Scientific Investment Philosophy

Jongho Kim

Cornell University

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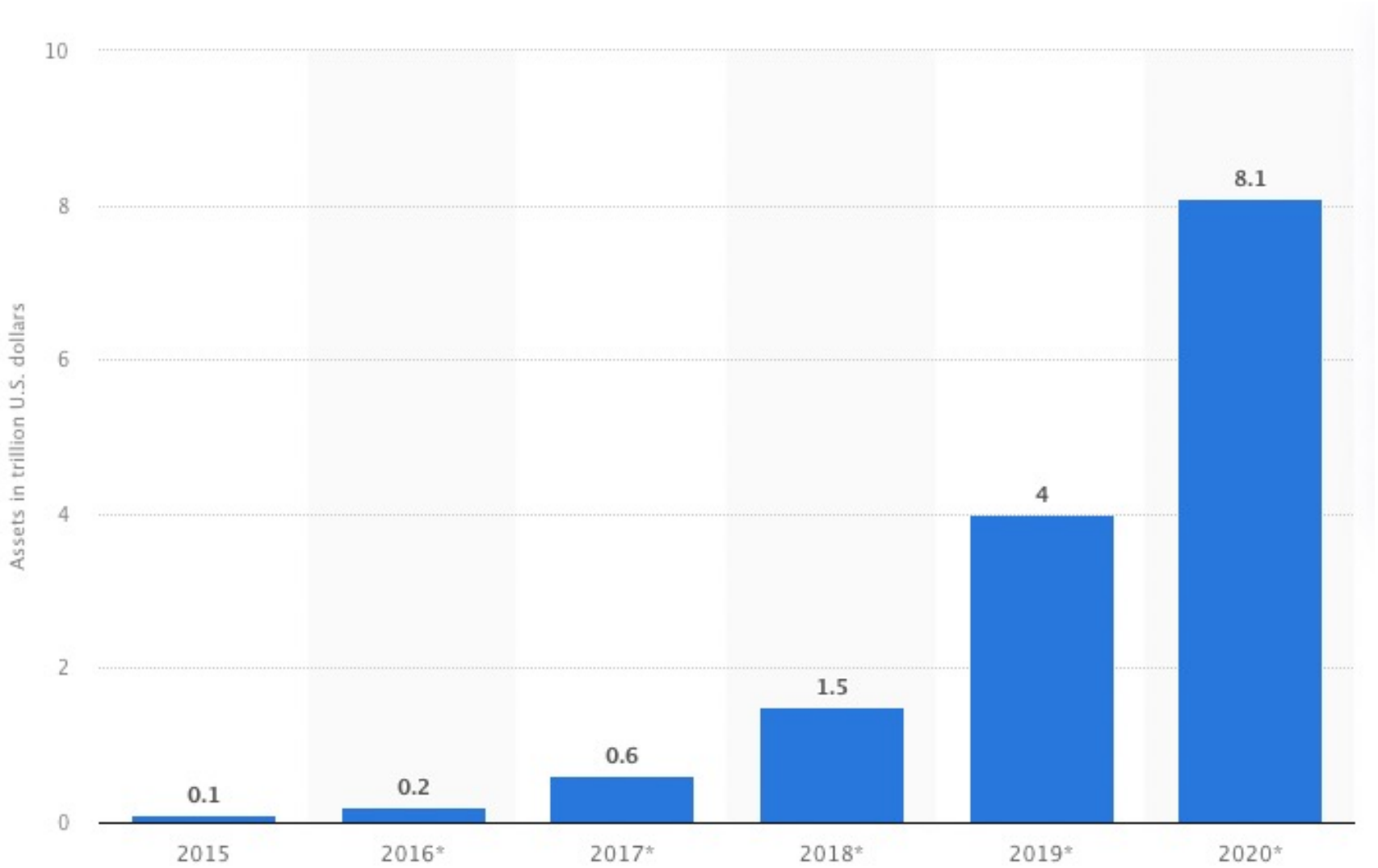
December & Company Asset Management

Fint

Asset Under Management (AUM) by Robo Advisors



(in trillion U.S. dollars)

https://www.statista.com/statistics/741512/aum-of-robo-advisors-globally/

Robo Advisor? How It Works?

- Step 1. Tell us about yourself
  - Investor's specific goals and risk preference

- Step 2. Get your personalized portfolio
  - Set up broadly diversified portfolio based on your goal and risk tolerance

- Step 3. Watch it works!

The Underlying Investment Philosophy of Robo Advisors

- **All Robo Advisors are Not the Same!**
  - Passive / Active investing
  - Goals (Goal driven Investment, Target Date Funds)

- **However, Most Robo Advisors …**
  - Provide portfolios made up of ETFs
  - Require lower management fee & account minimum

(Terminology) What Is an ETF?

- ETF (Exchange Traded Fund)
  - A basket of securities that trade on an exchange, just like a stock.
  - Tracks an index, sector, commodity, or other asset

    ex. SPY (SPDR S&P 500 ETF) tracks the S&P 500 Index

- Why ETF?
  - Easy diversification (ex. Can own hundreds of stocks)
  - Lower expense ratios (Mostly passively-managed fund)
  - Fewer broker commissions

(Terminology) Passive Funds & Active Funds

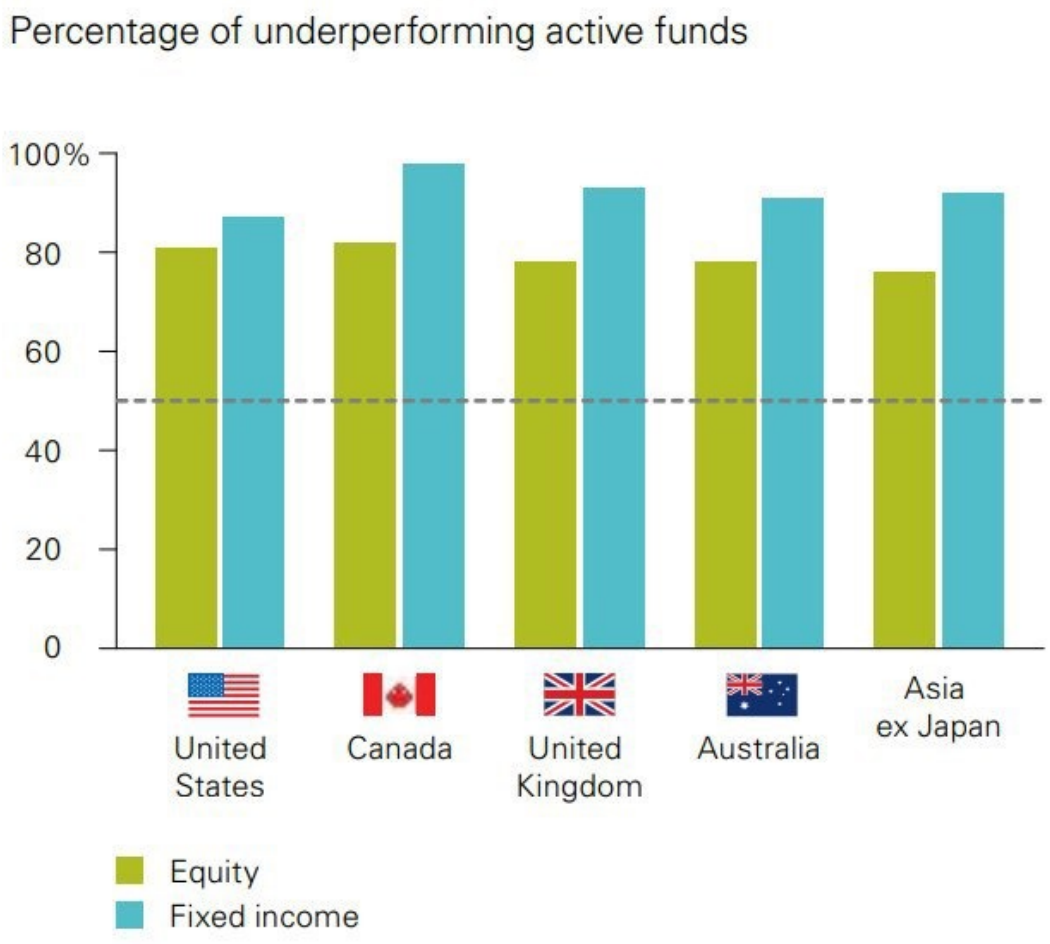
- Passive Funds
  - A market-cap-weighted index fund
  - Follow the efficient market hypothesis (EMH) which states that a stock's current price reflects all relevant information about its current and future earnings

- Active Funds
  - A traditionally actively managed fund in the same sub-asset class as the passive fund
  - Tend to have higher total expense ratios as well as higher tax costs

https://personal.vanguard.com/pdf/ISGACTPA.pdf

Active Funds Underperform across Countries

Figure 14. The performance of actively managed mutual funds versus their prospectus benchmarks



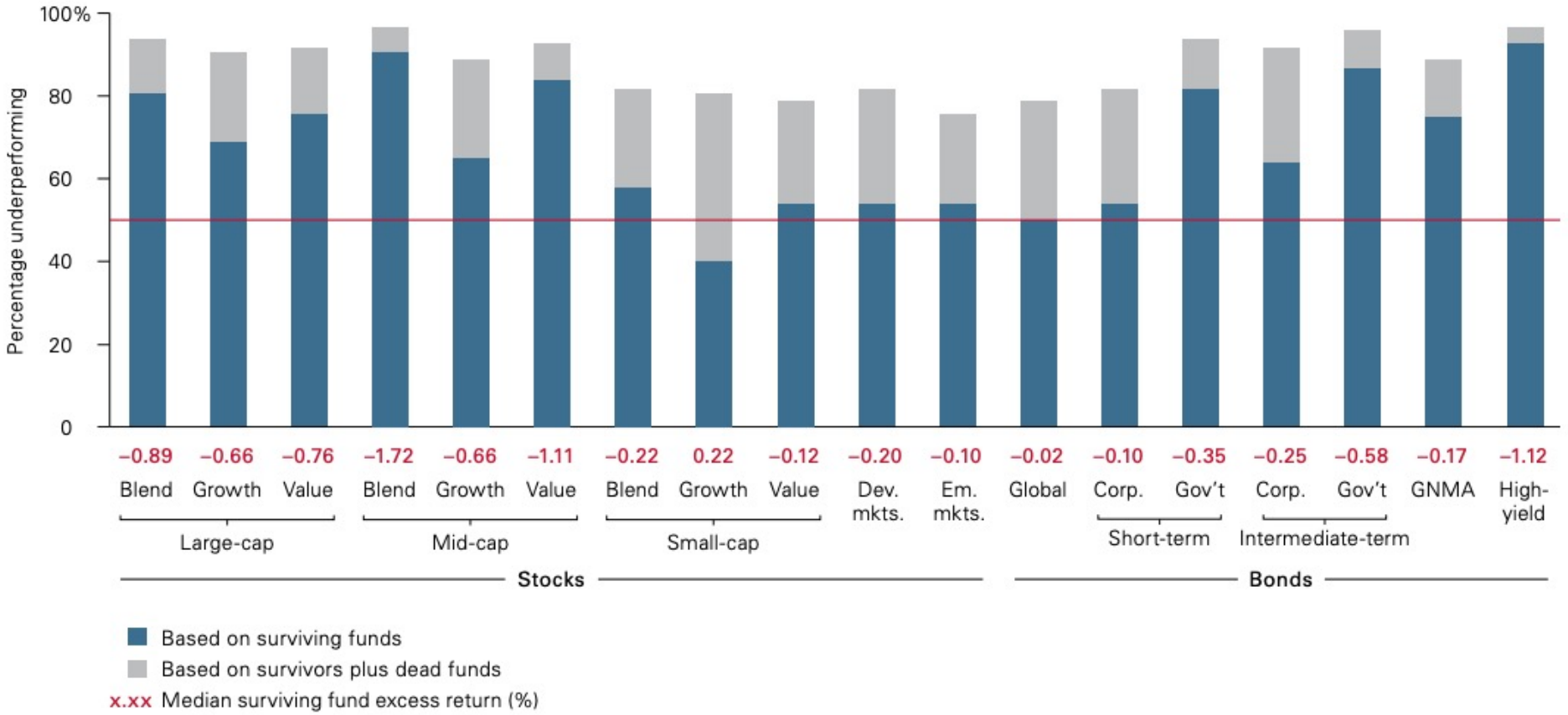
- Passive > Active Funds
  - 80% of active funds fails to beat the market in the long-term
- Low Costs > Timing Skills
  - Low costs, inherent in passive investing, are a key driver in the long-term outperformance

https://personal.vanguard.com/pdf/ISGPRINC_062020.pdf

Active Funds Underperform across Benchmarks

FIGURE 13

Percentage of active funds underperforming their prospectus benchmark over 15 years through December 2019



