

# Smart Beta, Monkeys and Upside Down Strategies

Helge Kostka  
Vice President,  
Research Affiliates Global Advisors  
(Europe) Limited

# Research Affiliates, LLC

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- › Research Affiliates is committed to be the preeminent source of insights and products that transform the global investment community for the benefit of investors.

## » Global leader in

- › Asset Allocation
- › Smart Beta

## » Profile

- › Approximately \$166 billion in assets managed using RA investment strategies as of December 2013<sup>1</sup>
- › Founded in 2002 by Rob Arnott and Jason Hsu

<sup>1</sup>As of 12/31/2013 based on estimates. Includes assets managed or sub-advised by Research Affiliates or licensees using RAFI®, Enhanced RAFI®, or GTAA strategies.

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# History of Asset Pricing

From CAPM to APT

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# Finance Circa 1965

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- » **Bill Sharpe's Capital Asset Pricing Model (CAPM)**
  - › “One factor” model to describe risk and return
    - › Market risk
  - › There is one risk premium that mattered
    - › Market risk premium

# Finance Circa 1975

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- » Steve Ross' Arbitrage Pricing Theory (APT)
  - › Multi-factor model to describe risk and return
    - › Equity market risk, interest rate risk, liquidity risk, credit risk, etc.
  - › There are multiple sources of risk premium that can be captured passively

# Finance Circa 1980

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## » Myriad of persistent equity anomalies

- › Value anomaly, Basu (1983)
- › Low volatility anomaly, Haugen and Heins (1975)
- › Small-cap anomaly, Banz (1981)

# Modern Day Finance

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## » Modern day equity factor model

- › Fama-French 3 Factor + MOM + BAB
  - › Market
  - › Value (HML)
  - › Small (SMB)
  - › Momentum (MOM)
  - › Low Beta (BAB)



# History of Equity Indexing

From Cap Weighting to Smart Beta

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# Benchmarking

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- » **Index as benchmark**

- › S&P 90 (1923 ~ 1957)
- › S&P 500 (1957 ~ present day)

- » **Index as indicators**

- › Leading indicator for NBER and Conference Board

# Original Passive Investing

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- » The first “market” index fund
  - › Wells Fargo/Nikko (1971)
- » The first “market” index mutual fund
  - › Vanguard (1976)

# Capturing Market Premium Passively

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## » Traditional Indices

- › Cap-weighted to measure market performance
- › Captures market risk premium effectively
- › Contains one source of equity return

# Smart Beta

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- » Non-price weighted indices
- » Non-traditional equity premiums
  - › Equal Weight indices capture small premium
  - › Fundamental indices capture value premium, dynamic as opposed to static exposure
  - › Low volatility indices capture low volatility premium

# Smart Beta is Cap-Weighting Evolved

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## » CAPM evolves into APT

- › One factor ➡ Multi-factor
- › Market premium ➡ Market + Value + Small + Low Volatility + Momentum premiums
- › Cap-weighted traditional index ➡ Smart Beta

# Complexity and Mystique are Not Helpful

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- » The science of Smart Beta is “old”
  - › The multitude of source of equity premium are well documented (for more than 30+ years)
  - › “Productizing” is about capturing these premiums cost effectively
  - › We do not need some new scientific framework to passively capture these equity premiums



# **The Surprising Alpha from Malkiel's Monkey & Upside Down Strategies**

# Equity Smart Beta Strategies

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- » Many offerings, many marketing claims, so...
  - › How much better are these strategies than market cap?
  - › What similarities can we identify?
  - › What are critical differences?
  - › How do we use Smart Beta strategies?

# Logic of Our Studies

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- » Make a claim
- » Show the strategy based on the claim outperforms the cap-weighted index
- » Construct a counter-intuitive strategy based on the claim turned upside-down:
  - › If the claim is right, the counter-intuitive strategy should underperform the cap-weighted index.

