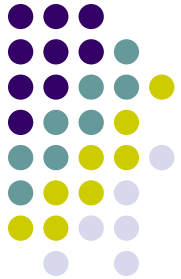
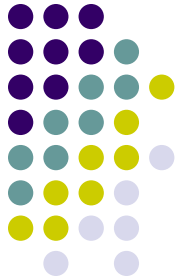
PERSI CONVENTIONAL INVESTING



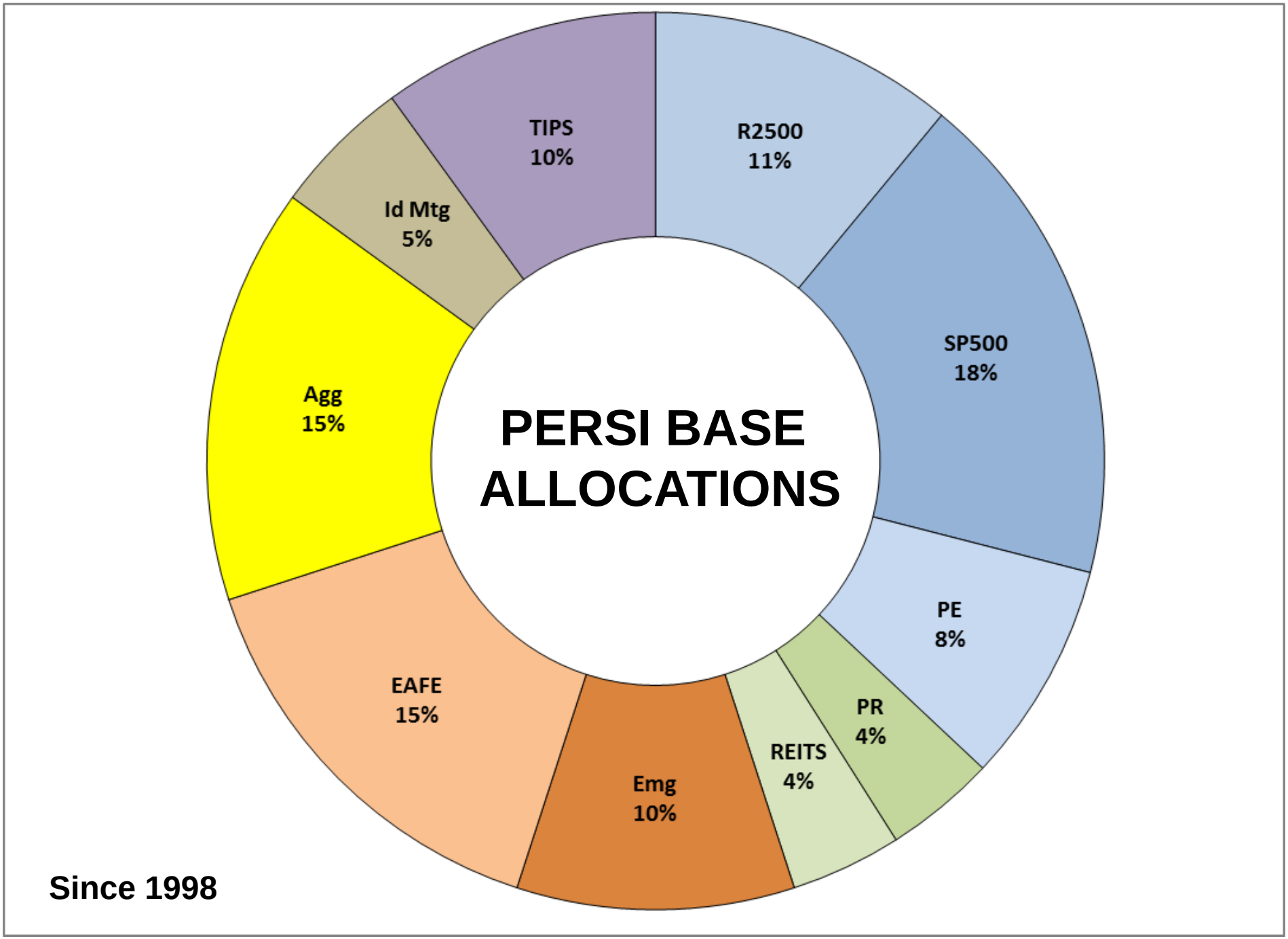
- **Simple**
  - Rely primarily on public markets as traditionally defined
  - 70/30 for 4%-5% real returns
- **Transparent –**
  - **Primarily liquid daily priced public securities**
  - Standard institutional private equity and real estate
- **Focused**
  - 10 traditional asset types
- **Patient** (5-10 Year Time Horizon)
  - Recognize markets are abnormal in nearer term

- Well established and easily explained tradition
- Produces Long Term Returns Equal to or Better than Alternative Approaches (e.g. Endowment Model)

PORTFOLIO DECISIONS



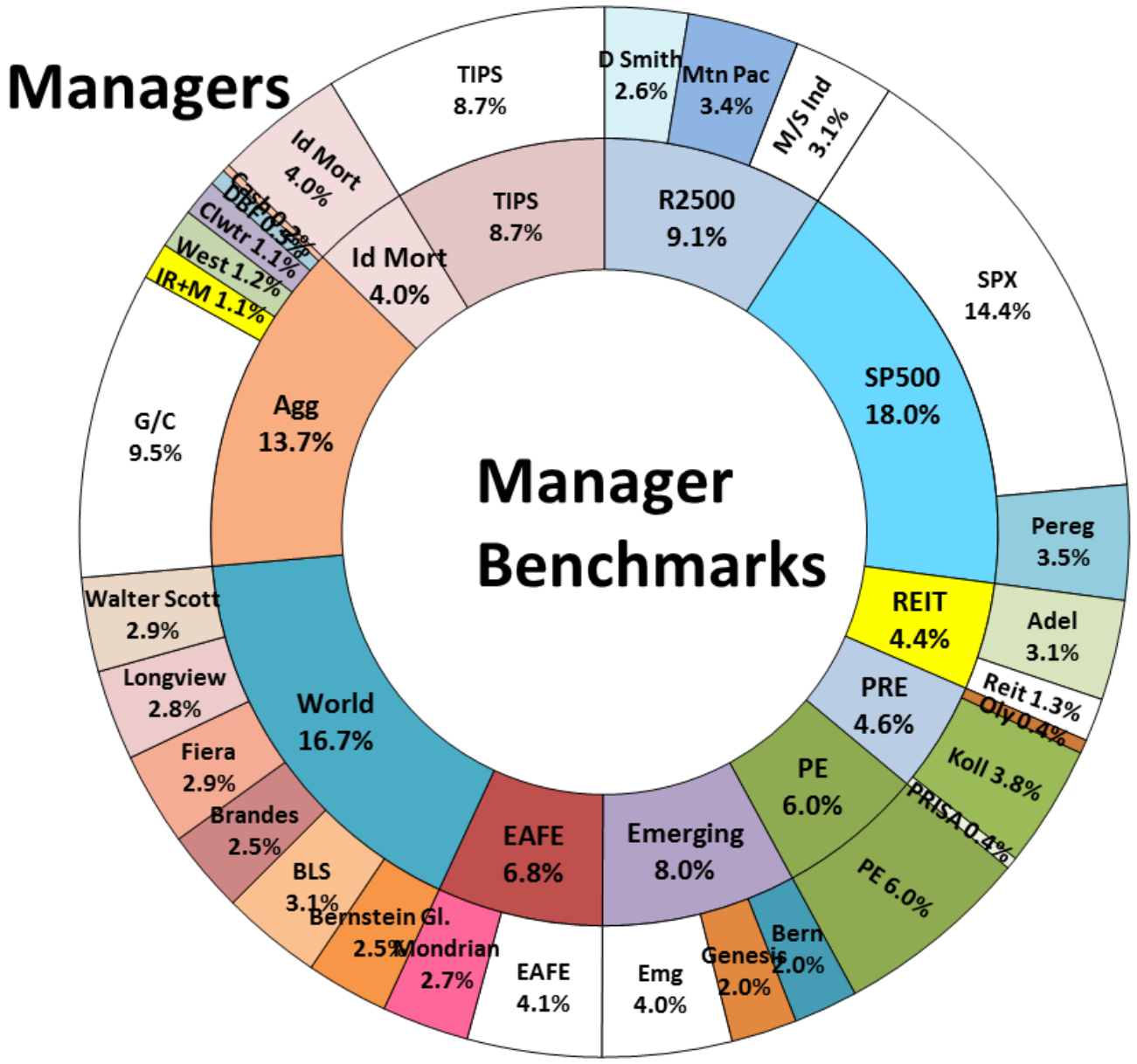
- Determine Basic Equity/Fixed Split
  - 70/30 FOR 3%-5% REAL RETURNS
- Home Country Bias
  - US BIAS
- Additional Diversification and Other Changes
  - 10 Traditional Asset Types
- Monitor Drift and Rebalancing
- Active/Passive Management Impact
  - 50% Indexed, 35% Traditional Active, 15% Private


PERSI BASE ALLOCATIONS
TIPS 10%
R2500 11%
SP500 18%
PE 8%
PR 4%
REITS 4%
Emg 10%
EAFE 15%
Agg 15%
Id Mtg 5%

Since 1998

Managers

- **Core Passive – 50%**
  - Basic Exposure
  - Cost Control
  - Risk Control, Rebalancing, Easy Transitions
- **Active Public Managers – 35% Private -15%**
  - Clear Styles or Concentrated Portfolios
    - No “Black Boxes”
  - No “Nine Box” Structures
  - “No Whining” Rule
    - Control Cash through Drift
    - “Guidelines” are Manager Expectations in Normal Times
  - Concentrated Relationships
    - Public – 18
    - Private -22
    - Real Estate - 2


Managers
Manager Benchmarks
TIPS 8.7%
D Smith 2.6%
Mtn Pac 3.4%
M/S Ind 3.1%
SPX 14.4%
Pereg 3.5%
Adel 3.1%
Reit 1.3%
Oly 0.4%
Koll 3.8%
PRISA 0.4%
PE 6.0%
Bern 2.0%
Genesis 2.0%
Emg 4.0%
EAFE 4.1%
Mondrian 2.7%
Bernstein Gl. 2.5%
BLS 3.1%
Brandes 2.5%
Fiera 2.9%
Longview 2.8%
Walter Scott 2.9%
G/C 9.5%
IR+M 1.1%
West 1.2%
Clwtr 1.1%
DBE 0.5%
Cash 0.2%
Id Mort 4.0%
TIPS 8.7%
R2500 9.1%
SP500 18.0%
REIT 4.4%
PRE 4.6%
PE 6.0%
Emerging 8.0%
EAFE 6.8%
World 16.7%
Agg 13.7%
Id Mort 4.0%

WHY CONVENTIONAL FOR PERSI?

