Verdad Curriculum

Table of Contents

Foreword

We have been running our internship program since 2014, hosting over 50 college students and MBAs for paid internships at our firm. The centerpiece of our internship is a daily seminar-style class taught by the partners at the firm. This class covers a wide range of material, from academic finance to accounting to corporate strategy and, of course, Verdad's own investment theories.

We decided earlier this year to share our syllabus for this class with you, our readers. We don't know precisely how this might be useful, perhaps some new to investing will use this as a self-taught course or others who run investment firms will use elements of this for their own interns. But we do know one group of folks we intend to share this with: every college student or MBA who applies to our internship but who we can't accept. We hope this will provide those we can't teach in person with some of the key elements of our thinking that we share with the select few we work with in person.

The credit for compiling this syllabus goes primarily to our summer intern, Aaron Rossi. Aaron took meticulous notes on the readings and the seminars and worked with us to synthesize and formalize the curriculum here. We would welcome your input on our syllabus. What are we missing? What is now outdated? What is redundant? We hope that we can open source our syllabus and improve by sharing.

We hope you enjoy and find this useful.

Markets

Class 1.1: Forecasting, Central Challenge of Investing

Key Themes

- Well-informed generalists are more accurate than experts at making predictions.
- The human brain is hard-wired to make quick and intuitive assessments that can often lead us astray.
- Mechanical forecasts are generally superior to clinical judgements.
- Useful concepts for making mechanical predictions include base rates and probability trees.

Expert Political Judgment: How Good Is It? How Can We Know?
In "Expert Political Judgment: How Good Is It? How Can We Know?", Philip Tetlock divides those making predictions into two groups: hedgehogs and foxes. Hedgehogs represent experts in a field, who have extensive experience within their domain, which they then use to formulate predictions. Meanwhile, foxes are those who understand the complexity and variety of inputs necessary to make an accurate forecast and are therefore skeptical of the hedgehog's overarching beliefs from within their field. Those categorized as foxes were significantly better at making predictions, while the dogmatic hedgehogs lagged in accuracy. Tetlock's findings bring many existing forecasts into question, especially when predictions are voiced by experts in a narrowly defined field. The book then delves into the cognitive biases that impact expert forecasting and human decision making in general.

Thinking Fast and Slow (Kahneman)
In "Thinking Fast and Slow", Kahneman details how cognitive biases determine our decisions, even if we are unaware of their existence. He divides the human thought process into two main systems: System 1 and System 2. System 1 represents intuition thinking related to (seemingly) obviously available truths, and is prone to first impressions, biases, fallacies, and oversimplification. Humans, in their attempt to make sense of a random world, rely on heuristics and biases which may not represent reality. Conversely, System 2 thinking relies on a slower, analytical, and considered process. While System 1 works when intuition is necessary, system 2 can lead to more accurate results. However, System 1 thinking can be trained to be more reliable through awareness of human failing such as the anchoring effect (where people tend to "anchor" estimates to values to which they were exposed), availability heuristic (where people tend to skew probabilities of events based on their exposure to information regarding them), loss aversion (where humans weigh losses much more heavily than gains), and the sunk cost fallacy (where unchangeable past decisions affect choices in current situations). Kahneman argues that while perfect decision making is impossible, simply being aware of which system (1 or 2) is governing a decision can provide valuable insight in the process.

Everybody's an Expert (Menand)
In this article, Louis Menand details key take-aways from Philip Tetlock's book "Expert Political Judgment: How Good Is It? How Can We Know?", where Tetlock thoroughly examines experts in the forecasting field, finding that experts are on average no better at predicting events than a reasonably informed "regular" person. Due to a series of human biases, compounded by the

environments within which experts exist, algorithmic predictions consistently perform as well or better than those of experts.

Clinical vs. Mechanical Prediction: A Meta-Analysis (Grove et al.)
Two general classes of data combination procedures have been extensively studied in the psychological and medical literatures: clinical judgment and mechanical prediction. Clinical judgement relies on informal, subjective methods. Mechanical prediction, including statistical prediction, actuarial prediction, and algorithmic prediction, is by contrast well specified. The authors show through meta-analysis that mechanical-prediction techniques were about 10% more accurate than clinical predictions. Depending on the specific analysis, mechanical prediction substantially outperformed clinical prediction in 33-47% of studies examined.

Superior Performance via Superior Price Forecasting (Woody Brock)
Strategic Economic Decisions, Inc. argues hedge fund underperformance is largely contingent on poor forecasting models, which fail to correctly incorporate conditional probabilities. While regression models may produce accurate results for stationary environments, arrow-bayes forecasts, which rely on probability trees, lead to a more accurate portrayal of outcomes.

Class 1.2: Growth Rates

Key Themes

- Analyst forecasts of future growth are unreliable.
- Growth rates of revenues and corporate profits do not exhibit persistence or predictability and cannot be explained out of sample.
- We should thus be skeptical of long-term growth forecasts and wary of stocks trading at high multiples of their earnings.

The Level and Persistence of Growth Rates (Chan et al)
An observational study by Chan, Karceski, and Lakonishok that examines the variability of long-term growth rates for firms over the time period from 1951 to 1998. The authors conclude that analyst forecasts and valuation ratios do not provide accurate growth predictions. The results of the paper thus call valuations into question; the market tends to reward firms with high historical growth and penalize firms with low historical growth. In aggregate, analyst growth estimates are roughly as effective as using dividend yields.

The Persistence and Predictability of Growth (Verdad)
This Verdad-published article summarizes "The Level and Persistence of Growth Rates" (Chan, Karceski, Lakonishok), and provides applications to investing. The study cited finds that long-term growth rates are neither persistent nor predictable, with the number of firms who maintain above-average earnings degrading by ~50% per year, implying that past firm growth does not significantly affect future growth. The article suggests that rather than identify a unique growth rate for individual firms, those building models contingent on future cash flows are statistically better off using a base rate such as GDP growth to make their forecast. This base-rate driven process for making more mechanical predictions may lead investors to remain overweight stocks with low growth expectations, and underweight stocks with high expectations.

Class 1.3: Randomness and Indexing

Key Themes

- Most active managers fail to beat the index after fees
- The historical performance of active managers makes low-cost ETFs and other indexed vehicles a*n attractive alternative to the majority of market participants*

Luck vs. Skill in the Cross-Section of Mutual Fund Returns (Fama & French)
Fama and French focus examine the performance of actively managed mutual funds investing in United States equities. Over the period from 1984-2006, the study finds that 67% of active managers have negative alpha after fees. If the average manager has zero skill, 50% of managers should underperform benchmarks by chance alone, drawing the conclusion that most active fund managers fail to even match index returns after fees. The proportion of active managers who beat their index degrades over time, so even past winners tend to fail over the longer term. The report evokes skepticism of the entire active mutual fund industry.

A Random Walk down Wall Street (Burton G. Malkeil)
In "A Random Walk", Burton G. Malkiel details how stock market follow a "random walk" distribution, where future performance cannot be extrapolated from past results. Thus, investors are better off holding a well-diversified portfolio which mitigates industry risk. Readers are urged to maintain skepticism of managers who claim to predict stock-market performance, especially within individual industries. The work provides in-depth reasoning for why retail investors should consider a broadly diversified portfolio of low-cost index funds, as opposed to the services of active managers, who underperform the market significantly over the long term.

Class 1.4 Excess Volatility Problem Part 1

Key Themes

In 1981, Robert Schiller identified the excess volatility problem noting that stock prices move 5-13x more than can be justified by subsequent changes in dividends and discount rates. Several authors have proposed explanations for the excess volatility problem:

- *Gabaix and Koijen claim excess volatility is largely due to systemic attributes of financial markets*
- *De Long, Shleifer, Summers, and Waldmann argue that noise traders with incorrect beliefs both affect prices and earn higher expected returns than rational investors due to their higher risk tolerance*
- *Schiller himself attributes excessive volatility to psychological factors that foster irrational exuberance in markets*

Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends? (Shiller)
Shiller examines the relationship between real changes in dividends and market price volatility, drawing the conclusion that changes in price are not related to real changes in dividends. In fact, the standard deviation of stock prices is highest when information about dividends is revealed smoothly, and lower when information about dividends is revealed in big lumps occasionally, contradicting a traditional cash flow pricing model, where share price equals the net present value of future projected cash flows. Shiller deduces that only 5 to 13 percent of market volatility can be explained by actual changes in expected dividends. The rest of market volatility, he says, is not due to interest rates or perceived large drops in dividends (which fail to materialize), but rather due to other factors not explored in the study.

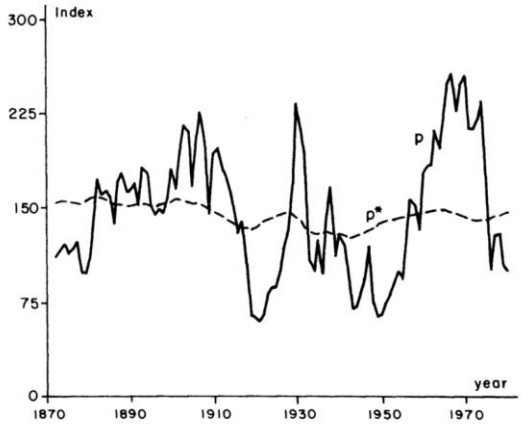


FIGURE 1
Note: Real Standard and Poor's Composite Stock Price Index (solid line p) and *ex post* rational price (dotted line p^*), 1871–1979, both detrended by dividing a long-run exponential growth factor. The variable p^* is the present value of actual subsequent real detrended dividends, subject to an assumption about the present value in 1979 of dividends thereafter. Data are from Data Set 1, Appendix.

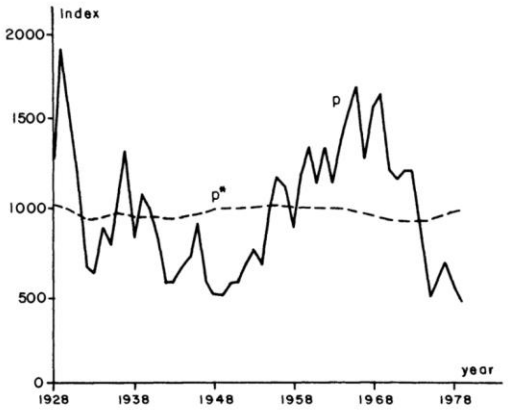


FIGURE 2
Note: Real modified Dow Jones Industrial Average (solid line p) and *ex post* rational price (dotted line p^*), 1928-1979, both detrended by dividing by a long-run exponential growth factor. The variable p^* is the present value of actual subsequent real detrended dividends, subject to an assumption about the present value in 1979 of dividends thereafter. Data are from Data Set 2, Appendix.

In Search of the Origins of Financial Fluctuations: The Inelastic Markets Hypothesis (Gabaix, Koijen)
This recent study argues that excess market volatility (unrelated to expected changes in future cash flows), is largely due to systemic attributes of financial markets. The study finds that price variation can be attributed to flows into and out of equities. The small price elasticity of demand of the aggregate stock market causes flows to have large impacts on prices. The study draws a conclusion that in aggregate, a $1 cash flow into markets corresponds to a $5 increase in aggregate valuations due to volume effects of stock purchases and fund mandates to maintain a balance between assets. As an extension of this logic, government purchases and firm share buybacks have an unexpected impact on price levels. Consequentially, government quantitative easing programs might be an efficient way to disproportionally affect price levels in equity markets, as capital inflows cause higher price levels due to systemic factors.

Noise Trader Risk in Financial Markets (De Long, Shleifer, Summers, Waldmann)
"Noise Trader Risk" argues that irrational noise traders with incorrect beliefs both affect prices and earn higher expected returns than rational investors due to their higher risk tolerance. Although sophisticated "arbitrageurs" generally understand fundamental risk when betting on a reversion of stock prices to the net present value of future cash flows, the study argues that these investors fail to fully incorporate the risk that noise trader beliefs will not revert to their mean for a long time, thus remaining irrational longer than an arbitrageur can maintain solvency. Even with a complete lack of fundamental risk, prices can diverge significantly from fundamental values. The study's model includes a steady supply of noise traders entering the market every period, ensuring that irrational behavior persists over market cycles. As noise traders contribute to irrational market behavior, sophisticated, rational investors curtail these pressures by generating interest against noise trader positions. The paper further draws the conclusion that a successful pursuit of a contrarian strategy (against noise) may require a long time horizon and incur significant risk along the way.