# Popular Smart Beta Strategies, U.S. 1964 – 2012

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Volatility Weight <sup>1</sup>	12.2%	19.1%	0.36	0.34
Fundamentals Weight <sup>7</sup>	11.6%	15.4%	0.41	0.42
Minimum Variance <sup>9</sup>	11.8%	11.7%	0.56	0.26
Maximum Diversification <sup>10</sup>	12.0%	14.0%	0.48	0.35
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	12.5%	16.8%	0.43	0.53
Risk Cluster Equal Weight <sup>12</sup>	11.2%	14.6%	0.41	0.31
U.S. Cap Weight <sup>4</sup>	9.7%	15.3%	0.29	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Popular Smart Beta Strategies, U.S. 1964 – 2012

Upside-down strategies also outperform!

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Volatility Weight <sup>1</sup>	12.2%	19.1%	0.36	0.34
Fundamentals Weight <sup>7</sup>	11.6%	15.4%	0.41	0.42
Minimum Variance <sup>9</sup>	11.8%	11.7%	0.56	0.26
Maximum Diversification <sup>10</sup>	12.0%	14.0%	0.48	0.35
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	12.5%	16.8%	0.43	0.53
Risk Cluster Equal Weight <sup>12</sup>	11.2%	14.6%	0.41	0.31
Inverse of Volatility Weight <sup>1</sup>	12.5%	15.6%	0.47	0.53
Inverse of Fundamental Weight <sup>7</sup>	14.1%	18.8%	0.47	0.54
Inverse of Minimum Variance <sup>9</sup>	12.7%	18.1%	0.41	0.48
Inverse of Maximum Diversification <sup>10</sup>	15.5%	17.6%	0.41	0.47
Inverse of Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	12.4%	17.3%	0.41	0.45
Inverse of Risk Cluster Equal Weight <sup>12</sup>	12.2%	19.0%	0.42	0.40
U.S. Cap Weight <sup>4</sup>	9.7%	15.3%	0.29	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Malkiel's Monkey, U.S. 1964 – 2012

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Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Average of 100 Malkiel's Monkey Portfolios <sup>13</sup>	11.3%	18.3%	0.33	0.21
U.S. Cap Weight <sup>4</sup>	9.7%	15.3%	0.29	0.00

Only 2 (*very unlucky*) monkeys underperformed  
the cap-weighted benchmark!

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Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)



# Value and Size Factors

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# Four-Factor Model Decomposition, U.S. 1964 – 2012

All non cap-weighted strategies have value and small size tilt

Strategy	Annual FFC Alpha	Alpha t-stat	Market Exposure	Size Exposure	Value Exposure	Momentum Exposure
Volatility Weight <sup>1</sup>	0.23%	0.46	1.10	0.55	0.16	-0.04
Fundamentals Weight <sup>7</sup>	0.64%	1.83	1.01	0.05	0.37	-0.09
Minimum Variance <sup>9</sup>	1.05%	1.39	0.70	0.13	0.34	0.00
Maximum Diversification <sup>10</sup>	0.40%	0.54	0.83	0.26	0.26	0.04
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	0.63%	1.32	1.03	0.36	0.26	-0.03
Risk Cluster Equal Weight <sup>12</sup>	0.31%	0.49	0.94	0.03	0.21	0.03
Inverse of Volatility Weight <sup>1</sup>	0.58%	1.13	0.97	0.28	0.33	-0.03
Inverse of Fundamental Weight <sup>7</sup>	1.40%	2.06	1.05	0.60	0.41	-0.11
Inverse of Minimum Variance <sup>9</sup>	0.54%	1.07	1.08	0.45	0.25	-0.04
Inverse of Maximum Diversification <sup>10</sup>	0.52%	0.94	1.07	0.38	0.28	-0.05
Inverse of Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	0.25%	0.51	1.04	0.41	0.27	-0.03
Inverse of Risk Cluster Equal Weight <sup>12</sup>	-0.16%	-0.19	1.06	0.62	0.41	-0.02
U.S. Cap Weight <sup>4</sup>	0.00%	0.00	1.00	0.00	0.00	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Malkiel's Monkey, U.S. 1964 – 2012

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All non cap-weighted strategies have value and small size tilt

Strategy	Annual FFC Alpha	Alpha t-stat	Market Exposure	Size Exposure	Value Exposure	Momentum Exposure
Average of 100 Malkiel's Monkey Portfolios <sup>13</sup>	-0.29%	-0.31	1.05	0.37	0.13	-0.02
U.S. Cap Weight <sup>4</sup>	0.00%	0.00	1.00	0.00	0.00	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Value and Size Factors