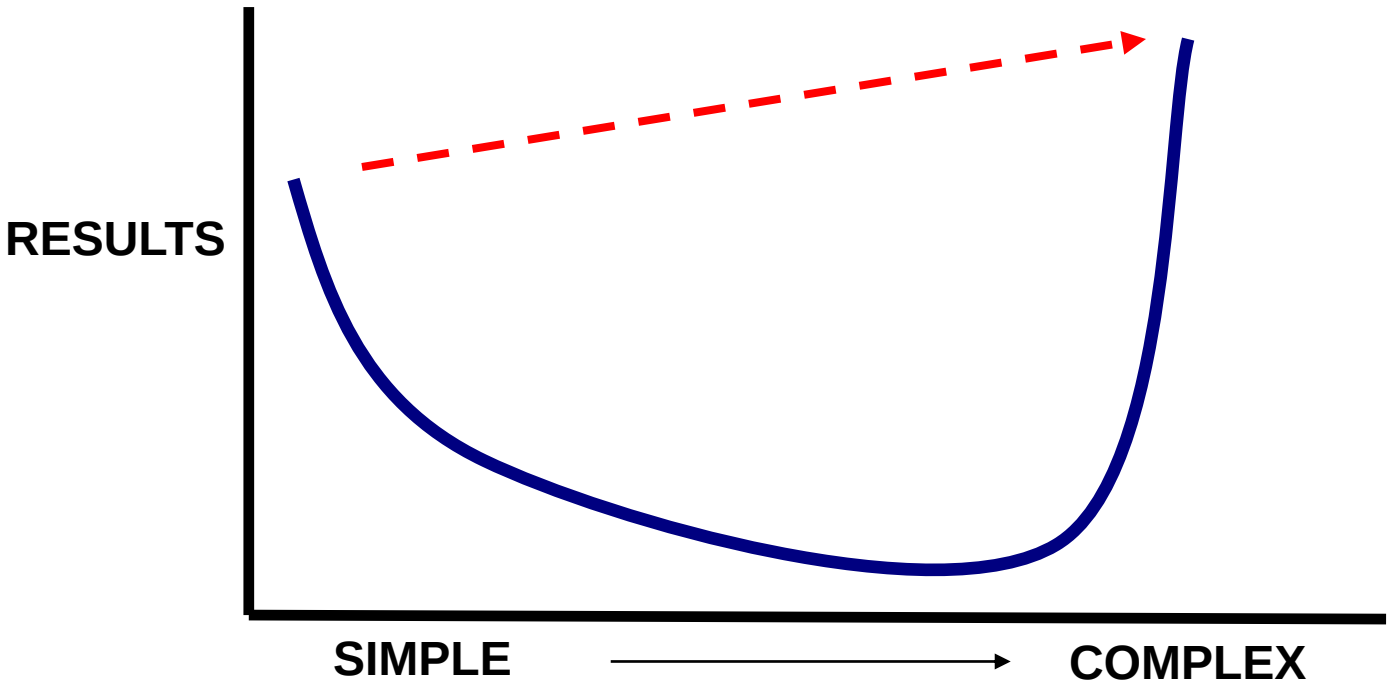
- **Conservative Return Needs**
  - **PERSI only needs market returns – 7.0% Nominal 4.0% Real**
  - **No evidence complexity adds to returns**

- **Resource Constraints**
  - **Small staff and public five member Board**
  - **In-house budget appropriated**
  - **All actions public**

- **Control**
  - **Simpler the portfolio, easier to monitor and operate**

- **Other**
  - **Easier to explain with well-understood concepts**
  - **Inexpensive (< 30 Basis Points)**
  - **Constituency has accepted through crises – has shown patience**
  - **Past was a mess: 1992 60% funded, bottom of peer universe**
  - **Competitive Returns, both in normal and crisis periods**

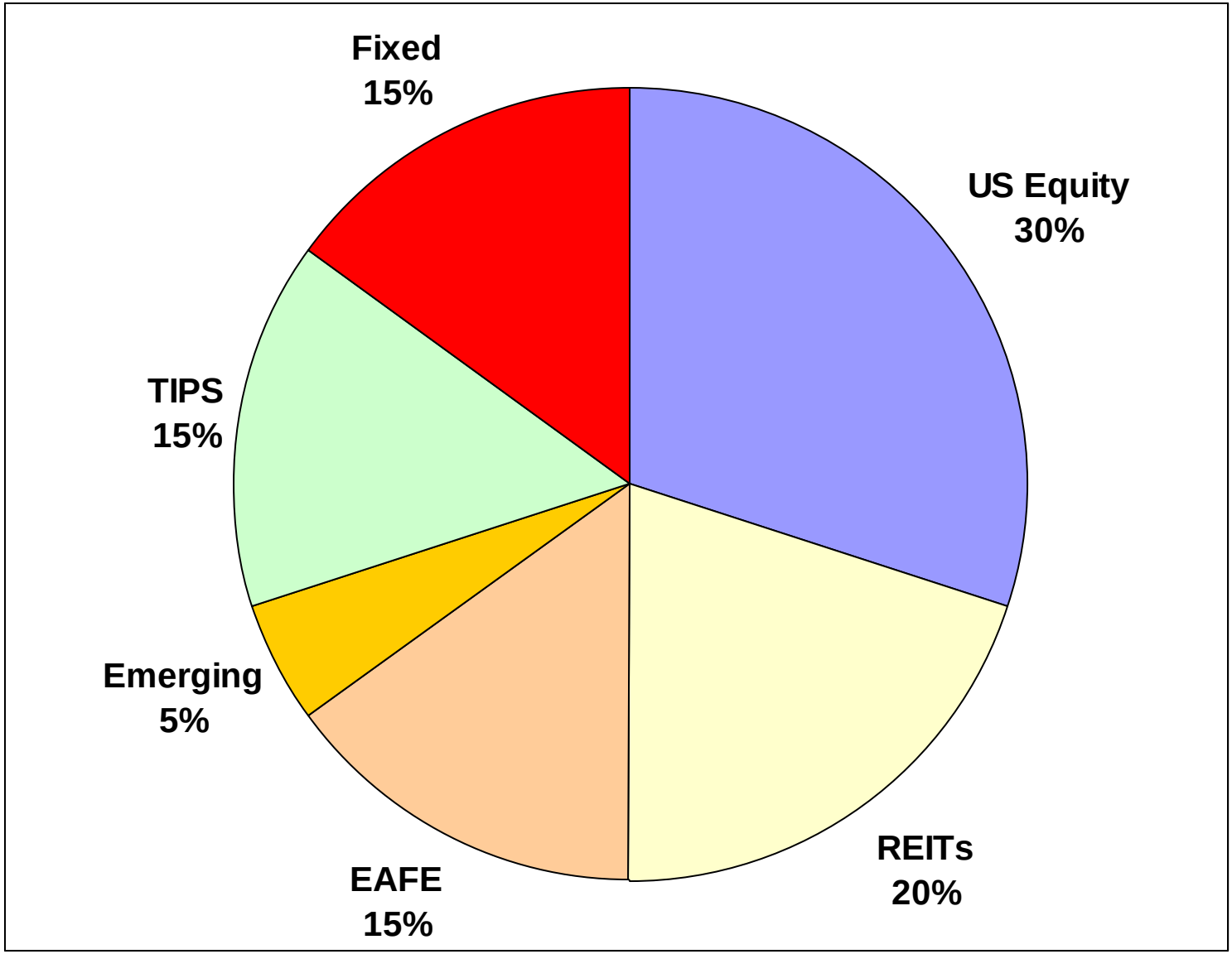
THE SWENSEN "J" CURVE



"**Few institutions and even fewer individuals exhibit the ability and commit the resources to produce risk-adjusted excess returns. . . .. No middle ground exists.** Low-cost passive strategies suit the overwhelming number of individual and institutional investors without the time, resources, and ability to make high-quality active management decisions. **The framework of the Yale model applies to only a small number of investors with the resources and temperament to pursue the grail of risk-adjusted excess returns."**