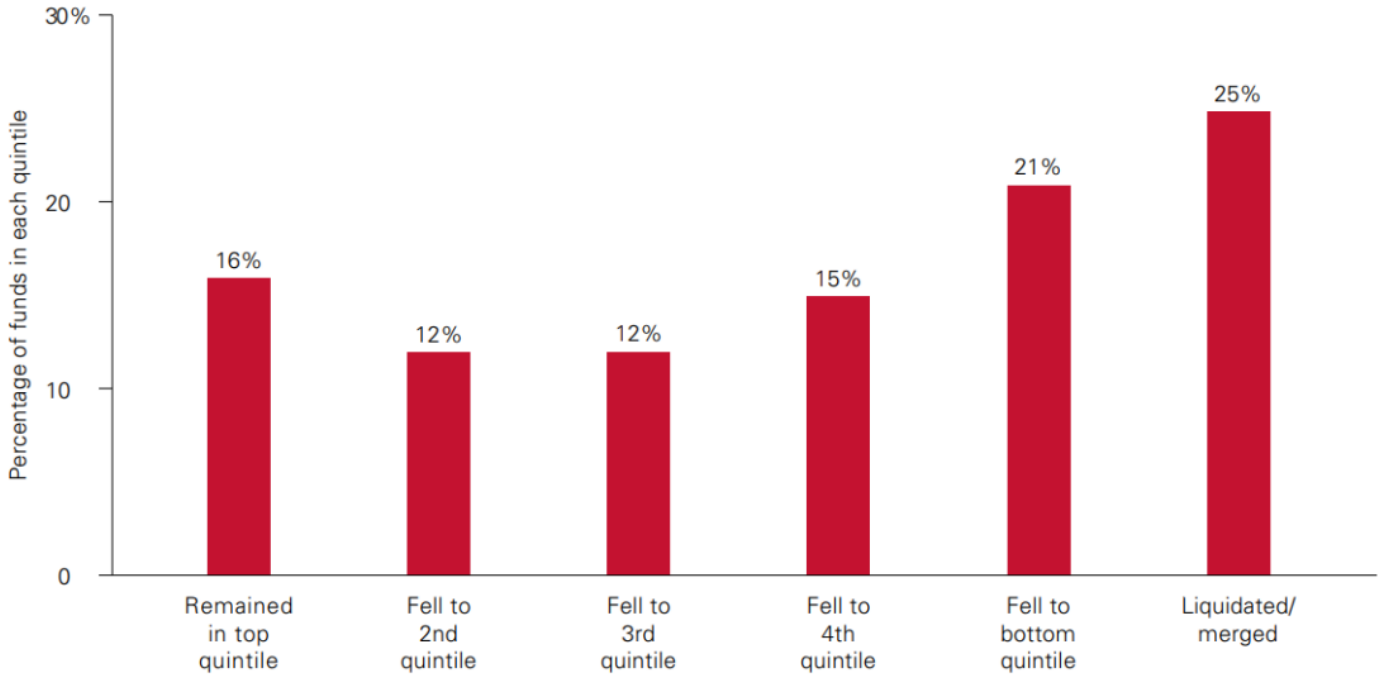
Notes: Data reflect the 15-year period ended December 31, 2019. Fund classifications provided by Morningstar, Inc.; benchmarks reflect those identified in each fund's prospectus. "Dead" funds are those that were merged or liquidated during the period.

Sources: Vanguard calculations, using data from Morningstar, Inc.

What If We Track Active Star Funds' Performance

Figure 18. Fund leadership is quick to change

How the top-performing stock funds of 2011 fared in the rankings five years later



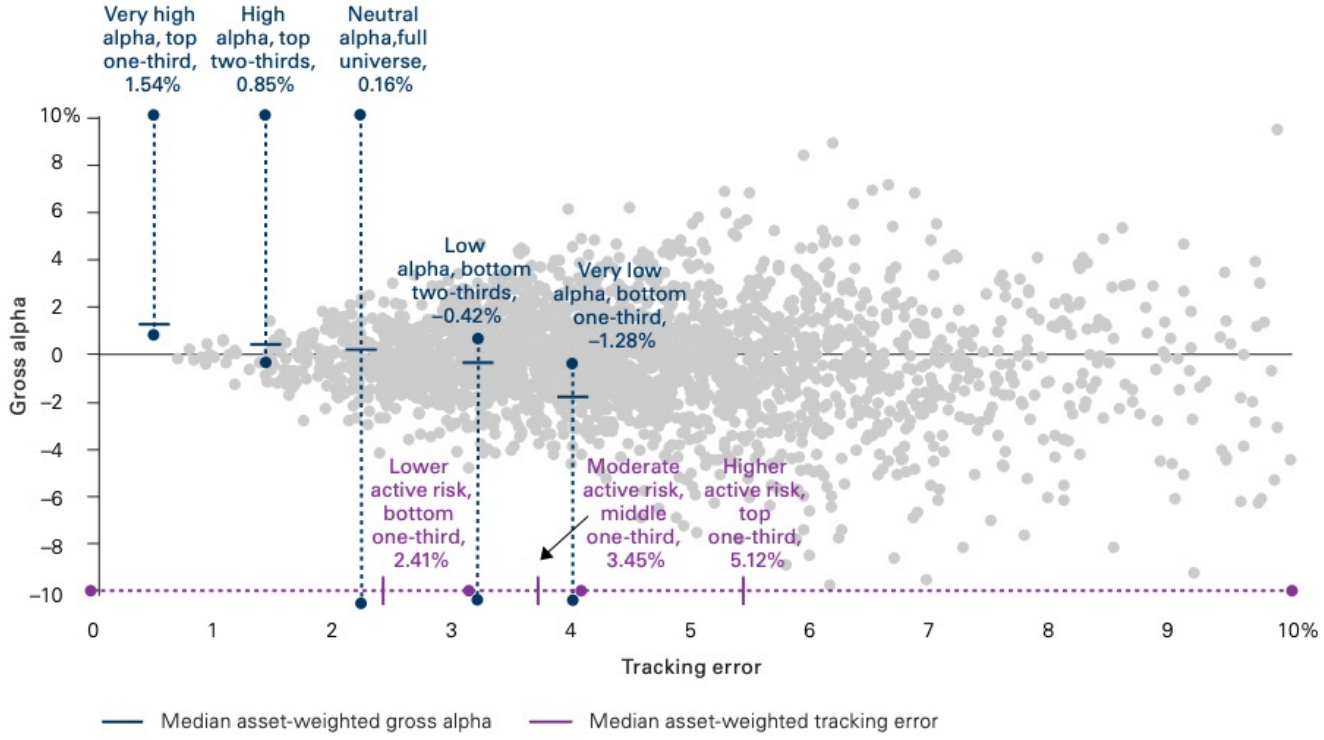
Notes: The chart ranks all actively managed U.S. equity funds within each of the Morningstar style categories based on their excess returns relative to their stated benchmark during the first five years through 2011 and compares how they fared over the next five years through 2016.

Sources: Vanguard calculations using data from Morningstar, Inc.

- 5 years later of top performing funds
  - Liquidated: 25%
  - Fell to bottom 5th quintile: 21%
- Don't chase star funds
  - Consistent outperforming?
  - Luck vs. Skill

Why Active Funds Will Continue to Underperform

Figure 7. Gross alpha expectations and active risk



Notes: Data are for the ten-year period from July 1, 2006, through June 30, 2016, and represent active equity funds with at least 36 months of history available to U.S. investors in the following categories: small-cap value, small-cap growth, small-cap blend, mid-cap value, mid-cap growth, mid-cap blend, large-cap value, large-cap growth, and large-cap blend. Funds that died or merged were included in the analysis. The oldest and lowest-cost single share class was used to represent a fund when multiple share classes existed. Asset-weighted results were calculated using each fund's average reported monthly assets. Each fund is represented one time in the figure; because the analysis is asset-weighted, the median gross alpha and median tracking error will not lie in the middle of the ranges for each alpha level and tracking error in the chart above. Alpha was calculated by regressing monthly gross returns against the Fama-French three factors of small minus big, high minus low, and excess return on the market over the risk-free rate. Tracking error was measured by calculating the standard error of the regression.

Source: Vanguard calculations based on data from Morningstar, Inc., and the Kenneth R. French data library.

- A larger tracking error correlated with a larger range of gross alpha
  - Tracking error: the difference between an actual position and its corresponding benchmark
- (Again) Luck! Not Skills

What's the value of robo-advisors when "buy and hold" is the best strategy?

