THE ROBUST ASSET ALLOCATION ("RAA") SOLUTION

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RAA Mission:
A low-cost, low-complexity, high-liquidity, diversified, tax-efficient, risk-managed retirement portfolio.

RAA Goal:
A One-Stop Retirement Solution.

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Presentation Outline

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WHAT IS YOUR PORTFOLIO'S MISSION?

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The Purpose-Driven Portfolio

Wealth is **built** by concentrated holdings…

…but wealth is **protected** by diversification.

- **Purpose of the portfolio:**

  Preserve and compound wealth to assure financial security.

- **Return objective:**

  RF (10Yr) + 400bps, **AFTER TAX.**

- **Risk appetite:**

  As low as practical to achieve objective.

- **Taxes:**

  A big disadvantage for private individuals ➔ minimize damage.

- **Human capital:**

  Don't confuse activity with higher risk-adjusted return potential.

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Strategy Assessment: Stick to FACTS

"Get your facts first, then you can distort 'em as you please."

– Attributed to Mark Twain

Assessment Category	Goal
Fees	Minimize
Access	Increase
Complexity	Lower
Taxes	Minimize
Search	Minimize

A One-Stop Retirement Solution Must Stick to the FACTS

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DOES COMPLEXITY ENHANCE ASSET ALLOCATION?

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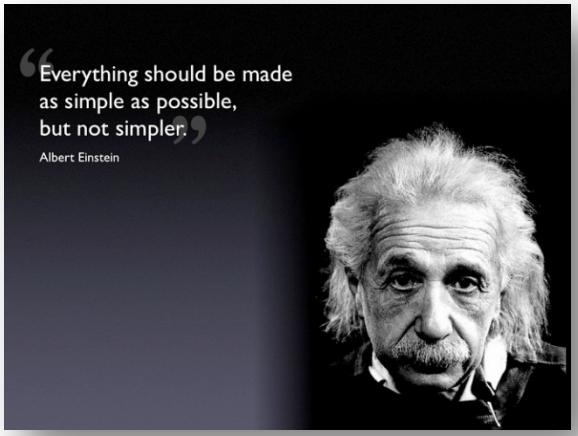
Do Fancy Models Work?

- Do Fancy Models Work? ***Not exactly…***
- "Of the 14 models we evaluate across seven empirical datasets, **none is consistently better than the 1/*N* rule…"**

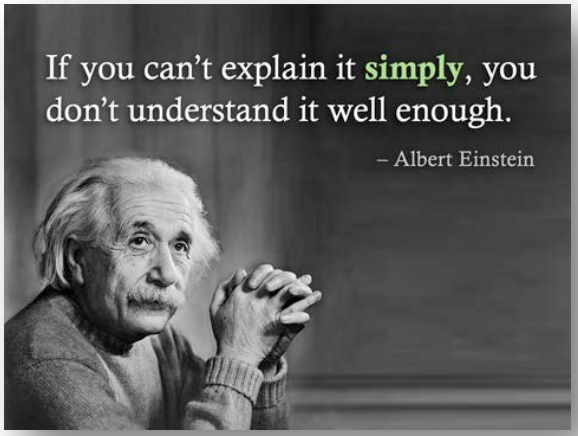
Table 3
Sharpe ratios for empirical data

Strategy	S&P sectors $N = 11$	Industry portfolios $N = 11$	Inter'l portfolios $N = 9$	Mkt/ SMB/HML $N = 3$	FF 1-factor $N = 21$	FF 4-factor $N = 24$
1/*N*	0.1876	0.1353	0.1277	0.2240	0.1623	0.1753
mv (in sample)	0.3848	0.2124	0.2090	0.2851	0.5098	0.5364
mv	0.0794	0.0679	−0.0332	0.2186	0.0128	0.1841
	(0.12)	(0.17)	(0.03)	(0.46)	(0.02)	(0.45)
bs	0.0811	0.0719	−0.0297	0.2536	0.0138	0.1791
	(0.09)	(0.19)	(0.03)	(0.25)	(0.02)	(0.48)
dm ($\sigma_\alpha = 1.0\%$)	0.1410	0.0581	0.0707	0.0016	0.0004	0.2355
	(0.08)	(0.14)	(0.08)	(0.00)	(0.01)	(0.17)
min	0.0820	0.1554	0.1490	0.2493	0.2778	−0.0183
	(0.05)	(0.30)	(0.21)	(0.23)	(0.01)	(0.01)
vw	0.1444	0.1138	0.1239	0.1138	0.1138	0.1138
	(0.09)	(0.01)	(0.43)	(0.00)	(0.01)	(0.00)
mp	0.1863	0.0533	0.0984	−0.0002	0.1238	0.1230
	(0.44)	(0.04)	(0.15)	(0.00)	(0.08)	(0.03)
mv-c	0.0892	0.0678	0.0848	0.1084	0.1977	0.2024
	(0.09)	(0.03)	(0.17)	(0.02)	(0.02)	(0.27)
bs-c	0.1075	0.0819	0.0848	0.1514	0.1955	0.2062
	(0.14)	(0.06)	(0.15)	(0.09)	(0.03)	(0.25)
min-c	0.0834	0.1425	0.1501	0.2493	0.1546	0.3580
	(0.01)	(0.41)	(0.16)	(0.23)	(0.35)	(0.00)
g-min-c	0.1371	0.1451	0.1429	0.2467	0.1615	0.3028
	(0.08)	(0.31)	(0.19)	(0.25)	(0.47)	(0.00)
mv-min	0.0683	0.0772	−0.0353	0.2546	−0.0079	0.1757
	(0.05)	(0.21)	(0.01)	(0.22)	(0.01)	(0.50)
ew-min	0.1208	0.1576	0.1407	0.2503	0.2608	−0.0161
	(0.07)	(0.21)	(0.18)	(0.17)	(0.00)	(0.01)

1) Keep it Simple



2) Complex ≠ Value



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Source: DeMiguel, V., L. Garlappi, and R. Uppal, 2009, *Optimal Versus Naïve Diversification: How Inefficient is the 1/N Portfolio Strategy?* Review of Financial Studies 5, 1915-1953.