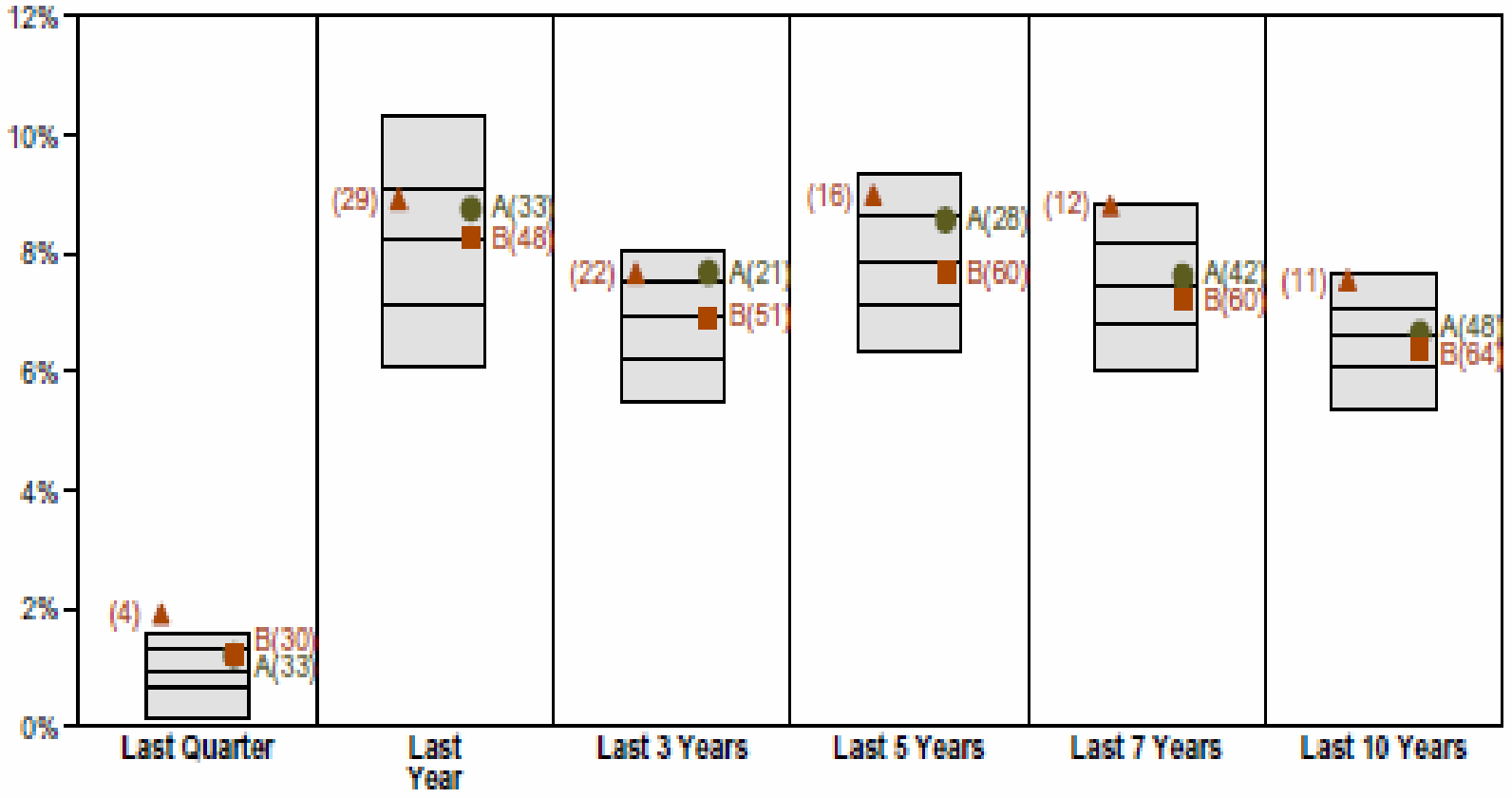
Dr. David Swensen The Yale Endowment 2013 Annual Report at p. 15 (emphasis added)

DAVID SWENSEN ***UNCONVENTIONAL SUCCESS***: A FUNDAMENTAL APPROACH TO PERSONAL INVESTMENT, Free Press, 2005



June 30, 2018

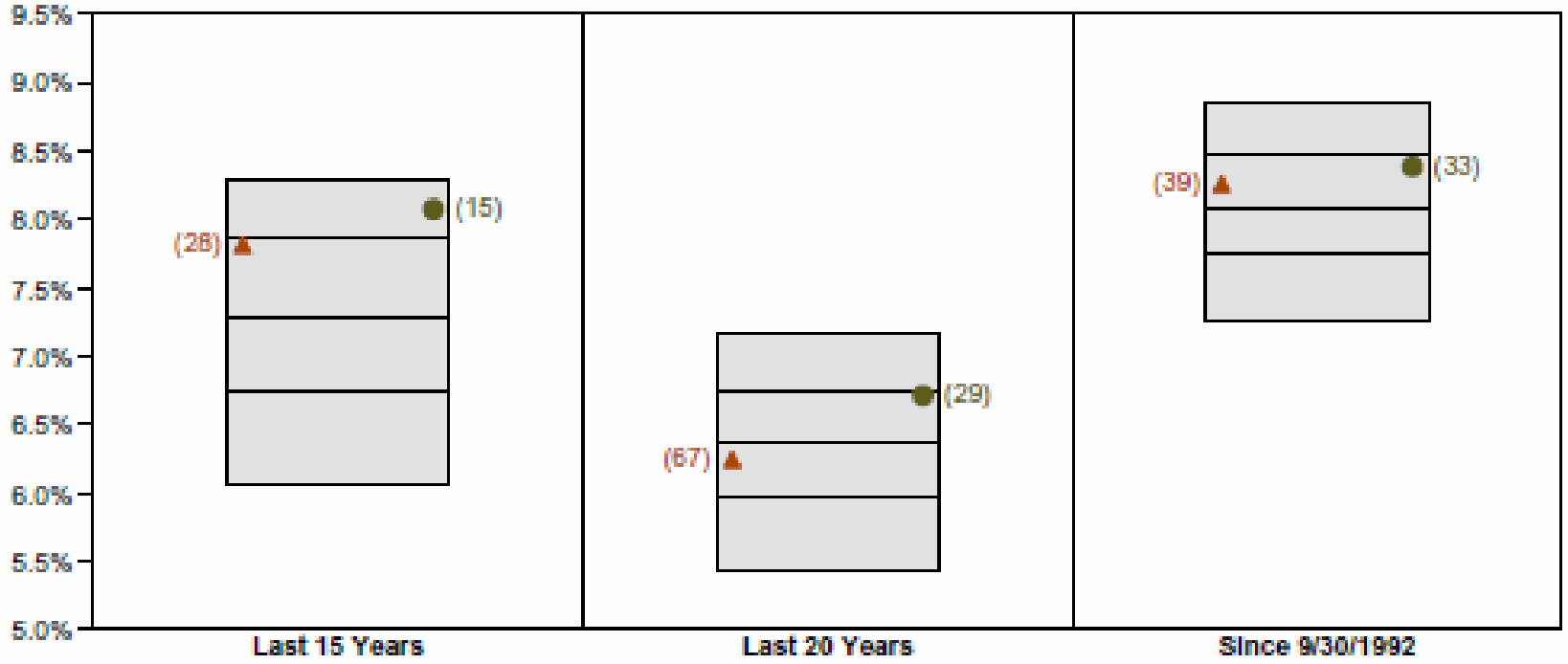
Performance vs Callan Public Fund Sponsor Database (Gross)



	Last Quarter	Last Year	Last 3 Years	Last 5 Years	Last 7 Years	Last 10 Years
10th Percentile	1.60	10.31	8.07	9.34	8.85	7.65
25th Percentile	1.34	9.09	7.54	8.66	8.18	7.05
Median	0.95	8.23	6.96	7.87	7.44	6.61
75th Percentile	0.64	7.15	6.24	7.14	6.80	6.11
90th Percentile	0.13	6.06	5.49	6.32	6.05	5.35
Total Fund ● A	1.21	8.74	7.67	8.56	7.61	6.64
Policy Target ■ B	1.24	8.27	6.91	7.67	7.22	6.37
LT Target ▲	1.91	8.90	7.66	8.98	8.80	7.54

June 30, 2018

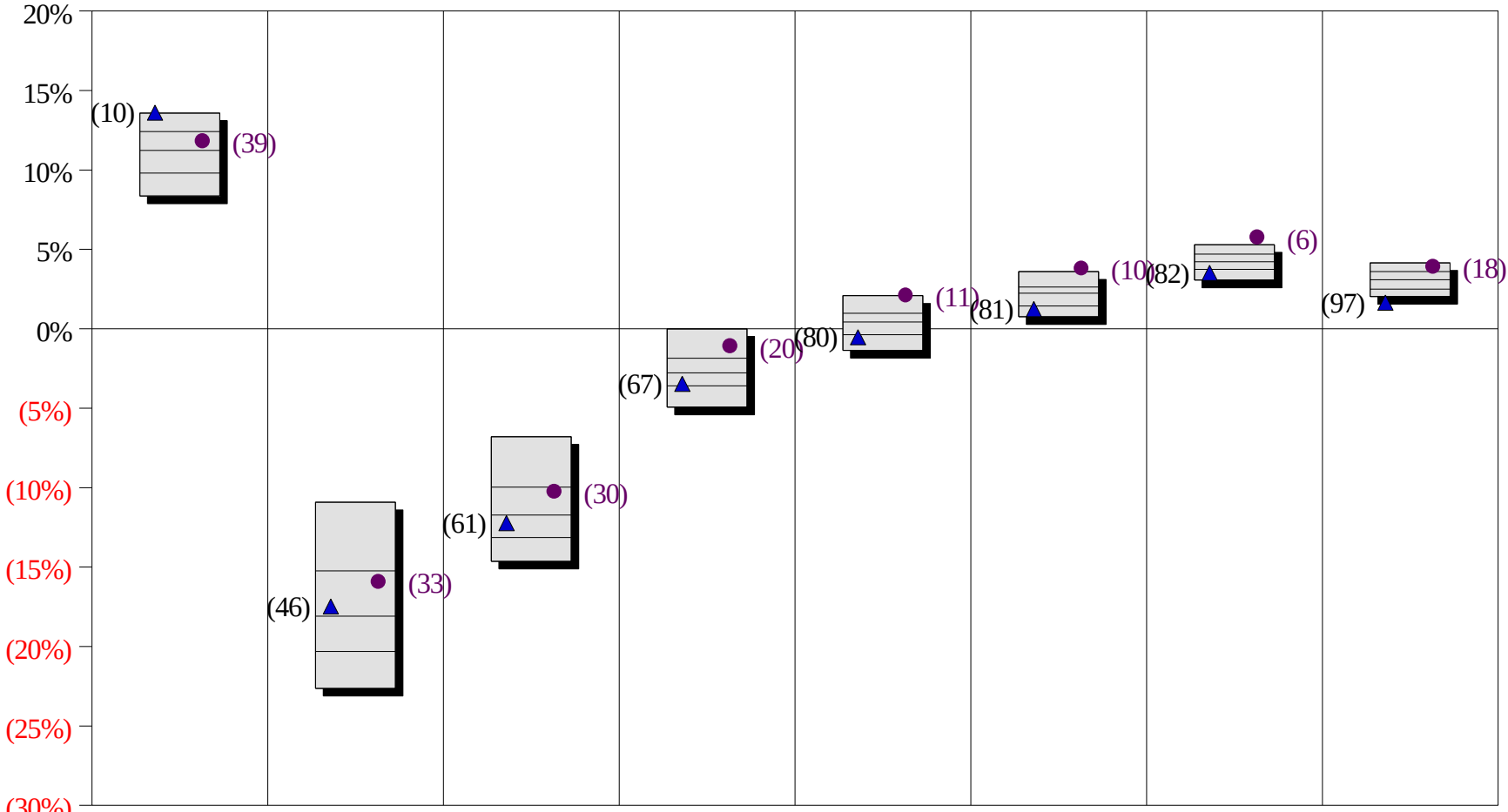
Performance vs Callan Public Fund Sponsor Database (Gross)