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- » Any portfolio return can be decomposed:

$$\begin{aligned} R_p &= n \cdot E[r_i w_i] \\ &= n \cdot E[r_i] E[w_i] + n \cdot \text{cov}[r_i, w_i] \\ &= EW + n \cdot \text{cov}[r_i, w_i] \end{aligned}$$

- › **EW** – Return of equally weighted portfolio – no skill
- ›  $n \cdot \text{cov}[r_i, w_i]$  – skill from security selection
- » Jonathan Berk: Value and size factors generate returns because they sort stocks based on prices
  - › *Cap-weighted is the only strategy in the study with negative skill*



# Global Findings

# Popular Smart Beta Strategies, Global 1991 – 2012

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Volatility Weight <sup>1</sup>	7.9%	16.9%	0.28	0.19
Fundamentals Weight <sup>7</sup>	11.0%	15.3%	0.49	0.72
Minimum Variance <sup>9</sup>	8.4%	9.9%	0.53	0.13
Maximum Diversification <sup>10</sup>	7.1%	11.3%	0.35	0.00
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	9.0%	14.8%	0.40	0.53
Risk Cluster Equal Weight <sup>12</sup>	9.5%	15.9%	0.40	0.36
Global Cap Weight <sup>4</sup>	7.1%	15.1%	0.26	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Popular Smart Beta Strategies, Global 1991 – 2012

Upside-down strategies also outperform!

Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Volatility Weight <sup>1</sup>	7.9%	16.9%	0.28	0.19
Fundamentals Weight <sup>7</sup>	11.0%	15.3%	0.49	0.72
Minimum Variance <sup>9</sup>	8.4%	9.9%	0.53	0.13
Maximum Diversification <sup>10</sup>	7.1%	11.3%	0.35	0.00
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	9.0%	14.8%	0.40	0.53
Risk Cluster Equal Weight <sup>12</sup>	9.5%	15.9%	0.40	0.36
Inverse of Volatility Weight <sup>1</sup>	9.3%	13.9%	0.44	0.53
Inverse of Fundamental Weight <sup>7</sup>	12.5%	15.7%	0.58	0.80
Inverse of Minimum Variance <sup>9</sup>	8.7%	16.2%	0.34	0.45
Inverse of Maximum Diversification <sup>10</sup>	8.9%	15.9%	0.36	0.48
Inverse of Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	8.5%	15.5%	0.35	0.40
Inverse of Risk Cluster Equal Weight <sup>12</sup>	9.4%	16.7%	0.38	0.35
Global Cap Weight <sup>4</sup>	7.1%	15.1%	0.26	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Malkiel's Monkey, Global 1991 – 2012

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Strategy	Return	Standard Deviation	Sharpe Ratio	Information Ratio
Average of 100 Malkiel's Monkey Portfolios <sup>13</sup>	8.1%	16.4%	0.31	0.16
Global Cap Weight <sup>4</sup>	7.1%	15.1%	0.26	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Four-Factor Model Decomposition, Global 1991 – 2012

All non cap-weighted strategies have value and small size tilt

Strategy	Annual FFC Alpha	Alpha t-stat	Market Exposure	Size Exposure	Value Exposure	Momentum Exposure
Volatility Weight <sup>1</sup>	0.12%	0.20	1.10	0.31	0.13	-0.06
Fundamentals Weight <sup>7</sup>	1.93%	2.98	0.98	0.09	0.43	-0.11
Minimum Variance <sup>9</sup>	1.73%	1.33	0.55	0.02	0.30	-0.06
Maximum Diversification <sup>10</sup>	0.12%	0.08	0.65	0.11	0.24	0.01
Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	0.53%	0.93	0.98	0.19	0.28	-0.03
Risk Cluster Equal Weight <sup>12</sup>	0.97%	0.66	1.00	0.25	0.21	0.08
Inverse of Volatility Weight <sup>1</sup>	0.77%	1.28	0.92	0.13	0.34	-0.04
Inverse of Fundamental Weight <sup>7</sup>	2.81%	3.44	0.99	0.35	0.51	-0.15
Inverse of Minimum Variance <sup>9</sup>	0.42%	0.76	1.07	0.24	0.23	-0.05
Inverse of Maximum Diversification <sup>10</sup>	0.50%	0.88	1.04	0.21	0.29	-0.07
Inverse of Risk-Efficient ( $\lambda=2$ ) <sup>11</sup>	0.44%	0.75	1.01	0.22	0.25	-0.06
Inverse of Risk Cluster Equal Weight <sup>12</sup>	0.63%	0.42	1.05	0.14	0.28	0.02
Global Cap Weight <sup>4</sup>	0.00%	0.00	1.00	0.00	0.00	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)