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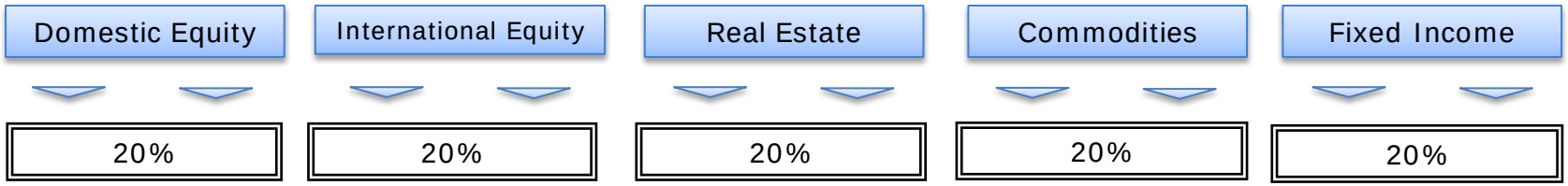
Simplify the Allocation Problem

The "IVY 5" Concept



The "IVY 5" Assets

- **SP500** = SP500 Total Return Index
- **EAFE** = MSCI EAFE Total Return Index
- **REIT** = FTSE NAREIT All Equity REITS Total Return Index
- **GSCI** = GSCI Index
- **LTR** = Merrill Lynch 7-10 year Government Bond Index

The "IVY 5" Philosophy

"Don't try anything fancy. Stick to a simple diversified portfolio, keep your costs down and rebalance periodically to keep your asset allocations in line with your long-term goals."

--David Swensen, Yale Endowment CIO.

Simplify; Simplify; Simplify

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Source: http://www.nytimes.com/2008/02/17/business/17swensen.html, Accessed 11/2/2014

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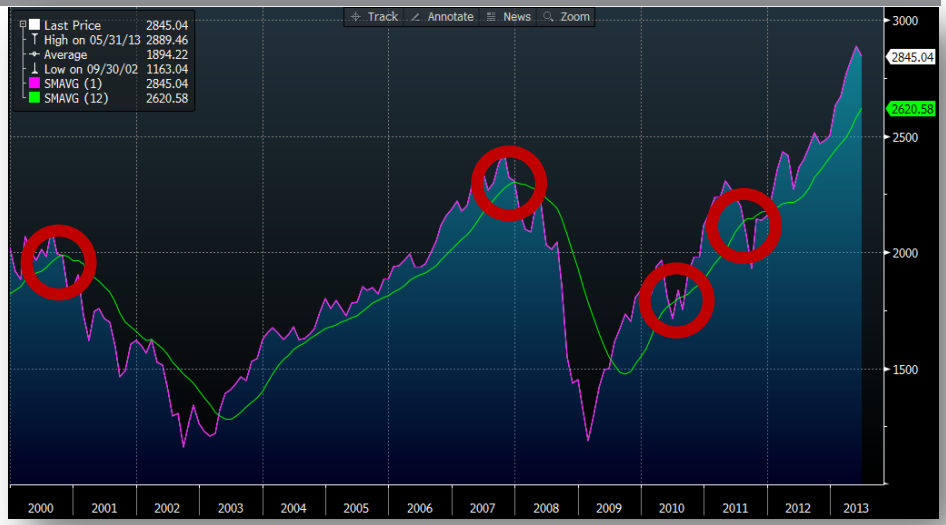
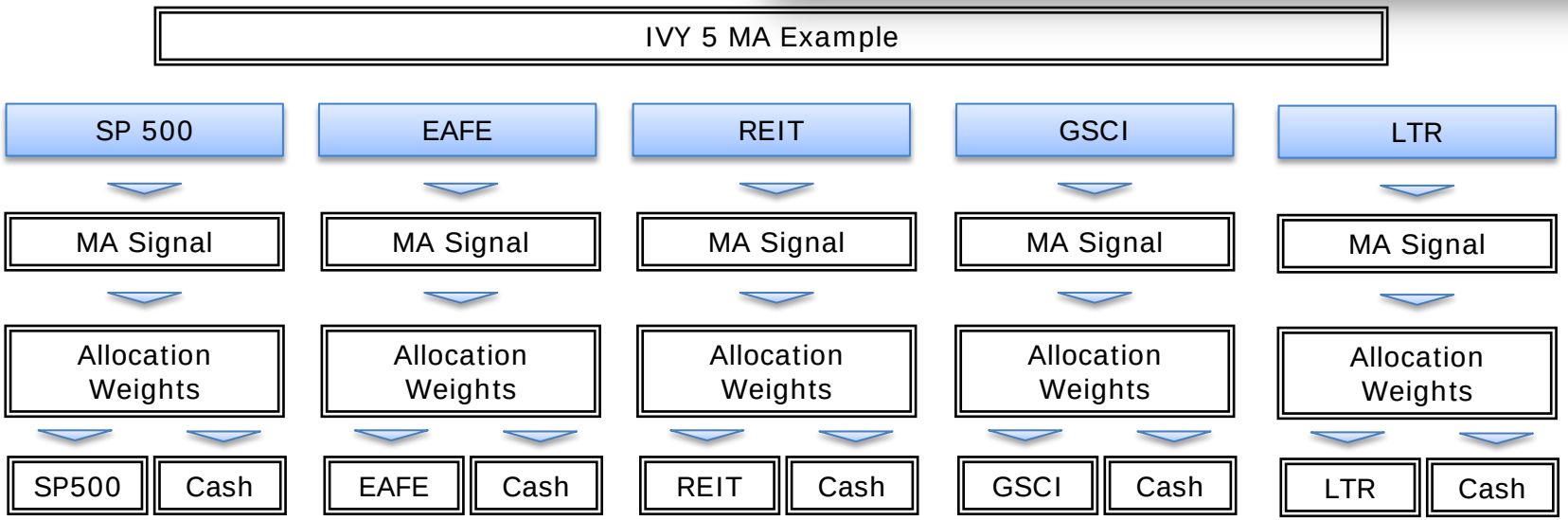
Simplify Risk-Management