Irrational Exuberance (Shiller)
To explain the causes of price movements not derived from changes in future expected dividends, Shiller turns to behavioral biases and psychological factors which cause investors to behave irrationally. Shiller also points to cultural factors such as the news media, which does not predict market movements, but rather "tags along" behind price movements. Thus, investors relying on news coverage to allocate capital serve to amplify market movements.

Class 1.5 Excess Volatility Problem Part 2

Key Themes

- We examine Stanford professor Mordecai Kurz's explanation of the excess volatility problem. Kurz argues that investors process information rationally but differently. The complex interaction of investor beliefs creates endogenous volatility.
- In markets, beliefs of investors tend to correlate, which can create opportunities for non-consensus arbitrageurs.
- Taking non-consensus arbitrage positions, however, faces limitations. Authors Shleifer and Vishny contend that arbitrage positions are not generally taken by a distributed number of small investors, but rather by a small number of specialized investors who hold large positions. While typical arbitrage models have positions that increase with higher mispricing, Shleifer and Vishny find this tenant fundamentally incorrect, as arbitrage positions incur high risk of capital being pulled by investors as positions become more extreme. Thus, arbitrageur positions do not continue to grow proportionally with the significance of a mispricing, but rather taper off as deviations from fundamental values become more extreme.

Endogenous Economic Fluctuations (Kurz)
In this landmark paper, Mordecai Kurz introduces the concept of rational belief equilibrium to explain excess market volatility. Kurz attributes price changes to endogenous risk, which arises within markets from differing beliefs of participants, rather than exogenous risk, which is driven by outside events such as news which impacts future dividends. Kurz's central arguments proposes that although market participants maintain rational beliefs, these beliefs are different from the true probabilities of an equilibrium process. Thus, these agents in rational belief equilibrium make forecasting mistakes. The aggregation of these mistakes over many participants, allows stock returns to be explainable, as they generate uncertainty and thus volatility. Put simply, variability of asset prices is caused by variations in the state of beliefs of the agents rather than by variations in the state of the actual dividends. Because two traders with the same information can hold opposing beliefs, their different assessments may lead to phenomena such as price inflation during periods of general economic decline.

The Limits of Arbitrage (Shleifer, Vishny)
Traditionally, arbitrageurs are viewed as keeping markets "in check" by establishing positions against noise trader irrationality which help drive prices to levels justified by expected future dividends. However, Shleifer and Vishny argue against arbitrage effectiveness against irrational pricing. They find that arbitrage positions are not generally taken by a distributed number of small investors, but rather by a small number of specialized investors who hold large positions. Importantly, these specialized investors are not investing their own capital, but rather the funds of unspecialized investors who are not keen on market behavior. While typical arbitrage models have positions increasing with higher mispricing, Shleifer and Vishny find this tenant fundamentally incorrect, as arbitrage positions incur high risk of capital being pulled by investors as positions become more extreme. Thus, arbitrageur positions do not continue to grow proportionally with the significance of a mispricing, but rather taper off as deviations from fundamental values become more extreme, mitigating the stabilizing effect of arbitrageurs.

Resolving the Market Efficiency Paradox (Fama vs. Shiller) (Woody Brock)
Here, Woody Brock establishes a strong overarching argument for drivers of excess volatility. He begins by introducing Fama's beliefs that due to market efficiency, it is almost impossible to beat the market except by luck. By extension, Fama argues for indexing and passive management as the most logical way to invest. Meanwhile, Shiller believes that the (Fama) efficient market hypothesis fails to explain excess volatility in the stock market, which is 19x higher than real changes in dividends. Brock identifies the market as a "stable process", where historical data reveals some information. Investors can establish a true time-invariant mean, but not when and by how much the market will deviate from this mean. Therefore, market participants are left to interpret available information rationally, which they apply consistent with Mordecai Kurz's Rational Belief Equilibrium, where excess volatility is due to correlated forecasting mistakes. Brock argues that Kurz's RBE, along with pricing model uncertainty, leads to excess volatility. He further challenges the field of behavioral finance, which attempts to attribute excess volatility to investor irrationality and biases but fails to support these claims with substantial data. Brock concludes with his blueprint for outperforming the market. Investors must either exploit structural changes in the economy (a stronger strategy for the long-term), or by exploiting endogenous risk, which occurs when markets overreact to news which is thought to impact future dividends (a stronger strategy in the short-term).

The limits of arbitrage with Fama & French (Q&A)
This brief section details Fama & French's thoughts on how "The Limits of Arbitrage" discredits the arguments of market efficiency. Fama opens by stating that the paper has been misinterpreted as "empirical evidence" when it is really "theory built on a set of assumptions." However, Fama calls the paper's assumptions ``clever", but reiterates that it must be supported by empirical data to refute the EMT. French begins by crediting several other studies which provide insight into price movements, as well as time periods in which arbitrage failed to correct prices. However, he maintains that although "The Limits of Arbitrage" operates under an assumption that prices do not fully reflect all publicly available information, the work implies that although prices may be "wrong", it is in the best interest of investors to treat them as if they are "right" (or efficient).

Quantitative Investing

Class 2.1: Market Efficiency Debunked

Key Themes

- The Capital Asset Pricing Model (CAPM), which attempts to establish a relationship between the risk and reward of assets, is a ubiquitous tool of modern finance.
- Empirically, CAPM fails to establish a relationship between risk and reward. Portfolios formed on market beta fail to explain variance in returns.
- Factor pricing models, pioneered by Eugene Fama and Kenneth French use price and accounting information to measure risk and explain returns. Examples of factors include size, value, and profitability.

The Capital Asset Pricing Model (Busted)(Fama & French)
In this paper, Fama and French challenge the assumptions which comprise the classic Capital Asset Pricing Model (CAPM). CAPM attempts to provide an expected return on an asset by adding the risk-free rate to a market risk premium, multiplied by the beta (or price sensitivity) of a security. Although the model is powerful and intuitive, its empirical record is flawed. Fama and French argue that this inaccuracy stems from a misunderstanding of market beta, which in the CAPM, relates risk directly with returns. This correlation – between market beta and returns – is functionally non-existent, with higher beta portfolios lagging in proportional returns. As a result, Fama and French introduce their three-factor model, which incorporates additional variables for company size (small minus big market capitalizations) and valuation (high minus low book to market ratios). These changes account for the outperformance of small stocks and value stocks when compared to traditional Sharpe-Lintner CAPM return expectations.

The Bankruptcy of Modern Finance Theory (Dan Rasmussen)
Dan Rasmussen challenges several key tenets of modern finance theory. Dan begins by detailing finance theories that are commonly taught today, including the dividend discount model and CAPM. While these concepts constitute the core of modern valuation frameworks today, research conducted by Shiller indicates they do not accurately describe the reality of stock price movements. Factor-based pricing models originally put forward by Fama and French provide alternative approach to valuation that withstands empirical scrutiny. Despite the existence of more robust alternatives, CAPM and the dividend discount model remain useful today for corporate planning and driving organizational consensus.

A Five-Factor Pricing Model(Fama & French)
Fama and French expand on the original three factor model to include variables for profitability and investment. In addition to the small minus big (SMB) and high minus low (HML) factors, which account for a size and valuation premium in returns, the researchers add a profitability factor (RMW) which measures the return spread between robust and weak companies, as well as a conservative minus average (CMA) factor for measuring firm cash flow re-investment. The RMW factor shows companies with higher profitability outperform those with lower profitability. The CMA investment factor shows firms that invest aggressively underperform those that invest conservatively. The resulting model maintains unexpected returns near 0 for most portfolios.

Factors from Scratch (O'Shaughnessy Asset Management: Livermore, Meredith, O'Shaughnessy)
In a comprehensive analysis of value stock returns over time, O'Shaughnessy Asset Management deconstructs the key performance drivers behind value stocks and the sector's historical outperformance when compared to high-multiple growth equities. The firm concludes that multiple expansion is a primary driver of value stock returns, which outpace an index of highly valued securities by 5.44% per year. Value stocks need not present exceptional growth numbers, so long as their performance beats the expectations that have lowered multiples. The paper concludes by attributing recent weakness in value stock returns to a weakness in value stock fundamentals, as opposed to broader market arbitrage strategies.

Quantitative Value (Carlisle, Gray)
Carlisle and Gray propose that the greatest risk-adjusted returns can be found through a combination of quantitative and value-based approaches. This combination of strategies, they argue, outperforms either a pure value or pure quantitative thesis. The authors then lay out three key steps for executing their strategy. First, investors should avoid risk of permanent capital loss by identifying and avoiding potential frauds. Second, investors should find the cheapest stocks possible, ranking the entire universe of stocks by valuation ratios. Third, investors should parse through these firms to find the highest quality stocks, ranking firms by profitability and financial strength. The results of this strategy yield an annualized return from 1974-2011 of 17.7%, with a standard deviation of 16.8%, which Carlisle and Gray portray as industry-leading metrics.

Have Investors Benefitted from Momentum Strategies? (Wes Crill)
This article examines excess returns derived from momentum strategies. While individual stocks certainly exhibit momentum patterns, where past positive performance leads into sustained growth, the excess return of strategies taking advantage of these movements decreases on individual stocks over time. Should investors engage in these strategies, they may consider smaller stocks, which exhibit more risk and hence more potential upside. The article examines momentum funds to find that most actively managed strategies have under-performed. In his closing remarks, Crill urges investors to incorporate momentum factors into their buy or sell decisions, rather than pursuing a pure-momentum strategy.

Class 2.2: Distress and Financial Ratios Part 1

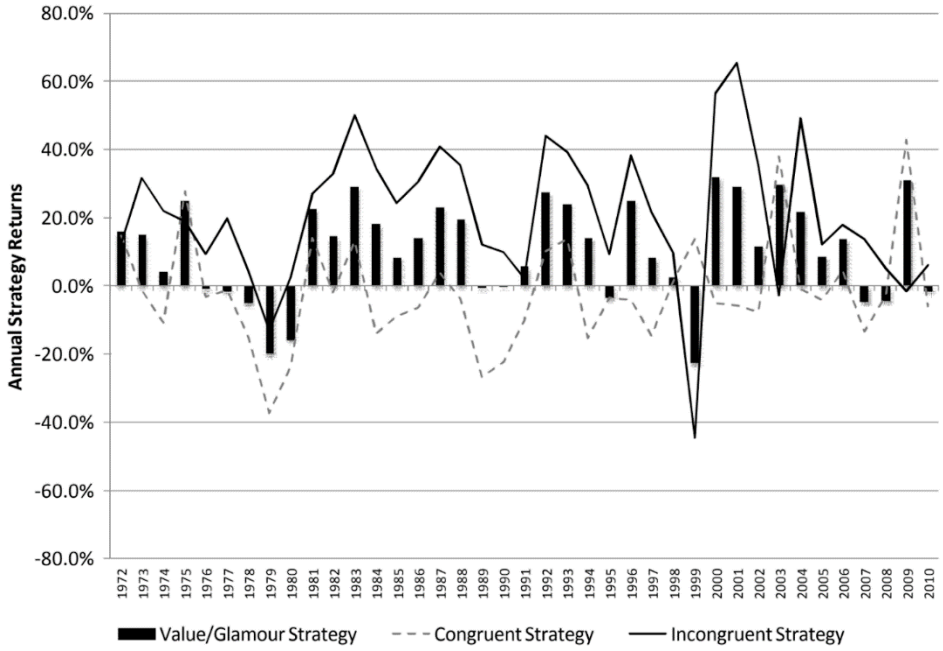
Key Themes

- Historically, value stocks have out-performed growth stocks. Some authors attribute this to systematic forecast errors; analysts routinely underestimate the potential of cheap, cyclical companies. Should we simply pile into the cheapest, most cyclical stocks in the market? Not quite.
- Conventional wisdom would have us believe that increases in risk lead to increases in reward. However, as shown by John Campbell in "In Search of Distress Risk," the cheapest, most distressed companies underperform the market. Investors earn no premium speculating on companies that carry significant risk of bankruptcy.
- Within the universe of value stocks, we must find ways to separate the winners from the losers. Financial ratios and metrics help us measure, rank, and filter companies.
- Financial ratios and metrics offer useful predictive measures that help us separate cheap stocks that are healthy from cheap stocks that are under distress.