- How Robo Advisors Create Unique Value to Investors?
  - Value 1. Truly diversified portfolio
  - Value 2. Risk tolerance of investors
  - Value 3. Nudging
  - Value 4. Transparency
  - Value 5. Cost

Value 1. Truly Diversified Portfolio

- Investing in a single ETF is not a truly diversified portfolio

- Need to develop weighting schemes for a variety of asset classes

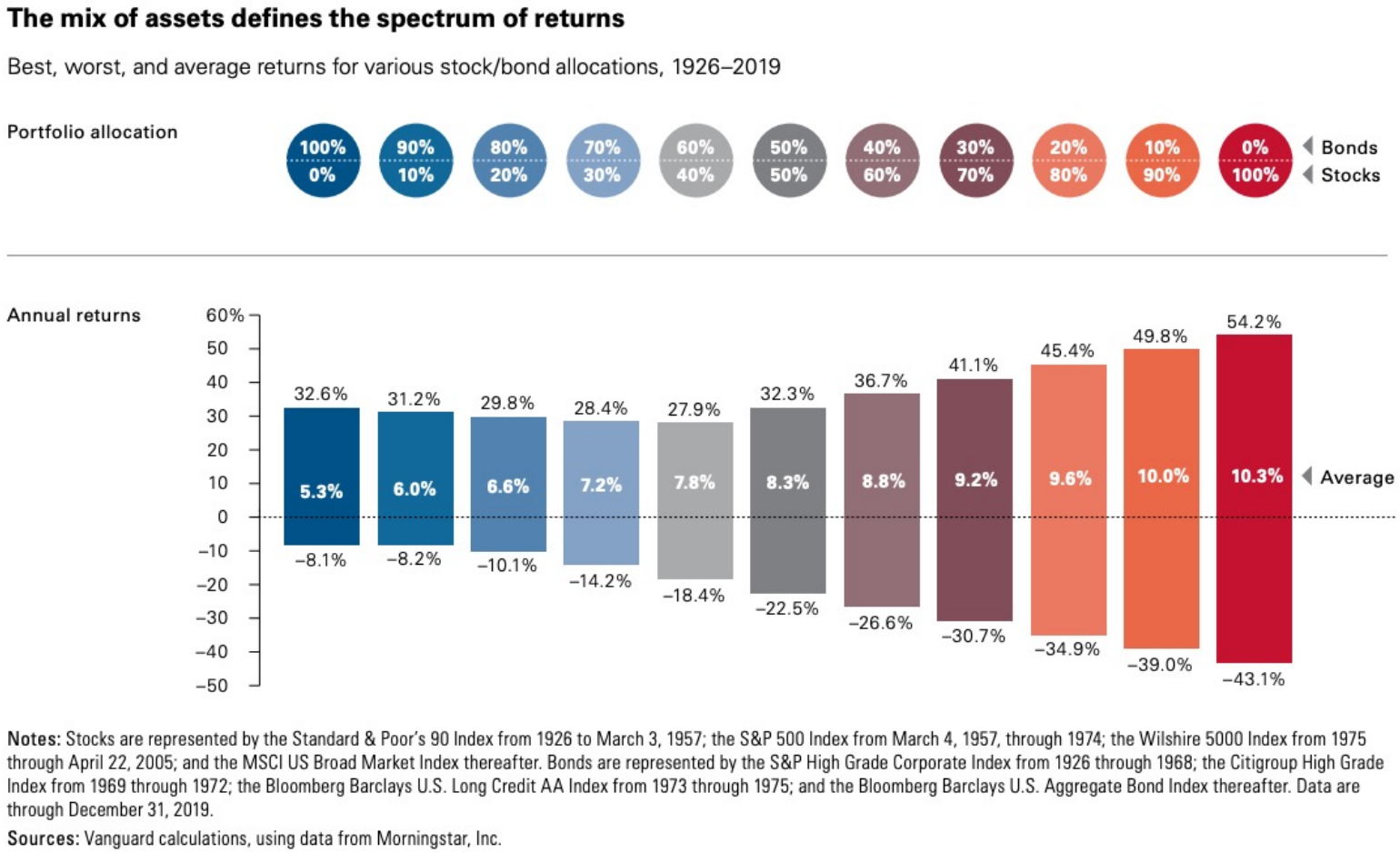
  1) Defining asset classes

     - Equity, Fixed Income, Real Estates, Commodities, etc
     - Plus, US, World, Developed Market, Emerging Market, etc

  2) Developing Weighting Schemes

     - Value weighted

Value 2. Different Risk Tolerance of Investors

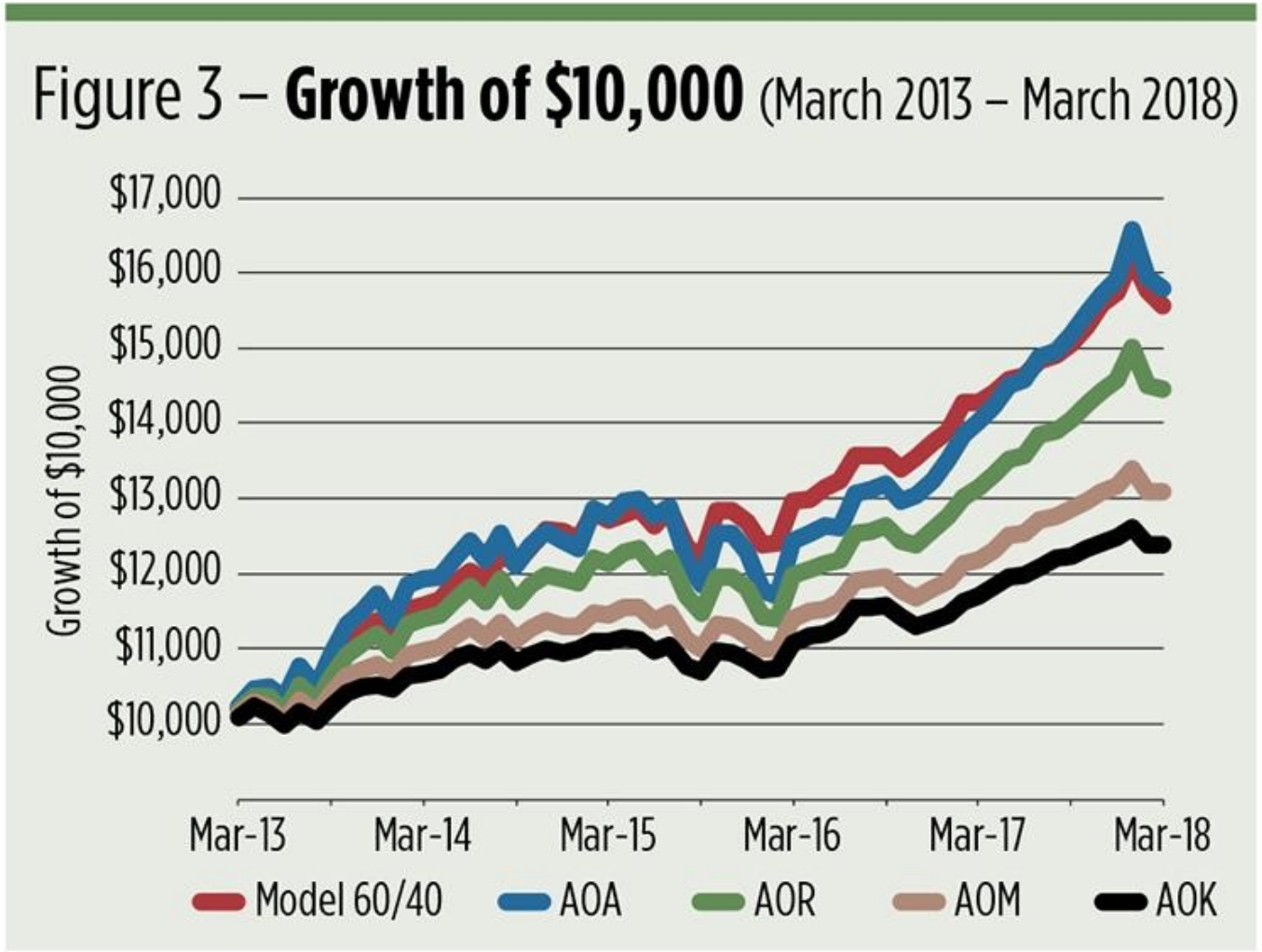


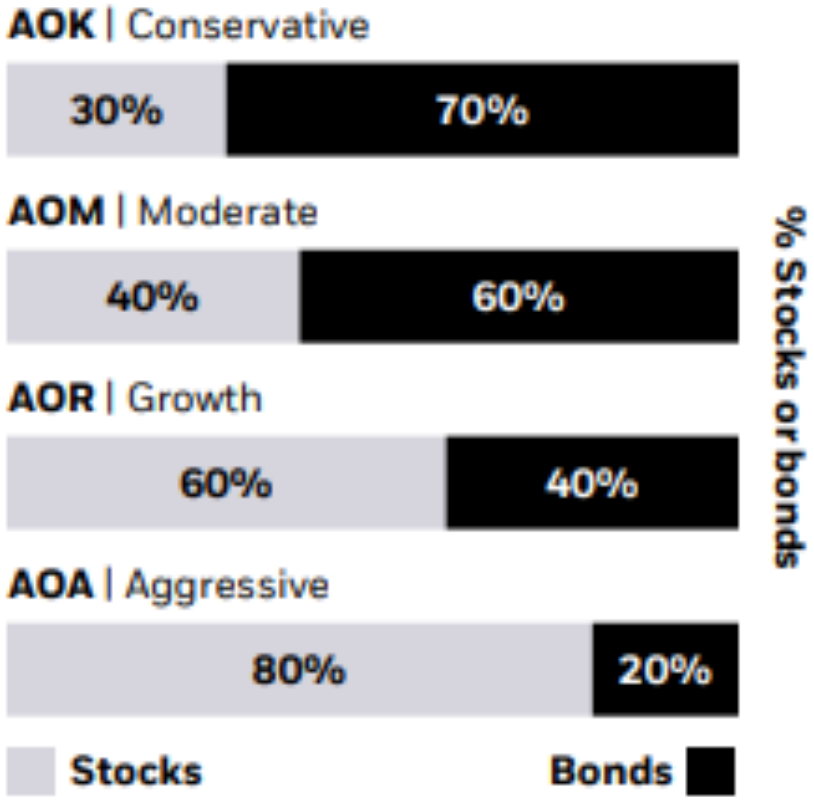
Notes: Stocks are represented by the Standard & Poor's 90 Index from 1926 to March 3, 1957; the S&P 500 Index from March 4, 1957, through 1974; the Wilshire 5000 Index from 1975 through April 22, 2005; and the MSCI US Broad Market Index thereafter. Bonds are represented by the S&P High Grade Corporate Index from 1926 through 1968; the Citigroup High Grade Index from 1969 through 1972; the Bloomberg Barclays U.S. Long Credit AA Index from 1973 through 1975; and the Bloomberg Barclays U.S. Aggregate Bond Index thereafter. Data are through December 31, 2019.

Sources: Vanguard calculations, using data from Morningstar, Inc.

- Return stats over 100 years
  - In the long run, the returns of stocks (10.3%) is higher than bonds (5.3%), but the drawdown is also high.
- Risk profile of investors
  - 40% of loss?