- **Robust Trend Following Strategy**
  - If MA rule triggered, buy risk, else, cash out.
    - E.g., Compare current price to the Average (past 12 months)





Simple Trend-Following Rules Have Worked

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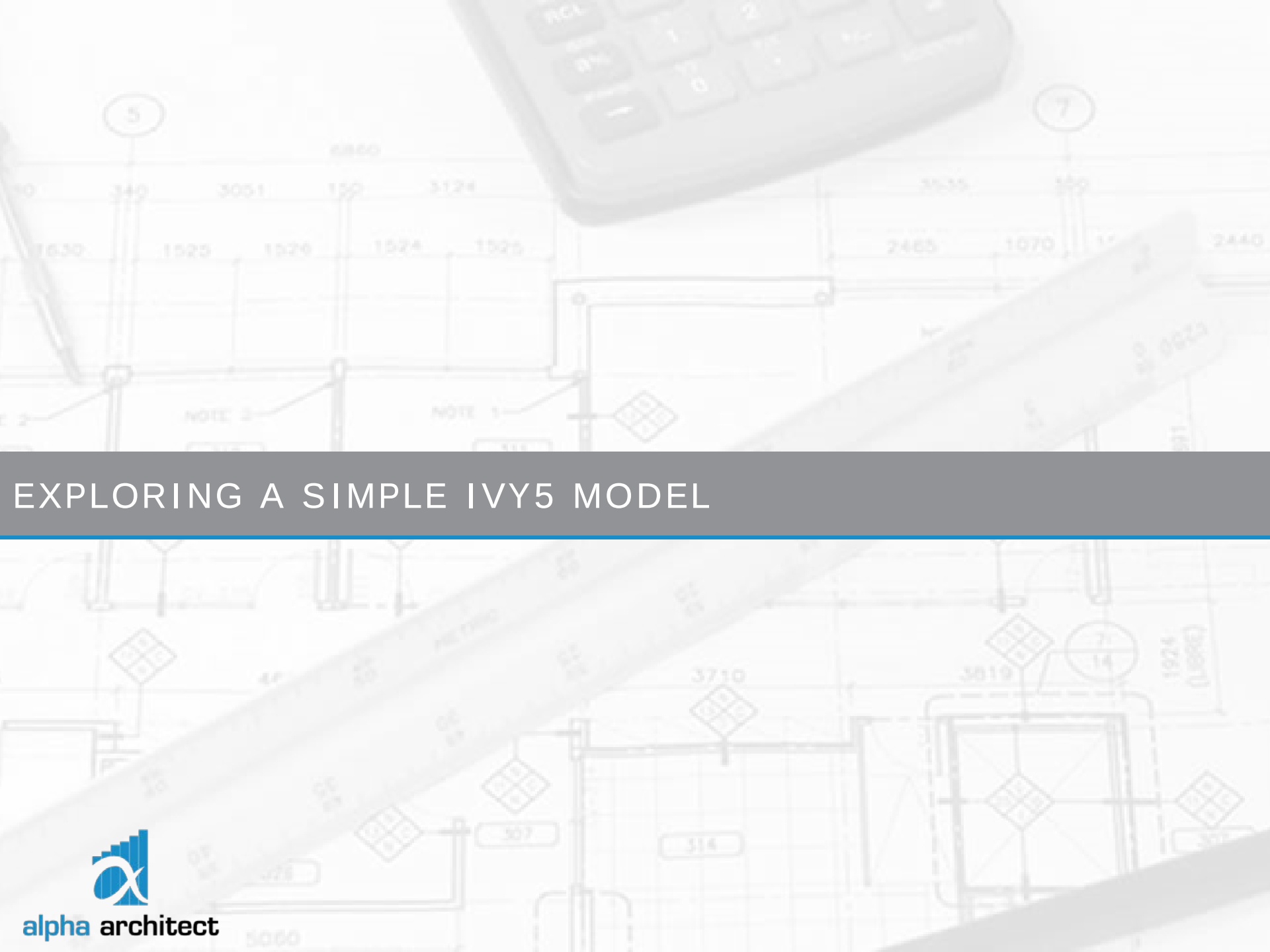
Source: Faber and Richardson, The Ivy Portfolio. New York: John Wiley & Sons, 2011.

EXPLORING A SIMPLE IVY5 MODEL



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Hypothetical Results

- **Simulated Historical Performance:** 1/1/1979 to 12/31/2013

- Results are **gross of management fee and transaction costs for illustrative purposes only.**
- These are simulated performance results and do not reflect the returns an investor would actually achieve.
- All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- Data is from Bloomberg and publicly available sources.
- Annually rebalanced.

- The following 5 asset classes are used in the back-test (referred to as the "**IVY 5**"):
  1. **SP500** = SP500 Total Return Index
  2. **EAFE** = MSCI EAFE Total Return Index
  3. **REIT** = FTSE NAREIT All Equity REITS Total Return Index
  4. **GSCI** = GSCI Index
  5. **LTR** = Merrill Lynch 7-10 year Government Bond Index (prior to 6/1982, Amit Goyal Data)

- Hypothetical performance results have many inherent limitations, some of which, but not all, are described in the disclosures at the end of this document. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program.