Identifying Expectation Errors in Value / Glamour Strategies: A Fundamental Analysis Approach (Piotroski, So)

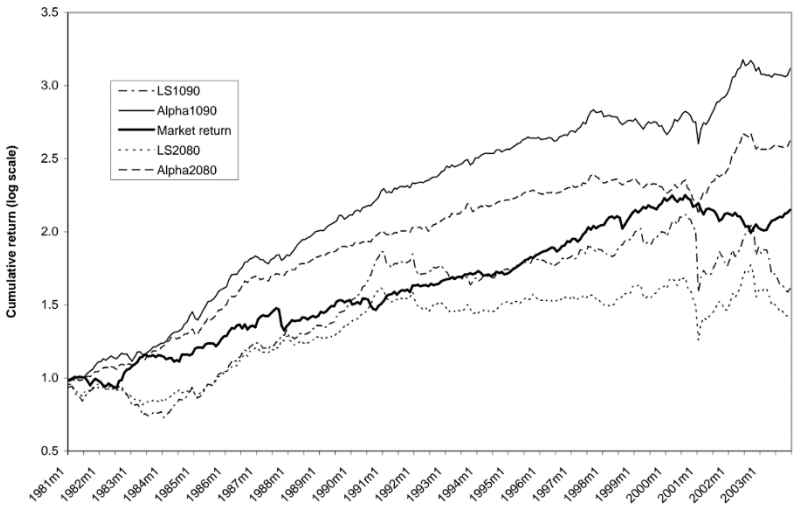
Piotroski and So explore key return drivers for value stock outperformance, arriving at the conclusion that earnings announcements largely drive growth for value stocks. The authors find that earnings announcement-based returns for value stocks significantly exceed the mean return for glamour stocks, largely due to analyst forecast errors. These forecast errors tend to create analyst coverage which is pessimistically biased for value firms, and optimistically biased for growth stocks. However, the paper details the nuance involved in choosing winners within the value sector. High or low pricing multiples must be judged contextually; firms with high or low pricing multiples are only mispriced if the pricing is not warranted given fundamental strength. Hence, returns are strongest among firms where expectations implied by current prices deviate from fundamentals. Market participants, the study finds, tend to price extreme value and extreme growth stocks homogeneously as similar securities, ignoring differences in underlying fundamental conditions. This lack of discrimination within value stocks leads to analyst revisions *ex post,* which drive returns higher. In summary, the paper argues that returns to a value strategy are an artifact of predictable expectation errors correlated with past financial data, which careful investors can take advantage of.

Figure 1
Annual Returns to Various Book-to-Market Strategies



In Search of Distress Risk (Campbell, Hilscher, Szilagyi)
Challenging the idea that value and size effects are compensation for the risk of financial distress, "In Search of Distress Risk" considers the underperformance of financially distressed firms since 1981, highlighting risk which is not always captured by standard CAPM or even the Fama-French 3 factor model. Although the Fama-French model causes financially distressed firms to have high Beta values and loadings on the HML (valuation) and SMB (size) factors, the underperformance of these firms suggests that the equity market has not properly priced distress risk. In fact, returns to distressed stocks are particularly low when increases in the VIX (Volatility Index) take place, a discrepancy with the mechanics of traditional pricing models where expected return increases proportionally with volatility expectations for stocks. Therefore, firms should be wary of firms with higher leverage, lower profitability, lower market cap, lower past stock returns, more volatile past stock returns, lower cash holdings, higher market-book ratios, and lower prices per share, as these are more likely to file for bankruptcy, be delisted, or receive a D (Default) credit rating. Investors who incorporate these factors into a long-short portfolio can consistently outperform.
Figure below: Example of how a long / short portfolio can outperform based on fundamentals

Figure 4: Returns on long-short distressed stock portfolios



Financial Ratios as Predictors of Failure (Beaver)

In order to best predict failure risk within equities, Beaver turns to financial ratios which may serve as leading indicators for subsequent firm failure, which he defines as the inability to pay financial obligations as they mature. These failures can take the form of bankruptcy, bond default, overdrawn accounts, or nonpayment of preferred stock dividends. Beaver begins by using an array of financial ratios which he finds prevalent in existing financial industry literature and metrics. By analyzing the values of different ratios in the five years preceding firm failure, Beaver derives significant predictive ability from several of them. The best predictor of failure is the cash-flow to total-debt ratio, which measures firm ability to service outstanding debt with existing cash flows. The next best predictors of failure are net income to total assets and total debt to total assets, which both measure ability of firms to maintain their outstanding debt, making them functionally similar to cash flow to total debt. Beaver highlights the importance of liquidity and cash flows for companies to survive in the long term, comparing corporations to reservoirs of liquid assets which are supplied by cash inflows and drained by outflows. The author further defines solvency as the probability that a reservoir will be exhausted, causing a firm's inability to repay obligations.

Although ratios are generally better at classifying non-failed firms, investors are unable to fully eliminate the possibility of investing in a firm which will fail. Beaver concludes that accounting-based ratios maintain significant explanatory power, but accounting discrepancies such as restatements, discretionary accruals, R&D spending, and differences in market and book value can cause a reduction in this predictive power. Thus, both market and accounting-based variables have significant predictive power, with accounting-based variables being generally stronger predictors of firm failure within the subsequent 5 years. Accounting-based variables possess significant explanatory power when it comes to estimating the probability of financial distress over 40 years of testing.

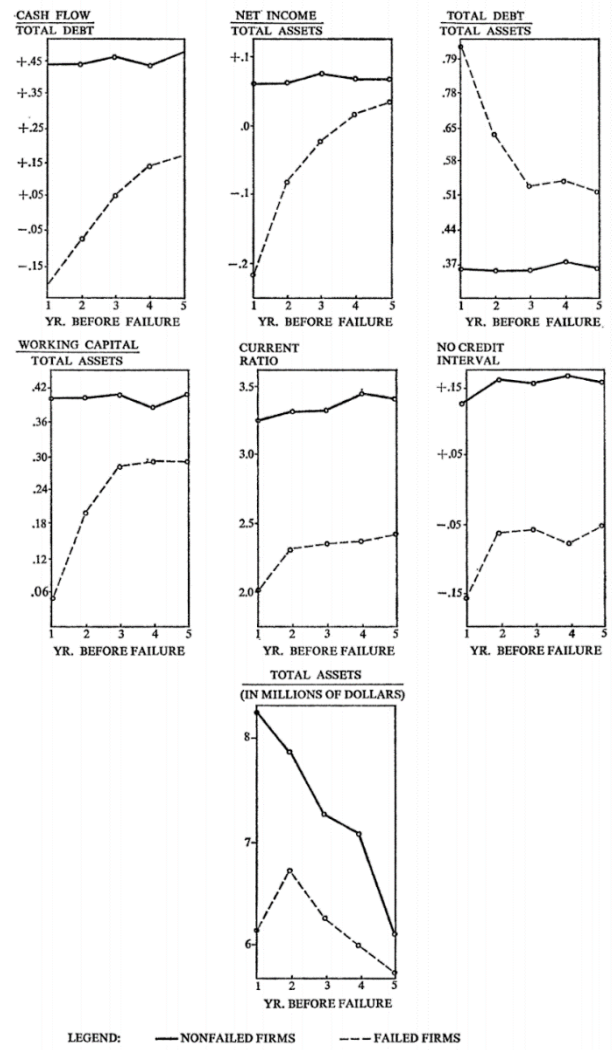


FIG. 1. Profile analysis, comparison of mean values.

Financial Statement Analysis and the Predictions of Financial Distress (Beaver, Correia, McNichols)

Taking a further look at financial statement-based ratios as predictors of financial distress, the authors find that accounting-based variables possess explanatory power when estimating the probability of financial distress. They further find that modern hazard analysis exhibits the greatest predictive power. The importance of predicting these failures lies in the loss profiles of failed companies. Because the loss associated with incorrectly predicting a company is not in financial distress is substantially greater than incorrectly predicting a company will fail when it does not, investors should be careful to analyze failure risk before taking a position. However, financial statement analysis is not infallible, as accounting numbers that are departures from GAAP are of a lower quality for bankruptcy prediction. This statement analysis is most predictive when analyzing deciles 1-8 of positive book to market ratios, and least predictive in firms which have negative book to market ratios. Ratio analysis is further useful as an explanatory variable to predict corporate bond ratings, which translate directly to the frequency of default by firms.

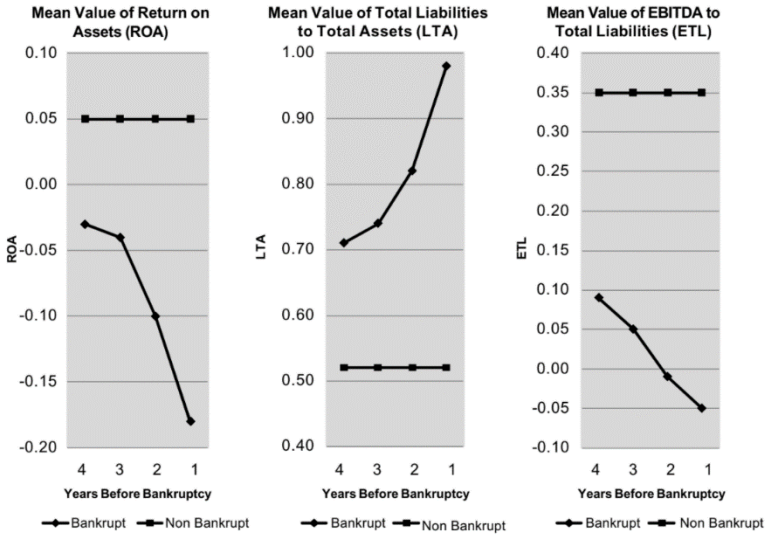


Fig. 3.1 Mean differences in ROA, ETL, and LTA as year of bankruptcy approaches
Source: Based on data from Table 6.3 of Beaver et al. (2005).

Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers (Piotroski)

Piotroski's paper deals with the central belief that markets fail to fully incorporate historical financial information into prices in a timely manner. To resolve this disconnect, he urges value investors to discriminate within their portfolios using financial statement information and ratios, finding that value investor mean return can be increased by at least 7.5% annually through careful selection of financially strong value stocks vs. an index. To amplify this strategy, Piotroski argues, investors can even buy expected winners while shorting expected losers (based on financial statement information). These excess returns are likely due to the systemic under-coverage by analysts of value stocks, which leads to a lack of available forecast data. Therefore, investors should reject a forecast-based approach, which has limited application for differentiating value stocks. Rather, value investors should rely on earnings announcements which beat analyst's low expectations, driving prices higher. Investors should choose these stocks based on fundamental analysis, which is successful in part due to the market's inability to fully include predictable earnings-related information into prices in a timely manner, effectively exploiting analyst and market ignorance of the high book-market sector.

Class 2.3: Distress and Financial Ratios Part 2

Key Themes

The equity value premium, one of the most empirically researched factors in finance, has significantly underperformed growth over the past decade. This class considers several explanations for the spread between value and growth returns. Potential reasons include:

- The inherent distribution of both equity and value factor returns causes high return variability, even over relatively long investment horizons.
- A recent surge in discovery and innovation has propelled growth equity valuations upward, leading investors to accept lower discount rates on their investments due to high implied future growth and profitability.
- Although many structural arguments attempt to justify depressed value factor returns, research has been unable to substantiate these claims, pointing to high expected returns for value.

Volatility Lessons (Fama, French)
Fama and French identify that in aggregate, investors must have long time horizons to reliably benefit from the equity value factor. The researchers find that negative equity premiums over one-month US treasury bills, value premiums, and size premiums are common for 3–to 5-year periods, and "far from rare" for 10-year periods. Therefore, although these premiums exist in aggregate, investors must understand the relatively high variability inherent in value and size factor investing, as well as equity investing in general when compared to treasury returns.

Reports of Value's Death May Be Greatly Exaggerated (Arnott et al)
The authors explore various arguments against the equity value premium but fail to find any with empirical justification. Among these explanations are three significant arguments:

1. Intangibles not captured by book value, causing B/P=based HL factor to distinguish poorly between growth and value
2. Widening valuation spread between growth and value pushed down past performance for B/P HML, pushing up likely future performance due to value's depressed state
3. Value's underperformance is simply an extreme left-tail outlier

The authors consider each of these explanations, finding that B/P fails to accurately capture the value premium due to its oversight of intangibles (which are not capitalized). Including intangibles in the metric improves average HML factor returns by 2.2% per year over the past 13.5 years. The authors also find that the massive increase in valuations spreads between growth and value stocks drove down relative returns. Value's recent performance is identified as an outlier, with the current drawdown occurring with a 2.3% frequency in bootstrap simulations.

