Center** to access:

Podcasts: interviews on topics centered around risk management and managed futures strategies. Each interview provides a unique perspective from leading industry participants and range from 5 to 30 minutes in length.

Managed Futures Research Digest: an aggregate of abstracts to help navigate the vast world of research papers. Topics include:

- General managed futures
- Performance and portfolio management
- Trend following
- Liquidity and volatility
- Performance measurement
- Performance in varying interest rate environments



Lintner Revisited: A Quantitative Analysis of Managed Futures: an update to Dr. John Lintner's seminal paper, which describes the diversification benefits that managed futures strategies can bring over the long-term to an equity/fixed income/hedge fund portfolio.

Learn more at **cmegroup.com/managedfutures**

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Risk Management for Pension Plans

Using Stock Index and Treasury futures

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Risk Management using futures is omnipresent:

No matter where you look, futures are an integral part of risk management.

Name of Company	Adverse Risk Exposure	Product	Futures/options used
Sun America	Equity market decline	Variable Annuities	S&P 500 futures/options on S&P 500 futures
General Mills	Raw material price increase	Cereal products	Corn futures
Vanguard Univ. of Texas Endowment	Cash Drag Cash Drag	Vanguard 500 Equity portfolio	S&P 500 futures S&P 500 futures
PIMCO	Cheap beta required	StocksPlus	S&P 500 futures/Fixed Income futures
U.S. Commodity fund	Need long exposure	Exchange traded fund	Commodity futures
Franklin Templeton	FX market risk in International portfolio	Mutual series funds	FX futures
Starbucks Oscar Meyer Kraft Foods Dannon	Dairy/coffee price increase Livestock price increase Dairy price increase Dairy price increase	Raw materials Raw materials Raw materials Raw materials	Dairy futures Cattle/hog futures Dairy futures. Dairy futures

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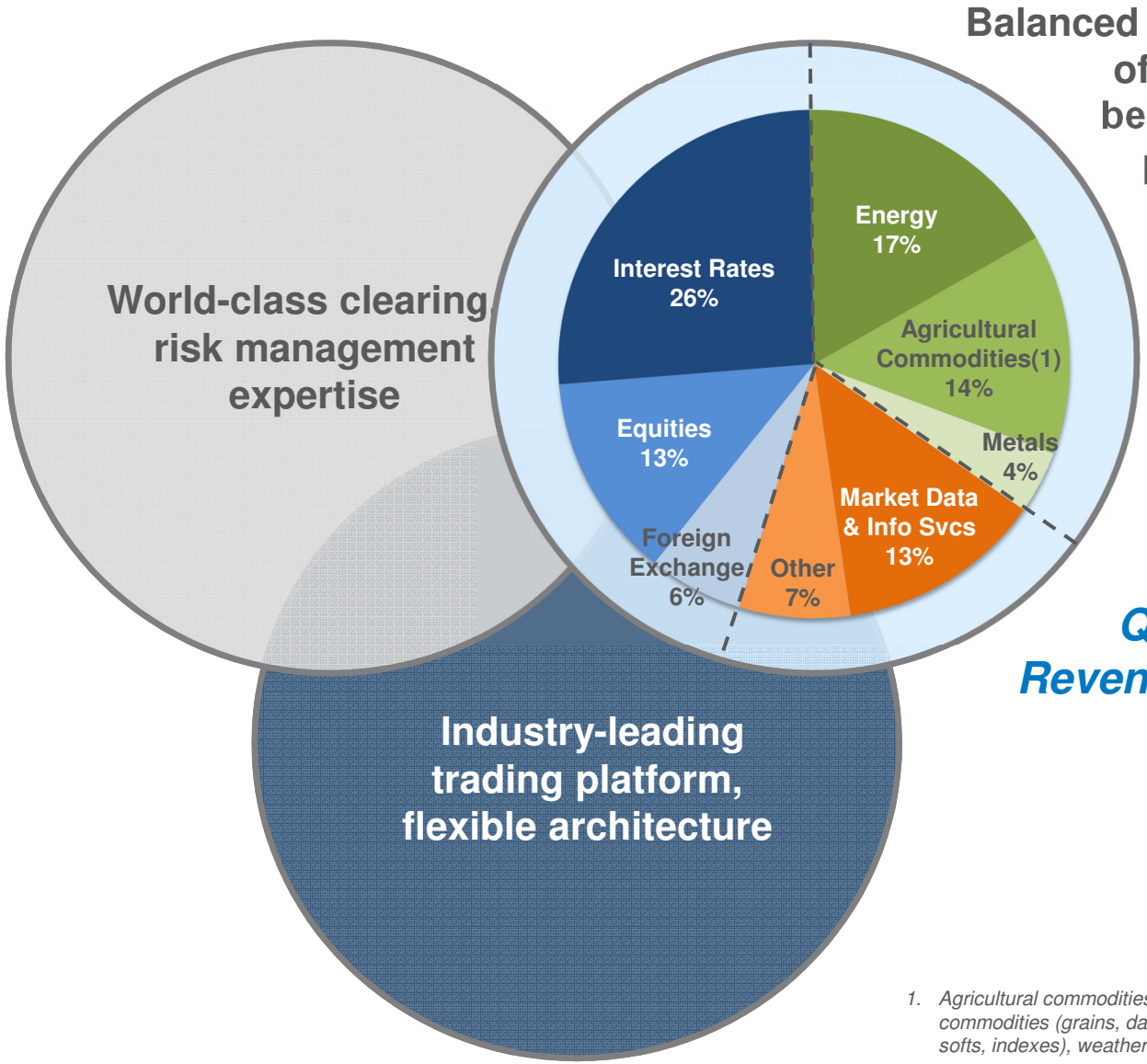
Unique Assets Provide Competitive Advantages