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Summary Statistics: Benchmarks (1/1979 to 12/2013)

Summary Statistics	SP500	EAFE	REIT	GSCI	LTR
CAGR	12.12%	9.38%	12.68%	6.62%	8.95%
Standard Deviation	15.27%	17.47%	17.50%	19.29%	8.66%
Downside Deviation (MAR=5%)	11.36%	12.39%	14.79%	13.47%	5.39%
Sharpe Ratio	0.51	0.32	0.50	0.18	0.47
Sortino Ratio (MAR=5%)	0.67	0.45	0.58	0.24	0.74
Worst Drawdown	-50.21%	-56.68%	-68.30%	-67.65%	-20.97%
Worst Month Return	-21.58%	-20.18%	-31.67%	-28.20%	-8.41%
Best Month Return	13.52%	15.58%	31.02%	22.94%	15.23%
Profitable Months	63.81%	60.00%	61.19%	56.67%	64.52%

Fixed Income

Domestic Equity

Real Estate

International Equity

Commodities

10-Year Bonds and US Equity Have Worked the Best

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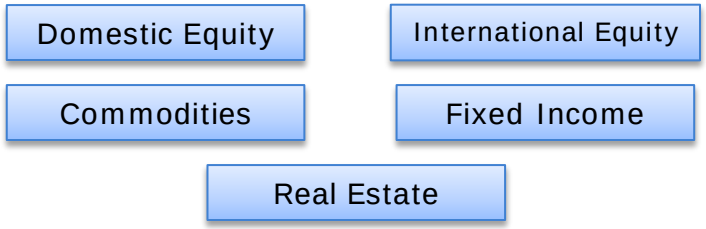
Summary Statistics: Strategy Performance (1/1979 to 12/2013)

- **IVY5_MA:** 5 assets, equal-weight, annual-rebalance, MA rule ➔ Tough to beat.
- **60/40:** 60% SP500; 40% LTR, annual-rebalance ➔ Tough to beat.

Summary Statistics	IVY5	IVY5_MA	60/40	SP500
CAGR	10.98%	11.15%	11.35%	12.12%
Standard Deviation	10.31%	7.53%	10.18%	15.27%
Downside Deviation (MAR=5%)	9.07%	6.05%	7.09%	11.36%
Sharpe Ratio	0.59	0.80	0.63	0.51
Sortino Ratio (MAR=5%)	0.66	0.98	0.89	0.67
Worst Drawdown	-45.32%	-12.65%	-25.29%	-50.21%
Worst Month Return	-19.48%	-10.37%	-13.14%	-21.58%
Best Month Return	8.59%	7.37%	9.70%	13.52%
Profitable Months	69.29%	71.90%	66.90%	63.81%



The Simple IVY5 Model with MA Rules Has Worked

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Source: Alpha Architect, LLC

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Implementation Challenges

- **We can't buy IVY5 index returns, only backtest them.**
  - Investment vehicles cost money, so we need to choose wisely.
  - To replicate the IVY5 we could use IVV (7bps), EFA (34bps), IYR (46bps), GSG (75bps), and IEF (15bps).
  - *ETF fee costs of 35.4bps, on average, plus transaction costs and RIA fees.*

3 Simple Improvements Over IVY5

1. We believe value and momentum can work.

- How do we get access to these without buying the asset manager a new yacht each year?
  - Focus on affordable exposures that take active bets (not closet index) on value and momentum.

2. We believe we can deliver a simple and effective risk management system.

- The IVY5_MA uses moving average rules. But we can do better.
  - We focus on deploying long-term moving average rules and time-series momentum rules.

3. We believe we can minimize taxes.

- Annually rebalance taxable accounts.
- Systematically harvest losses.
- Tax manage risk management events (i.e., MA rule triggers a move to cash).

We Can Improve Upon the Simple IVY5 Model

ADD SECURITY SELECTION BENEFITS

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Momentum Works

- **MOM_10** = Top Decile Momentum
  - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/10_Portfolios_Prior_12_2.zip
- **SP500** = SP500 Total Return Index
- **Simulated Performance:** 1/1/1963 to 12/31/2013

Summary Statistics	MOM_10	SP500
CAGR	17.47%	10.30%
Standard Deviation	21.52%	14.93%
Downside Deviation (MAR=5%)	15.28%	10.62%
Sharpe Ratio	0.63	0.40
Sortino Ratio (MAR=5%)	0.89	0.56
Worst Drawdown	-51.30%	-50.21%
Worst Month Return	-26.74%	-21.58%
Best Month Return	23.09%	16.81%
Profitable Months	63.89%	61.60%

- Benchmark results are gross of management fee and transaction costs for illustrative purposes only.
- These are simulated performance results and do not reflect the returns an investor would actually achieve.
- All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- Data is from Bloomberg and publicly available sources.

Value Works

- **VAL_10** = Top Decile Value
  - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Portfolios_Formed_on_BE-ME.zip
- **SP500** = SP500 Total Return Index
- **Simulated Performance:** 1/1/1963 to 12/31/2013

Summary Statistics	VAL_10	SP500
CAGR	15.43%	10.30%
Standard Deviation	20.37%	14.93%
Downside Deviation (MAR=5%)	14.61%	10.62%
Sharpe Ratio	0.57	0.40
Sortino Ratio (MAR=5%)	0.79	0.56
Worst Drawdown	-64.50%	-50.21%
Worst Month Return	-28.13%	-21.58%
Best Month Return	36.69%	16.81%
Profitable Months	62.91%	61.60%

- Benchmark results are gross of management fee and transaction costs for illustrative purposes only.
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- All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- Data is from Bloomberg and publicly available sources.