Two Centuries of Innovation and Growth
How can we explain the outsized returns of technology companies? The argument that innovation allows growth stocks to use resources more efficiently, deliver higher profit margins, and maintain faster earnings growth has been underscored equity returns over the past 10 years. Verdad considers the relationship between "breakthrough" (novel and impactful) patents and returns for technology companies. While innovation was once cyclical, the scale of new findings has increased with patents in computers and electronics. Because these breakthrough innovations forecast future productivity, advancements in innovation may justify the excess returns found in the technology sector over the past decade. However, in-favor technology stocks require lower returns for investors to hold their stock, leading to a low cost of capital and expected return equivalent to the

market during innovation waves (9.7%). Meanwhile, returns on value stocks have historically compounded at 13.8% per year, above both the innovation index and market at large.

Class 2.4: Distress and Financial Ratios Part 3

Key Themes

- Profitability, defined as gross profit/assets, offers investors a complementary factor to value with economically high historical returns.
- Profitable firms typically trade at higher multiples, but still deliver excess returns.
- Profitability has a similar explanatory power as book-to-market
- The profitability factor tends to do well when the value factor does poorly, and vice versa.

The Other Side of Value: The Gross Profitability Premium (Novy-Marx)
In this analysis of the impacts of profitability on firm returns, Novy-Marx finds that profitability has roughly the same power as book-to-market in predicting the cross-section of average returns. Although profitable firms maintain higher valuations in equity markets, they generate higher returns despite their multiples. The author quantifies the excess returns of the market's most profitable companies, as the profitability premium returns a 0.31% higher monthly average return than the least profitable public stocks. Novy-Marx further finds that the profitability premium also applies to international markets. However, differences between value and profit stocks with high returns exist. Because value and profitability strategy returns are negatively correlated, combining the two strategies independently (not sorting on both factors) within the same portfolio provides significant excess returns, as evidenced in the higher Sharpe ratios of a 50/50 profitability/value portfolio detailed below. The two halves of the portfolio are natural complements to each other, as profitability performs well when value performs poorly, and vice-versa. Profitability has roughly the same power as book-to-market predicting the cross-section of average returns

Quality Minus Junk (Asness, Frazzini, Pedersen)
In "Quality Minus Junk", companies are sorted based on three groups of factors to separate high- and low-quality firms. The authors consider profitability metrics such as gross profits, margins, earnings, accruals, and cash flows, growth metrics based on five-year trends in the listed profitability metrics, and safety, which comprises return-based measures of safety. The study finds that although high quality firms command higher (scaled) prices, the explanatory power of quality remains limited, leaving some large variations in price unexplained. However, a quality minus junk (QMJ) screening factor earns significant risk adjusted returns for several reasons. Quality stocks are low beta and seen by investors as safe havens. During periods of distress, significant inflows are observed into high-quality securities, challenging a risk-based explanation for the lower than actual analyst earnings estimates which are imposed on quality stocks. As a result, the low price of quality predicts a high future return of quality stocks relative to junk, leading to excess returns.

Class 2.5: Quantitative Investing Background Part 1

Key Themes

- We should seek falsifiable theories and hypotheses; we should be able to test their claims empirically and with high evidentiary standards.
- Deductive logic proceeds from general observation, to hypothesis, to supporting evidence. Deduction constitutes a 'top-down' approach to making claims. Inductive logic uses the same process in reverse order. From particulars a hypothesis is induced, tested, and subsequently formulated into a general claim. Induction constitutes a 'bottom-up' approach to making claims.
- Marrying the two styles of thought is fruitful. Deduction requires us to think causally, while induction requires us to ensure the falsifiability of our ideas.

Against Method Pg. 5-23 (Feyerabend)
In this provocative excerpt, Feyerabend calls into question the fundamental basis of modern scientific discovery, which he attributes to radical and contrarian theories discouraged by traditional scientific method. His writings argue for "theoretical anarchism", where scientists should not be restricted by an adherence to epistemological systems. Because the world which we explore is largely unknown, Feyerabend argues, we must keep our options open, maximizing the possibility of new discovery. In fact, the work details how some of the best discoveries, including Einstein's theory of relativity, occurred because some thinkers either *decided* not to be bound by certain "obvious" methodological rules, or because they *unwittingly* broke them. Given any rule, there are always circumstances when it is advisable not only to ignore the rule, but to adopt its opposite. In his harsh criticism, Feyerabend writes that the well-trained rationalist "will be quite unable to discover that the appeal to reason to which he succumbs so readily is nothing but a *political maneuver*. In his commentary of the trial of Galileo, the author provides perspective at the time. In hindsight, the actions of Galileo appear rational, but they seemed to pursue "silly cosmology" at the time. In his application of historical fact to modern science, Feyerabend urges science must be protected from ideology and societies which may stifle growth if strictly adhered to.

The Logic of Scientific Discovery Pg. 1-34 (Popper)
Refuting prevalent deductive methods which dominate the development of theories in modern science, Popper argues for a principle of induction, where theories must be falsifiable in order to be rigorously tested and accepted. He describes "there can be no statement in science which cannot be tested, and therefore none which cannot in principle be refuted by falsifying some of the conclusions which can be deduced from them." Therefore, inductive statements are constrained to probabilities at best, supported by existing observations, and not exposed to empirical tests which may serve to disprove a theory in its entirety. In Popper's ideal process of science, a claimed conclusion must be falsifiable using empirical evidence, and the field of science should focus intensely on finding evidence contrary to claims made, in stark contrast to inductive reasoning, which Popper decrees as "metaphysical", and by definition untestable. The quintessential example of a Black Swan applies: We should not seek to confirm our theory that all swans are white by observing more and more white swans. Rather, the sighting of a single black swan can empirically prove that the theory "All swans are right" is incorrect, rendering it falsifiable.

Class 2.6: Quantitative Investing Background Part 2

Key Themes

While most literature does not intentionally mislead its readers, the incentive structure inherent in academic publishing, where lax review standards and positive conclusions lead to publication and citations, leads researchers to findings which:

- Simply cannot be replicated
- Are poached from subsets of data and lose significance when 'outliers' are incorporated
- Or have been identified through brute-force approaches that neglect to identify the causal significance of certain correlates.

Why Most Published Research Findings are False (Ioannidis)
Academic communities share an increasing concern that most current published research findings are false. John Ioannidis explores the reasons behind this trend, finding that falsehood is largely determined by study power and bias, the number of other studies exploring similar questions, and the ratio of "true to not relationships among the relationships probed in each scientific field." Overall, findings are less likely to be true when studies conducted in a field are smaller, when effect sizes are smaller, when there is a greater number of tested relationships, greater flexibility in designs, definitions, outcomes, and analytical modes, when researchers are exposed to greater financial and other interest, and when more teams are involved in a scientific field in chase of statistical significance. In fact, for most study designs and settings, it is more likely for a research claim to be false than true.

The Scientific Outlook in Financial Economics (Harvey)
Harvey's comprehensive study examines the finding of "significant" results which reject a null hypothesis in academic literature. This study's narrative focuses on the abnormally high rates of positive findings in studies across scientific disciplines. The chart below displays this discrepancy by field, with published literature in Space Sciences slightly over 60% reporting support for the tested alternate hypothesis, compared to over 90% in the psychiatry / psychology discipline. The author attributes this bias to several factors, including an incentive to produce "significant" results which increase publication and citation in academic journals. Journals wish to publish papers with positive results (which drive citations), incentivizing researchers to engage in data mining and "*p*-hacking", feigning statistical significance. For the Business / Economics in particular, the authors propose several reasons why an elevated proportion of studies have positive findings, including a lack of replication and flexibility in financial economics. The author proposes a series of recommendations for studies moving forward, to ensure that statistical significance is meaningful and replicable in financial literature. The true rate of discovery should decrease over time, as the more accessible findings in a relatively new field such as financial economics should be easier to discover, and therefore take less time overall.

Image below: Use to show breakdown of proportion of "positive" vs. "negative" findings in published literature within each industry

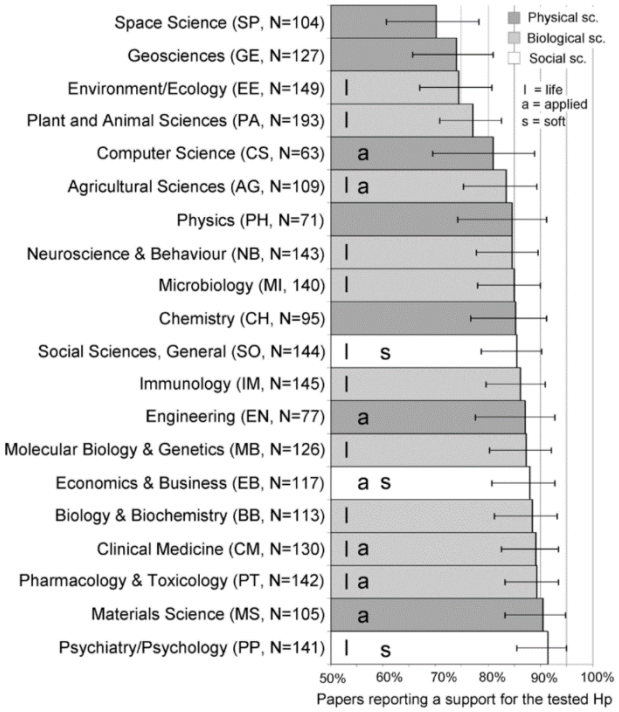


Figure 2. Percent of research papers reporting support for the tested hypothesis by field. Source: Fanelli (2010).

Testing Strategies based on Multiple Signals (Novy-Marx)

Novy-Marx sets out to analyze the use of multiple signal strategies and overfitting data in financial literature. The paper finds that "Highly Significant" back tested performance is easy to generate by selecting stocks using combinations of randomly generated signals which have no true predicted power. Applying this to prevalent financial literature, the paper argues that inferences drawn from popular tests such as Piotroski and others are misleading due to bias from overfitting. In fact, over July 1963 to December 2014, active returns to a strategy based on a 50/50 mix of stock's *z*-scores for value and momentum are completely indistinguishable from active returns to a 50/50 mix of strategies based on individual *z*-scores. Therefore, heavily back-tested multi-signal Sharpe ratios which result from some combination of variables do not imply that any individual signal has any power predicting returns, nor do they indicate future excess returns. In fact, the addition of additional variables in financial models comes with diminishing returns, favoring simpler models which rely on fundamental theory, and are not merely included to increase adherence to regression data.

The illusion of predictability: A Call to Action (Ord)

In "The Illusion of Predictability", Ord focuses on how financial researchers can arrive at conclusions by "data dredging" historical figures without any sound theory as to why certain variables should hold explanatory power. To illustrate, he runs 101 sets of random variables, and is able to explain 93% of variation (an impressively high proportion in financial explanatory models) by using purely random variables, illustrating the concept and plausibility of data-dredging with large datasets. Ord further argues that widely used confidence intervals are not the best representative statistics to express accuracy of data. Rather, he argues for prediction intervals, which better estimate predicted values for future observations. In order to best correct the misconceptions in financial literature, Ord outlines several standards which papers including linear

regression analysis should adhere to. Other forecasting methods may require different standards, but the spirit of transparency and accurate reporting should be maintained.

Anomalies and False Rejections (Chordia, Goyal, Saretto)
Taking a closer look at financial studies conducted in the past, Chordia, Goyal, and Saretto find that some hypotheses appear significant at conventional thresholds from Classical Hypothesis Testing (CHT) even if they are true under the null. This leads to false rejections (type 1 error) and false discoveries (type 2 error). Financial researchers must be careful of relying on pure statistics. The researchers find that 45.3% of discoveries under CHT are false, leading to a high Fake Discovery Proportion. Essentially half of excess return conclusions are not statistically significant. Readers should approach "significant" conclusions with skepticism.

Business Cycle

Class 3.1: Recessions

Key Themes

- Credit markets amplify financial shocks and transmit them to the real economy, what Bernanke calls the “financial accelerator.”
- High yield spreads (defined as the difference between yields on non-investment-grade corporate "junk" interest rates and investment-grade AAA-rated debt) provide a gauge for these financial accelerator events and other stages of the business cycle.

The Financial Accelerator in a Quantitative Business Cycle Framework (Bernanke, Gertler, Gilchrist)
The "Financial Accelerator" describes the amplification effects which credit markets have on financial shocks to the macroeconomy. Because of this mechanic, relatively small shocks on the economy can end up with outsized effects. When small shocks increase perceived risk for lenders, access to debt capital declines for companies, increasing insolvency. The premium paid for external financing through debt capital markets maintains a countercyclical nature, enhancing swings in borrowing, investment, spending, and production. The study considers monetary policy shocks, technology shocks, government expenditure shocks, and a one-time, unanticipated transfer of wealth from households to entrepreneurs. The authors find that with the financial accelerator mechanic included, the initial response of output to a given monetary impulse is about 50% greater, and effect on investment is nearly twice as great, highlighting the wide-spanning amplification effects of the financial accelerator.