Q2 2015 Revenue Mix

1. *Agricultural commodities includes all agricultural commodities (grains, dairy, livestock, forest, NYMEX softs, indexes), weather and real estate*

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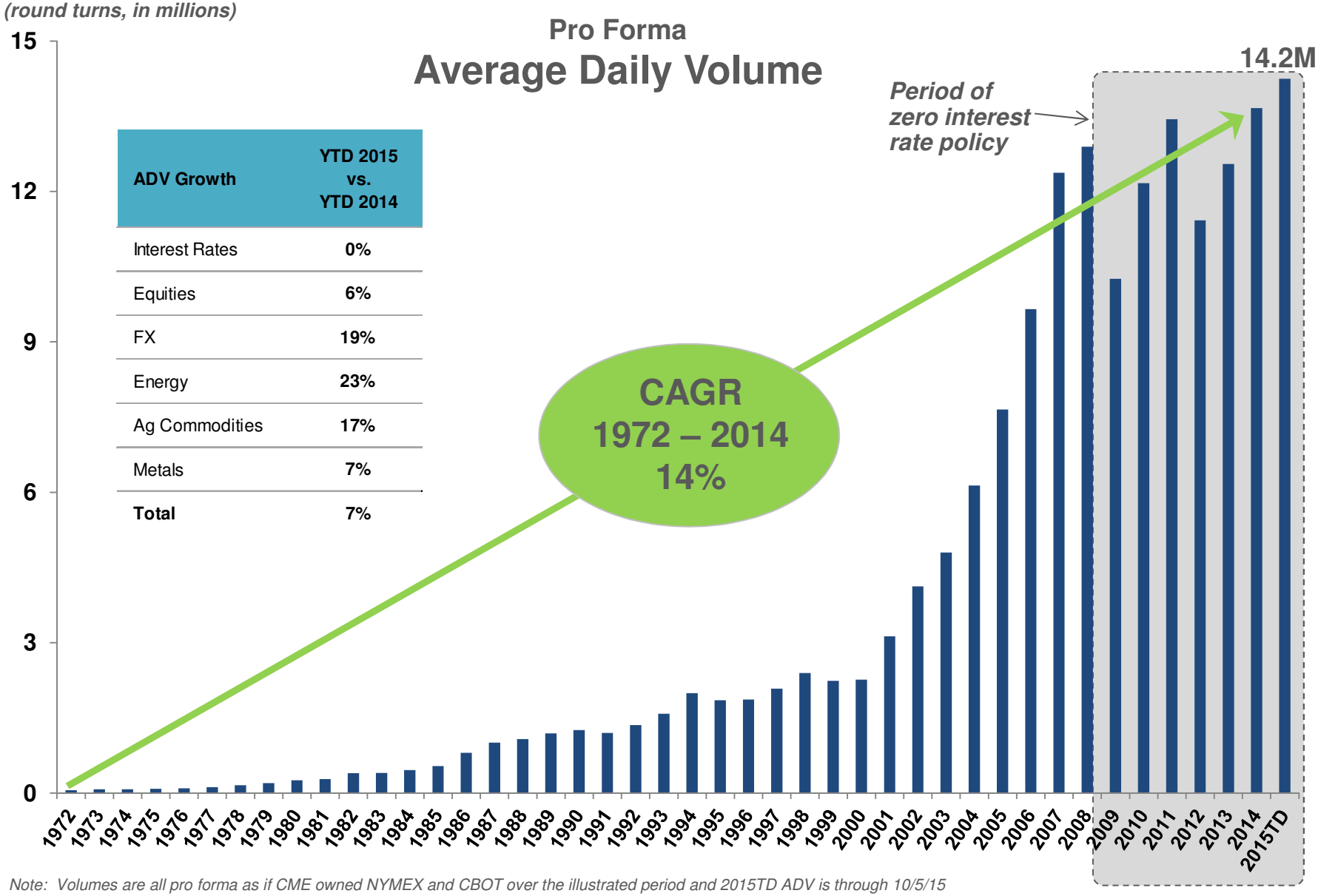
Long-Term Growth in a Variety of Environments