Value and Momentum Have Worked

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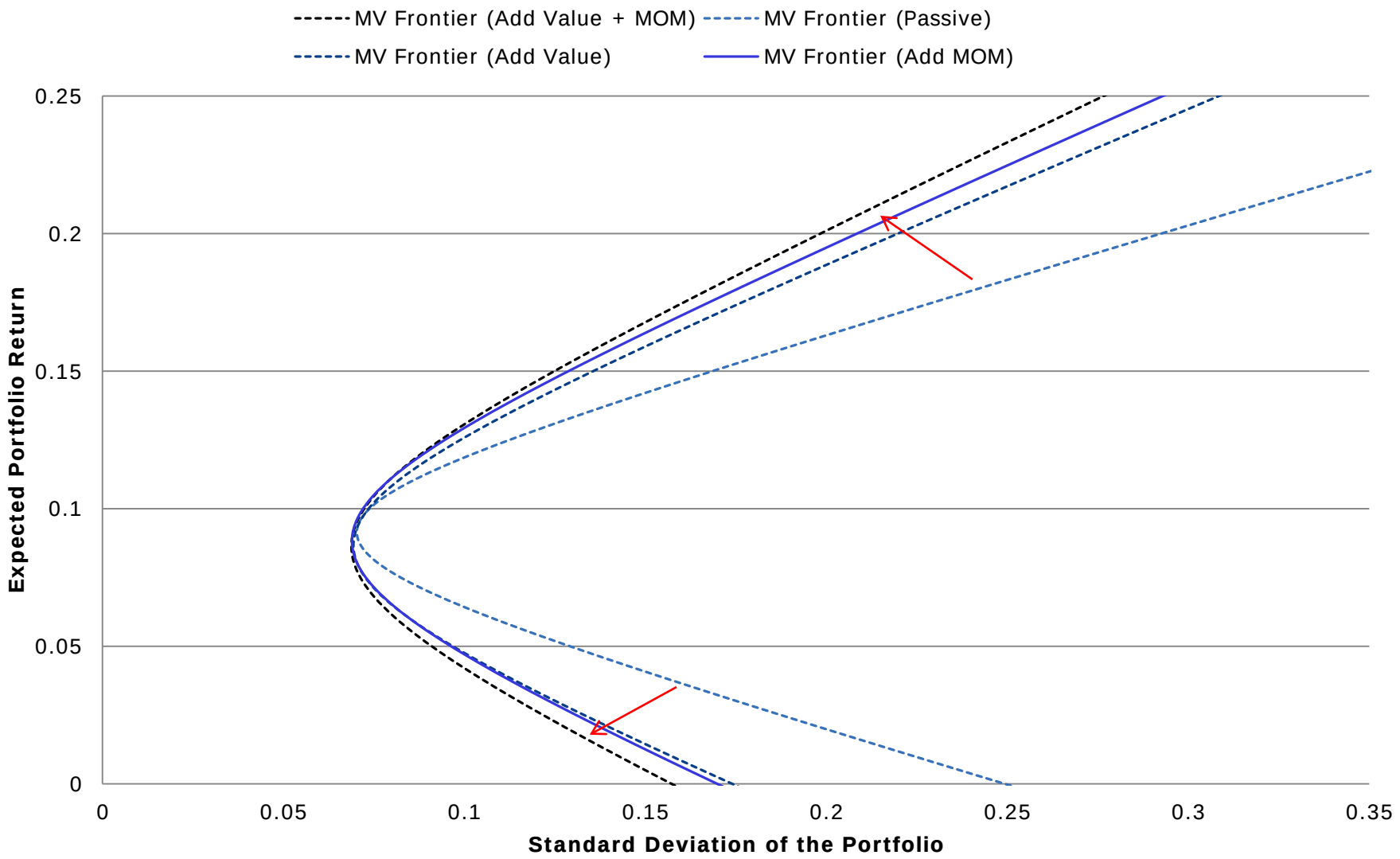
Expanding the Efficient Frontier with Value and Momentum



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ADD ENHANCED RISK-MANAGEMENT

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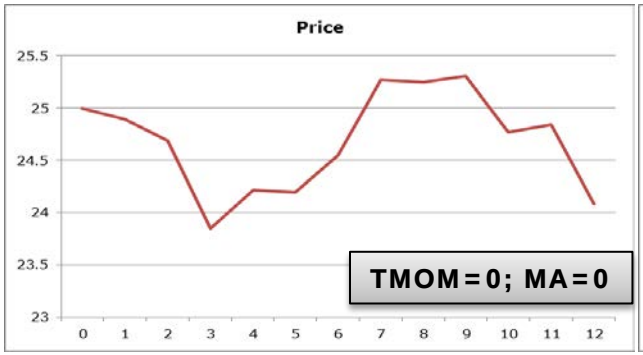
Enhanced Risk-Management Methodology

- **Our Risk-Management system uses two rules:**
  - **Time Series Momentum Rule (TMOM)**
    - Excess return = total return over past x months less return of T-bill
    - If Excess return >0, go long risky assets. Otherwise, go alternative assets (T-bills or Zero).
  - **Simple Moving Average Rule (MA)**
    - Moving Average (N) = average N month prices
    - If Current Price – Moving Average (N) > 0, go long risky assets. Otherwise, go alternative assets (T-bills or Zero).
  - **Relationship between TMOM and MA Rules**
    - Define MA as follows: $MA_t(N) = \frac{x_t + x_{t-1} + \cdots + x_{t-N+1}}{N}$ (N period moving average calculated at time t)
    - Define MOM as follows: $TMOM_t(N) = \left(\frac{x_t}{x_{t-N}} - 1\right) - rf$ (N period excess return calculated at t)
    - We can state the following: $MA_t(N) - MA_{t-1}(N) = \frac{x_t - x_{t-N}}{N}$
    - We can state the following: $TMOM_t(N) = \left(\frac{x_t}{x_{t-N}} - 1\right) - rf = \left(\frac{x_t - x_{t-N}}{x_{t-N}}\right) - rf = \left(\frac{x_t - x_{t-N}}{N}\right)\frac{N}{x_{t-N}} - rf$
    - Which implies the following relationships between MOM and MA: $TMOM_t(N) = (MA_t(N) - MA_{t-1}(N))\frac{N}{x_{t-N}} - rf$
      - MOM and MA are mathematically related, but different. See examples below using simulated data.