# Malkiel's Monkey, Global 1991 – 2012

All non cap-weighted strategies have value and small size tilt

Strategy	Annual FFC Alpha	Alpha t-stat	Market Exposure	Size Exposure	Value Exposure	Momentum Exposure
Average of 100 Malkiel's Monkey Portfolios <sup>13</sup>	0.15%	0.10	1.02	0.23	0.18	-0.03
Global Cap Weight <sup>4</sup>	0.00%	0.00	1.00	0.00	0.00	0.00

See notes slide for disclosures regarding individual strategies.

Source: Research Affiliates, LLC, based on Arnott, Hsu, Kalesnik and Tindall (2013)



# Choosing a Smart Beta Strategy

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# Implementation Is the Primary Differentiator

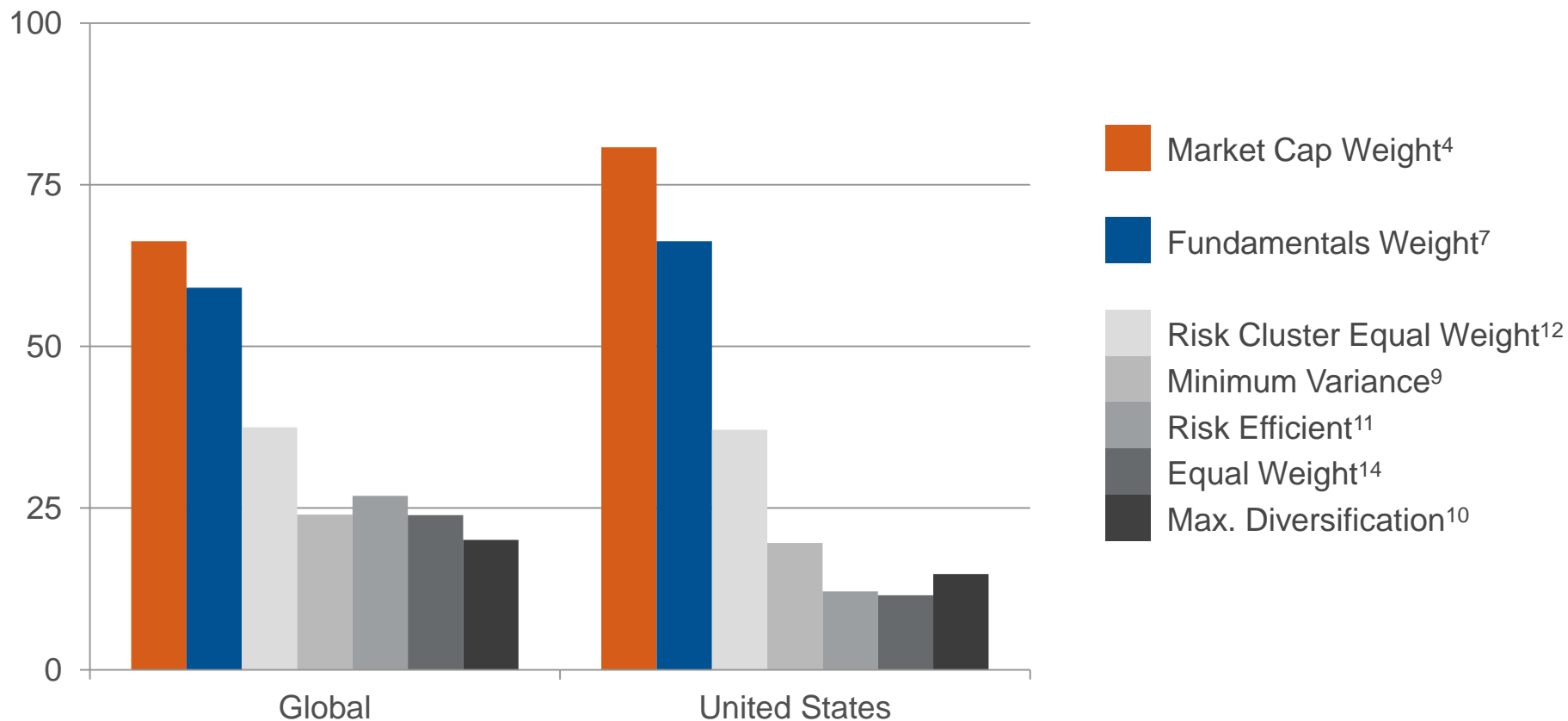
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- » Many smart beta strategies suffer from high implementation costs.
- › Investors should seek to:

Maximize	Minimize
Capacity/Liquidity	Turnover
Economic Representation	Trading Costs

# Fundamentals Weight Has the Greatest Liquidity

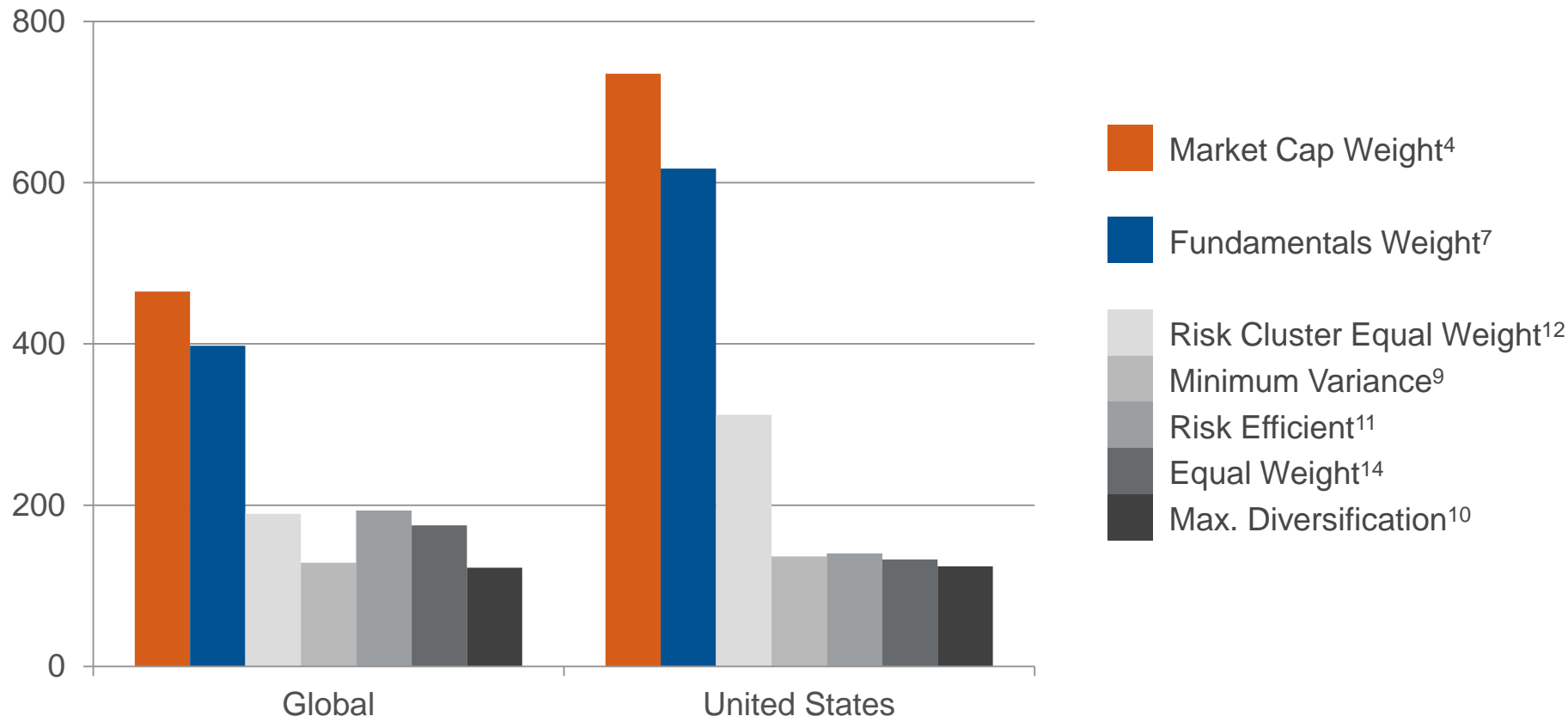
Market Cap in USD Billions – Jan 2012



Above figures all represent weighted averages.  