(round turns, in millions)



ADV Growth	YTD 2015 vs. YTD 2014
Interest Rates	0%
Equities	6%
FX	19%
Energy	23%
Ag Commodities	17%
Metals	7%
Total	7%

Note: Volumes are all pro forma as if CME owned NYMEX and CBOT over the illustrated period and 2015TD ADV is through 10/5/15

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CME Most Liquid Products: Interest Rates

LEADING PRODUCTS Q3 2015

Built on the heritage of CME, CBOT, NYMEX, COMEX and KCBT, CME Group markets bring together commercial producers and manufacturers, institutional investors, hedge funds, proprietary trading firms and active individual traders from around the globe, trading the widest range of benchmark futures and options contracts listed on any exchange. It creates a deep, diverse pool of liquidity that let's you manage risk, capitalize on every opportunity and realize the maximum possible return on every trade.

Listed below you will find our leading futures and options contracts based on interest rates, equity indexes, energy, foreign exchange (FX), agricultural commodities, and metals.

INTEREST RATES

CONTRACT	FUTURES TICKER*	OPTIONS TICKER*	CONTRACT SIZE	MINIMUM TICK SIZE	FUTURES				OPTIONS				
					Average Daily Volume (ADV)	ADV % Change (Quarter YoY)	ADV Notional ($) (in Millions)	Open Interest	ADV	ADV % Change (Quarter YoY)	% Traded Elec	ADV Notional ($) (in Millions)	Open Interest
Eurodollar[1]	GE	GE	$1,000,000	Nearby: 0.0025 = $6.25 Others: 0.005 = $12.50	2,258,489	-17%	$2,258,489	11,070,842	958,743	4%	21%	$957,508	25,350,179
10-Year Treasury Note[2]	ZN	OZN	$100,000	1/2 of 1/32 = $15.625	1,257,008	-6%	$125,701	2,774,209	374,331	-13%	63%	$37,433	1,863,054
5-Year Treasury Note[2]	ZF	OZF	$100,000	1/4 of 1/32 = $7.8125	757,802	-6%	$75,780	2,434,756	90,469	-36%	65%	$9,047	728,293
2-Year Treasury Note[2]	ZT	OZT	$200,000	1/4 of 1/32 = $15.625	335,524	12%	$67,105	1,135,018	10,943	25%	53%	$2,189	90,071
U.S. Treasury Bond[2]	ZB	OZB	$100,000	1/32 = $31.25	277,761	-27%	$27,776	494,745	97,500	49%	72%	$9,750	431,897
Ultra T-Bond[2]	UB	OUB	$100,000	1/32 = $31.25	117,636	15%	$11,764	636,108	361	-54%	71%	$36	3,303
30 Day Federal Funds[2]	ZQ	OZQ	$5,000,000	Nearby: 0.0025 = 10.4175 Others: 0.0050 = 20.835	113,565	204%	$567,823	924,464	1,142	495%	8%	$5,712	48,507
Deliverable Swap Futures[2]	T1U, F1U, N1U, B1U	–	$100,000	2YR = 1/4 of 1/32 5Yr, 10YR, 30YR = 1/2 of 1/32	6,046	-14%	$605	88,032	–	–	–	–	–