Multiple Risk-Management Models Enhance Robustness

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ADD TAX-MANAGEMENT

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Tax-Management is Critical

	2012 Tax Rate	2013 Tax Rate	Heath Care Tax	2013 Total	% Increase
Tax-exempt Interest	0%	0%	0%	0%	**0%**
Qualified Dividends	15%	20%	3.80%	23.80%	**59%**
Long-term gains	15%	20%	3.80%	23.80%	**59%**
Non-qualified dividends	35%	39.60%	3.80%	43.40%	**24%**
Short-term gains	35%	39.60%	3.80%	43.40%	**24%**
Taxable interest	35%	39.60%	3.80%	43.40%	**24%**

Annual Rebalance

- We conduct the overall portfolio rebalance around the 1-year horizon.
- We maximize short-term losses and minimize long-term gains

Short-Term Harvesting

- We harvest losing positions to realize short-term losses. We use correlated replacement property to minimize tracking error.
- We replace the original property 31 days later to avoid wash sale rules.

Tax-Efficient Hedging

- We avoid gain recognition during hedging events via futures and highly correlated exposures.
- Goal is to defer taxes, while simultaneously conducting risk-management.

Minimize Realized Tax Liability; Maximize Deferral Opportunities

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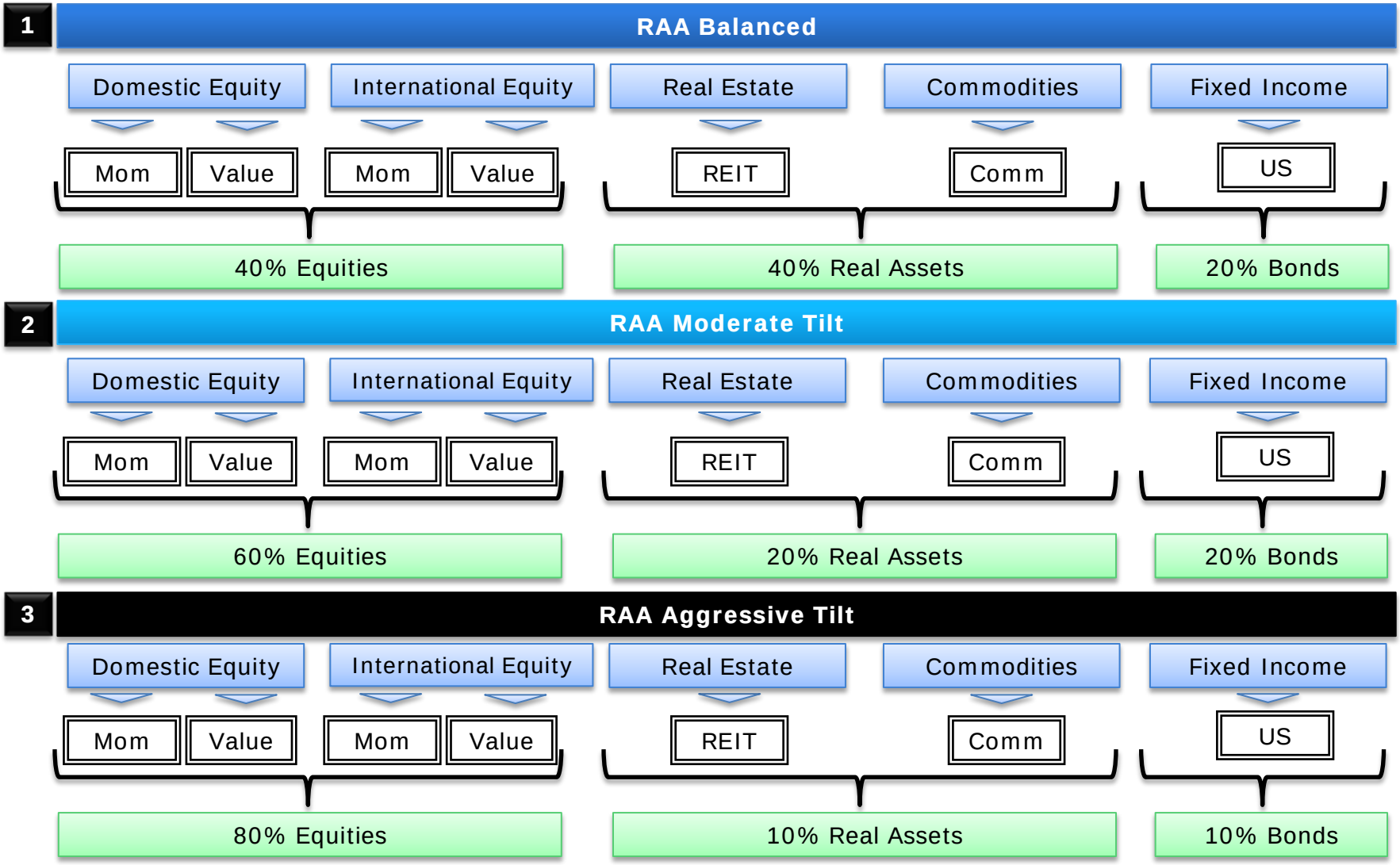
Three (3) RAA Options