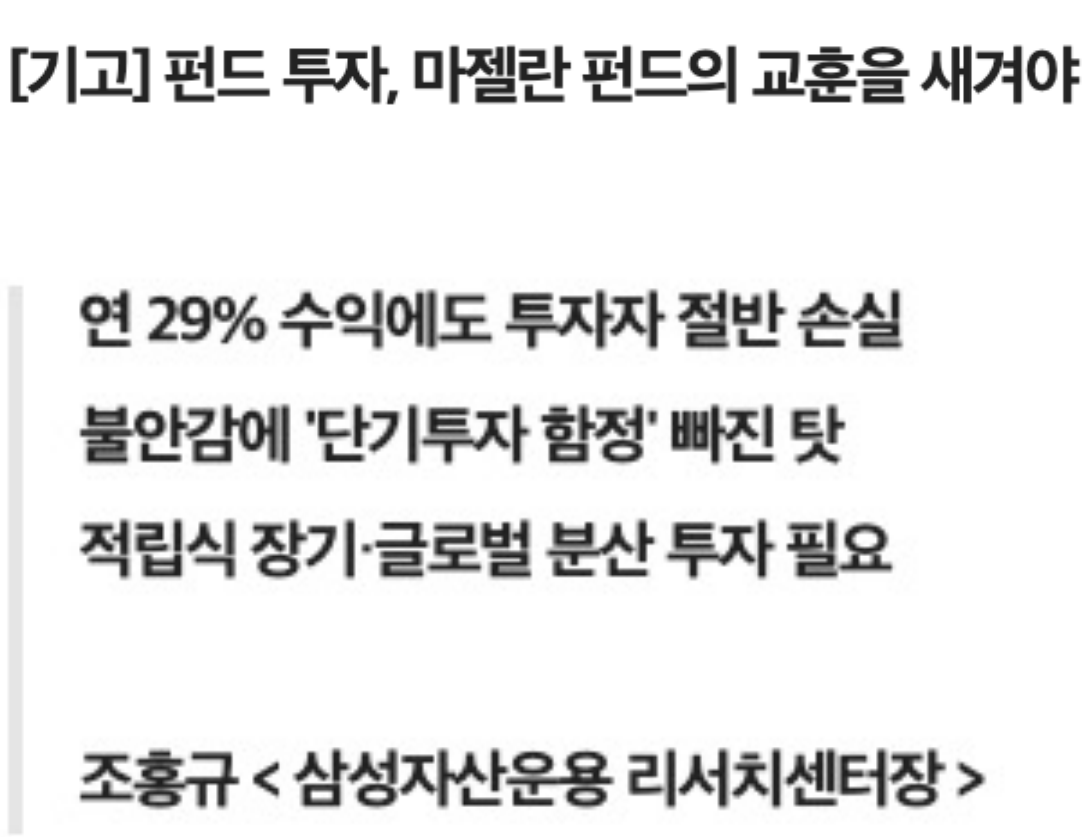
Value 2. Different Risk Tolerance of Investors





https://www.ishares.com/us/products/239733/ishares-conservative-allocation-etf

Value 3. Nudging: Interventions through a Mobile Platform


[기고] 펀드 투자, 마젤란 펀드의 교훈을 새겨야

연 29% 수익에도 투자자 절반 손실

불안감에 '단기투자 함정' 빠진 탓

적립식 장기·글로벌 분산 투자 필요

조홍규 < 삼성자산운용 리서치센터장 >

https://www.hankyung.com/opinion/article/2017102297321

- Individual Investor's Behavioral Biases
  - Improper Market Timing
  - System1 vs. System2 (Loss != Gain)

- However, Robo Advisors can nudge through mobile platforms and interventions
  - Long term investments
  - Diversification
  - Prevent from behavioral biases

Value 4. Transparency

매일경제

라임운용, 6200억 규모 펀드환매 중단

A1면 1단 | 기사입력 2019.10.08. 오후 10:51 최종수정 2019.10.09. 오후 3:09 기사원문 스크랩 본문듣기 · 설정

25 12 요약봇 가

주가 떨어져 자산회수 안돼

1주전 환매연기 이어 초강수
사모펀드업계 초대형 악재

사모헤지펀드 수탁액 1위인 라임자산운용이 이달 초 사모채권이 편입된 펀드 환매를 연기한 데 이어 이번에는 메자닌이 주로 편입된 펀드의 환매를 중단하기로 했다. 이번에 환매 중단된 펀드 설정액이 6200억원 규모에 달하는 것으로 알려져 해당 운용사뿐 아니라 업계 전체에 미치는 파장이 만만찮을 것으로 전망된다.

https://www.donga.com/news/Economy/article/all/20191009/97802773/1

- Transparent return performance & portfolio holdings
  - Robo Advisors transparently invest money through each individual's account, rather than collecting all money in one place

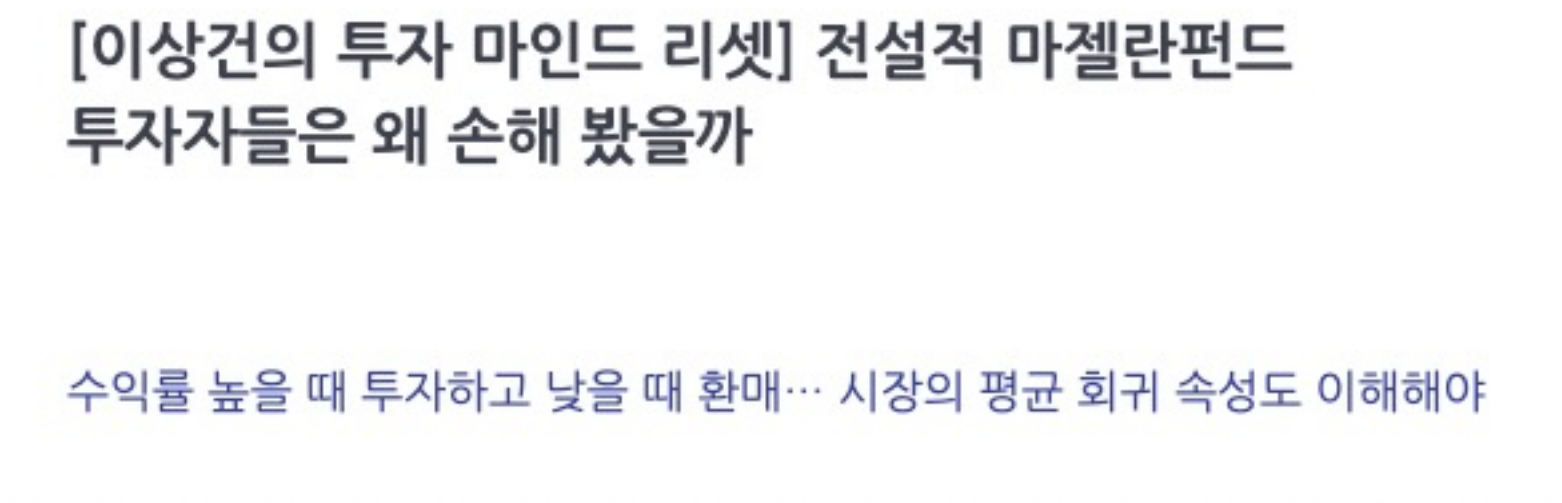
Value 5. Cost (+ Tax Consideration)

- Very low operating costs
  - Do not need for face-to-face offline channels
  - Automated personalization for small amounts of money

- Tax consideration
  - For high tax bracket: Capital gain > Interest income (Dividend income)

Still, Why Do We Need Robo? What's Wrong with Individual Investors?

- **Investment Fallacy 1. Market Timing**


[이상건의 투자 마인드 리셋] 전설적 마젤란펀드 투자자들은 왜 손해 봤을까

수익률 높을 때 투자하고 낮을 때 환매… 시장의 평균 회귀 속성도 이해해야

- 13-year average annual return of 29.2% achieved, but more than half of the fund investors suffered losses?!

https://jmagazine.joins.com/economist/view/326973

What's Wrong with Individual Investors?

- **Investment Fallacy 2. Active Investing**

  - What percentage of individual investors are making profits compared to the market through active investing?

  - In the futures market, 98% of individual investors end up with losses, and the remaining 2% do not make significant profits.

What’s Wrong with Individual Investors?

- **Investment Fallacy 3. Concentrated Portfolio**

  - The biggest misconception about diversification:

    - "Diversification is difficult for individuals to pursue because it increases the number of stocks they have to manage.”

What's Wrong with Individual Investors?

- **Investment Fallacy 4. Misconceptions about stock investing**

  - Prejudices about stock investing:

    - Prejudice 1. Investing in stocks is done to become extremely wealthy

    - Prejudice 2. It is possible to find a strategy in the stock market that avoids losses and only yields absolute returns.

    - Prejudice 3. The stock market is a zero sum game.

What's Wrong with Individual Investors?

- **Investment Fallacy 1. Market Timing**
- **Investment Fallacy 2. Active Investing**
- **Investment Fallacy 3. Concentrated Portfolio**
- **Investment Fallacy 4. Misconceptions about stock investing**

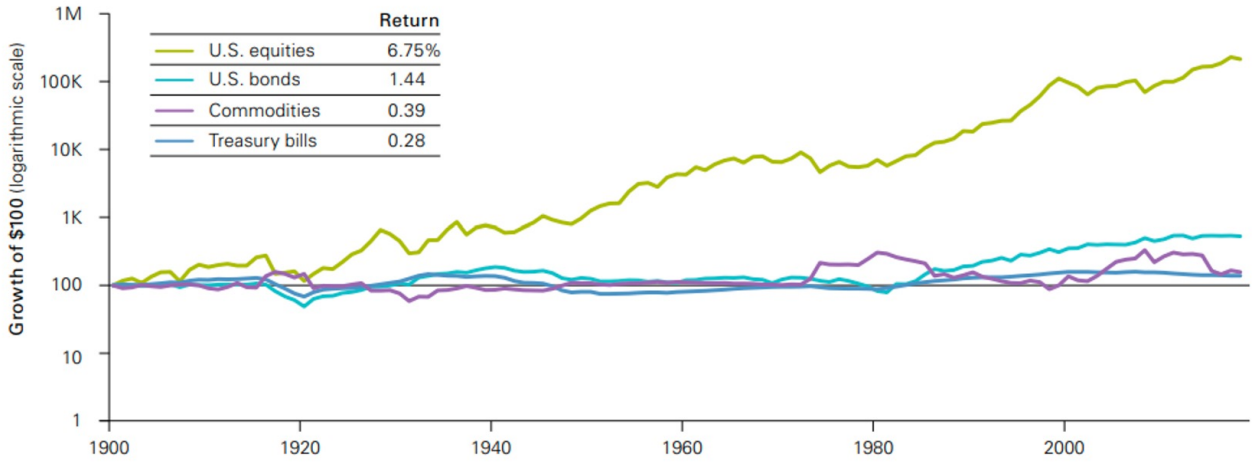
Investment Philosophy

- **Principle 1. Long Term Investment**
  - To turn investing from speculation into a statistical pursuit, sufficient time is needed for statistical outcomes to be realized.

- Characteristics of risky assets

Figure 7. Long-term performance

Real returns, 1900–2018



Notes: The commodities return is based on spot price and does not represent the return of a futures-based investment. See Appendix A-3 for more information on the long-term returns of commodities.

Sources: Vanguard, Global Financial Data, U.S. Federal Reserve, and Bloomberg.

Investment Philosophy

- **Principle 2. Diversification**
  - Similarly, to make investments based on statistical evidence, you must follow the law of large numbers to enjoy the characteristics of average risk assets (upward trend in the long term).

Investment Philosophy

Table 4
Returns to Bootstrapped Stock Portfolios, July 1926 to December 2016. The indicated numbers of stocks are selected at random for each month, value-weighted portfolio returns are computed each month for the selected stocks, and these returns are linked over 1-, 10-, and 90-year horizons. The procedure is repeated 20,000 times. Each linked return is compared to zero, to the actual holding return on one-month Treasury bills, and to the actual holding return to the value-weighted portfolio of all stocks in the database. Mean, Med, Skew refer to the mean, median, and standardized skewness computed across the 20,000 outcomes.