Information in the High Yield Bond Spread for the Business Cycle: Evidence and some Implications (Gertler, Lown)
While many other financial indicators of distress such as the term spread, paper-bill spread, and Federal Funds rate have lost predictive power recently, high yield spreads (defined as the difference between yields on non-investment grade corporate "junk" interest rates and investment-grade AAA rated debt) are demonstrated to have consistent explanatory power for the business cycle. While other indicators focus on monetary policy, the high yield spread focuses on the premium paid for non-investment grade debt, making the metric reflective of the external finance premium for the broad class of firms with imperfect credit access. Thus, the HY spread is not influenced by changes in the conduct of monetary policy since the 1980s which have dampened the explanatory power of other metrics. The HY spread also provides an extreme sensitivity to default risk, leading to detection of a greater variety of factors than other indicators. According to the authors, the high yield spread serves as a powerful indicator of GDP growth, given its strong inverse correlation to the output gap reflective of GDP growth or decline.

Class 3.2: Recoveries

Key Themes

- Return predictors become considerably more valuable during times of crisis and less valuable during times of economic expansion.
- Evidence suggests that size and value factors proxy risks associated with business cycle fluctuations.
- Evidence suggests that cyclical companies, or those that are at risk of default during recessionary events, offer investors a premium.

Time-Varying Short-Horizon Predictability (Henkel, Martin, Nardari)
Much of the academic literature in finance focuses on return predictors, as researchers try to explain market movements using several key variables. Henkel, Martin, and Nardari find that the informativeness of these return predictors diminishes significantly during periods of business cycle expansion and increases significantly during times of financial distress. The authors argue that the reasoning behind this discrepancy lies in the nature of short-term predictability, which diminishes during business cycle expansions because of management's ability to "smooth" informative variables. During periods of crisis, the less-smoothed predictor variables retain an increased power. The researchers compared several renowned indicators, including term spread, dividend yield, interest rate spread (10yr-1yr), and the short-term (30-day) treasury yield, eventually finding the high-yield spread as the best indicator for times of economic recession.

Yield Spreads as Alternative Risk Factors for Size and Book-to-Market (Hanh, Lee)
This paper investigates the size and book-to-market factors proposed by Fama and French and examines whether they proxy for risks associated with business cycle fluctuations. The authors find that changes in the default spread (difference between corporate and treasury yields), and term spread (difference between long- and short-term yields) capture differences in average returns along the size and book-to-market dimensions, meaning that changes in returns can be explained using spreads just as well as the Fama-French factors, although these factors (size and book-to-market) lack clear economic links to systematic risk. The paper further suggests that higher average returns on small stocks and value stocks are compensation for higher risks not captured by market beta, as evidenced by the pattern of covariances with change in the default and term spread. The paper provides empirical support for a risk-based interpretation of size and book-to-market effects.

The time-series relations among expected return, risk, and book-to-market (Lewellen)
Previous studies imply that, at a fixed point in time, B/M conveys information about the firm's expected return relative to other stocks. The key difference between Lewellen's work and previous analysis lies in his focus on temporal changes in book to market, and those effects on returns. Lewellen's technical work examines expected return across time-series, focusing on the relationship between B/M and changes in expected returns over time. However, this relationship is closely correlated to risk, and the time variation in expected returns is well explained by the three-factor model measuring risk. Increases in B/M effectively forecast increases in expected returns.

Accounting Fundamentals and Systematic Risk: Corporate Failure over the Business Cycle (Ogneva, Piotroski, Zakolyukina)
The distress anomaly – the fact that financially distressed companies offer anomalously low returns relative to their riskiness – has puzzled financial academics for many years. Maria Ogneva, Joseph Piotroski, and Anastasia Zakolyukina broaden the definition of 'distress' to include cyclicality. The

authors subsequently find that companies with a high probability of defaulting during a recession (i.e., are cyclical) indeed do offer a premium.

Class 3.3: Inflation

Key Themes

- Changes in the rate of growth and changes in the rate of inflation are the main drivers of asset class performance.
- Historically, portfolio construction has relied on an understanding and measurement of asset class correlations. These correlations, however, are not static and change over time.
- Instead of attempting to predict changes in correlations among assets to divine an allocation mix, investors could focus on predicting changes in the prevailing economic environment, which may be measured by changes in the rates of growth and inflation.
- Thus, instead of forecasting third-order relationships (changing asset class correlations), investors can focus on forecasting first-order relationships (the impact of growth and inflation rates on asset class performance), a problem with far fewer dimensions.

Bridgewater: Understanding Correlations (Prince, Rotenberg, Minicone)
Many portfolio risk-management practices rely on assumptions about correlations between asset classes, most notably stocks and bonds. This piece from Bridgewater questions the underlying assumptions about correlations that drive many investing strategies today. Over the past decade, stock-bond correlations have failed to hold up, leading to a deterioration of pension funding status which relied upon a sustained correlation between the two assets. Thus, expectations of correlation can lead to risk issues should these correlations cease. The writers detail their belief that correlations do not exist as an inherent characteristic of an asset class, but rather as a statistical artifact reflecting how things happened to turn out in the past. This historical correlation provides little or no insight into the future relationships between assets, and thus should not be used to structure a portfolio.

The authors argue that returns of assets can be understood through an "All Weather Lens", where asset prices are stated in terms of discounted scenarios. Three main drivers behind asset prices are identified: Discounted growth, discounted inflation, and risk premiums. The correlation between assets is driven by three key variables. First, the beta exposure of each asset class to each driver. For example, stocks and Real Estate have similar beta exposures to growth and inflation, and thus may be positively correlated. Second, the relative volatilities of drivers at each point in time are considered. Stocks and bonds are similarly exposed to inflation, but retain opposite exposure to growth, leading them to appear correlated during periods of inflationary volatility, but negatively correlated during sustained growth volatility. Lastly, the correlation of drivers to each other must be accounted for. To illustrate, corporate spreads have a high beta to growth, and low beta to inflation. Gold maintains an opposite exposure profile. Correlation between growth and inflation will be a driver of correlations between corporate spreads and growth. These drivers between correlations explain the negative correlation between stocks and bonds throughout the past decade. Because discounted economic growth has been much more volatile than discounted inflation, and stocks and bonds have opposite exposure to economic growth, the two assets lost the correlation established in the volatile-inflation period of the 1970s through 1990s.

Predicting the correlation of two assets is difficult, as it is necessary to predict relative volatilities and correlations of discounted economic growth, inflation, and risk premiums (the three drivers identified earlier). Making effective use of correlation assumptions becomes essentially as difficult

as producing alpha outright. Instead, investors should seek diversification by balancing exposures to environments, a more robust strategy than trying to balance exposures through expectations of future correlations.

The Best Strategies for Inflationary Times (Neville, Draaisma, Funnell, Harvey, Van Hemert)
Because of a recent lack of significant inflation, investors remain unclear on how to react to recent heightened inflation risk. How should investors best prepare for times of significant inflation? This paper reviews performance of several different asset classes across periods of inflationary regimes, defined as times when headline year over year inflation is accelerating, and the level moves to 5% or more. The authors identify eight of these regimes within the United States, attributing them mostly to unexpected inflation causing asset reprices.

Across these time periods, several trends emerge. Nominal bonds sustain weak returns, as expected due to rising inflation's association with rising yields and declining bond prices. However, equities also perform poorly, a problematic profile for the tradition 60-40 equity-bond investor. The best performance during inflationary times is observed in commodities, which show much higher real returns during rising inflation environments than other times. Equities tend to underperform less stable economic climates; specifically, costs tend to rise with inflation more than output prices (which are sticky, as economists like to say). Although credit suffers negative real returns, TIPS (Treasury Inflation Protected Securities) are robust and generate positive real returns in inflationary and non-inflationary regimes. However, the return profile of different strategies varies across inflationary periods, with recent TIPS pricing levels implying high expected inflation. Alternative investments have mixed return profiles, with residential real estate holding its value, but lagging commodities significantly. Collectibles also display strong real returns, but are difficult to implement due to liquidity, volume, and data issues.

In summary, the authors find energy commodities as a leading inflation hedge, at a +41% real return during inflationary regimes. Meanwhile, investment grade and high-yield corporate bonds both exhibit -7% annualized returns during inflationary periods.

Verdad: On Inflation (Vasilachi)
Inflation is difficult to predict, and there is no perfect way to protect against inflation. Even TIPS investors can't expect to generate abnormal returns in inflationary environments. Instead, they are only compensated for inflation. Looking at inflation beta and average annualized returns by asset from 1970-2020, commodities and gold retain the highest inflation beta, with 10Y treasuries representing the most negative inflation beta. When predicting inflation, two popular methodologies are prevalent today: The survey of professional forecasters, and the breakeven rate (the spread between US Treasury Yield and TIPS yield). Both slightly underestimate inflation but are much less volatile than real changes. Research from Bridgewater and Hedgeye suggests that markets react more to changes in the rate of inflation than inflation itself. Thus, investors should worry less about high or *low* inflation, but rather about *rising* or *falling* inflation. Unfortunately, expert forecasts fail to accurately measure changes in the rate of inflation. However, applying business cycle indicators and commodity returns can lead to better predictions of short-term volatility. The High Yield Spread and slope of the yield curve serve as strong indicators of expansion / contraction of private and public credit and can help forecasting inflation. Allocating to inflation positive assets (TIPS, Gold) when inflation is predicted to rise and 10-year US Treasuries when inflation is predicted to fall might offer an alternative to holding a balanced 50/50 portfolio.

Class 3.4: Bubbles

Key Themes

- Market tops are difficult to predict, but some measures – such as the number of new buyers in a market – may indicate when conditions are becoming frothy.
- Human psychology features prominently in bubble formation. Shleifer notes systematic tendency of humans to extrapolate recent news, both good and bad into the future.
- Trend-following offers a simple framework for participating in bull markets but avoiding severe drawdowns when they materialize.
- Harvard financial economists note a relationship between the likelihood of financial crises and trailing credit / asset price growth.

Ray Dalio on Bubbles

Ray Dalio details Bridgewater's "Bubble indicator", which he monitors to give perspective on relative valuations in equity markets. By employing six key measures, Bridgewater attempts to quantify whether equities are in a bubble or not. The six factors are outlined below:

- How high are prices relative to traditional measures?
- Are prices discounting unsustainable conditions?
- How many new buyers (not previously in the market) have entered the market?
- How broadly bullish is sentiment?
- Are purchases being financed by high leverage?
- Have buyers made exceptionally extended forward purchases (built inventory, contracted forward purchases, etc.) to speculate or protect themselves against future price gains?

The article highlights that in 2000 and 1929, the aggregate gauge of these indicators had a 100th percentile read. In today's market, some stocks are in extreme bubbles (particularly emerging technology companies), while others are not in bubbles.

Crisis of Beliefs (Shleifer, Gennaioli)

Written in 2018, Shleifer's "Crisis of Beliefs" uses behavioral economics to explain financial phenomena, focusing on foundations of economic theory to build a model which explains excess market volatility. Shleifer breaks the book down into three main parts, beginning with commentary on expectations of investors (and the aggregation of errors in these expectations) and credit cycles, which are crucial for understanding market movements. Shleifer proposes these metrics as tools to explain the 2008 crisis. In the next portion of his writing, Shleifer articulates how beliefs and expectations can be measured with survey data and provides evidence that his use of the Gallup survey of individual investors and the Duke CFO survey, among others, is a good proxy for expectations. The authors find that managers allocate assets to mutual funds when optimistic. Next, the Diagnostic Expectations model is presented, which implies that both beliefs and errors are predictable from the underlying biological realities which drive human decision making. Rather than being rational, humans are extrapolative from experience, and this leads to the over-extrapolation of good and bad times into the future by corporations, investors, policy makers and other actors. Whenever equities are doing well, analysts over-estimate how well they will do in the future. This observation applies to credit markets as well, where credit expansions are larger than they should be, and credit contractions are larger in magnitude than should be justified by underlying changes in risk. Therefore, the authors argue, this over-reaction to news is what contributes to excess volatility.