1. These contracts are listed with, and subject to, the rules and regulations of CME.

2. These contracts are listed with, and subject to, the rules and regulations of CBOT.

CME Most Liquid Products: Equity Index futures

EQUITY INDEX

CONTRACT	FUTURES TICKER*	OPTIONS TICKER*	CONTRACT SIZE	MINIMUM TICK SIZE	FUTURES				OPTIONS[3]				
					Average Daily Volume (ADV)	ADV % Change (Quarter YoY)	ADV Notional ($) (in Millions)	Open Interest	ADV	ADV % Change (Quarter YoY)	% Traded Elec	ADV Notional ($) (in Millions)	Open Interest
E-mini S&P 500[1]	ES	ES	$50	0.25 = $12.50 Spread 0.05 = $2.50	2,004,322	26%	$200,347	2,890,886	588,497	34%	100%	$59,072	3,557,120
E-mini NASDAQ-100[1]	NQ	NQ	$20	0.25 = $5.00 Spread 0.05 = $1.00	310,046	15%	$26,988	262,704	5,137	-47%	100%	$437	35,212
E-mini Dow $5[2]	YM	OYMC/OYMP	$5	1.00 = $5.00	193,197	35%	$16,213	66,104	612	23%	100%	$0	23,184
Nikkei 225 (YEN)[1]	NIY	–	¥500	5.00 = ¥2500	63,124	74%	$4,854	89,502	–	–	–	–	–
E-mini S&P MidCap 400[1]	EMD	EMD	$100	0.10 = $10.00 Spread 0.05 = $5.00	23,713	22%	$3,402	90,765	–	–	–	–	–
Nikkei 225 (USD)[1]	NKD	KN/JN	$5	5.00 = $25.00	20,264	35%	$1,922	47,294	–	–	–	–	–
S&P 500[1]	SP	CS/PS	$250	0.10 = $25.00 Spread 0.05 = $12.50	12,629	5%	$6,255	103,366	55,838	33%	0%	$28,196	587,888
E-mini S&P Select Sector Futures	XAY, XAP, XAE, XAF, XAV, XAI, XAB, XAK, XAU	–	XAF: $250 x S&P Financial Select Sector Index price All other Select Sector futures: $100 x respective S&P Select Sector Index price	XAF: 0.05 = $12.50 All others: 0.10 = $10.00	3,704	73%	$213	39,723	–	–	–	–	–

1. These contracts are listed with, and subject to, the rules and regulations of CME.
2. These contracts are listed with, and subject to, the rules and regulations of CBOT.
3. American Style options represented only.

*Tickers displayed are CME Globex product codes.

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CME Most Liquid Products: Energy and FX

ENERGY

CONTRACT	FUTURES TICKER*	OPTIONS TICKER*	CONTRACT SIZE	MINIMUM TICK SIZE	FUTURES				OPTIONS				
					Average Daily Volume (ADV)	ADV % Change (Quarter YoY)	ADV Notional ($) (in Millions)	Open Interest	ADV	ADV % Change (Quarter YoY)	% Traded Elec	ADV Notional ($) (in Millions)	Open Interest
Crude Oil (WTI)	CL	LO	1,000 U.S. barrels	$0.01 per barrel	791,628	37%	$37,528	1,619,016	194,652	50%	63%	$8,412	4,640,563
Natural Gas	NG	ON, LN	10,000 million British thermal units	$0.001 (0.1¢) per mmBtu	290,261	16%	$8,238	929,773	77,127	-1%	14%	$2,165	2,868,667
RBOB Gasoline	RB	OB	42,000 U.S. gallons	$0.0001 per gallon	161,241	14%	$10,493	367,007	1,520	52%	22%	$105	24,988
NY Harbor ULSD	HO	OH	42,000 U.S. gallons	$0.0001 per gallon	143,523	9%	$9,704	383,222	2,522	-50%	9%	$171	155,347
Crude Oil (Brent)	BZ	BE	1,000 U.S. barrels	$0.01 per barrel	107,194	28%	$5,689	169,277	1,134	-81%	1%	$16	275,916

These contracts are listed with, and subject to, the rules and regulations of NYMEX.