	1-Year horizon			10-Year horizon			Life (90-Year) horizon		
	Mean	Med	Skew	Mean	Med	Skew	Mean	Med	Skew
Bootstrapped single-stock positions									
Holding return	0.1656	0.0406	6.99	2.4538	0.2772	65.03	9498.26	0.095	96.45
% > 0	53.59%			56.18%			50.76%		
% > T-bill	50.79%			47.77%			27.45%		
% > VW mkt	42.86%			29.38%			3.97%		
Bootstrapped 5-stock portfolios, value weighted									
Holding return	0.1316	0.1072	1.08	1.9180	1.2364	9.03	8954.97	949.36	47.24
% > 0	64.33%			83.60%			99.94%		
% > T-bill	59.98%			72.29%			96.48%		
% > VW mkt	47.20%			40.77%			22.68%		
Bootstrapped 25-stock portfolios, value weighted									
Holding return	0.1226	0.1252	0.10	1.8188	1.3977	1.64	6355.47	3174.56	10.02
% > 0	70.00%			95.96%			100.00%		
% > T-bill	64.94%			86.86%			100.00%		
% > VW mkt	48.69%			45.37%			36.81%		
Bootstrapped 50-stock portfolios, value weighted									
Holding return	0.1208	0.1290	−0.09	1.7980	1.4009	1.15	5860.71	3843.32	4.40
% > 0	71.21%			98.38%			100.00%		
% > T-bill	66.19%			90.70%			100.00%		
% > VW mkt	49.10%			46.70%			40.94%		
Bootstrapped 100-stock portfolios, value weighted									
Holding return	0.1195	0.1318	−0.21	1.7805	1.3760	0.90	5441.81	4217.49	2.95
% > 0	72.00%			99.57%			100.00%		
% > T-bill	67.09%			93.08%			100.00%		
% > VW mkt	49.28%			47.54%			43.29%		

Comparison of the probability of outperforming T-Bills between diversified investment and single stock investment.

Investment Philosophy

- **Principle 3: Don’t be overly sensitive to losses**
  - This response to losses prevents exploitation of the statistics confirmed through backtes ting
  - Short-term momentum and reversal of portfolio returns do not have much statistical evi dence to support them.

- **Principle 4: Don’t engage in market timing**
  - Rather than predicting when the market will rise or fall, it is more important to always be invested (how much risk exposure has your asset been exposed to for how long?).

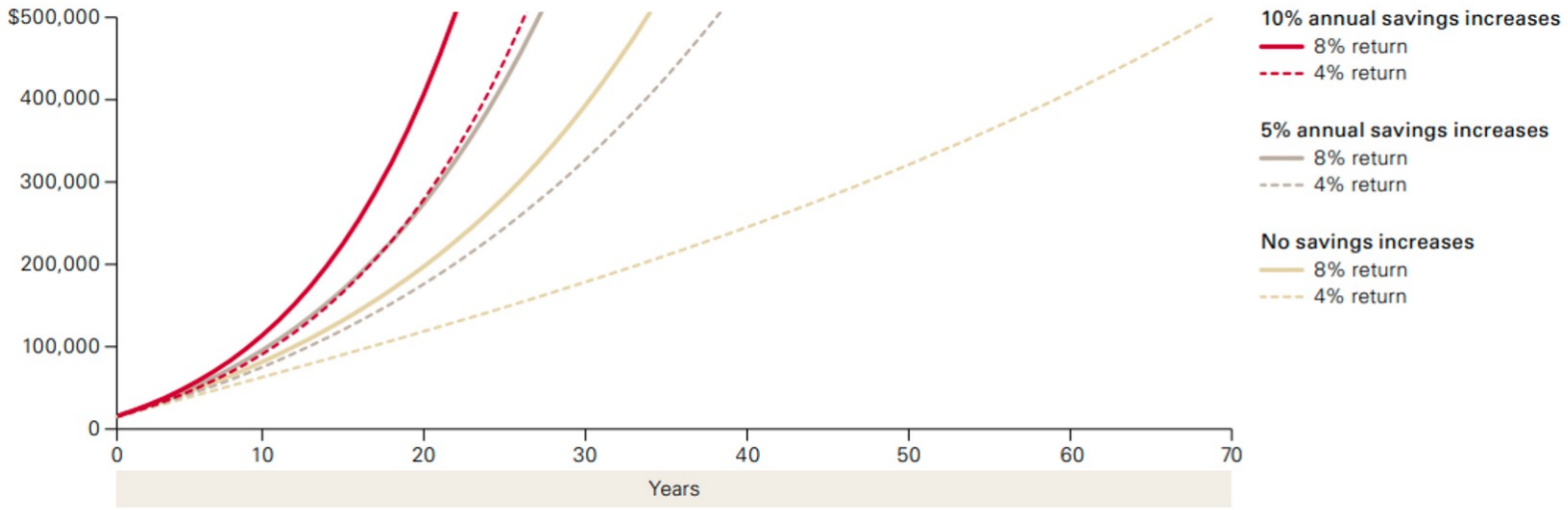
Investment Philosophy

- **Principle 5: Passive management rather than active management**

- **Principle 6: Efforts to find a good investment strategy <<<< efforts to increase savings rates and labor income.**

Figure 20. Increasing the savings rate can dramatically improve results

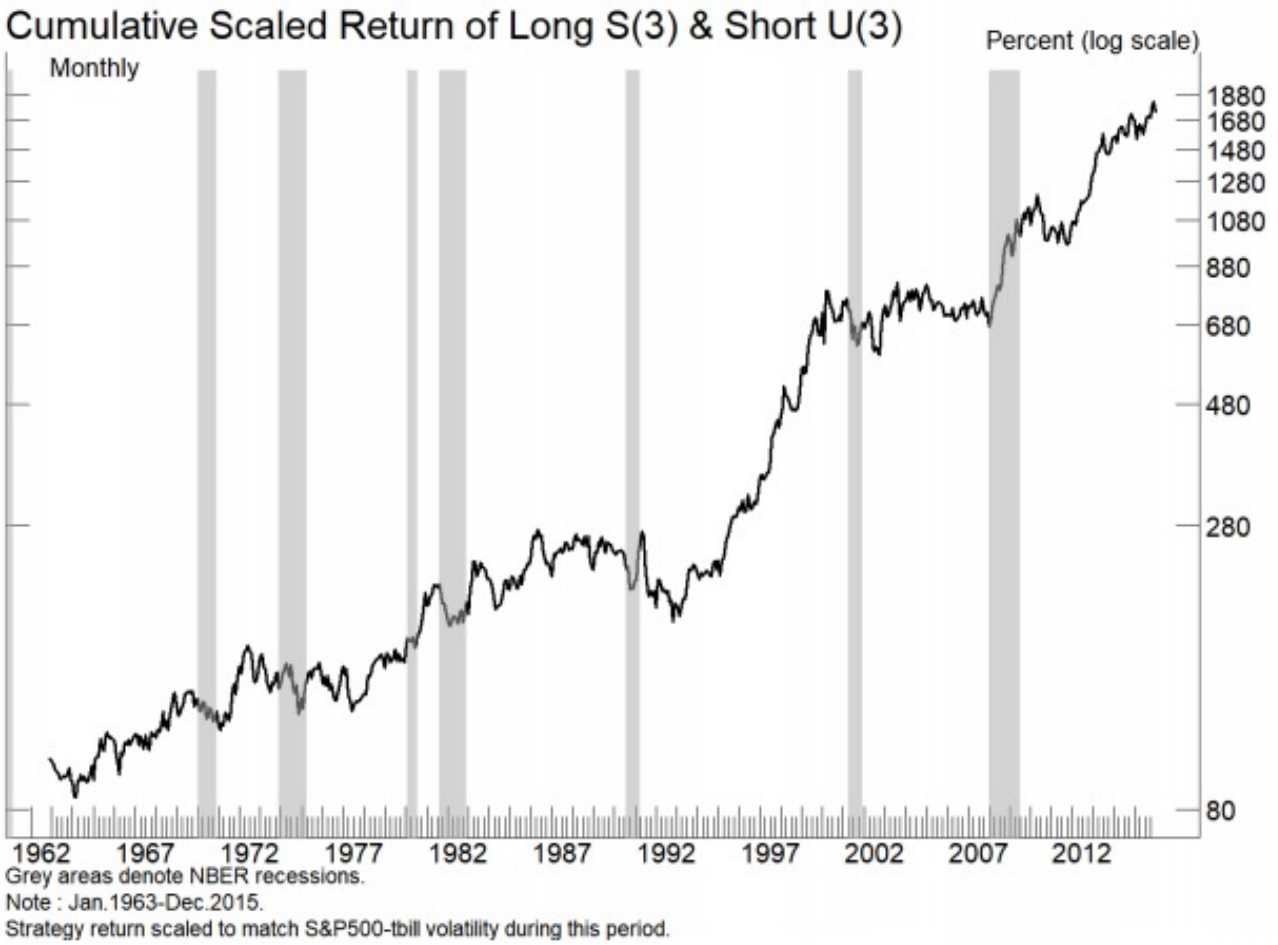
Years needed to reach a target using different contribution rates and market returns



Part2. Untangling Skill and Luck: Scientific Investment Principles

Return Performance Cannot be a Signal for Good Strategy

Exhibit 1: Long–Short Market-Neutral Strategy Based on NYSE Stocks, 1963-2015

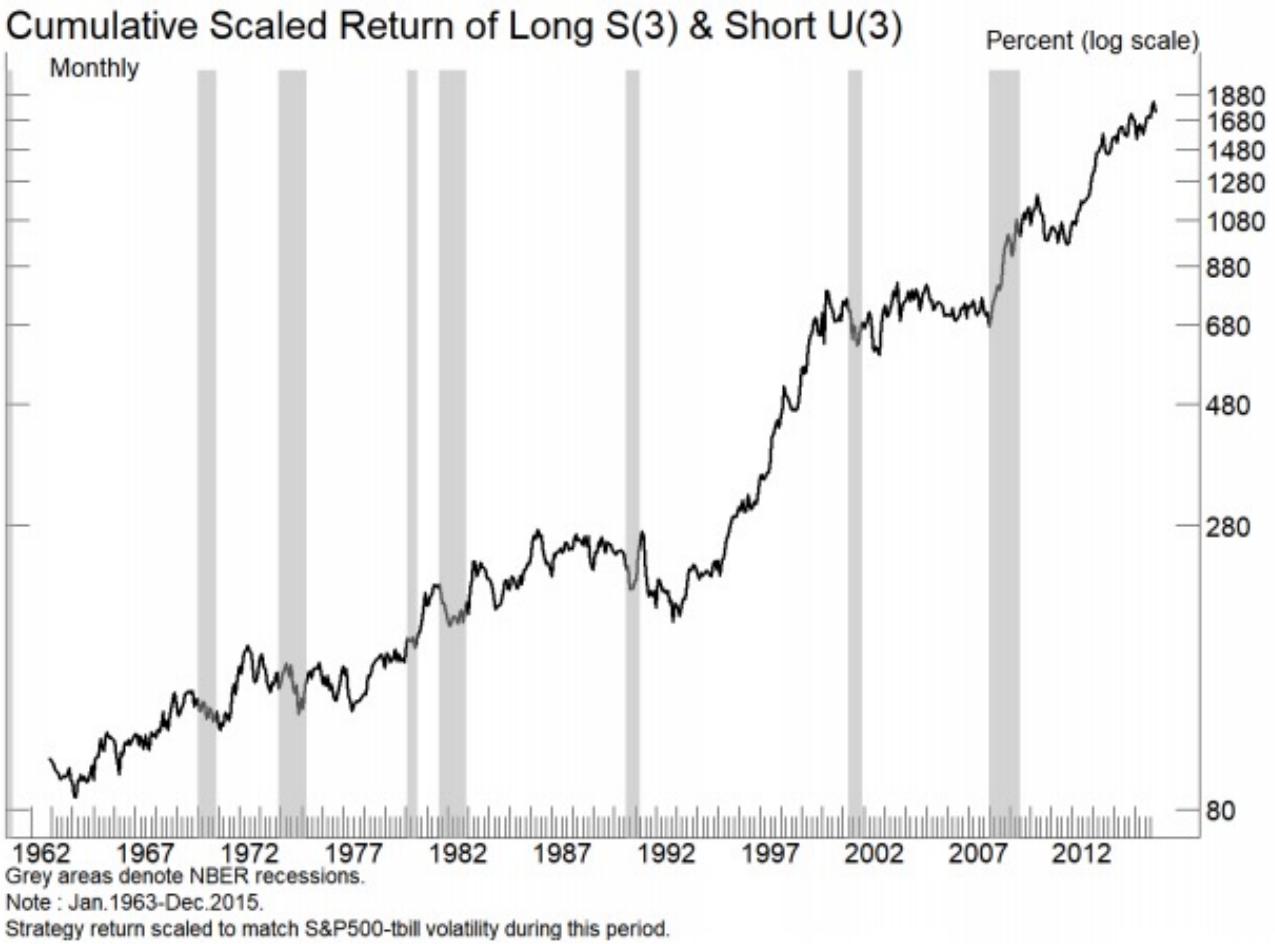


- **Good Strategy or Bad Strategy?**
  - 6% alpha a year
  - Consistent over 50 years
  - Does well during the financial crisis, gaining nearly 50%
  - Turnover less then 10% a year
  - Sharpe is simply amazing

Arnott, Robert D. and Harvey, Campbell R. and Markowitz, Harry, A Backtesting Protocol in the Era of Machine Learning (November 21, 2018). Available at SSRN: https://ssrn.com/abstract=3275654 or http://dx.doi.org/10.2139/ssrn.3275654

Why is Scientific Investment Important?