Three Options For Our Program

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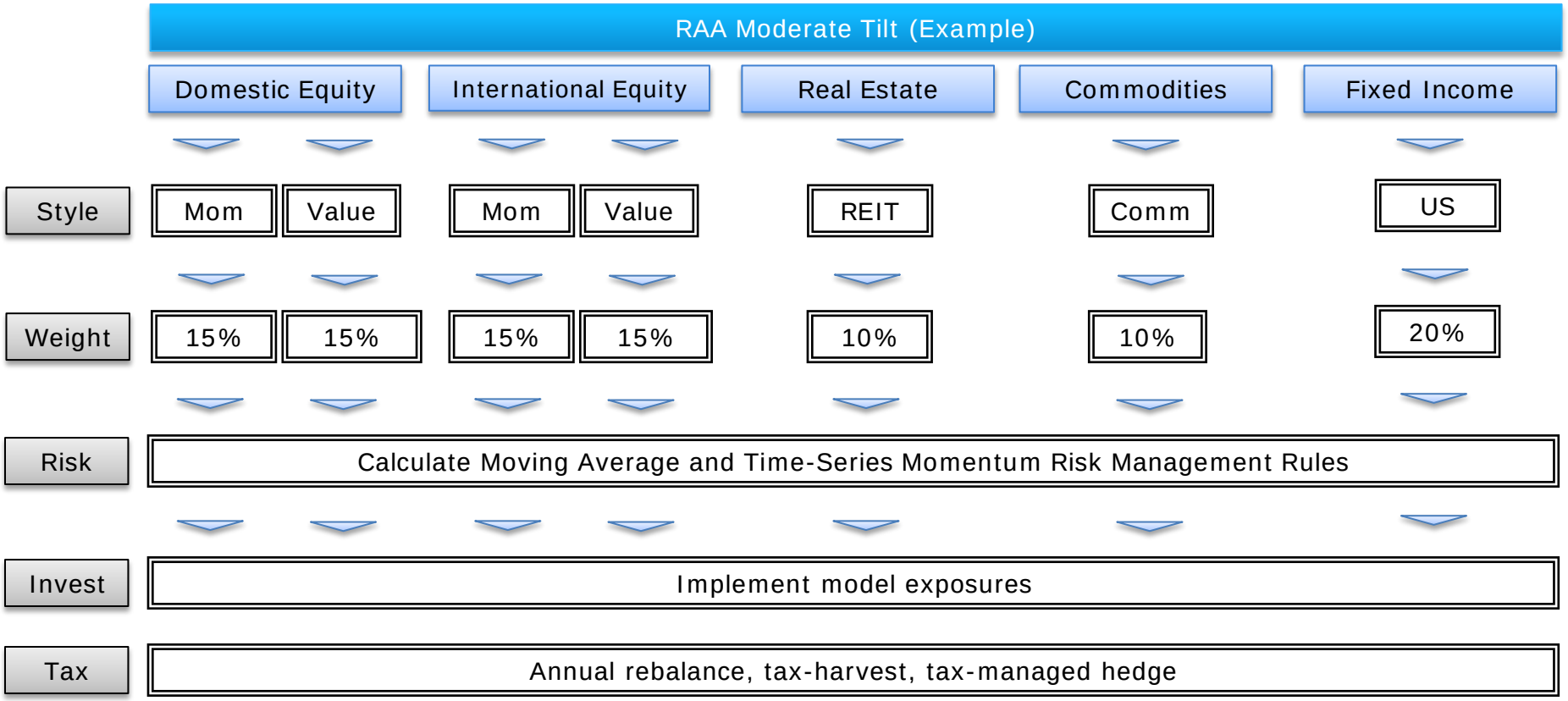
Example RAA Process



Keeping it as Simple as Possible, but No Simpler.

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Hypothetical Results

- **Simulated Historical Performance:** 1/1/1992 to 12/31/2013

- Benchmark results are **gross of management fee and transaction costs** for illustrative purposes only.
- Strategy results are **net of 50bps management fee and 50bps transaction costs** (1% total annual costs).
- These are simulated performance results and do not reflect the returns an investor would actually achieve.
- All returns are total returns and include the reinvestment of distributions (e.g., dividends).
- Data is from Bloomberg and publicly available sources.
- Annually rebalanced.
- MA and MOM risk-management rules applied.

- The following 5 asset classes are used in the RAA back-test:
  1. **SP500** = SP500 Total Return Index
  2. **EAFE** = MSCI EAFE Total Return Index
  3. **REIT** = FTSE NAREIT All Equity REITS Total Return Index
  4. **GSCI** = GSCI Index
  5. **LTR** = Merrill Lynch 7-10 year Government Bond Index (prior to 6/1982, Amit Goyal Data)
  6. **MOM_10** = Top Decile Momentum
     - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/10_Portfolios_Prior_12_2.zip
  7. **VAL_10** = Top Decile Value
     - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Portfolios_Formed_on_BE-ME.zip
  8. **IMOM_5** = Top Quintile Momentum (Average Top 3 market cap quintiles)
     - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Global_ex_US_25_Portfolios_ME_Prior_12_2.zip
  9. **IVAL_5** = Top Quintile Value (Average Top 3 market cap quintiles)
     - http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ftp/Global_ex_US_25_Portfolios_ME_BE-ME.zip

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Summary Statistics: Benchmarks (1/1992 to 12/2013)

Domestic Equity

Summary Statistics	SP500	MOM_10	VAL_10
CAGR	9.39%	14.15%	14.00%
Standard Deviation	14.61%	21.59%	21.32%
Downside Deviation (MAR=5%)	11.05%	15.46%	16.41%
Sharpe Ratio	0.50	0.59	0.59
Sortino Ratio (MAR=5%)	0.46	0.69	0.64
Worst Drawdown	-50.21%	-51.30%	-64.50%
Worst Month Return	-16.70%	-24.59%	-28.13%
Best Month Return	10.93%	23.09%	36.69%
Profitable Months	64.39%	63.26%	63.26%

International Equity

Summary Statistics	EAFE	IMOM_5	IVAL_5
CAGR	5.88%	10.78%	9.03%
Standard Deviation	16.74%	17.88%	18.43%
Downside Deviation (MAR=5%)	12.35%	13.22%	13.41%
Sharpe Ratio	0.26	0.51	0.41
Sortino Ratio (MAR=5%)	0.17	0.52	0.40
Worst Drawdown	-56.68%	-52.86%	-58.98%
Worst Month Return	-20.18%	-18.81%	-24.84%
Best Month Return	12.80%	12.68%	16.12%
Profitable Months	59.47%	59.85%	56.82%

Real Assets & Bonds

Summary Statistics	REIT	GSCI	LTR
CAGR	10.92%	3.45%	7.22%
Standard Deviation	19.50%	20.93%	6.12%
Downside Deviation (MAR=5%)	16.71%	15.00%	3.92%
Sharpe Ratio	0.49	0.13	0.71
Sortino Ratio (MAR=5%)	0.44	0.04	0.55
Worst Drawdown	-68.30%	-67.65%	-6.78%
Worst Month Return	-31.67%	-28.20%	-5.71%
Best Month Return	31.02%	19.67%	8.73%
Profitable Months	61.36%	56.44%	65.53%

*The results are hypothetical results and are NOT an indicator of future results and do NOT represent returns that any investor actually attained. Please see disclosures for additional information. Additional information regarding the construction of these results is available upon request. Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index.