	Last 15 Years	Last 20 Years	Since 9/30/1992
10th Percentile	8.29	7.15	8.86
25th Percentile	7.88	6.75	8.48
Median	7.29	6.37	8.08
75th Percentile	6.74	5.97	7.75
90th Percentile	6.07	5.42	7.27
Total Fund ●	8.07	6.71	8.39
LT Target ▲	7.61	6.24	8.26

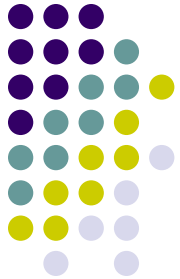
June 30, 2009

Performance vs CAI Public Fund Sponsor Database



	Last Quarter	Last Year	Last 2 Years	Last 3 Years	Last 4 Years	Last 5 Years	Last 7 Years	Last 10 Years
10th Percentile	13.58	(10.92)	(6.79)	(0.01)	2.08	3.59	5.29	4.15
25th Percentile	12.41	(15.24)	(9.97)	(1.85)	0.98	2.63	4.70	3.59
Median	11.23	(18.09)	(11.73)	(2.77)	0.42	2.25	4.21	3.08
75th Percentile	9.80	(20.32)	(13.15)	(3.60)	(0.38)	1.43	3.74	2.50
90th Percentile	8.36	(22.64)	(14.64)	(4.93)	(1.37)	0.75	3.07	2.03
Total Fund ●	11.70	(16.04)	(10.36)	(1.19)	2.00	3.70	5.64	3.79
Total Fund Target ▲	13.60	(17.48)	(12.23)	(3.46)	(0.53)	1.24	3.52	1.65

SWENSEN PEER RANKINGS
Total Funds: Foundations and Endowments
BNY Mellon Universe – June 30, 2012 (236 Funds)

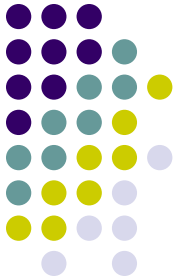


	1 Yr	2Y	3Y	4Y	5Y	7Y	10Y
Return %	***4.1***	***13.7***	***15.9***	***5.0***	***2.9***	***6.1***	***8.0***
Yale	***4.7***	***13.0***	***11.6***	***1.2***	***1.8***	***8.1***	***10.6***
Median	**0.2**	**9.4**	**10.6**	**2.4**	**1.5**	**5.1**	**6.6**
Rank	***7***	***2***	***1***	***5***	***16***	***22***	***15***
(1 Highest)							
Yale	***6***	***5***	***15***	***73***	***43***	***4***	***1***

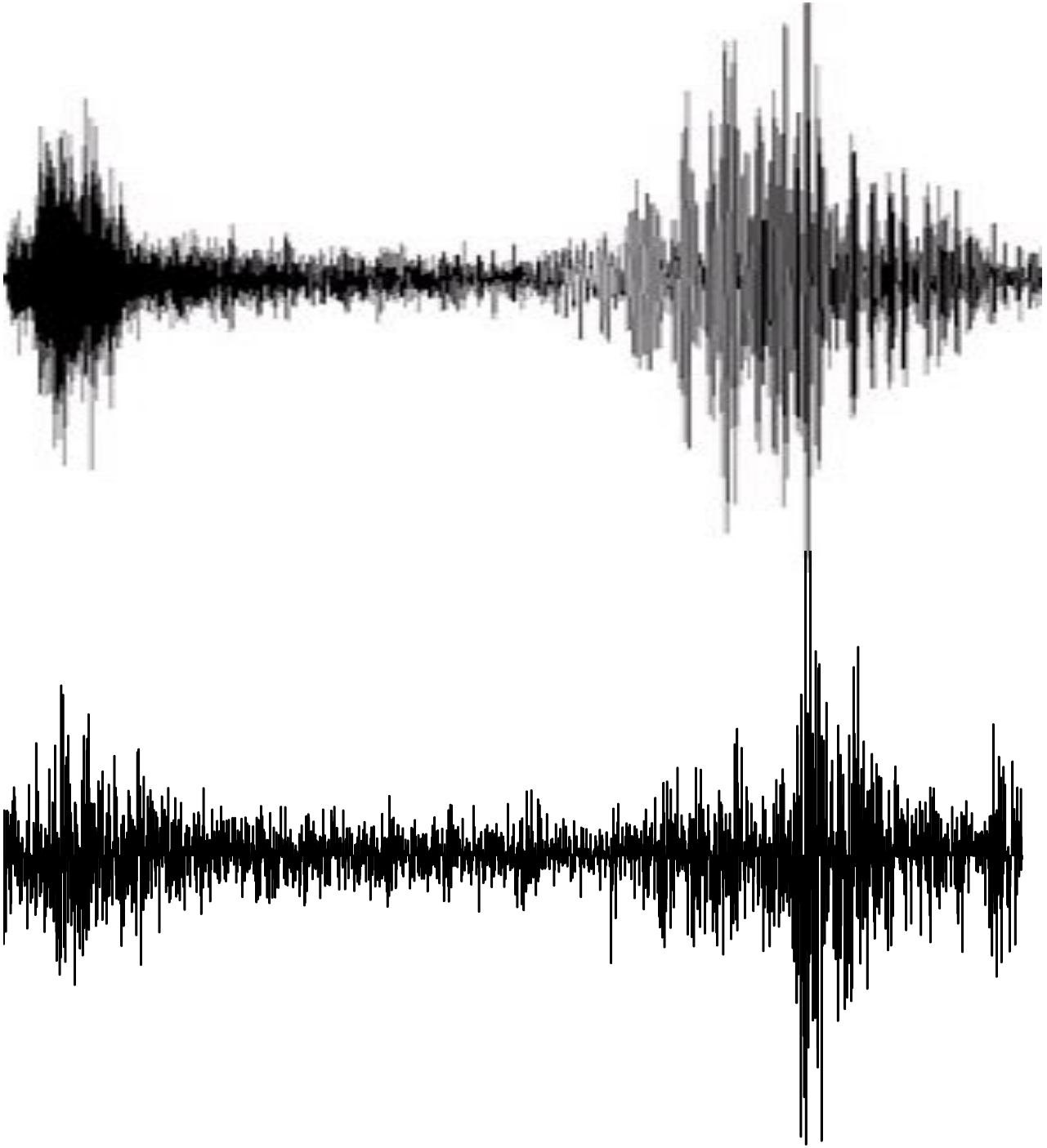
ENDING June 30, 2014		ENDING December 31, 2013		ENDING March 31, 2014	
FUNDS	**5 Year**		**5 Year**		**5 Year**
Swensen	**14.7%**	New Zealand	**16.2%**	**Swensen**	17.3%
Columbia	**14.2%**	**Swensen**	15.5%	Median PF	**14.5%**
Princeton	**14.0%**	Median PF	**12.6%**	CalPERS (net)	**13.0%**
Yale	**13.5%**	Ontario Teach	**12.4%**	GIC	**12.4%**
Notre Dame	**13.2%**	Norway	**12.0%**	Aust Fut Fund	**11.2%**
MIT	**13.2%**	APFC	**11.2%**	PSP	**11.0%**
Median PF	**13.1%**	CalPERS (net)	**10.9%**	CPPIP	**10.0%**
Stanford	**13.1%**	Temasek	**10.9%**	BC	**9.4%**
Dartmouth	**13.0%**	Caisse Depot	**10.0%**		
Penn	**12.8%**	Alberta	**8.8%**		
Chicago	**12.6%**	OMERS	**8.4%**		
CalPERS	**12.5%**	KIC	**8.3%**		
Cornell	**11.7%**	ATP	**7.5%**		
Harvard	**11.6%**				
Brown	**11.5%**				