FX

CONTRACT	FUTURES TICKER*	OPTIONS TICKER*	CONTRACT SIZE	MINIMUM TICK SIZE	FUTURES				OPTIONS				
					Average Daily Volume (ADV)	ADV % Change (Quarter YoY)	ADV Notional ($) (in Millions)	Open Interest	ADV	ADV % Change (Quarter YoY)	% Traded Elec	ADV Notional ($) (in Millions)	Open Interest
EUR/USD	6E	6E	125,000 euros	$0.0001 per euro increments ($12.50/contract)	240,311	22%	$33,519	323,668	38,926	16%	97%	$5,425	310,910
JPY/USD	6J	6J	12,500,000 Japanese yen	$0.000001 per Japanese yen increments ($12.50/contract)	149,576	14%	$15,400	172,423	12,821	2%	95%	$1,317	152,916
AUD/USD	6A	6A	100,000 Australian dollars	$0.0001 per Australian dollar increments ($10.00/contract)	94,829	-3%	$6,853	142,432	6,654	-5%	98%	$481	89,289
GBP/USD	6B	6B	62,500 British pounds	$0.0001 per British pound increments ($6.25/contract)	92,705	-11%	$8,972	158,450	8,132	-49%	94%	$787	98,946
CAD/USD	6C	6C	100,000 Canadian dollars	$0.0001 per Canadian dollar increments ($10.00/contract)	72,417	24%	$5,529	136,601	6,346	0%	98%	$485	53,602
MXN/USD	6M	6M	500,000 Mexican pesos	$0.000025 per Mexican peso increments ($12.50/contract)	45,771	6%	$1,382	142,417	64	19%	92%	$2	1,458
CHF/USD	6S	6S	125,000 Swiss francs	$0.0001 per Swiss franc increments ($12.50/contract)	19,474	-52%	$2,529	38,639	366	-66%	100%	$48	8,202

These contracts are listed with, and subject to, the rules and regulations of CME.

CME Most Liquid Products: Ags and Metals

AGRICULTURE

CONTRACT	FUTURES TICKER*	OPTIONS TICKER*	CONTRACT SIZE	MINIMUM TICK SIZE	FUTURES				OPTIONS				
					Average Daily Volume (ADV)	ADV % Change (Quarter YoY)	ADV Notional ($) (in Millions)	Open Interest	ADV	ADV % Change (Quarter YoY)	% Traded Elec	ADV Notional ($) (in Millions)	Open Interest
Corn[2]	ZC	OZC	5,000 bushels	$0.0025 per bushel	332,334	47%	$6,587	1,306,853	115,327	23%	62%	$2,283	1,369,545
Soybeans[2]	ZS	OZS	5,000 bushels	$0.0025 per bushel	193,378	19%	$9,023	704,310	72,198	-16%	69%	$3,373	885,211
Chicago SRW Wheat[2]	ZW	OZW	5,000 bushels	$0.0025 per bushel	119,288	32%	$3,096	367,295	26,442	18%	62%	$695	270,584
Soybean Oil[2]	ZL	OZL	60,000 lbs.	$0.0001 per lb.	108,786	29%	$1,911	402,194	8,019	12%	37%	$140	127,502
Soybean Meal[2]	ZM	OZM	100 Short Tons	10 cents per short ton	97,950	26%	$3,174	368,032	9,969	-16%	59%	$317	192,968
Live Cattle[1]	LE	LE	40,000 lbs.	$0.00025 per lb.	53,316	-11%	$3,070	261,720	15,649	-24%	64%	$894	315,635
Lean Hogs[1]	HE	HE	40,000 lbs.	$0.00025 per lb.	36,832	-18%	$1,006	200,424	10,643	-23%	74%	$296	249,568
KC HRW Wheat[2]	KE	OKE	5,000 bushels	$0.0025 per bushel	27,124	33%	$699	185,885	922	206%	33%	$24	28,790

1. These contracts are listed with, and subject to, the rules and regulations of CME.
2. These contracts are listed with, and subject to, the rules and regulations of CBOT.