Verdad: Investing in a Bubble (Elbakari, Macy, Vasilachi)
During the years leading up to the dot-com bubble, many renowned investors perceived the market's irrational status. However, most were too early to truly capitalize on their opinions. Dalio, Lynch, Marks and Klarman (among others) were all wary of high valuations, but the market continued to outperform. Soros eventually lost $700M on a short position against internet firms, leading spokesman Pattison to comment "We called the bursting of the internet bubble too early." March 2000 marked a significant change in this period, beginning with Greenspan's announcement of rising rates. The NASDAQ would fall 75% from its peak values by 2002. After this crisis, value stocks emerged as a winner after the bubble. However, a value strategy would have underperformed significantly during the extended periods of growth, leading the authors to consider a trend-following strategy, where "bubble"-like assets are held while prices increase, and sold into cash or bonds when valuations fall below a 200-day moving average. These assets are bought again when the price returns above this average. Following this trend-following strategy produced returns in line with a pure small-cap value strategy, which would require excessive courage and discipline while lagging the market by wide margins for years, and reduced underperformance and drawdowns. Combining trend-following with small-cap value produces similar results, a compelling alternative for disciplined investors in years where valuations continue to rise.

Predictable Financial Crises (Greenwood et al.)
Conventional wisdom would have it that financial crises are sudden and unpredictable events. Financial economists at Harvard – Robin Greenwood, Samuel Hanson, Andrei Shleifer, and Jakob Sorensen – contend that financial crises are indeed predictable. The authors develop a model tracking credit and asset price growth that can explain a substantial increase in the probability of a crisis over a 3-year time horizon.

Randomness

Class 4.1: Different Perspectives on Corporate Strategy

Key Themes

- Corporate strategy comes in different flavors. We explore a few interesting approaches including Porter's five forces, Fifer's cost cutting strategies, disciplined approaches to capital allocation, and OODA loops / the lean startup methodology.
- Porter focuses on scale and market share as core definers of corporate strategy. He believes opportunities and threats are largely defined by a market's structure and a company's ability to create barriers that thwart competition from other firms.
- The Chicago school offers a bottom-up vision for competitive strategy that focuses on a company's relationship with its consumers. Analyses from the Chicago school suggest that Porter's theories – while nice sounding – have no empirical merit.
- Fifer pinpoints actionable measures to cut costs and thus boost profits.
- Observe-Orient-Decide-Act (OODA loop) is a decision framework developed by USAF Colonel John Boyd. In a business setting, the OODA framework favors quick decision making in reaction to emerging conditions, a strategy especially applicable to emerging industries with high degrees of uncertainty.
- The Lean Startup expands the OODA loop framework into a philosophy of iterative improvement.

How Competitive Forces Shape Strategy (Porter)
In this influential piece, Porter details his belief that competition in industry is rooted in economics and competitive forces. Porter's five basic forces are: Threat of new entrants, bargaining power of suppliers, bargaining power of customers, threat of substitute products or services, and the industry jockeying for position among current competitors. Overall, weaker forces lead to a greater opportunity for superior performance, while stronger forces are more indicative of an efficient market, where firms have more trouble maintaining superior profits. Threat of entry revolves around the difficulty of entering a market. These include economies of scale, product differentiation, capital requirements, cost disadvantages, and government interventions. Bargaining power of suppliers refers to the reliance of producers on individual suppliers. Higher bargaining power, Porter argues, leads to pricing power and higher firm profits. Similarly, bargaining power of customers can lead to lower supply-side profits, and higher production-side profits. As firms compete, which Porter refers to as "jockeying for position", then profits are driven down. Thus, the most profitable businesses exist in areas where Porter's forces are subdued, and firms can retain "market power" which theoretically leads to higher sustained profitability.

The Gospel According to Michael Porter (Dan Rasmussen)
Rasmussen challenges Porter's *Competitive Strategy*, a collection of principles often regarded as gospel by investors across the value/growth spectrum. Rasmussen contrasts Porter's lack of empirical proofs with the Chicago School's empirical backing of Benjamin Graham's traditional approach to value investing. Rasmussen argues superior businesses have a superior product or cheaper means of production, not because they wield "market power." By examining outcomes of antitrust cases, developments in the field of industrial organization, and results of mergers and acquisitions Rasmussen dismantles Porter's intuitively pleasing but largely unscientific approach to competitive strategy.

Double Your Profits in Six Months or Less
To increase profits, firms must increase revenues or decrease costs. Fifer's provocative book focuses on the high spending levels present in American industry, and how to reduce them. He outlines 78 rules, many of which reference cost-cutting. Many focus on what Fifer calls "non-strategic" costs, or those not related to essential business functions. Specifically, Fifer questions unnecessary SG&A spending, and suggests cutting useless employees from firms. Other methods include cutting offices for executives, first-class travel, and unnecessary spending on office supplies. Fifer argues for a strict meritocracy, firing people not up to standard.

OODA Loops
The Observe-Orient-Decide-Act framework developed by USAF Colonel John Boyd operates under the assumption that agility can overcome raw power in dealing with human opponents. In a business setting, the OODA framework favors quick decision making in reaction to emerging conditions, a strategy especially applicable to emerging industries with high degrees of uncertainty such as cyber security and cyberwarfare. By assessing new situations and reacting decisively, even with imperfect information, large companies may optimize their business decisions moving forward.

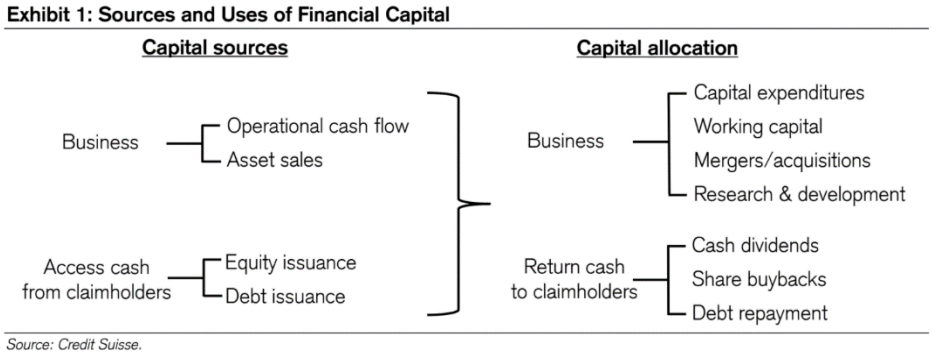
The Lean Startup (Eric Ries)
In this take on iterative improvement, Eric Reis urges startup companies to embrace rapid experimentation and short product development cycles. Business progress should be expressed through "validated learning", or empirical statements about business prospects which eliminate rationalization of decisions in hindsight. This validated learning of customer needs should be backed up by improvements in core business metrics. By moving away from forecasting and slow, stagnant business models, Ries' "Lean Startup" creates a framework through which emerging enterprises can quickly adapt to best suit their customer's needs, enabling success in the long term. The author goes on to outline specific guidance for each phase of the startup process, including acceleration and later phases of growth. An overarching theme exists in the work, with an explicit emphasis on eliminating unnecessary production, management, reliance on predictions, and size.

Class 4.2: Allocation Guidelines

Key Themes

- Mauboussin believes corporate strategy should be driven by capital allocation methods that drive growth, profitability, and reinvest profits to generate long-term returns to investors. Allocators should remain laser focused on return on invested capital (ROIC) and avoid low-returning projects at all costs.
- Capital allocation is the most fundamental responsibility of any senior management team. Most CEO's, however, fail to allocate capital effectively.
- ROIC is a useful measure for tracking and measuring efficacy of capital allocation. The measure is similar to Gross Profit / Assets in that it helps describe capital efficiency: the spread a company earns above its cost of capital.

Capital Allocation (Mauboussin, Callahan, Majd)
Mauboussin's exhaustive analysis of capital allocation strategies provides a historical and analytical view of how managers have and should invest returns from a business. The authors identify capital allocation as senior management's most fundamental responsibility. Most CEOs, however, fail to allocate capital effectively. The figure below shows sources and uses of financial capital.



Calculating ROIC (Mauboussin)
"Does one dollar invested in the business generate value of more than one dollar in the market?" The answer to this question lies in the ROIC metric, which analyzes capital efficiency, and can provide insight into a firm's competitive advantage.

The Outsiders: (Will Thorndike)
Despite the focus that many analysts and educational institutions place on operational efficiency, a key driver of share value increases is capital allocation. Will Thorndike considers 8 exceptionally successful, yet contrarian CEOs, noting a commitment to basing business decisions off numbers when working to build long-term shareholder value.

Class 4.3: Randomness & Modeling Part 1

Key Themes

- Randomness pervades our lives and the stock market. We should incorporate randomness into our forecasts and analytical models.
- Model-based forecasts are a critical component of modern finance. In particular, discounted cash flow analyses constitute the core of financial and investment decision making for the majority of firms.
- Discounted cash flow models call for extensive projections that rely on clinical judgement and fail to incorporate a range of potential scenarios.
- Monte Carlo models use base rates and volatility measures from reference classes to generate a distribution of possible outcomes that represent a range of scenarios for investors to consider.
- Monte Carlo models offer a more empirically robust approach to forecasting equity returns as they avoid clinical forecasts that arrive at point-estimates, where the rate of success is extraordinarily low.
- Research shows that we can improve our ability to make forecasts by tracking their performance over time.

Fooled by Randomness (Taleb)
Taleb's *Fooled by Randomness* focuses on how random chance is often understated or ignored in decision making. Humans believe the world is more explainable than it really is. Patterns and relationships, that we believe to be causal, often emerge as artifact of statistical noise. Markets are especially susceptible to this type of misinterpretation. In closing, Taleb portrays probability as a qualitative subject which can be thoughtfully grasped and incorporated into intuitive reasoning.

Evidence-Based Individual Security Forecasting (Verdad)
While many securities underwriting and valuation roles in financial services use Discounted Cash Flow (DCF) models as a primary tool, this Verdad piece argues that this model is inherently flawed. In a traditional DCF, free cash flows are projected into the future, and are then discounted back to establish a net present value for the security today. However, the article cites the lack of evidence that DCFs work, both in theory and in practice. Because growth is neither predictable nor persistent, the underlying assumptions upon which the DCF model is built are flawed, as the models rely heavily on earnings 3-5 years in the future. The article also criticizes the traditional DCF's use of the CAPM to assess cost of equity, as CAPM has been empirically disproven. In place of a DCF, the article suggests investors consider a Monte Carlo simulation model, which synthesizes thousands forecast scenarios that incorporate randomness into its calculations. The model then produces a representative distribution of outcomes that investors can use to gauge risk and reward. Real results from the model on thousands of US and Japanese securities find explanatory power like that of the Fama-French model.

Figure 1: DCF Model vs. Monte Carlo Model

Variable	DCF Model	Monte Carlo Model
Revenue Growth	A fundamental analyst might come to believe that a company will grow revenue at 6% per year for six years and input that as a driver into a DCF model.	The Monte Carlo model would generate a thousand different paths revenue might take given a mean (like GDP growth) and a standard deviation (like the historical standard deviation of company revenue).
EBITDA Margin	A fundamental analyst might come to believe that a company's EBITDA margin should be, say, 10% over the next five years and input that number into a DCF model.	The Monte Carlo model would generate a thousand different paths margins might take given a mean (historical average margins) and a standard deviation (the historical standard deviation of company margins).
Exit Multiple	A fundamental analyst might assume that in 3-5 years the company can be sold at the same multiple at which the company trades today.	The Monte Carlo model would generate a thousand different potential exit multiples given a mean (a 1/4 mean reversion from current multiples to market averages) and a standard deviation (the historical standard deviation).

The Monte Carlo model then provides a distribution of potential investment returns given a thousand

Verdad: An Alternative Approach to Financial Modeling for Individual Companies
Furthering their writing on Monte Carlo simulation, the Verdad team focuses on a new "reference class forecasting" approach, which is based on 3 steps. First, investors should identify a reference class of securities which fit their valuation target (ex. small value equities). Next, investors should obtain statistics and base rates from that reference class and use specific information about the individual case to adjust the baseline prediction relative to the reference class (ex. adjusting *to leveraged* small-cap value from small-cap value). As a result, forecasters can improve their accuracy, as base rates retain more predictive power than forecasts. This holds true across revenue growth, which is subject to high volatility, margins, which usually compress over time, and valuation multiples, which mean revert. By incorporating these base rates into a Monte Carlo model which simulates changes in revenues, margins, and exit multiples, investors can analyze a distribution of possible outcomes.

Numbers and Narrative: Modeling, Story Telling, and Investing (Damodaran)
Aswath Damodaran rejects both a purely empirical and a purely qualitative approach to valuation. Damodaran begins by outlining common illusions and fallacies in valuation, beginning with illusions perpetrated by quantitatively focused strategies. These include illusions of precision, where actors believe that quantifying risk makes it dissipate, illusions of objectivity, where all valuations are biased due to preconceptions and beliefs, and illusions of control, where more detail and buzzwords are added to valuations without increasing accuracy. Conversely, illusions perpetrated by qualitative approaches are driven by narrative.