See notes slide for disclosures regarding individual strategies.  
Source: Research Affiliates, LLC.

# Fundamentals Weight Leads in Daily Volume

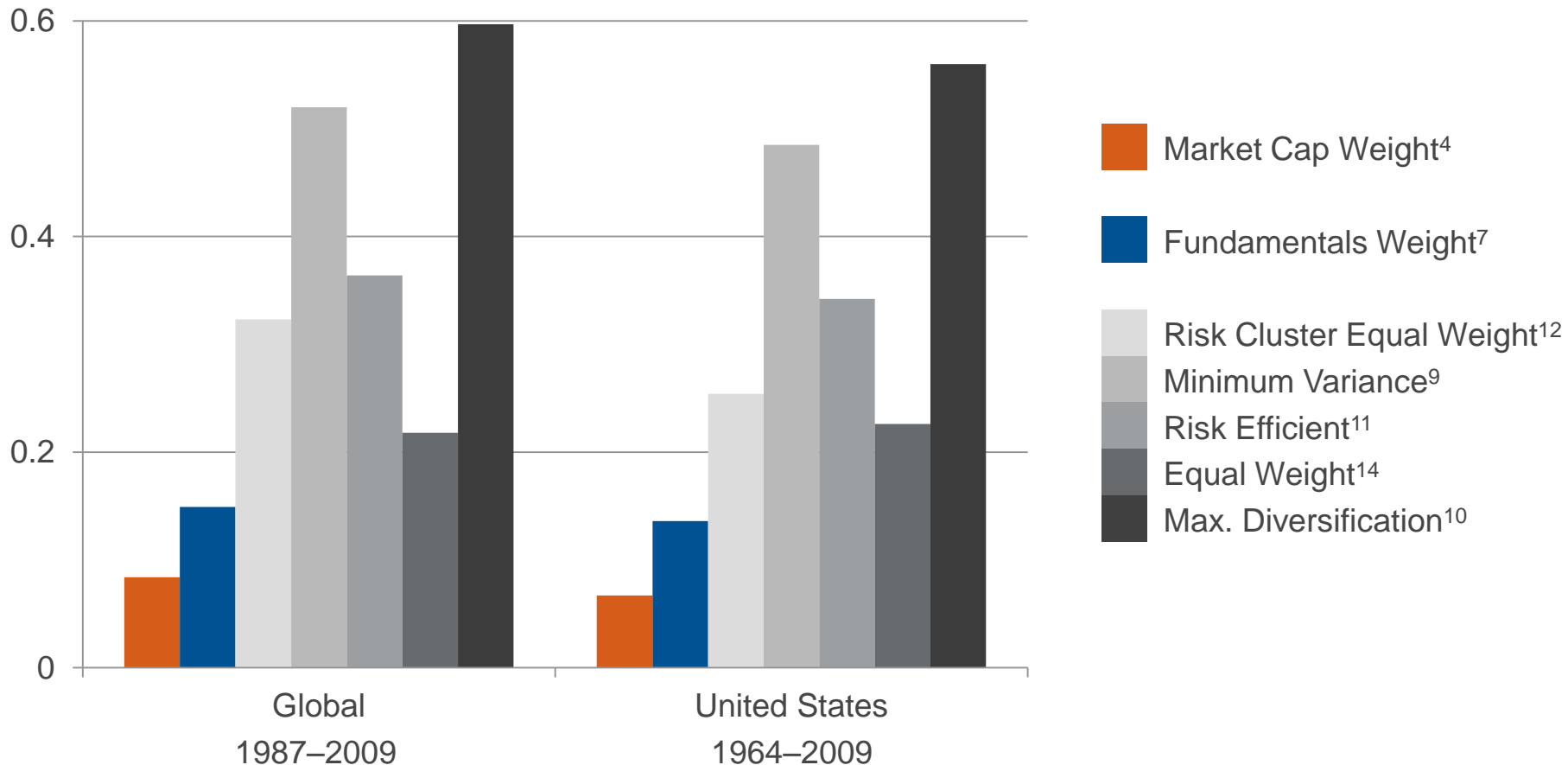
Average Daily Volume in USD Millions – Jan 2010