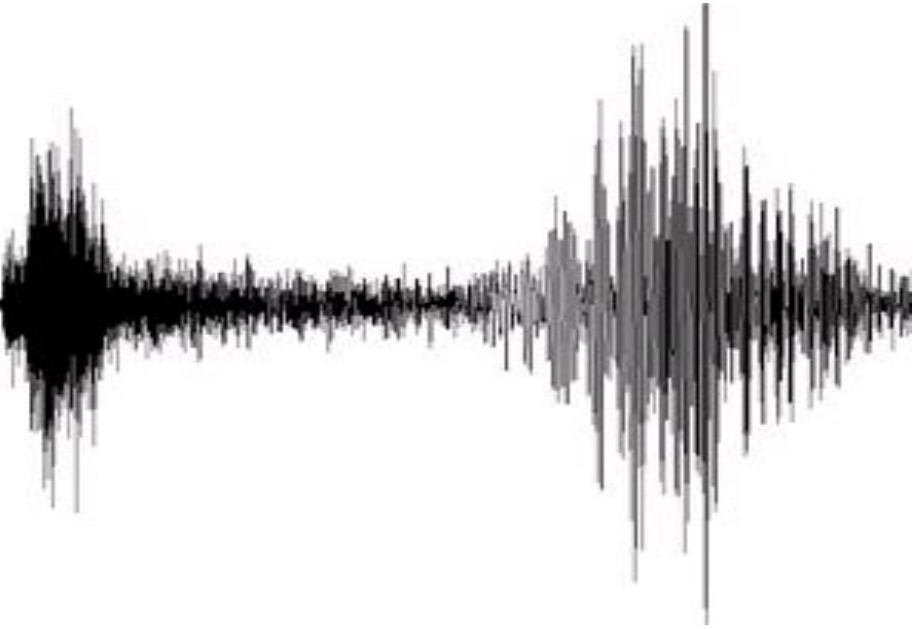
PROBLEMS WITH STANDARD APPROACH: EMOTIONAL EXHAUSTION

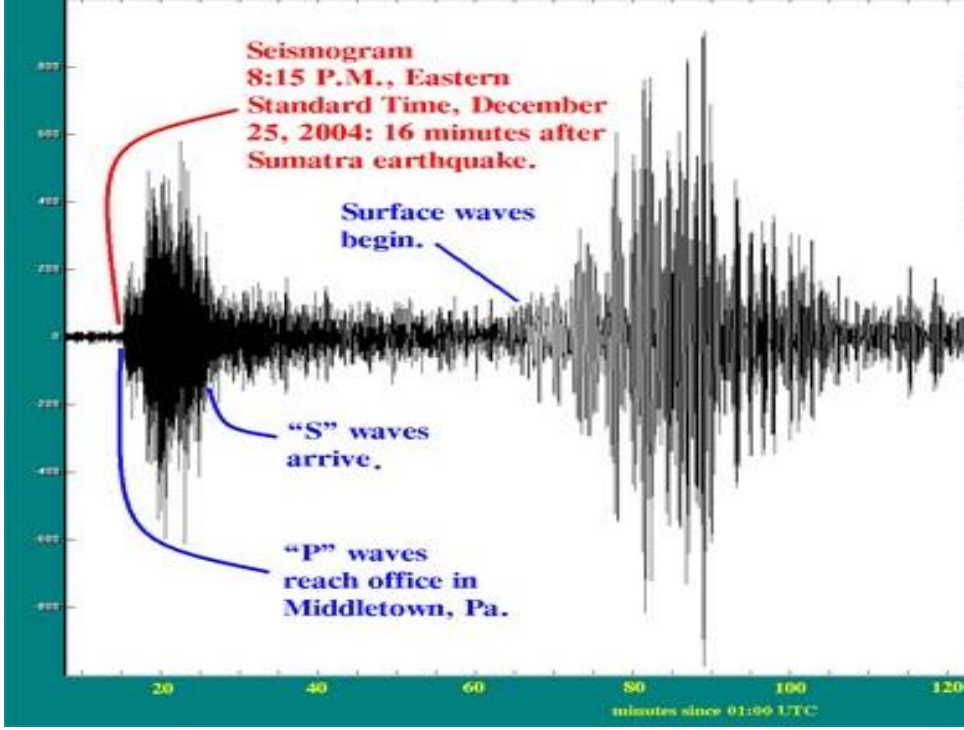
NEED PATIENCE

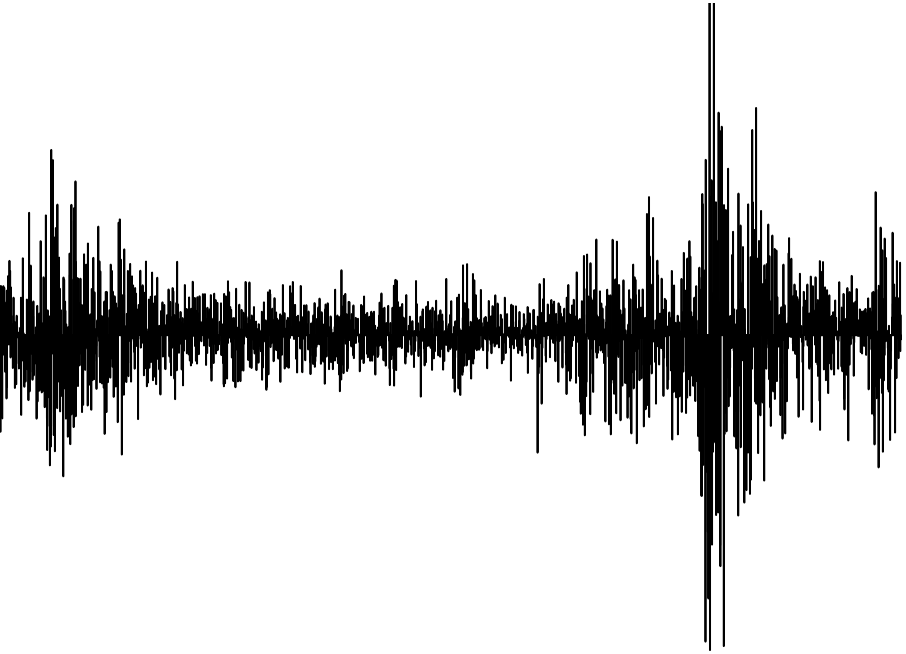


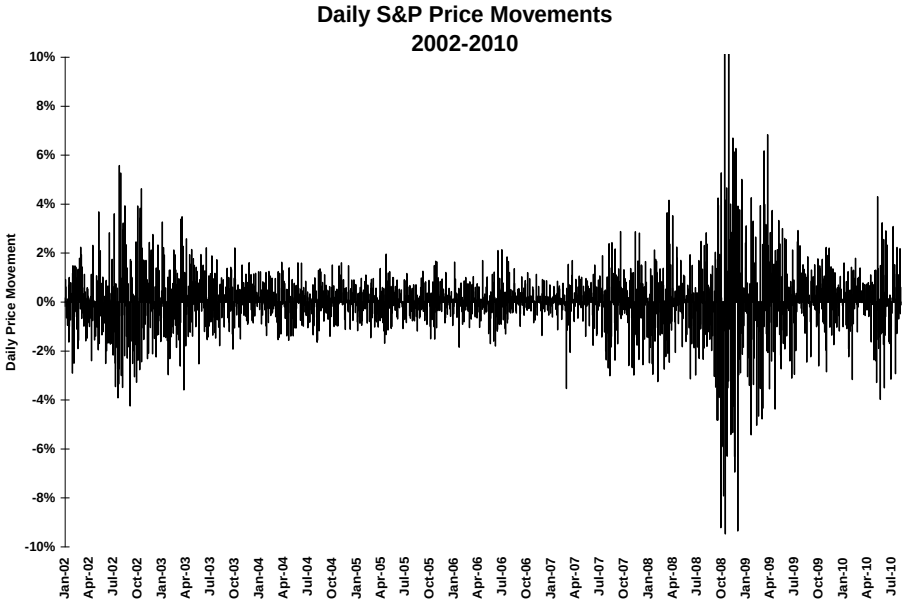
- **Need to wait 5-20 years for results**
- **Dependent on "Equity Risk" and Return**
  - **Must accept short term roller coaster volatility**
- **Abandon quest for higher than market returns**
  - The Vegas Effect
- **Boring**
  - **Harder to do nothing rather than something – "CNBC disease"**
- **Assumptions do not apply in shorter term (1-4 Years)**
  - **Markets not efficient or rational**
  - **Prices are not random in "coin tossing sense"**
  - **Risk often not related to return**
  - **Diversification no protection in crisis: just equities, government bonds, and cash**
  - **Problem of complex markets and complex adaptive systems in near term:**
    - **Mandelbrot and Hudson, *The (Mis)Behavior of Markets, (*Basic Books 2004)**
    - **Phillip Ball, *Critical Mass* (Farrer, Strauss and Giroux 2004)**
    - **Nassim Taleb, *The Black Swan (2nd Ed)* (Random House 2007)**






Seismogram
8:15 P.M., Eastern Standard Time, December 25, 2004: 16 minutes after Sumatra earthquake.
Surface waves begin.
"S" waves arrive.
"P" waves reach office in Middletown, Pa.
20
40
60
80
100
120
minutes since 01:09 UTC