Accelerating learning in Active Management: *The Alpha-Brier Process* (Tetlock)
Despite the overall inaccuracy of forecasts, an alpha-brier process can help distinguish between skill and luck-based predictions. The process reduces noisiness of forecasts (such as X "might" or "could" happen) and makes it easier to distinguish skill from luck as drivers of portfolio performance. The process further allows managers to test which methods of training, incentivizing, and aggregating judgements delivers the biggest boost to accuracy. By collecting systematic data on staff performance, the process eliminated ambiguity from performance evaluations. Correct probability forecasts lead to low, good brier scores, while incorrect forecasts lead to a bad, high score. Scoring is relative to the confidence of a prediction, and whether or not the events occurred. Through this method, Tetlock finds it is possible to improve the accuracy of probability judgements. Applying lower brier scores can lead to higher alpha in portfolio management, but this path has not been widely explored because of skepticism surrounding probability judgements. However, the more pervasive this skepticism, the greater the opportunity to exploit market inefficiencies.

Class 4.4: Randomness & Modeling Part 2

Key Themes

- Fragile systems are those actively harmed by volatility. Robust systems are those resilient to volatility, up to a certain point, and Antifragile systems are actively helped by volatility, and often harmed by a lack of it.
- Debt increases the dispersion of returns for equities and thus the range of outcomes when confronted with volatility.
- Describing a firm's ability to deleverage is quite valuable as it allows you to cut off left-tailed outcomes.

Antifragile (Taleb)
Taleb groups systems into three buckets – Fragile, Robust, and Antifragile – by their reaction to instances of volatility. Fragile systems are those actively harmed by volatility, Robust systems are those resilient to volatility, up to a certain point, and Antifragile systems are actively helped by volatility, and often harmed by a lack of it. Taleb generally favors exposure to systems with Antifragile properties, characterized by small negative downside, but huge potential upside. More concretely, Taleb argues for a "barbell" investing strategy, where the majority of assets are in safe, inflation protected securities, while a small minority is invested in highly volatile, high upside vehicles which have a potential for limited loss, but massive upside potential.

Statistical Consequences of Fat Tails (Chapter 3, Taleb)
"Thick tails" describe a distribution that is of higher kurtosis than a normal one. In thick-tailed distributions, extreme events away from the center of the distribution play a more substantial role than in a normal one. Individual stocks, which can lose no more than 100% of their price but can gain multiples of their price in a single year, are best described by right-skewed distributions with a thick tail of highly positive outcomes. In these thick-tailed distributions, Black Swan events are not more frequent, but they are more consequential. Taleb contends that statistics is "overstandardized", and many common financial measures including beta, and the Sharpe ratio, are highly uninformative because they do not map well to thick-tailed distributions. In short, we should be aware of the shape of distributions for different outcomes and be careful in how we measure and assess them.

High Multiple Growth Stocks (Goldman Sachs)
A prime example of fragility, this Goldman Sachs piece details how growth stocks are susceptible to two main risks: regulation and valuation. High EV/sales growth stocks typically underperform. Although they deliver the same upside as cheaper stocks when they consistently beat earnings and growth estimates, highly valued stocks are exposed to more downside when missing forecasts (a characteristic of a fragile system).

Class 4.5 Behavioral Explanations

Key Themes

- Forecasting errors drive most market premiums. Return distributions are 0.5x higher on news days and 6x higher on earnings announcement days. Biased expectations provide the most compelling explanation for this variance; firms with biased expectations about future cashflows are corrected with the arrival of public cash flow news.
- Evidence suggests these biases are systematic. Investors are too optimistic about expensive stocks and too pessimistic about value stocks.
- In fact, 80% of excess returns to value investing occur on days of news release. Value returns are 7x higher on earnings announcement days and 2x higher on Dow Jones news release days.

Anomalies and News (Engelberg et al.)
Examining return distributions around news days, the authors find that returns are 50% higher on corporate news days and are 6 times higher on earnings announcement days. Biased expectations provide the most compelling explanation for this effect, as firms with biased expectations about future cashflows are corrected with the arrival of public cash flow news. Firms for which an agent has overly optimistic (pessimistic) cashflow expectations have negative (positive) news-day returns. Therefore, expectations "corrected" by actual news events can describe a significant portion of anomaly premiums in financial markets.

What Drives the Value Premium? (Verdad)
In their analysis of the Engelberg paper, Verdad established that forecasting errors drive a majority of market premiums. Investors are too optimistic about expensive stocks, and too pessimistic about value stocks, leading to greater and more frequent positive surprises for value stocks. As a result, 80% of excess returns to value investing occur on days of news release. Value returns are 7x higher on earnings announcement days and 2x higher on Dow Jones news release days.

Verdad's Strategy

Class 5.1: Size Effects in Value Investing

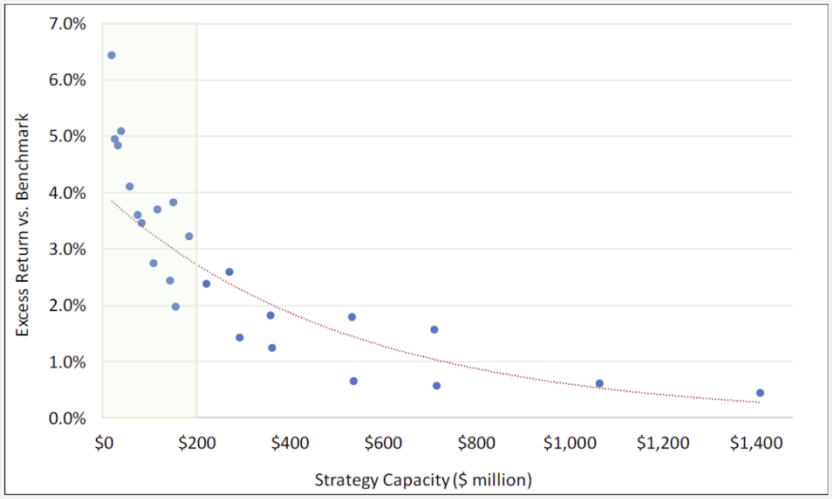
Key Themes

- Investing in small stocks comes with many advantages. Valuation spreads between the most and least expensive companies are much wider in the small-cap space, providing greater room for manager discrimination.
- As AUM increases, so does average price to book, leading to a decreased exposure to the value factor. Studies have found that ~90% of fund performance variability is explainable using assets under management alone.

Size Matters: How Market Structure Favors Small Funds (Verdad)
Verdad interrogates the relationship between fund returns and total assets under management (AUM). There are many more small stocks than large stocks, which leads to a broader distribution of valuations and greater selection opportunity among small cap equities. By virtue of their size, most small cap stocks are inaccessible to fund managers and ETFs seeking to run high AUM strategies. Therefore, funds must reduce capacity to increase selection opportunity and access excess returns.

Size Matters 2: Evidence from Europe (Verdad)
Continuing their series on size effects and investing, Verdad comments on the broader set of opportunities which smaller funds can access. Because there are far more small-cap stocks than large-cap stocks, investors constrained to large-cap investing would miss 78% of the opportunity set. As it pertains to value, the cheapest decile of European stocks has outperformed the most expensive decile by between 6.4% and 17.5% per year since 1997. However, most of the value premium is attributable to small companies. The cheapest stocks within the small-cap segment tend to trade at a discount to the cheapest stocks within the large-cap segment. Therefore, to achieve higher returns, funds must stay small to concentrate on cheap small-cap stocks with low trading volume. Minimum trading volume affects the capacity of strategies, leading to a negative relationship between fund size and outperformance over a benchmark. The article closes by stating the difficulty in separating luck from skill when evaluating fund performance. Instead, investors should assume that successful managers provide stronger exposure to factors such as value, profitability, or momentum.

Figure 6: Higher Capacity Strategies Have Lower Excess Returns (July 1997–June 2018)



Sources: S&P Capital IQ, MSCI, and Verdad analysis.

Class 5.2: Verdad's Strategy (Equities)

Key Themes

- Verdad discusses the benefit of using machine learning algorithms to parse through accounting data and forecast the likelihood of bankruptcy. Firms with high estimated probability of debt paydown earn higher returns than those that do not.
- The firm's machine learning algorithm constitutes a robust base rate forecasting mechanism that delivers 65% accuracy in predicting debt paydown over the subsequent year.
- The most levered stocks have the highest return dispersion and, therefore, the biggest forecast errors. The "Holy Grail" of investing would be to invest in the extremes of factors (i.e., leverage), where dispersion is highest, but avoid the most negative outcomes. Achieving this requires a catalogue of historical forecasts and their accuracy.
- By scoring historical model forecasts by their accuracy, where underperforming stocks that were forecast to outperform score poorly, Verdad constructs an uncertainty measure: "the probability of being wrong." The probability of being wrong allows Verdad to invest more confidently in factor extremes, where dispersions are high, as they can avoid the most uncertain and thus negative outcomes.

Forecasting Debt Paydown Among Leveraged Equities (Chingono, Rasmussen)
"Forecasting Debt Paydown" describes the findings of a machine learning algorithm developed by the authors, which can forecast debt paydown with up to 65% precision over the next year in out-of-sample testing. Further findings suggest that stocks with higher estimated debt paydown earn higher average returns one year ahead; the authors identify a 10.3% spread between the 10th and 1st decile of estimated debt paydown. The author's model relies on a boosted tree algorithm which likely captures non-linear relationships and interactions well, using data from the UChicago CRSP database. Applying these findings to investing, the authors find that a strategy which selects stocks in both the 10th decile of estimated debt paydown probability, and the bottom half of P/B value returns 16.4% average annual return, with a 31.4% standard deviation. After controlling for 3 Fama-French factors, the strategy has a 9.3% risk adjusted return.

The Signal and the Noise (Debt Paydown Model) (Verdad)
This brief Verdad research article focuses on how predicting deleveraging within the leveraged small-cap value space can lead to excess returns. The firm finds that predicting debt paydown is highly correlated with returns. The Verdad debt paydown algorithm is 65% accurate in predicting debt paydown over the next year in out of sample testing, a marked improvement from the actual rate of debt paydown within small cap firms. In a system where multiples drive volatility, and correlation to markets drives stock pricing, predictions informed by base rates which embrace uncertainty are likely to succeed.

Voting Machines (Probability of Being Wrong) (Verdad)
In government and in investing, ideological partisans act over-confidently based on inaccurate forecasts. Because evidence has shown that experts are no better than non-experts at making forecasts about the future, Verdad developed a model which identifies the probability of being wrong. The use of several models together: probability of debt paydown, value, profitability, and

momentum factors, and anticipation of forecast errors, leads to superior risk-adjusted returns for the firm. Using this ensemble model improves returns by about 3% relative to a linear model.

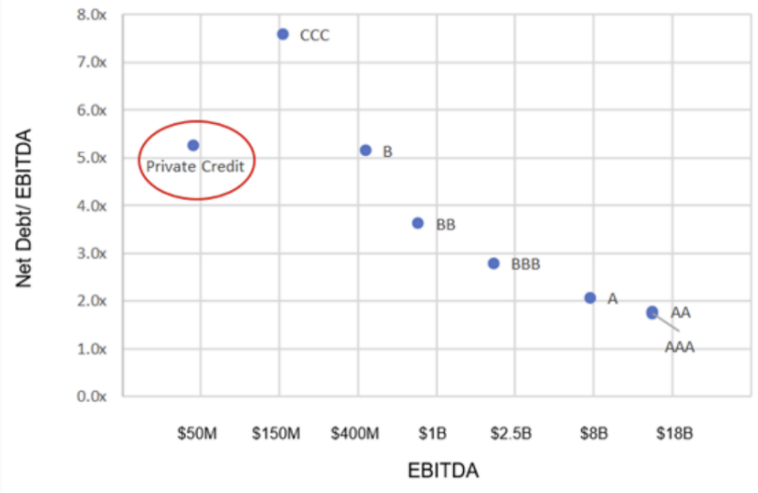
Class 5.3: Verdad's Strategy (Credit)

Key Themes

- Verdad takes a quantitative approach to investing credit markets by examining the risk/reward tradeoffs across the credit spectrum.
- Historically, BB bonds have outperformed other rating categories. While BB bonds suffer from higher default rates than higher rated counterparts, the increases in yield more than compensate investors for this risk. However, moving any further down in rating quality results in a deterioration of returns as increases in yield fail to compensate investors for increasing default risk.
- The shift toward alternatives has taken investors away from bonds. This shift, advocated by Yale Endowment's sage David Swensen, has been in part driven by the exceedingly low interest rate environment.
- Bonds still offer investors a valuable source of diversification. Empirical studies suggest bonds improve Sharpe ratios and mitigate drawdowns when compared to pure equity portfolios.