Above figures all represent weighted averages.  
See notes slide for disclosures regarding individual strategies.  
Source: Research Affiliates, LLC.

# Fundamentals Weight Has Low Trading Costs

## Average Annual Turnover



Above figures all represent weighted averages.  
See notes slide for disclosures regarding individual strategies.  
Source: Research Affiliates, LLC.

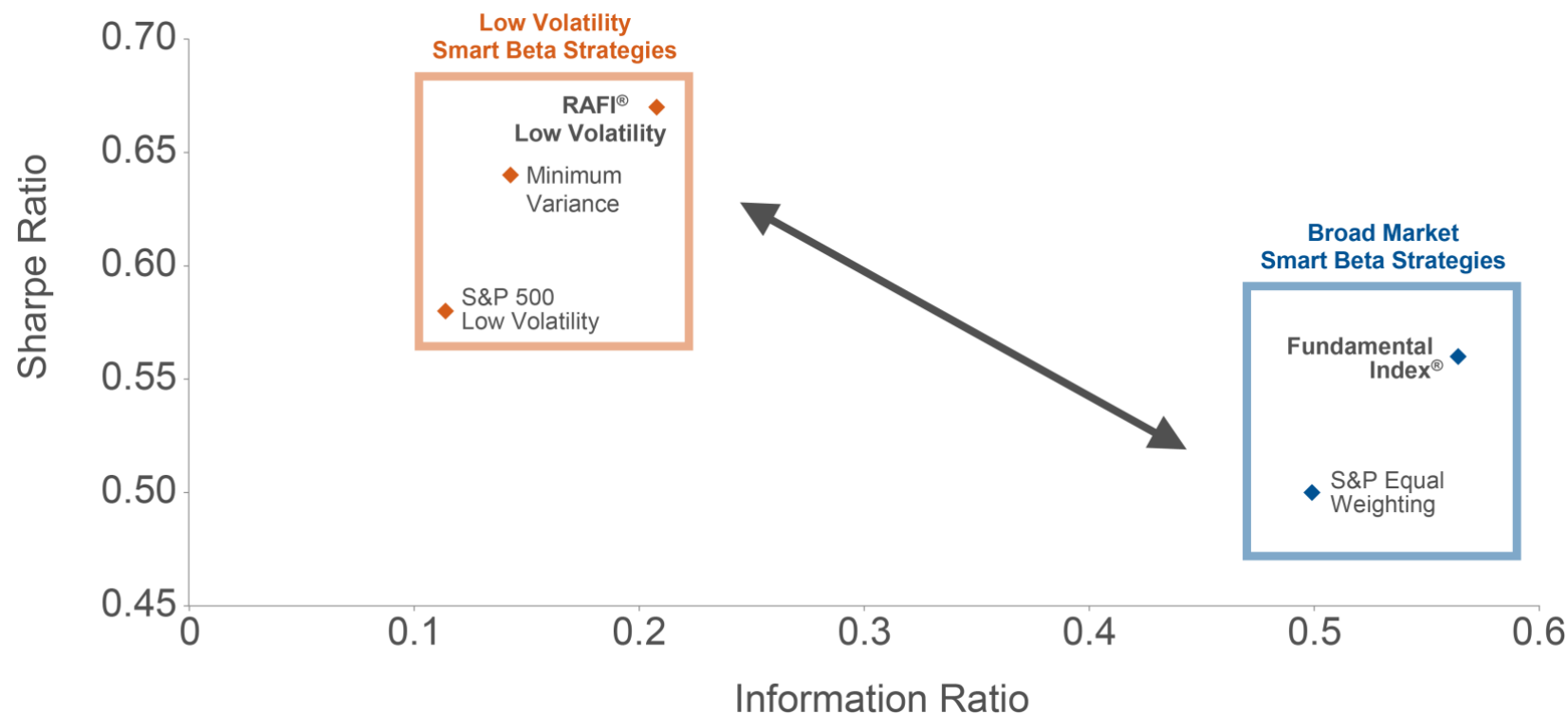


# How Do We Use Smart Beta

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# Information Ratio vs. Sharpe Ratio Investors

Is Your Risk Tracking Error or Volatility?



Source: Research Affiliates, LLC, based on data from CRSP/Compustat and Standard & Poor's. For the periods 1991-2012.

# If Equity Tracking Error is Your Risk

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- » **Beta 1 Smart Beta strategies provide low tracking error**
  - › Offers effective value and small premium capture
  - › Cannot capture low beta premium effectively
  - › Can use equity barbell solution to incorporate some “low beta” premium
    - › Underweight low volatility global equities + overweight “beta 1” EM equities to match ACWI benchmark

# If Equity Volatility is Your Risk

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- » Low volatility Smart Beta provides low volatility
  - › Can offer effective value, small and low beta premium capture

# Thank You

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# Notes: Strategy Simulation Descriptions

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<sup>1</sup>Volatility weighted: Weighted based on the standard deviation of monthly returns over the five year window prior to index construction.

<sup>2</sup>Market Beta Weighted: Weighted based on CAPM betas using market factor kindly provided by Kenneth French on his website.

The market beta loading is estimated using monthly returns data over five years window prior to index construction.

<sup>3</sup>Downside Semi-Deviation Weighted: Weighted based on downside semi-deviation of the monthly returns over five year period prior to index construction.

<sup>4</sup>Cap-Weighted: Weighted based on market capitalization. The market capitalization is computed using December close of the year prior to index construction.