*Tickers displayed are CME Globex product codes.

METALS

CONTRACT	FUTURES TICKER*	OPTIONS TICKER*	CONTRACT SIZE	MINIMUM TICK SIZE	FUTURES				OPTIONS				
					Average Daily Volume (ADV)	ADV % Change (Quarter YoY)	ADV Notional ($) (in Millions)	Open Interest	ADV	ADV % Change (Quarter YoY)	% Traded Elec	ADV Notional ($) (in Millions)	Open Interest
Gold[1]	GC	OG	100 troy ounces	$0.10 per troy oz.	170,366	16%	$19,126	417,079	32,283	14%	70%	$3,629	1,328,830
Copper[1]	HG	HX	25,000 pounds	$0.0005 per lb.	68,142	26%	$4,062	152,530	98	-18%	74%	$6	2,963
Silver[1]	SI	SO	5,000 troy ounces	$0.005 per troy oz. (outright transactions); $0.001 per troy oz. (spreads/settlement)	51,901	5%	$3,864	157,625	4,720	-28%	85%	$352	146,141
Platinum[2]	PL	PO	50 troy ounces	$0.10 per troy oz.	15,223	23%	$748	75,554	143	-72%	15%	$7	3,815
Palladium[2]	PA	PAO	100 troy ounces	$0.05 per troy oz.	5,859	-13%	$357	26,700	155	-76%	7%	$10	5,212

1. These contracts are listed with, and subject to, the rules and regulations of COMEX. 2. These contracts are listed with, and subject to, the rules and regulations of NYMEX.

How Plan Sponsors Use Stock Index Futures

Cash Equitization

Managing fund cash flows …

- **Equity managers may need to deploy additions or pay out withdrawals on short notice**

Buy futures ➔ To deploy capital additions

Sell futures ➔ To cover withdrawals or distributions

- **Funds managed in this way should keep pace with bogey**
- **Provides equity manager time to … (i) identify specific securities to buy or sell; and, (ii) manage order entry**

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Cash Equitization

Maintaining portfolio integrity …

- **Futures provide "beta" or "benchmark" exposure**
  - **Many index funds try to replicate performance of benchmark index**
  - **Thus, some asset managers passively buy and hold futures as proxy for portfolio investment … a "passive" investment strategy**
  - **Added benefit … frees up cash for redemptions or distributions because of futures margining policies**
- **This only works if futures provide "cheap beta" … (i) low tracking error; and (ii) low transaction costs**

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Derivatives Case Study I: Financial Weapons of Mass Destruction or Tools of the Wise?

Pretend for a moment that you are the portfolio manager of the Vanguard Group's Vanguard 500 Index fund.

The following numbers appear on your Bloomberg terminal:

E-mini S&P 500 Dec futures:	1984.00
S&P 500 Cash Index:	1994.29
LIBOR Rate:	0.23 %
Time to Expiration:	89 days

Approximately $10,000,000 in good funds needs to be invested….

What will you do ???

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Derivatives Case Study I: Financial Weapons of Mass Destruction or Tools of the Wise?

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Time to Expiration:	89 days

Approximately $10,000,000 in good funds needs to be invested….

What will you do ???

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Derivatives Case Study I: Cash Equitization

No subject engenders more phone calls than the fair value of stock index futures

Not a well understood concept…as fair value by itself gives little information. Actual basis vs. theoretical basis is more useful.

Theoretical fair value = cash[1 + (r - d)*x/365]

where:

r =	interest rate (not T-bills)
d =	dividend rate of underlying
x =	number of days until expiration

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Derivatives Case Study I: Financial Weapons of Mass Destruction or Tools of the Wise?

As of June 30, 2013, Valley Forge based *Vanguard Group* listed the following futures positions in their Vanguard 500 Index Fund

Long 1109 Sep S&P 500 stock index futures

Long 115 Sep S&P 500 E-mini stock index futures

Gus Sauter, the former CIO of Vanguard, often stated publicly how he used stock index futures as valuable tool.