Exhibit 1: Long–Short Market-Neutral Strategy Based on NYSE Stocks, 1963-2015



- **Strategy: S(3) – U(3)**
  - S(3): Long all stocks with "SSS" as the first letters of their ticker symbol
  - U(3): Short all stocks with "UUU"

Arnott, Robert D. and Harvey, Campbell R. and Markowitz, Harry, A Backtesting Protocol in the Era of Machine Learning (November 21, 2018). Available at SSRN: https://ssrn.com/abstract=3275654 or http://dx.doi.org/10.2139/ssrn.3275654

Why is Robustness Check Important?

- **Without robust evidence, we cannot**
  - become a long term investor
  - tolerate drawdowns (loss)

    Ex. Even if some strategy crashed in 2008, most of it recovered in 2009
  - invest large amounts of money

Why is Robustness Check Important?

- **Without robust evidence, we cannot**
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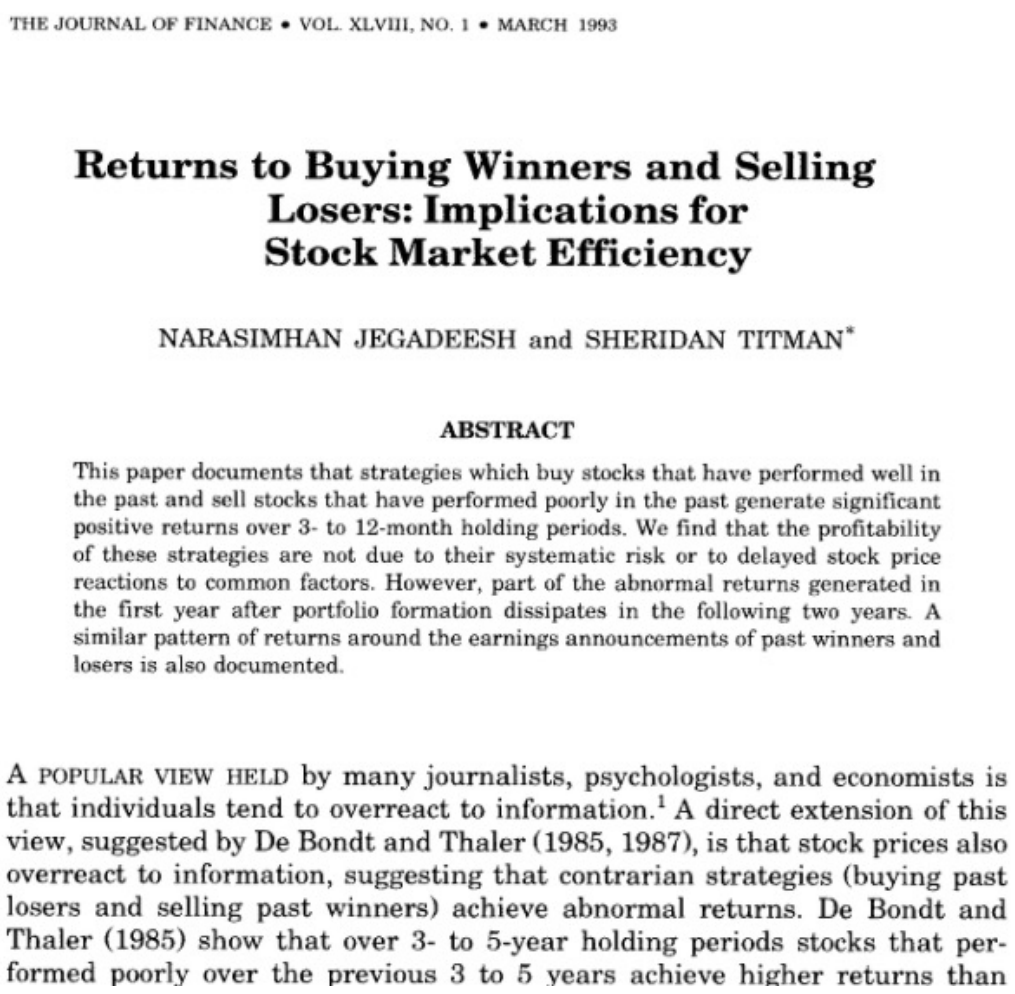
- Then, what's the in-depth approach in finance literature?

Asset Pricing Literature

- **Multi Factor Models**
  - Employs a set of different factors to analyze and explain equilibrium prices of an asset

- **Factor Model Examples**
  - Momentum, Reversal, Small Size, Value (Book to Market), Low Volatility
  - Fama French 3 Factor / 5 Factor Model
  - CAPM is actually a single factor model ($R = Rf + B(Rm-Rf)$)

Robustness Checks for Factors



THE JOURNAL OF FINANCE • VOL. XLVIII, NO. 1 • MARCH 1993

Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency

NARASIMHAN JEGADEESH and SHERIDAN TITMAN*

ABSTRACT

This paper documents that strategies which buy stocks that have performed well in the past and sell stocks that have performed poorly in the past generate significant positive returns over 3- to 12-month holding periods. We find that the profitability of these strategies are not due to their systematic risk or to delayed stock price reactions to common factors. However, part of the abnormal returns generated in the first year after portfolio formation dissipates in the following two years. A similar pattern of returns around the earnings announcements of past winners and losers is also documented.

A POPULAR VIEW HELD by many journalists, psychologists, and economists is that individuals tend to overreact to information.[1] A direct extension of this view, suggested by De Bondt and Thaler (1985, 1987), is that stock prices also overreact to information, suggesting that contrarian strategies (buying past losers and selling past winners) achieve abnormal returns. De Bondt and Thaler (1985) show that over 3- to 5-year holding periods stocks that performed poorly over the previous 3 to 5 years achieve higher returns than

- General Finance Paper Structure
  - First 5-10 pages describe the strategy (20%)
  - But, remaining 40 pages are all about robustness checks (80%)
- Overfitting is simply too easy
  - Small Data
  - Low Signal-to-noise Ratios
  - Evolving Markets

Approaches to Find More Significant Factors

- **Approach 1. A Zoo of New Factors**
  - Finding a new factor after controlling all existing factors …
  - Financial, Macro, Behavioral, Accounting, Microstructure etc

- **Approach 2. Factor Rotation, Factor Momentum**
  - 500+ factors in asset pricing literature
  - "Extrapolative Factor Momentum", Hanlin Yang, 2019

- **Approach 3. Machine Learning for Asset Pricing**

Feng, Guanhao, Stefano Giglio, and Dacheng Xiu. "Taming the factor zoo: A test of new factors." *The Journal of Finance* 75.3 (2020): 1327-1370.

Replicating Factors

- **"Replicating Anomalies", The Review of Financial Studies, 2018**
  - 65% of the 452 anomalies in literature cannot clear the single test hurdle of the absolute t-value of 1.96.

- **Why doesn't the known factor work well?**
  - "Does Academic Research Destroy Stock Return Predictability?", Journal of Finance, 2015
    - Out of sample & post publication return predictability decreased
  - False Discovery (Type 1 Error)
    - Inflated by 12% (Zimmermann, 2020)

How Can Strategies Everyone Know Still Work?

- **Source of Abnormal Returns**
  - **Type1. Risk Compensation**
    - Compensation from exposures to systemic risk

      Ex) Small Size, High Vol

  - **Type2. Mispricing**
    - Efficient Market Hypothesis (EMH)
      - Null Hypothesis: News is rapidly and fully incorporated in prices

        Ex) Inherently Inefficient Information (Text)

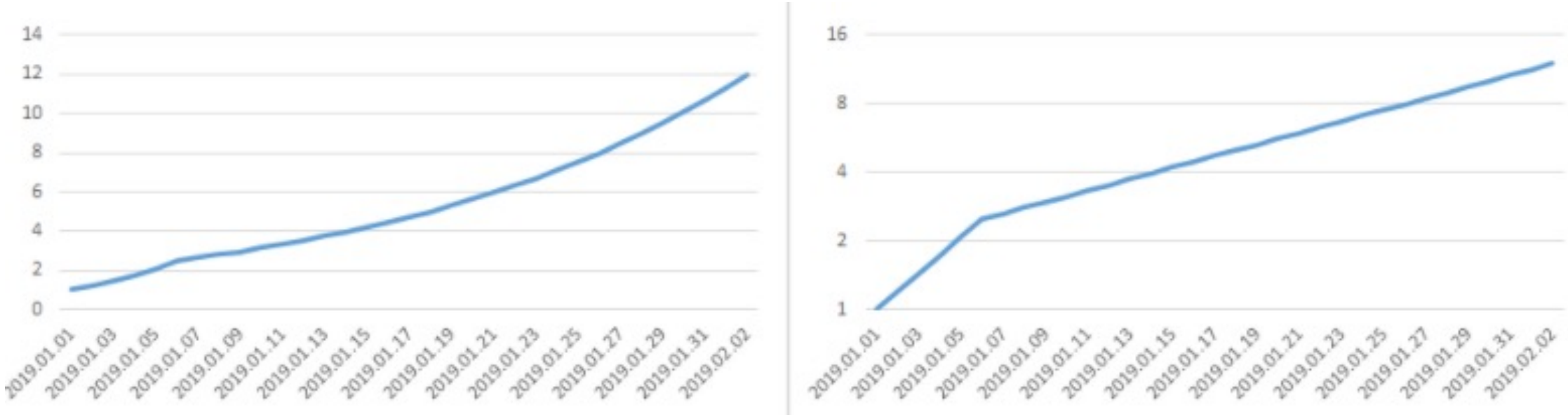
Part3. Statistical Tests to Increase Robustness

Property of Robust Factors

- **Property 1. Consistent & Significant Outperformance**
- **Property 2. Return Predictability across the Investment Universe**
- **Property 3. Less Affected by Rebalancing Timings**