<sup>5</sup>Book Weighted: Weighted based on the book value of equity. We use the book value from the fiscal year two years prior to index construction. We introduce delay to avoid forward-looking bias.

<sup>6</sup>Five-year Average Earnings Weighted: Weighted based on the average of the five-year earnings. The averaging period covers the five fiscal years ending with the fiscal year two years prior to index construction. We introduce delay to avoid forward-looking bias.

<sup>7</sup>Fundamentals Weighted: Weighted based on the five year averages of cash flows, dividends, sales and the most recent book value of equity. We introduce two year delay to avoid forward-looking bias. Following the original method, we select top stocks with the largest fundamental weight. For details see Arnott, Hsu, and Moore (2005).

<sup>8</sup>Earnings Growth Weighted based on five-year average dollar change in earnings divided by the average absolute dollar value of earnings over the five-year period. The last fiscal years of the measuring window is taken two years prior to index construction. We introduce delay to avoid forward-looking bias.

<sup>9</sup>Minimum Variance: To construct the minimum variance strategy we use the method of Clarke, de Silva, and Thorley (2006).

<sup>10</sup>Maximum Diversification Portfolio optimized to maximize expected diversification ratio, which is defined as the ratio of weighted average risk to the expected portfolio risk. For details see Choueifaty and Coignard (2008).

<sup>11</sup>Risk-Efficient ( $\lambda=2$ ) Mean-variance optimized portfolio assuming that expected excess returns are proportional to the stocks' downside semi-deviation, and with stringent constraint to limit portfolio concentration. For details see Amenc et al (2010).

<sup>12</sup>Risk Cluster Equal Weight Applying statistical methods to identify major market risk factors, assumed to be driven by industries and geographies, and then equally weight these uncorrelated risk clusters.

<sup>13</sup>Malkiel's Monkey: Average of 100 portfolios, where each of the individual portfolios is rebalanced annually by randomly selecting 30 stocks out of the universe of the largest 1000 stocks by market capitalization.

<sup>14</sup>Equal Weighting: Equally weighted portfolio of 1000 largest stocks by market capitalization

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