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Aside from managing cash, did futures add any other benefits ?

Year	Vanguard 500 fund	S&P 500 Index	difference
2007	5.39	5.49	-.10
2008	-37.02	-37.00	-.02
2009	26.49	26.46	.03
2010	14.91	15.06	-.15
2011	1.97	2.11	-.14
2012	15.82	16.00	-.18
2013	32.18	32.39	-.21
2014	13.51	13.69	-.18
2015 ytd	- 5.38	- 5.29	-.09

*through October 23 2015, vanguard 500 annual expense ratio is 17 basis points or .17%

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How Plan Sponsors Use Interest Rate Futures

The Great Bull Market in Treasuries…..continues

10 Year Treasury Yields over 45 years

10 Year Japan JGB (Japan Government Bond) yields

But...If rates head back up…..*Measuring Risk*

Breakeven analysis…

- **Breakeven (B/E) rate analysis asks … how far must rates rise before price decline offsets 1 year of coupon income and investor breaks even?**
- **May be estimated as yield divided by duration**
- ***E.g.*, Treasury return = 0 if rates rise 28 basis points**

Breakeven (B/E) Rate Analysis
(10/2014)

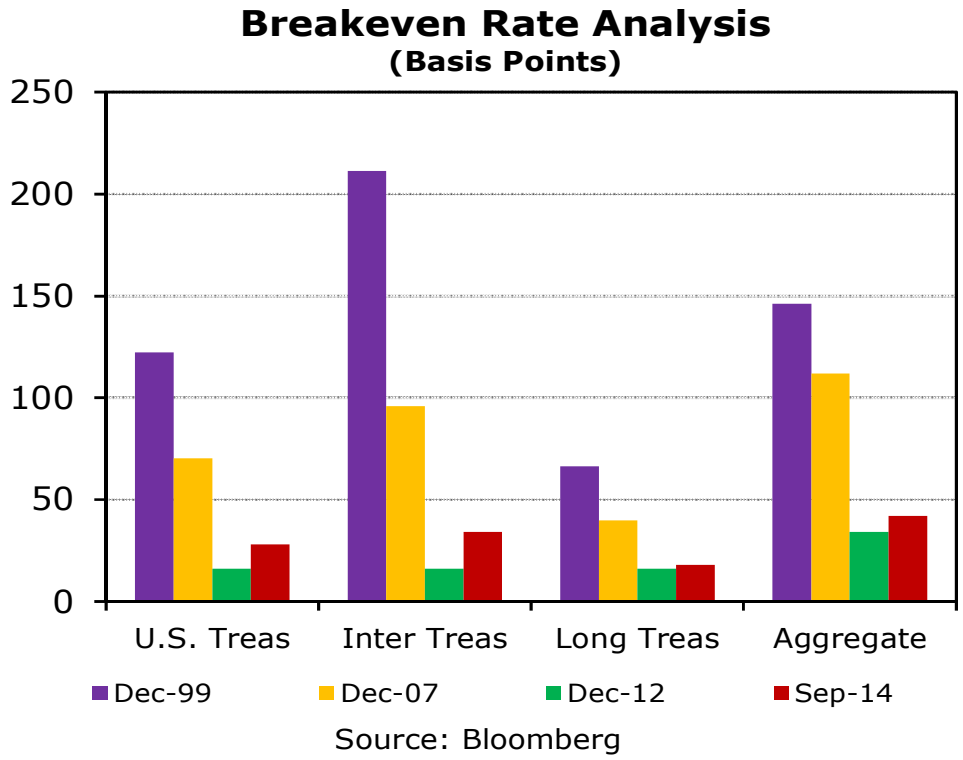
Barcap Index	2014 YTD Return	Duration (Years)	Yield	B/E Rate Advance
U.S. Treasury	3.06%	5.3	1.50%	28 bps
Intermediate Treasury	1.59%	3.7	1.27%	34 bps
Long Treasury	15.15%	16.7	3.08%	18 bps
Aggregate	4.10%	5.6	2.36%	42 bps