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Benchmark results are gross of management fee and transaction costs for illustrative purposes only.

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Summary Statistics: Strategy Performance (1/1992 to 12/2013)

- **RAA_BAL** = 40% Equity; 40% Real; 20% Bonds. Equity split between value and momentum. Risk-Managed.
- **RAA_MOD** = 60% Equity; 20% Real; 20% Bonds. Equity split between value and momentum. Risk-Managed.
- **RAA_AGG**= 80% Equity; 10% Real; 10% Bonds. Equity split between value and momentum. Risk-Managed.
- **IVY5_MA** = 40% Equity; 40% Real; 20% Bonds. Moving average rule applied.
- **60/40** = 60% Equity; 40% Bonds.

Summary Statistics	RAA_BAL	RAA_MOD	RAA_AGG	IVY5_MA	60/40
CAGR	9.39%	10.01%	10.77%	8.32%	8.09%
Standard Deviation	7.45%	8.06%	9.71%	6.71%	8.59%
Downside Deviation (MAR=5%)	5.54%	5.74%	6.93%	4.98%	6.21%
Sharpe Ratio	0.86	0.87	0.81	0.80	0.62
Sortino Ratio (MAR=5%)	0.77	0.85	0.83	0.65	0.51
Worst Drawdown	-13.51%	-13.01%	-16.28%	-13.60%	-26.30%
Worst Month Return	-7.74%	-8.11%	-9.53%	-7.17%	-9.58%
Best Month Return	6.14%	6.93%	8.46%	5.39%	7.04%
Profitable Months	70.83%	68.18%	66.29%	69.70%	65.91%

RAA Has Worked Historically

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Strategy results are net of 50bps management fee and 50bps transaction costs (1% total annual costs).

INVESTMENT TERMS

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Summary

Description	Robust Asset Allocation (RAA)
Options	Balanced, Moderate Tilt, Aggressive Tilt; Tax-Management
Structure	Separately Managed Accounts (SMA)
Management Fee	0.50%
Subscription	Monthly
Redemption	Monthly (30 day notice)
Minimum Investment	Initial: US $1,000,000 / Additional: US $100,000

RAA = Robust Asset Allocation
RM = Risk-Managed
Bal = Balanced
Mod = Moderate Tilt
Agg = Aggressive Tilt
Examples: *RAA Bal RM*= Robust Asset Allocation Balanced Tilt Risk-Managed

An Affordable One-Stop Retirement Solution

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APPENDIX

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Statistics Descriptions

- **CAGR:** Compound annual growth rate
- **Standard Deviation:** Sample standard deviation
- **Downside Deviation:** Sample standard deviation, but only monthly observations below 41.67bps (5%/12) are included in the calculation
- **Sharpe Ratio (annualized):** Average monthly return minus treasury bills divided by standard deviation
- **Sortino Ratio (annualized):** Average monthly return minus treasury bills divided by downside deviation
- **Worst Drawdown:** Worst peak to trough performance (measured based on monthly returns)
- **Rolling X-Year Win %:** Percentage of rolling X periods that a strategy outperforms
- **Sum (5-Year Rolling MaxDD):** Sum of all 5-Year rolling drawdowns
- **Down %**: The Down Number Ratio is a measure of the number of periods that the investment was down when the benchmark was down, divided by the number of periods that the benchmark was down. The smaller the ratio, the better
- **Up %**: The Up Number Ratio is a measure of the number of periods that the investment was up when the benchmark was up, divided by the number of periods that the benchmark was up. The larger the ratio, the better
- **Tracking Error:** Tracking Error is measured by taking the square root of the average of the squared deviations between the investment's returns and the benchmark's returns
- **Negative Correlation:** Correlation of returns relative to benchmark returns when the benchmark is negative
- **Positive Correlation:** Correlation of returns relative to benchmark returns when the benchmark is positive

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Disclosures

Performance figures contained herein are hypothetical, unaudited and prepared by Alpha Architect, LLC; hypothetical results are intended for illustrative purposes only.

Past performance is not indicative of future results, which may vary.

There is a risk of substantial loss associated with trading commodities, futures, options and other financial instruments. Before trading, investors should carefully consider their financial position and risk tolerance to determine if the proposed trading style is appropriate. Investors should realize that when trading futures, commodities and/or granting/writing options one could lose the full balance of their account. It is also possible to lose more than the initial deposit when trading futures and/or granting/writing options. All funds committed to such a trading strategy should be purely risk capital.

Hypothetical performance results (e.g., quantitative backtests) have many inherent limitations, some of which, but not all, are described herein. No representation is being made that any fund or account will or is likely to achieve profits or losses similar to those shown herein. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently realized by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or adhere to a particular trading program in spite of trading losses are material points which can adversely affect actual trading results. The hypothetical performance results contained herein represent the application of the quantitative models as currently in effect on the date first written above and there can be no assurance that the models will remain the same in the future or that an application of the current models in the future will produce similar results because the relevant market and economic conditions that prevailed during the hypothetical performance period will not necessarily recur. There are numerous other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results. Hypothetical performance results are presented for illustrative purposes only.

Indexes are unmanaged, do not reflect management or trading fees, and one cannot invest directly in an index.

There is no guarantee, express or implied, that long-term return and/or volatility targets will be achieved. Realized returns and/or volatility may come in higher or lower than expected.

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QUESTIONS?

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