Daily S&P Price Movements
2002-2010
Daily Price Movement
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
-10%
Jan-02
Apr-02
Jul-02
Oct-02
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
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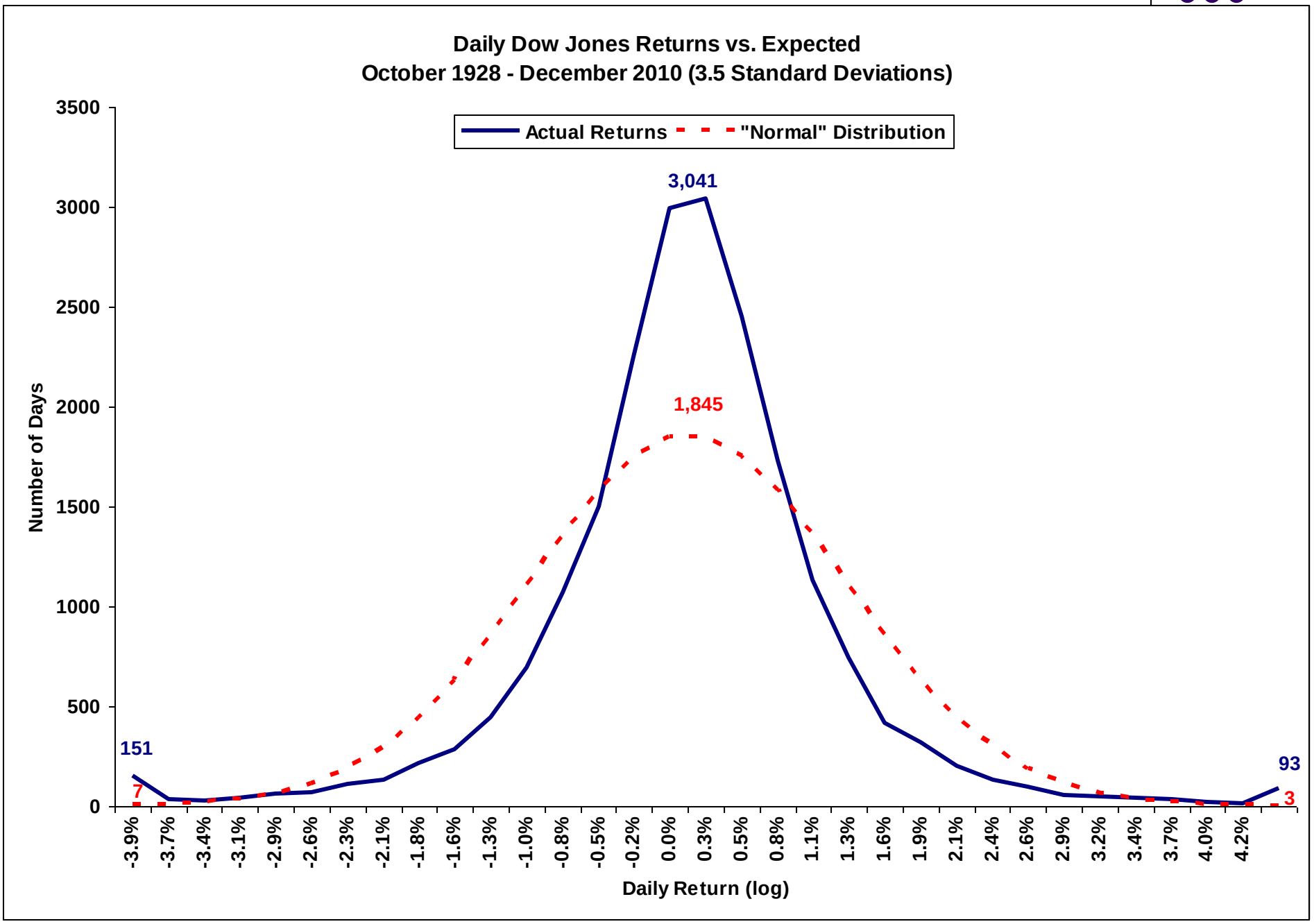
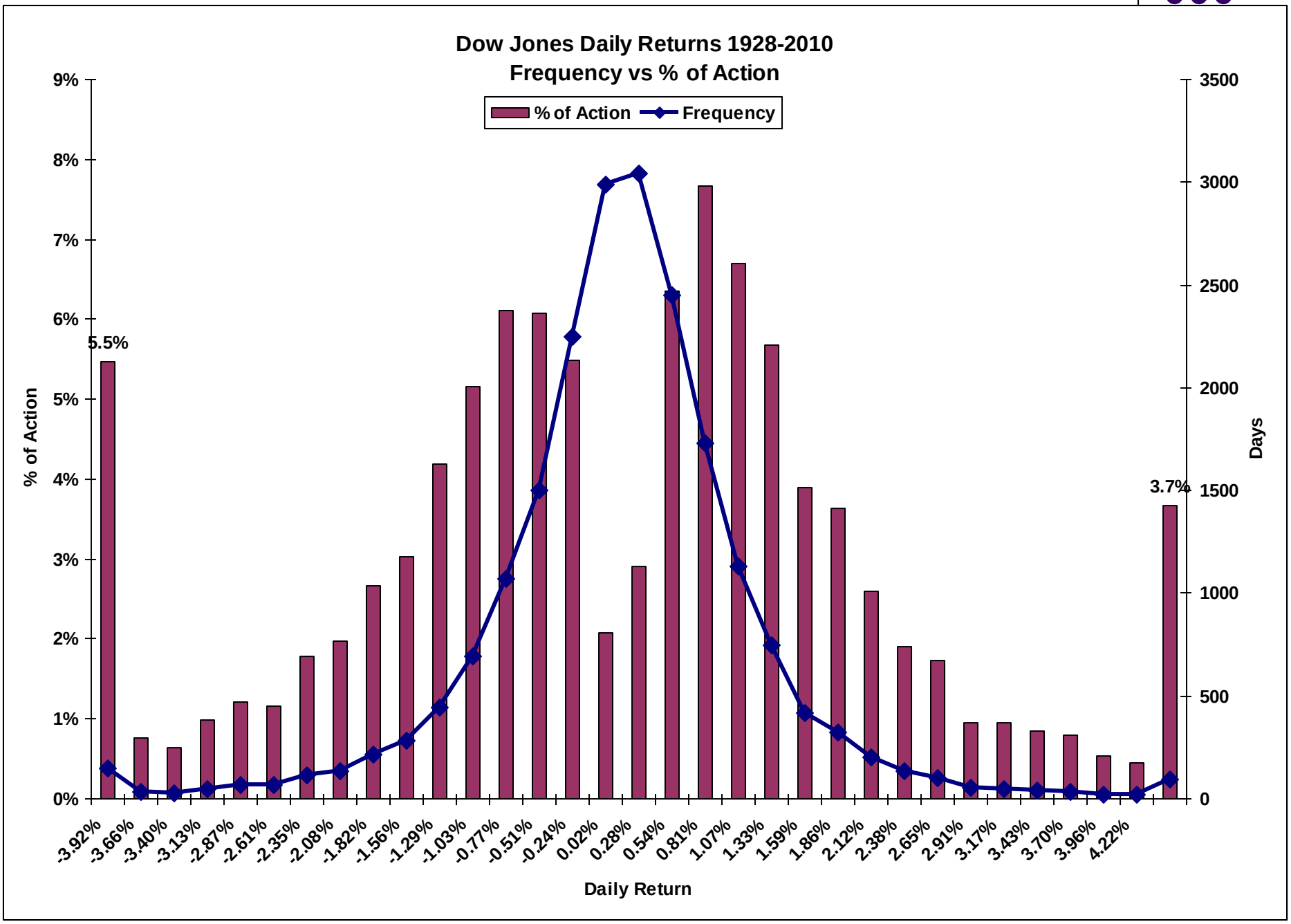
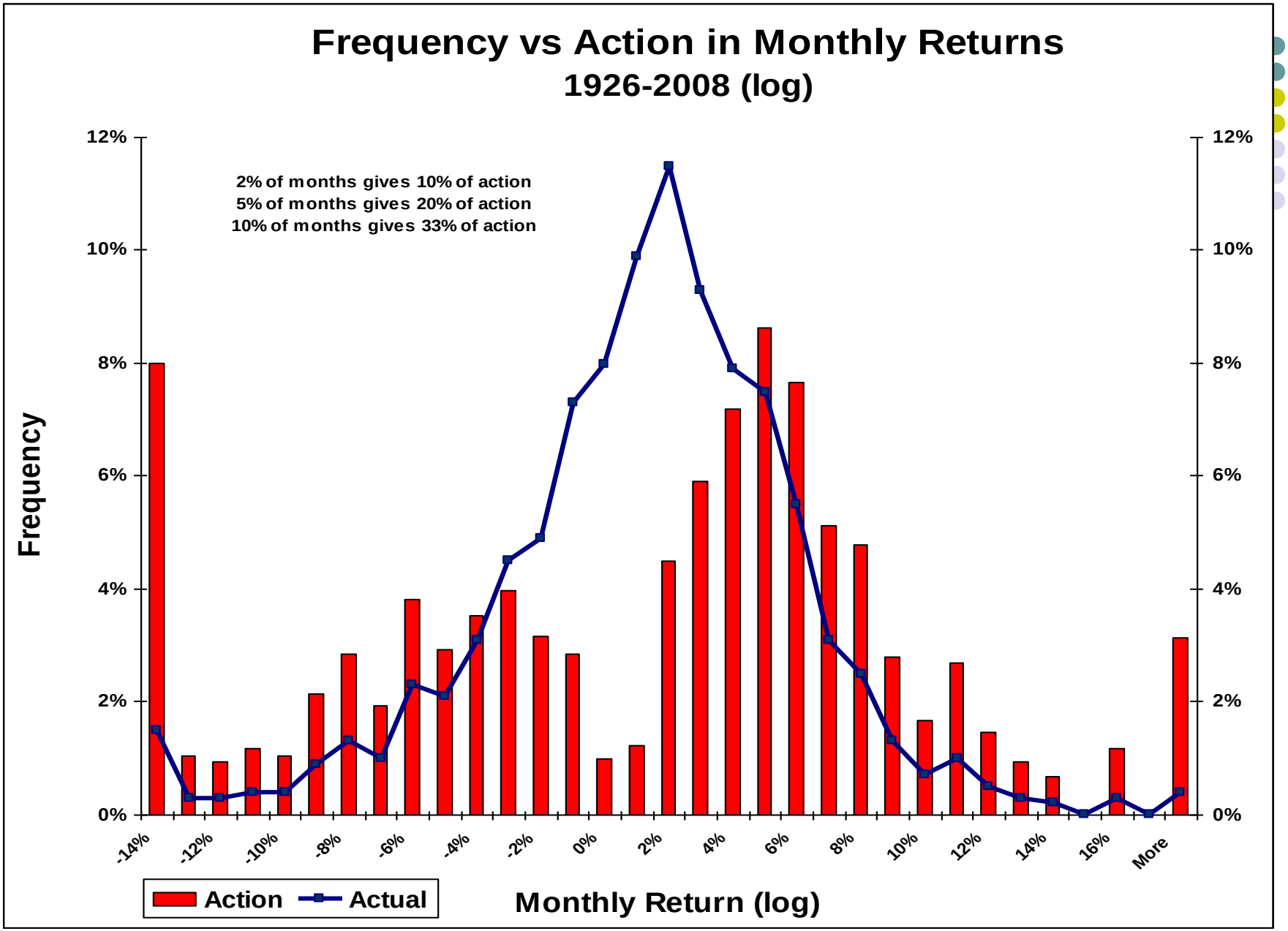
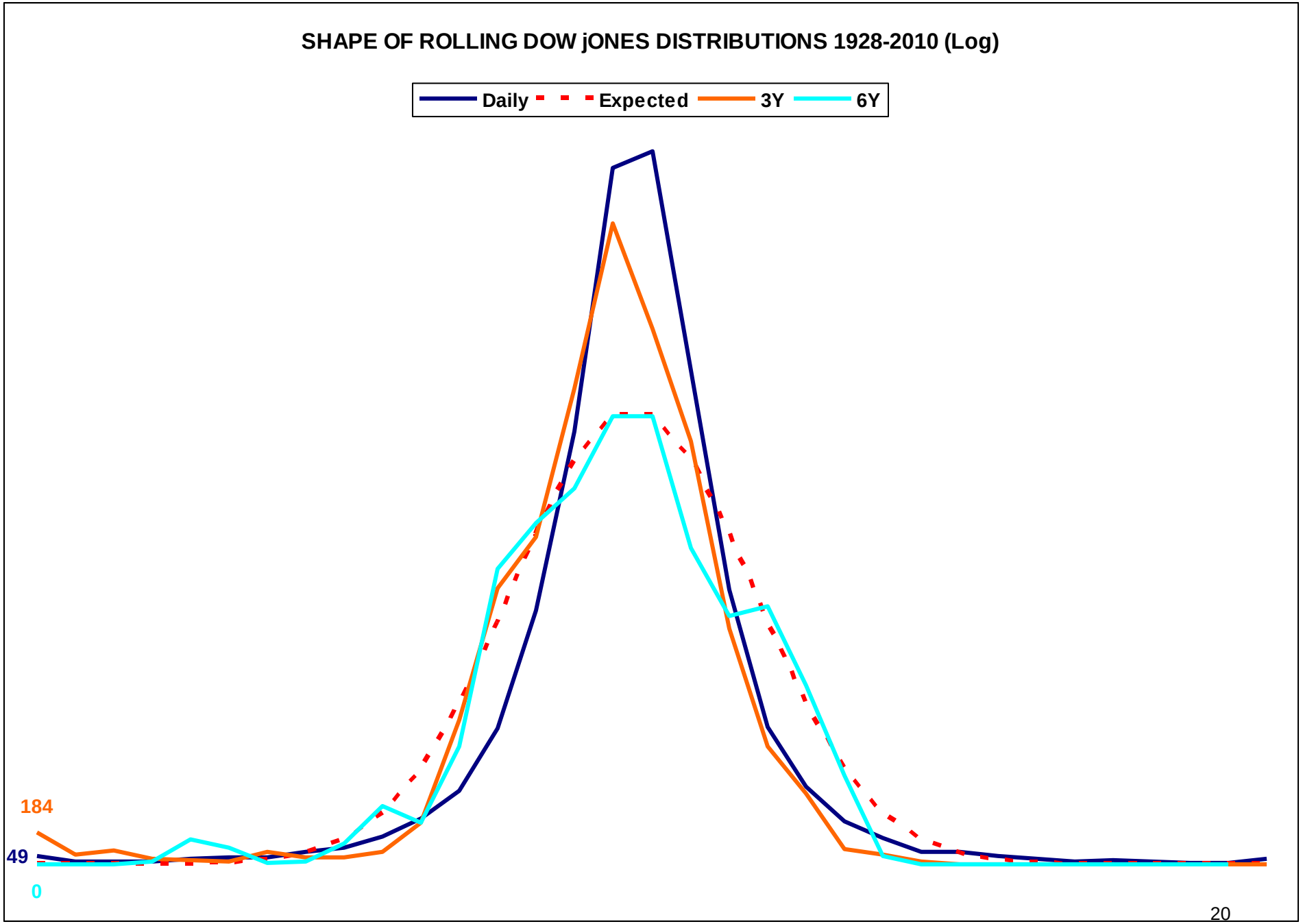
Apr-09
Jul-09
Oct-09
Jan-10
Apr-10
Jul-10