Property 1. Consistent & Significant Outperformance

- **Log Scale Return: Optical illusion effect of eyes**

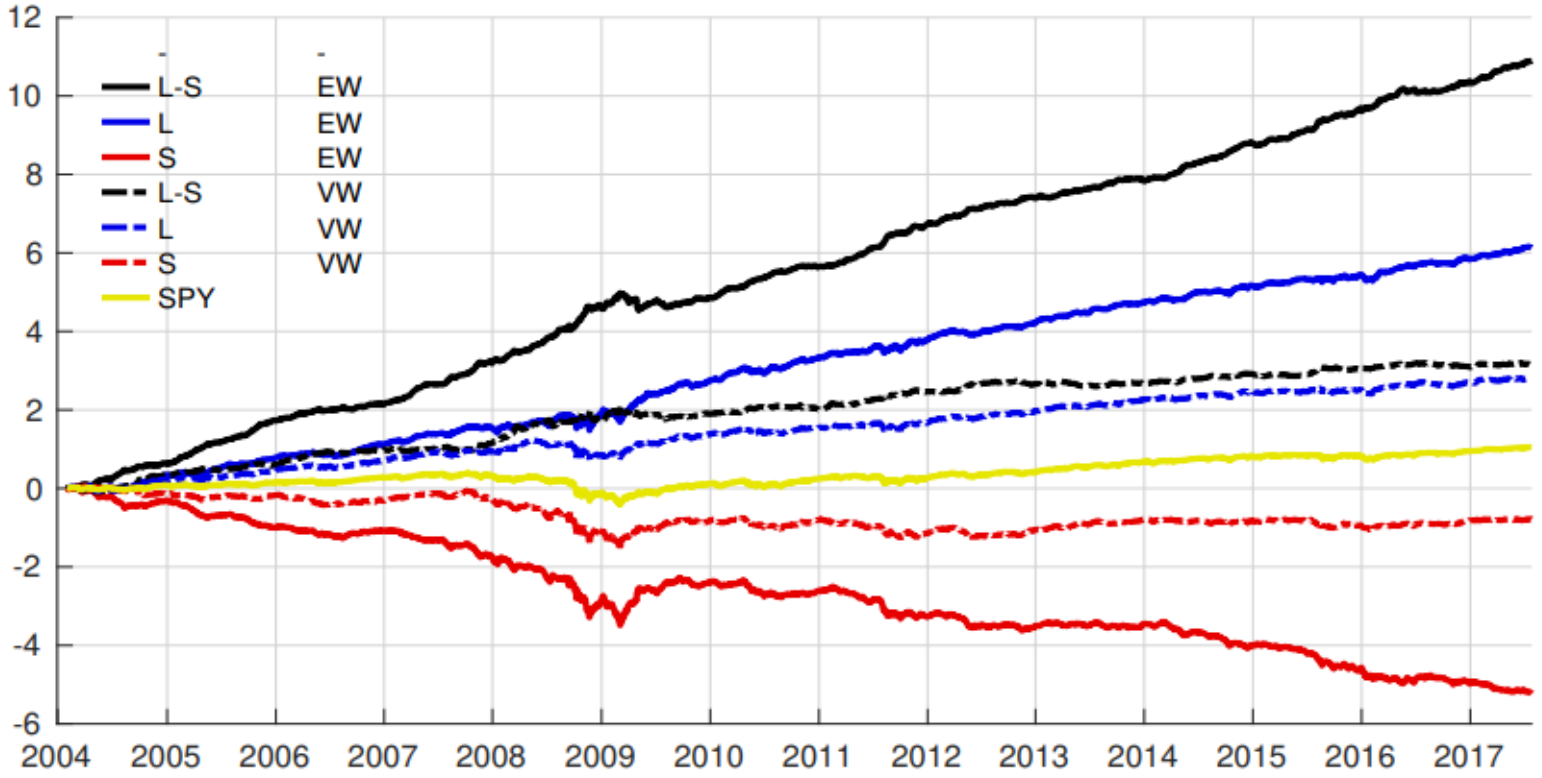


Linear Scale

Log Scale

Property 2. Return Predictability across the Investment Universe

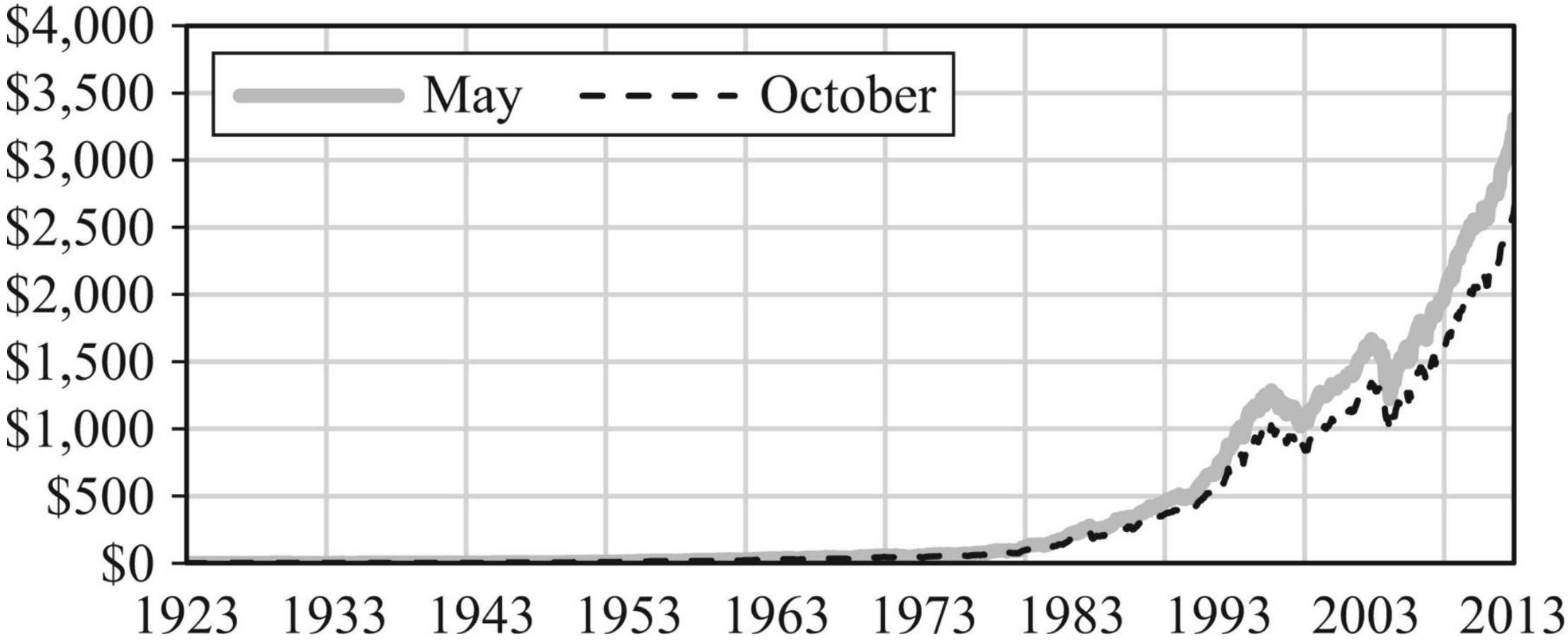
- **Cross Sectional Test**



- Cross Section vs. Time Series
  - Long / Benchmark Return Performance (T-Stats)
  - Long / Short Return Performance (T-Stats)

Ke, Zheng and Kelly, Bryan T. and Xiu, Dacheng, Predicting Returns with Text Data (September 30, 2020). University of Chicago, Becker Friedman Institute for Economics Working Paper No. 2019-69, Yale ICF Working Paper No. 2019-10, Chicago Booth Research Paper No. 20-37, Available at SSRN: https://ssrn.com/abstract=3389884 or http://dx.doi.org/10.2139/ssrn.3389884

Property 3. Rebalancing Timing Test



"Rebalance Timing Luck: The Difference Between Hired and Fired", The Journal of Investing, 2019

Critical Thinking on the Source of Abnormal Returns

- **Source of Abnormal Returns**
  - **Type1. Risk Compensation**
    - Compensation from exposures to systemic risk

      Ex) Small Size, High Vol

  - **Type2. Mispricing**
    - Efficient Market Hypothesis (EMH)
      - Null Hypothesis: News is rapidly and fully incorporated in prices

        Ex) Inherently Inefficient Information (Text)

Type1. Risk Compensation

- **Size Factor**
  - Small businesses have more risks such as business sustainability and bankruptcy, but they can expect high growth rates, resulting in higher long-term returns as compensation for the risks.