Source: Barclays Capital, Bloomberg

Measuring Risk

Breakeven analysis…

- **B/E Rate Advances backing off all-time historical lows … but only as rates have risen off historic lows**
- **This point, coupled with the magnitude of outstanding Treasury issuance, translates into massive potential risk borne by Treasury investors**



Managing Duration

US Treasury futures can be used to adjust duration.

$$HR = [(D_{target} - D_{current}) / D_{current}] \times (BPV_{port} \div BPV_{futures})$$

Where:

- D_{target} = revised targeted duration
- $D_{current}$ = current duration
- BPV_{port} = basis point value of the current portfolio
- $BPV_{futures} = BPV_{CTD} \div CF_{CTD}$

Managing Duration: Single Contract Overlay

Example: Long $100 million U.S Treasury portfolio with an average modified duration of 6.0 years, and a BPV of $600 per million. The PM is concerned rates may rise. How many contracts should she sell to adjust the duration from 6.0 to 4.5 years?

Step 1: Identify which contract to use
Step 2: Identify that contract's CTD issue
Step 3: Calculate contract's CF adjusted BPV
Step 4: Calculate HR

Managing Duration: Single Contract Overlay

Step 1: Identify which contract to use

Contract	Coupon	Maturity	Net Basis	BPV/mm	CF	BPV/cf	Mod Dur
TUH5	0.875	12/31/2016	1.59	19.53	0.9160	21.33	1.94
FVH5	1.500	5/31/2019	-1.47	42.81	0.8362	51.19	4.22
TYH5	2.125	9/30/2021	-0.81	64.66	0.7939	81.45	6.21
USH5	6.250	5/15/2030	-0.25	171.14	1.0245	167.05	11.01

The contract with a duration close to your targeted duration is generally the best for a single contract overlay.

For this example we will use the FVH5 as its duration is closest to our 4.5 year target.

Managing Duration: Single Contract Overlay

Step 2: Identify that contract's CTD issue

Contract UST 5-Year Note MAR 120.295 Repo Rate 0.16

100000 Notional # Days 77

Coupon	Maturity	Basis/32s	BPV/m	CF	Carry	Net Basis
1.500	5/31/2019	7.57	42.81	0.8362	9.04	-1.47
1.625	6/30/2019	17.36	43.73	0.8380	9.94	7.41
1.625	7/31/2019	25.94	44.50	0.8352	9.91	16.03
1.625	8/31/2019	36.78	45.23	0.8324	9.86	26.91
1.750	9/30/2019	44.15	46.13	0.8345	10.72	33.43
1.500	10/30/2019	54.02	46.58	0.8220	9.04	44.98
1.500	11/30/2019	64.36	47.37	0.8192	9.04	55.31
1.625	12/31/2019	74.83	48.33	0.8215	9.95	64.88

Step 3: Calculate contract's CF adjusted BPV

BPVcontract = BPVctd ÷ CFctd

BPVcontract = $42.81 / 0.8362 = $51.20 per $100,000 face amount

Managing Duration: Single Contract Overlay

Step 2: Calculate Hedge Ratio

HR = [(Dtarget – Dcurrent) / Dcurrent] x (BPVport ÷ BPVfutures)

HR = [(4.5 – 6.0) / 6.0] x (60000 / 51.20)

HR = -0.25 x 1171.875

HR = -292.96 or Sell 293 FVH5 contracts to adjust portfolio's duration from 6.0 to 4.5 years.

Managing Duration: Single Contract Overlay

Shortening duration in anticipation of higher rates

If yields rise by 100 basis points, portfolio value may decline by 4.5% or $4.5 million

But this is preferable to 6% or $6.0 million decline if duration unadjusted

$1.5 million or 150 basis points (1.50%) represents “alpha” or enhanced return

Sell 293 Five-year T-note futures ➔ **Reduces portfolio duration from 6.0 to 4.5 years**

Disclaimer

Futures trading is not suitable for all investors, and involves the risk of loss. Futures are a leveraged investment, and because only a percentage of a contract's value is required to trade, it is possible to lose more than the amount of money deposited for a futures position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles. And only a portion of those funds should be devoted to any one trade because they cannot expect to profit on every trade.

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