Daily Dow Jones Returns vs. Expected
October 1928 - December 2010 (3.5 Standard Deviations)
Actual Returns
"Normal" Distribution
Number of Days
Daily Return (log)
3,041
1,845
151
7
93
3
3500
3000
2500
2000
1500
1000
500
0
-3.9%
-3.7%
-3.4%
-3.1%
-2.9%
-2.6%
-2.3%
-2.1%
-1.8%
-1.6%
-1.3%
-1.0%
-0.8%
-0.5%
-0.2%
0.0%
0.3%
0.5%
0.8%
1.1%
1.3%
1.6%
1.9%
2.1%
2.4%
2.6%
2.9%
3.2%
3.4%
3.7%
4.0%
4.2%


Dow Jones Daily Returns 1928-2010
Frequency vs % of Action
% of Action
Frequency
% of Action
Days
Daily Return
5.5%
3.7%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
3500
3000
2500
2000
1500
1000
500
0
-3.92%
-3.66%
-3.40%
-3.13%
-2.87%
-2.61%
-2.35%
-2.08%
-1.82%
-1.56%
-1.29%
-1.03%
-0.77%
-0.51%
-0.24%
0.02%
0.28%
0.54%
0.81%
1.07%
1.33%
1.59%
1.86%
2.12%
2.38%
2.65%
2.91%
3.17%
3.43%
3.70%
3.96%
4.22%



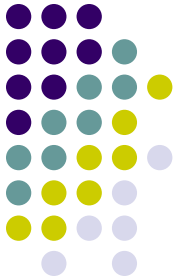
Source: Actual returns from Ibbotson's *Stocks, Bonds Bills and Inflation,* as of 12/31/08. Expected returns generated randomly using Ibbotson data.
Past performance is not a guarantee of future results.


SHAPE OF ROLLING DOW jONES DISTRIBUTIONS 1928-2010 (Log)
Daily
Expected
3Y
6Y
184
49
0
20

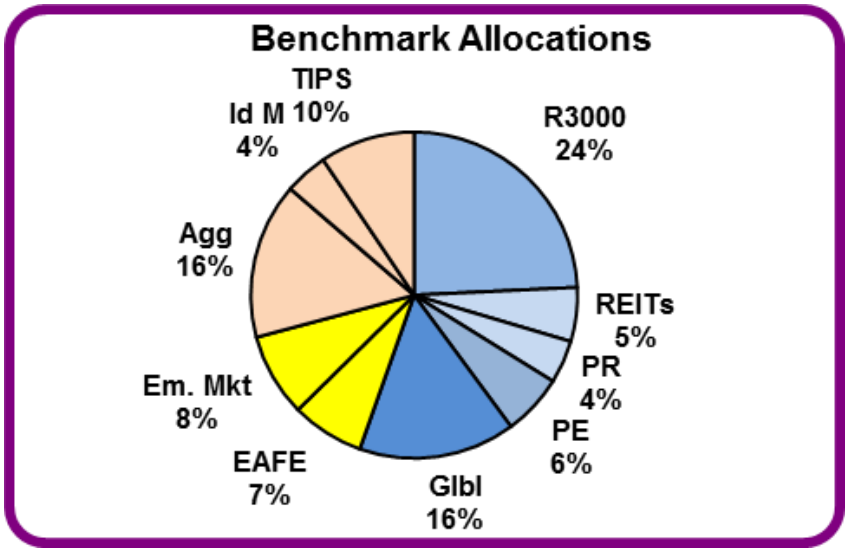
APPENDIX I

REBALANCING

DRIFT AND REBALANCING



- Drift
  - Equity Bias for Long Term Return and Cash Reinvestment
- Occasional rather than Strict Rebalancing
  - Non-Linear Benefits from “Free Lunch”
  - Macro Consistency/ Active Management Issue
    - Everyone can’t do a mean reversion strategy at once
  - Benefits only in 10-30 year period
    - Longer Periods (30+ years) should never rebalance: stocks should become main asset
    - 40 basis points a year over 10 years, not consistently
  - Needs to be monitored



	Month	3 MO	FYTD	1 Yr	2 Yr	3 Yr	4 Yr	5 Yr
Total Fund	1.8%	3.7%	12.1%	12.8%	6.0%	6.1%	7.8%	9.1%
No rebalancing	1.4%	3.0%	12.7%	12.7%	5.9%	6.4%	8.4%	10.7%
Benchmark (55-15-30)	1.4%	3.0%	12.4%	12.6%	6.2%	6.6%	8.6%	10.8%
PERSI rebalancing	1.4%	3.0%	13.1%	13.3%	6.4%	6.9%	9.0%	11.1%

MAY 31, 2017

APPENDIX II

THE ALTERNATIVES

ENDOWMENT MODEL

RISK BASED PORTFOLIOS

RISK BUDGETING

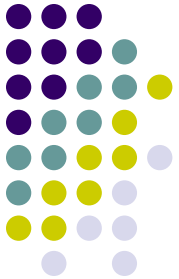
RISK PARITY

RISK FACTORS

“Kristopher "Kip" McDaniel, Editor-in-Chief and EVP, aiCIO; Ken Frier, CIO, UAW Retiree Medical Benefits Trust; Eugene Podkaminer, Vice President, Capital Markets Research Group, Callan Associates; and Andrew Ang Columbia Business School ***share a hearty laugh over the poor souls still using the asset class model.”***

Picture and Caption aiCIO Alert 12/16/2013 (emphasis added)

The "Endowment Model"