Type2. Efficient Market Hypothesis

M&A Example

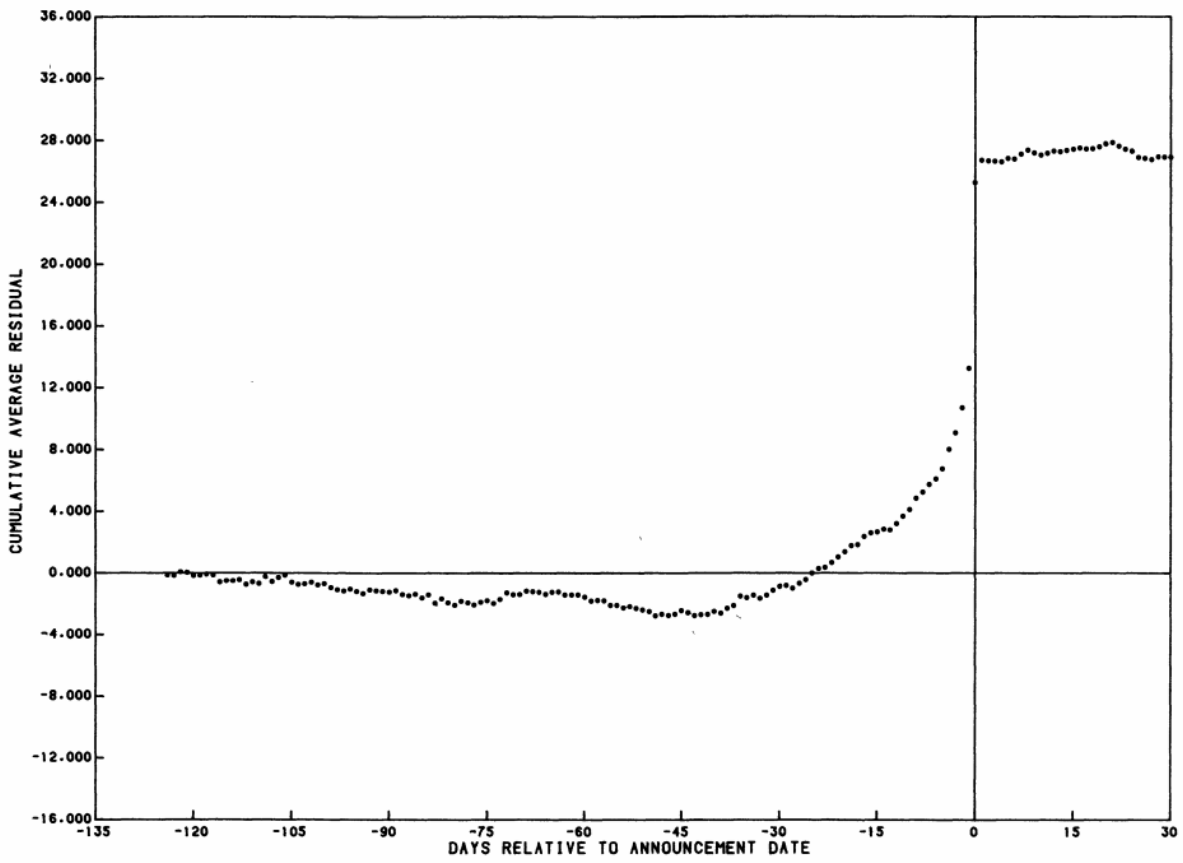


Figure 1. Cumulative Average Residuals–Market Model–Entire Sample

Y: Cumulative abnormal return
X: Days relative to Announcement Date

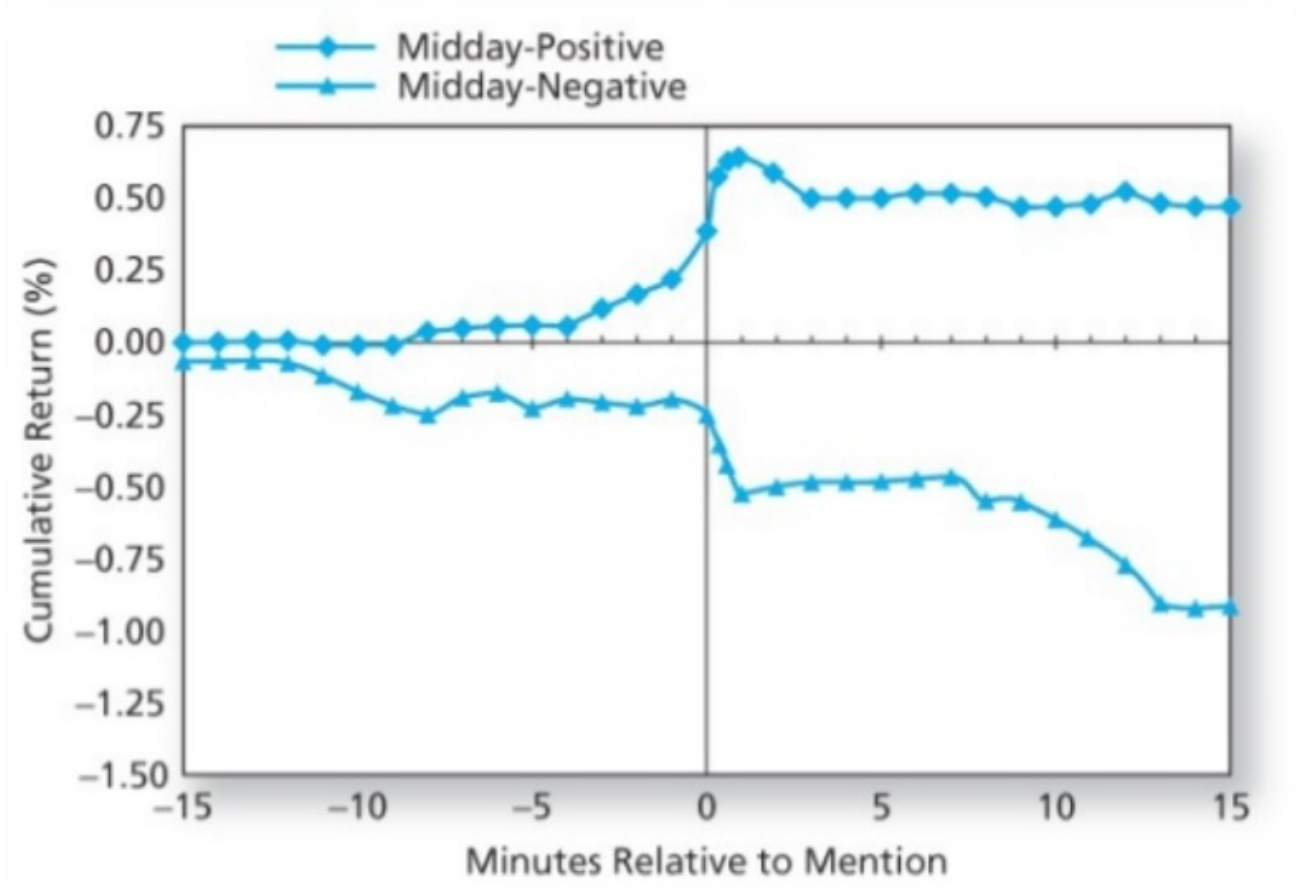
Price response of 194 firms that were targets of takeover attempts

Acquired Firms Information is fully incorporated into prices by **Day 0 (News becomes public)**

Keown, Arthur J., and John M. Pinkerton. "Merger announcements and insider trading activity: An empirical investigation." *The journal of finance* 36.4 (1981): 855-869.

Type2. Efficient Market Hypothesis - Real Time Market Efficiency

CNBC TV Report Example



Y: Cumulative Return
X: Minutes Relative to Mention

Positive reports fully incorporated **within 3 minute.**

The impact of **negative reports** is gradual, lasting **15 minutes.**

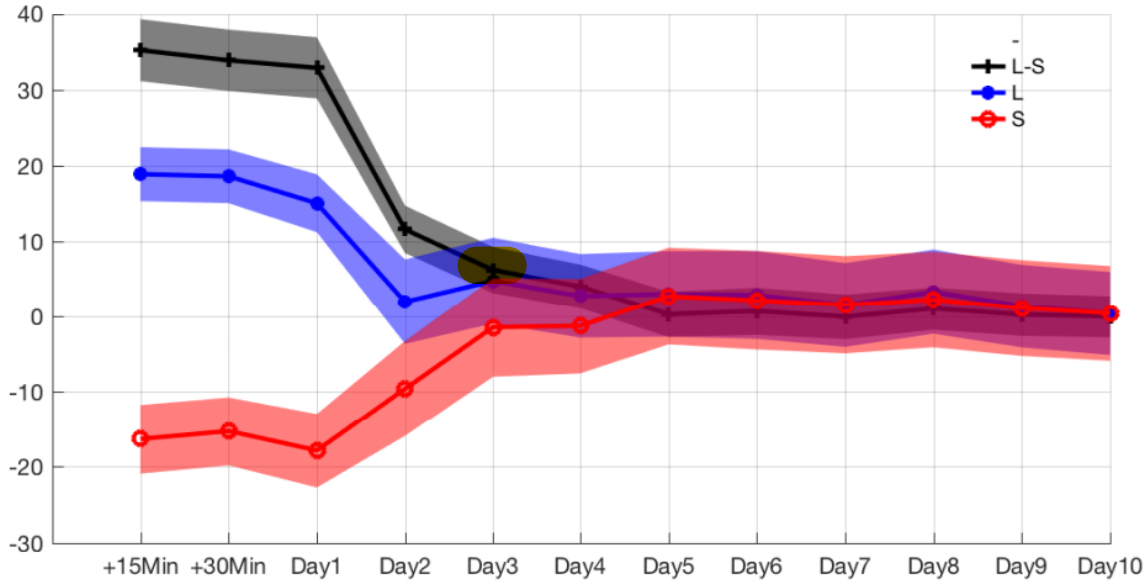
Busse, Jeffrey A., and T. Clifton Green. "Market efficiency in real time." *Journal of Financial Economics* 65.3 (2002): 415-437.

Type2. Efficient Market Hypothesis - News Sentiments

- **News Assimilation Scheme**

Sentiment information is essentially fully incorporated into prices by the start of **Day +3**

Figure 8: Speed of News Assimilation



Y: average returns in basis points per day with shaded 95% confidence intervals.
X: after the article's time stamp and is held for one day

Ke, Zheng Tracy, Bryan T. Kelly, and Dacheng Xiu. *Predicting returns with text data*. No. w26186. National Bureau of Economic Research, 2019.

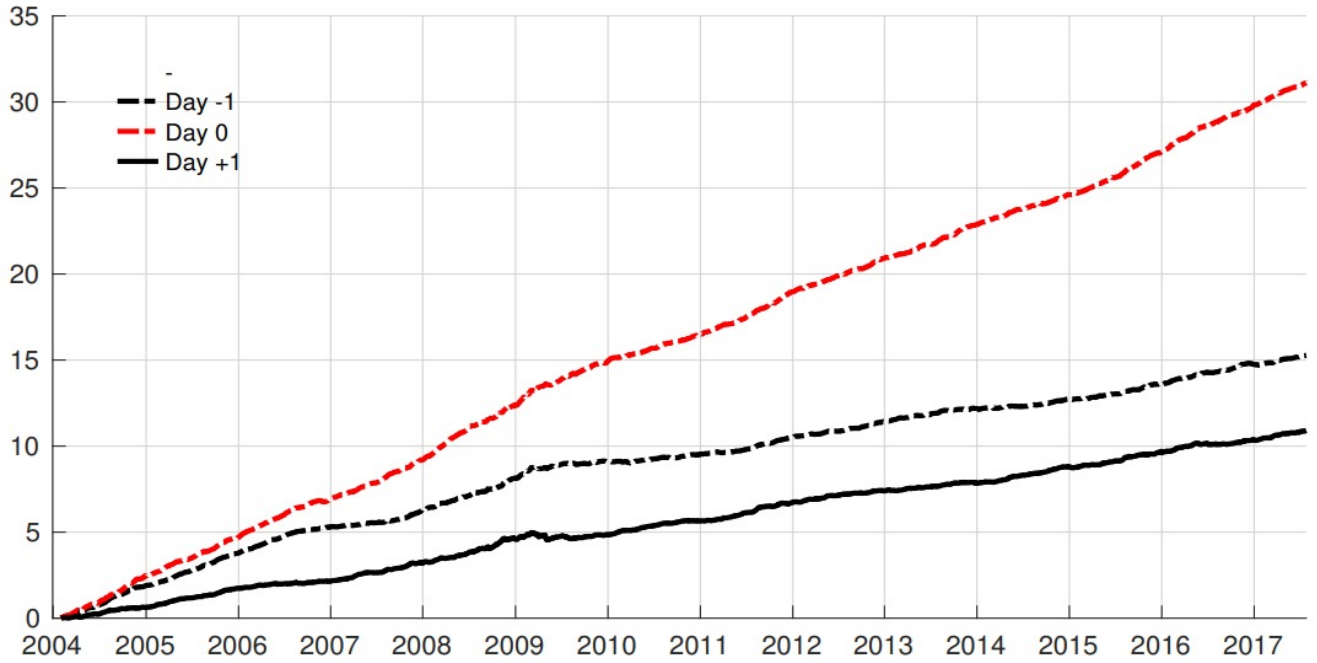
Type2. Efficient Market Hypothesis - News Sentiments

- **News Assimilation Scheme**

Day 0 > Day -1 > Day +1

news is very up-to-date

Figure 7: Price Response On Days −1, 0, and +1



Y: cumulative log returns of long-short portfolios sorted on sentiment scores

Ke, Zheng Tracy, Bryan T. Kelly, and Dacheng Xiu. *Predicting returns with text data*. No. w26186. National Bureau of Economic Research, 2019.

Implications of the EMH

- **Why Efficient? (Grossmand and Stiglitz, 1980)**

- **Source of Efficiency**
  - The cost of obtaining information < investment returns.

- **Example) Efficiency 비교**
  - Less Efficient (고비용 정보) < More Efficient (저비용 정보)

  - Small Cap < Large Cap
  - Emerging < US

  - High Dimensional < Low Dimensional Data
  - Text << Numeric

Critical Thinking Examples

- 1) S(3) – U(3)
- 2) (Risk Premium) Small Size Firm vs. Big Size Firm
- 3) (Inherently Inefficient Information) Text Data

Thank You