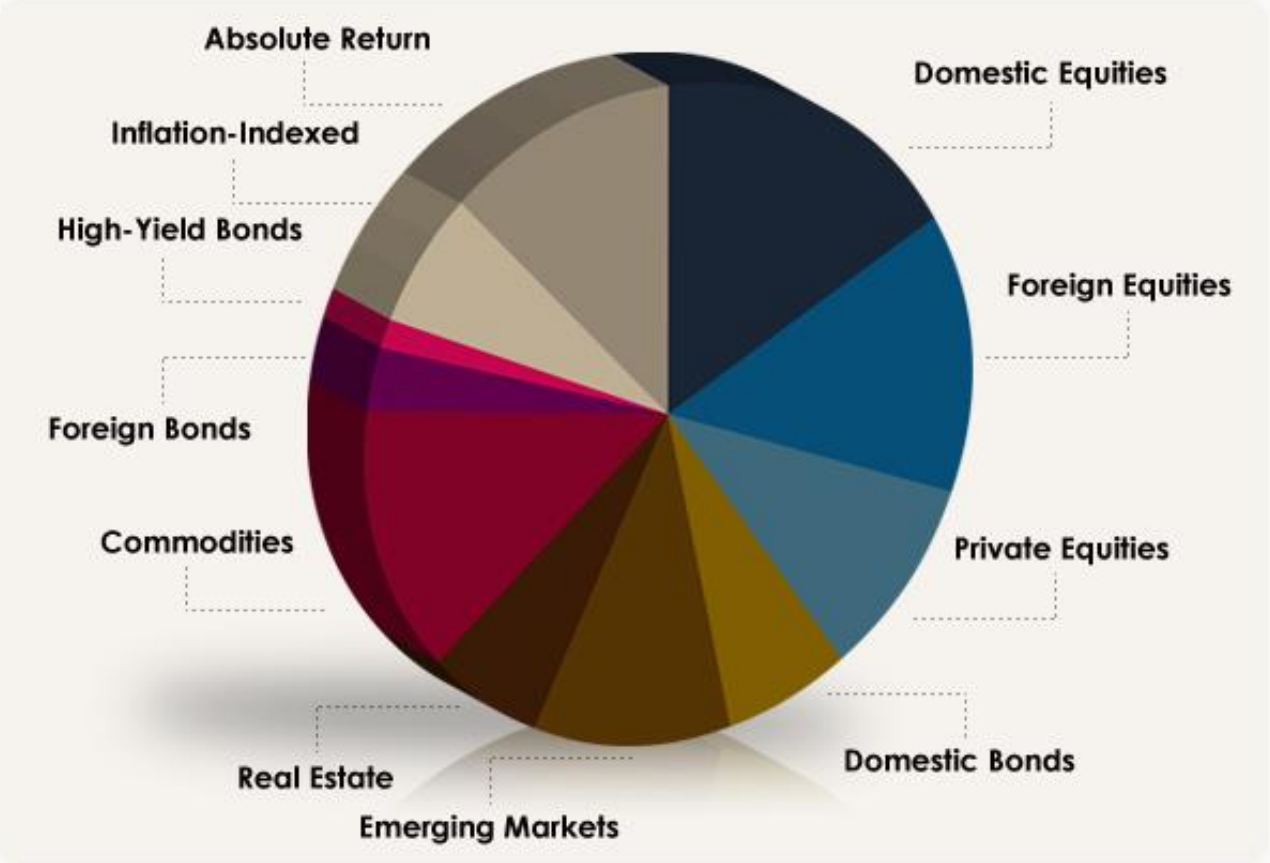


- **Reduces Exposures to Public Securities**
  - Few Investment Grade Bonds, Reduced Public Equities
  - Discourages "Buy and Hold" Public Securities
- **Reliance on Intense Active Management**
  - Hedge Fund, Opportunistic Investment
- **Greater Investment in Private and Illiquid Vehicles**
- **Belief in Commodities and other non-traditional assets (Timber, Infrastructure) as "real return" asset types**
- **Often re-structures the fund into investment factors rather than asset classes**
  - Separation of "beta" (market) and "alpha" (manager skill)
  - Inflation, credit exposure, interest rates, special opportunities
- **Attempts to Manage through a Crisis**
  - Changing allocations for "new" investment environment
  - Delay or soften rebalancing to await calmer times

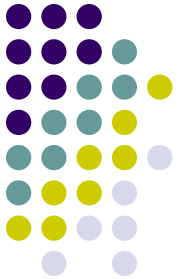
2008

HARVARD MANAGEMENT COMPANY, INC.

Non-Cash Asset Allocation

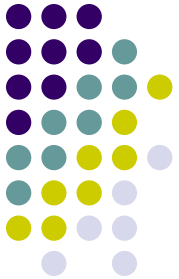


Example: ENDOWMENT MODEL FAILED STRESS TEST OF 2008-2009 Conventional Investing Passed



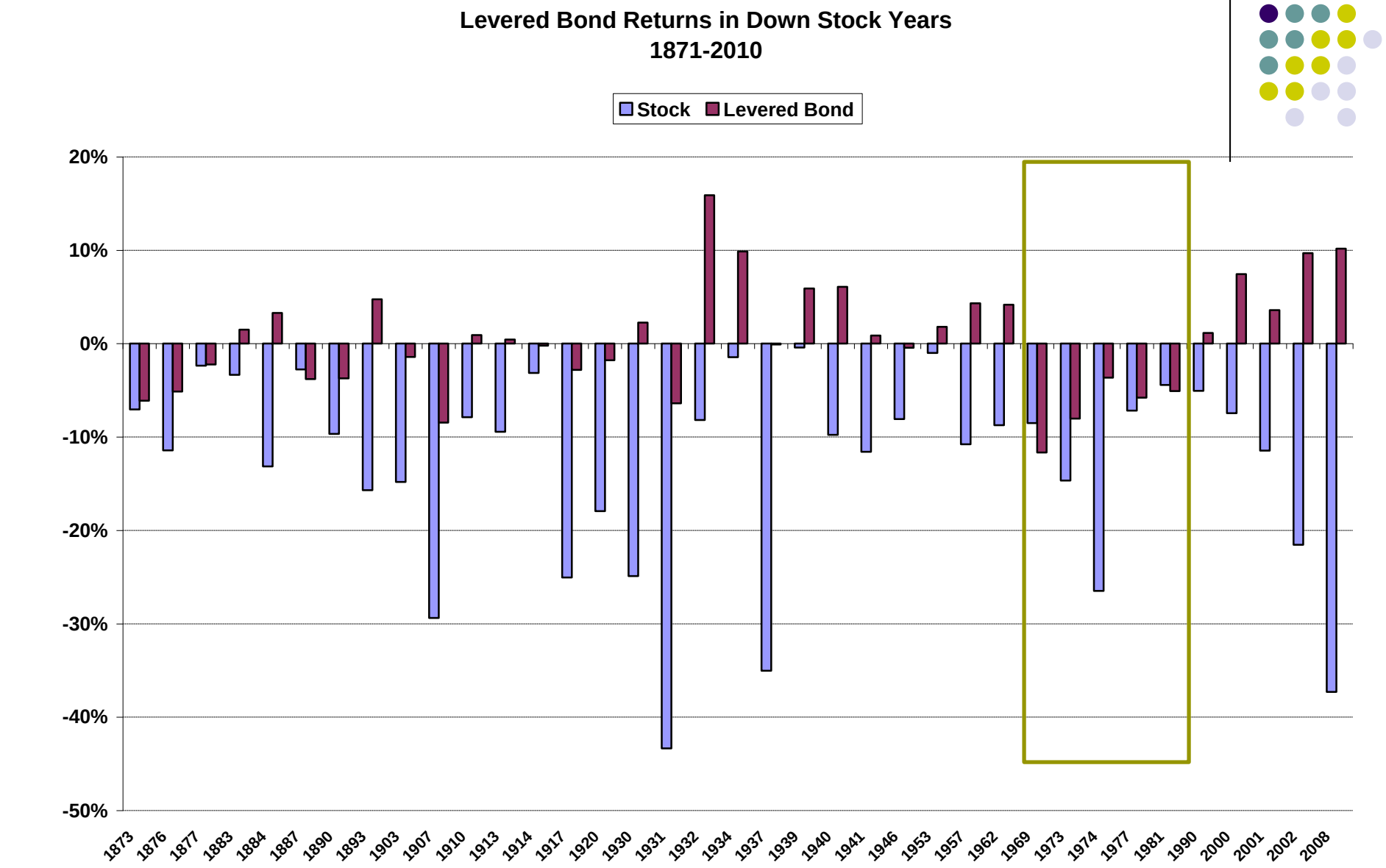
- **More volatile than simple portfolios**
  - Extra “diversification” failed – no place to hide
  - Lost 10% more than simple funds in FY 2009
    - Harvard -27.3%, Stanford -25.9%, Yale -24.3%
    - PERSI -16.3%, Nevada -15.7%, Median Public -16.9%
- **Active opportunistic and absolute return strategies devastated**
  - Hedge funds (-15% to -20%) vs fixed income (+6.0%)
  - Government bonds in conventional approach did their job
- **Liquidity disappeared when needed most**
  - Hedge funds gated, margin calls on leveraged strategies and portable alpha, no access to private assets
  - Sold liquid investments or borrowed at worst time
- **Opportunity Lost**
  - Unable to rebalance, missed rebound and 2%-3% rebalancing gain
- **Headline risk (e.g. Madoff and Westridge)**
- **Resource risks: Incentive compensation and resources restricted**
- **Need to pick top quartile or top decile managers consistently**
- **Institutions crippled and taking years to recover**
  - **Many still below levels at Lehman Bankruptcy**
  - Conventional approach had moderate losses and recovered quickly
    - -16% in 2009, all losses from Lehman recovered in 17 months (September 2008 to February 2010)

RESPONSE TO 2008-2009
RISK CENTRIC ASSET ALLOCATION



- Risk Budgeting
  - Attempts to Control Volatility
  - Problem of Time Frame – No Unit of Risk
  - Volatility and Diversification Paradox
- Risk Parity
  - Reduce dependence on equities, maintain return by levering bonds and other assets
  - Problem: Works when leverage works, fails when doesn't
- Risk Sleeves
  - Recast Asset Classes and group by "macro risks and returns"
  - Problem – no agreement on risk factors. Two current approaches
    - **Re-slice the pie (e.g., real assets, corporate exposure, etc.)**
      - But still have overlapping pieces
    - **Add new factors (e.g., volatility, political risk, etc.)**
      - But no real history, difficult to benchmark and invest

Levered Bonds and Risk Parity only worked consistently in last 20 years



But previous 20 years would have been a disaster, and in most of the big stock crashes

RISK SLEEVE STRUCTURES (2013)

Norway

1. Term
2. Credit Aa
3. Credit Baa
4. Credit HY
5. FX Carry
6. Liquidity
7. Value/Growth
8. Small/Large Cap
9. Momentum
10. Volatility

PCA (Jan 2013)

1. Growth
2. Private Growth
3. Absolute Return
4. Growth Diversify
5. Inflation
6. Interest Rates
7. Interest Rate Uncertainty

SDCERA

1. Growth
2. Stable Value
3. Real Assets

Danish Pension PKA
(Equity Premia includes)

1. Developed Markets
2. EM Markets
3. Frontier Markets
4. Small Cap
5. Low Volatility
6. Dividends
7. Implied Volatility
8. Momentum
9. Value
10. Quality
11. Merger Arb
12. Liquidity
13. "Tactically Traded Risk"

ATP

1. Interest Rates
2. Credit
3. Equities
4. Inflation
5. Commodities

CalSTRS (Jan 2013)

1. Growth Risk
2. Interest Rate
3. Going-In Yield
4. Inflation
5. Liquidity
6. Market Leverage
7. Regulatory/Govt
8. Unexplained

BlackRock

1. Real Rates
2. Inflation
3. Credit
4. Liquidity
5. Political
6. Economic

Alaska Permanent Fund

1. Company Exposure
2. Cash and Interest Rates
3. Real Assets
4. Special Opportunities

CalPERS

1. Growth
2. Income
3. Liquidity
4. Real Assets
5. Inflation
6. Abs. Rtn.
7. Multi

Janus Institutional

Equity
1. Systematic
2. Emerging
3. Size
4. Value

Fixed
1. Credit
2. Duration
3. Momentum

Currency
1. Carry
2. Momentum

Commodity
1. Relative Value
2. Momentum
3. Roll Yield