Fool's Yield (Verdad)
When considering fixed income investments, credit analysts are focused on company negatives and bankruptcy risk. However, these investors can still be fooled into extrapolating low bankruptcy rates into the future, falling victim to what Verdad calls "fool's yield." Recent corporate debt default rates remain subdued relative to historical base rates, leading many investors to seek higher returns in lower-rated credit. However, as opposed to investing in AAA and AA rated bonds with low yields or B and CCC bonds with increased risk, investors should turn to the BB category, where realized returns and Sharpe ratios peak. Instead, many managers have transitioned to private credit markets, which Verdad finds have failed to outperform the broader high yield market. The private credit markets offer a similar net debt / EBITDA to B bonds, but these issuances are from companies smaller than typical CCC bonds, exposing investors to additional risk. Therefore, investors should focus on BB-rated debt to maximize risk-adjusted returns.

Figure 5: Private Credit vs. Liquid High Yield



Source: Public filings, Verdad analysis

A Flight from Safety (Verdad)
In a shift away from a traditional asset allocation equity-bond portfolio, institutional asset allocations have shifted ~20% of their portfolios from fixed income to alternatives. Falling interest rates have likely driven this flight, as yields on traditional fixed-income products fall. Infamous Yale endowment manager David Swensen has vocally discouraged endowment investing in corporate fixed income, believing that corporate credit does not provide adequate safety or returns. However, Verdad finds that corporate credit has an attractive risk-return profile on its own, with bonds having higher Sharpe Ratios and lower drawdowns than equities. Corporate debt premiums are also generally higher than Swensen's assumptions, and the author finds that adding BBB corporate debt to a portfolio comparison can improve returns by 26bps per year, improving the Sharpe ratio by 0.04. Bonds further provide safety over equities due to their elevated position in the capital structure relative to equity investors, who are effectively the last priority in a liquidation scenario. However, current low rates make many yields unattractive.

Does Factor Investing Work in Bonds? (Verdad)
In short, yes, factor investing does work in bond. Verdad's Greg Obenshain tests numerous factors – including momentum and default probability scores – to bond data and finds that factor models outperform benchmarks. To enhance bond returns, the author suggests the application of leverage strategies to high yield bonds. To Bridgewater founder Ray Dalio, "Levering up low-risk assets so you can diversify away from risky investments is risk reducing."

Class 5.4: Verdad's Strategy (Opportunities)

Key Themes

- Verdad synthesizes knowledge of financial accelerator events, information contained within the high yield spread, and the time-varying predictability of return predictors to construct an approach to investing in crises.

Crisis Investing (Verdad)
"Crisis Investing" outlines the fundamental strategic choices that constitute Verdad's equity and debt investment strategies. First, investment factors have greater explanatory power in recessions. The well-known Fama-French factors of excess return, namely Valuation: High minus Low (HML), Firm investment: Conservative minus Aggressive (CMA), and Size: Small minus Big (SMB) all exhibit an 8x increased explanatory power during periods of distress. Second, the High Yield Spread offers a strong measure of financial accelerator events and thus a robust crisis indicator. Verdad considers a High Yield spread above 6.5 (one standard deviation above the center value of spreads) as a crisis threshold, at which point they recommend waiting 2-3 months before deploying capital, allowing time for the crisis to develop, and ensure that buying occurs as close as possible to a recovery period.

Class 5.5: Emerging Markets (FX + Opportunities)

Key Themes

- Global crises drive investors in developed countries to reduce their risk exposures and liquidate positions in emerging markets.
- Verdad distinguishes between global crises, where markets everywhere are affected, and idiosyncratic crises, where only certain local markets are affected.
- Idiosyncratic (country-specific) crises typically do not present equity investors with attractive opportunities, as firm fundamentals are affected to a higher degree. During idiosyncratic crises, investors are instead urged to invest in sovereign debt, which tends to offer stronger performance than equities in these instances.
- Since emerging markets offer poor returns during normal times, and crash frequently, shorting local currencies when EM regions are not in crisis can be attractive.

Emerging Markets Crisis Investing (Verdad)
Historically, EM equities have delivered meager performance. Choosing only to invest when a country has experienced a significant drawdown, or when markets globally have drawn down, can dramatically boost returns. Despite high GDP growth, emerging markets have experienced slow growth and high volatility. Frequent crises contribute to this underperformance, as emerging markets are less likely to recover after a crisis than developed markets. The authors study every EM crisis since 1987 (71 crises over 18 markets), finding that investors can reap excess returns by only investing in the two years immediately following a crisis (defined as a period when major EM stock markets drew down at least 50%. Investing in EM equity indices during global crises (when all markets draw down uniformly) would have returned on average 91% over 2 years, with an 84% chance of positive returns versus 23% return for the S&P 500 with a 75% chance of positive returns. However, investing in these same indices during country-specific crises (when one or a handful of markets draw down) does much worse. In these situations, sovereign debt performs better than equities (figure 13). The discrepancy between types of crises lies in foreign investment to EM stocks. When crises occur in developed markets, investors pull money from emerging equities, transferring negative price movements from developed to emerging markets, despite no or little change in emerging business fundamentals. Because of this, it is advantageous to buy EM large value stocks in equal weights during global crises and EM sovereign debt during idiosyncratic ones. If coupled with holding US treasuries in times of no crisis, this joint strategy produces equity-like returns with debt-like risk.

Carry Trades and Currency Crashes (Brunnermeier, Nagel, Pedersen)
The carry trade – a strategy that borrows low interest currencies to buy high interest currencies – is subject to crash risk. The economic theory, Uncovered Interest Parity (UIP), dictates that exchange rate fluctuations should cancel out any difference in interest rate between two countries. Empirical studies show, however, that this relationship does not always hold and that the carry trade has had historically profitable periods. That said, positive carry is associated with negative skewness in exchange rate; carry traders expose themselves to significant downside risk. In times of crisis when investors become more risk averse, carry trades are unwound and losses can be severe.

Class 5.6: Cycle Investing

Key Themes

The core tenets of a counter-cyclical investing strategy are:

- Contrarian use of business cycle indicators to increase risk exposure during crises and decrease risk exposure at market peaks
- Use of price trends to hedge against short-term negative shocks to growth and positive shocks to inflation
- Dynamic asset allocation in response to changing economic environments to maximize returns, minimize drawdowns and avoid lost decades

Countercyclical Investing: Foundations of a Cycle-Driven Approach to Asset Allocation
(Verdad)

In their comprehensive piece on asset allocation, Verdad presents a framework for how investor should react within the four defining quadrants of economic growth, as defined by rising or falling growth, and rising or falling inflation. The firm creates a model which captures crisis opportunities while avoiding major losses form negative shocks to growth or positive shocks to inflation, building upon their previous "Crisis Investing" research. Three main objectives underscore the research: First, the portfolio should achieve drawdowns comparable to a traditional 60/40 equity/bond portfolio. Second, returns must remain consistent across macro-economic conditions with no lost decades of underperformance. Third, this approach must outperform a 100% equity approach in terms of total return. This approach relies on the use of business cycle indicators (namely high-yield spreads and the slope of the yield curve) to increase risk exposure during crises and decrease exposure at market peaks, as well as the use of price trends to hedge against short-term negative shocks to growth and positive shocks to inflation. Lastly, the approach employs dynamic asset allocation in response to changing economic environments to increase returns and reduce drawdowns.

To indicate when investors should shift asset allocations, the authors suggest the use of high yield spreads (the difference between sub-investment grade bonds and the corresponding US treasury rate) as a primary business cycle indicator. When spreads are tight (low), the slope of the yield curve is incorporated to estimate the direction of inflation and differentiate between two falling growth environments: one with rising inflation where investing in real assets outperforms, and one with falling inflation where fixed income investments provide favorable returns. Incorporating a trend-following strategy, where large downward price movements are sold and then re-bought when prices return to prior levels, can protect investors from the most extreme loss situations, reducing max drawdowns by about half.

As opposed to a pure equity strategy, this portfolio incurs drawdowns comparable to a 60/40 portfolio, consistency of returns across macro-economic conditions, with no lost decades, and outperforms a 100% equity approach I terms of total return. Should an investor have implemented the strategy since 1970, they would have outperformed equities by about 500 bps per year, all the while maintaining a superior risk profile. Periods of underperformance do exist, mostly during times of high growth, where the S&P 500 returns > 15% yearly, and the Verdad asset allocation strategy lags behind this stellar growth in the index due to its diversification away from high price levels during growth periods.

The Best Macro Indicator (Verdad)
The high yield spread not only predicts returns in small-cap value, but also across a full range of assets. The high yield spread is measured by difference between rates of below investment grade corporate bonds and the corresponding US treasury rate. Lower spreads indicate easy availability to money, while higher spreads indicate tight credit conditions and fund flows away from risky assets. In addition to the level of spreads, investors should also consider its direction: narrowing or widening. Directional changes in the high yield spread provides similar information to the slope of the yield curve, which can help guide allocation decisions.

Class 5.7: Understanding Private Markets

Key Themes

- Venture capital as an asset class benefits from lottery-like returns of very few high-profile deals (eBay) and fund successes (Accel Partners. In reality, venture as an asset class has underperformed public equity benchmarks on a 3-, 5-, 10-, and 15-year horizon with periods of outperformance limited to the early 2000s tech bubble and the 2008 crisis, which were not marked down to the same extent as equity markets.
- Real Estate Investment Trusts (REITs) operate like a stock and bond hybrid, generating returns through cash distributions from rental income and capital appreciation. REITs have performed similarly to small-cap stocks over long time horizons and better than large-cap stocks or bonds, with volatility levels lower than small-cap stocks but higher than large-cap stocks or bonds.
- Private Equity: Historical outperformance of private equity had all but vanished as the asset class as underperformed the S&P 500 and Russell 2000 in recent years. The greatest driver of this underperformance has been a general increase in valuations.
- Private credit has exploded in recent years, growing from $37B in 2004 to $109B in 2010, to $261B in 2019. Investing in private credit vehicles may expose investors to riskier companies, especially those whose leverage ratios exceed 6x debt/EBITDA multiple.

The Lure of Venture Capital (Verdad)
Since the asset classes' inception, stories of outsized returns such as Benchmark's investment in eBay (which returned $5B on a $85M investment) have captured the minds of investors. This Verdad piece examines whether these stories are representative of the Venture industry at large, or if Venture returns behave more like a lottery where random chance dictates returns. When considering Cambridge associates' VC index, Venture as an asset class has underperformed public equity benchmarks on a 3-, 5-, 10-, and 15-year horizon, with periods of outperformance limited to the early 2000s tech bubble and the 2008 crisis, where illiquid VC holdings weren't marked down to the same extent as equity markets. This chronic underperformance is due to the distribution of returns within the venture space, with a small minority of funds driving massive excess returns, while the rest of the industry lags. The distribution of investment returns *within* a fund follows a similar structure, with most firm investments providing stagnant returns or losses, and a small number of "home run" investments driving an outsized portion of fund returns. Size effects also exist in venture, with smaller funds tending to outperform larger ones. The paper argues that VC is another example of private market underperformance, with probabilities of picking a successful VC fund similar to those of choosing a successful startup.

The Lasting Value of Real Estate (Verdad)
Contrasting returns in private real estate (RE) and public Real Estate Investment Trusts (REITs), this Verdad piece finds that private RE funds come with higher risk and lower returns than investors are led to believe. For background, publicly traded REITs own and manage income-producing real estate and generate returns through both property cash flows (rent/lease payments) and capital appreciation (increases in value of property). These trusts are required to distribute at least 90% of annual taxable income as shareholder dividends, causing REITs to operate as stock-bond hybrids. The paper then looks at 30 years of historical data, finding that

REITs maintain similar returns to small-cap equities, with volatility levels similar to large-cap equities, as well as a relatively low correlation to equities in general. In addition, REIT drawdowns are of a smaller magnitude relative to equities. When compared to private real estate, REITs perform well across retail, industrial, commercial, and residential sectors. Another key differentiator between the two lies in fee structures. While private RE funds cling to a traditional "2 & 20" structure, where a flat 2% management fee and 20% performance fee can erode shareholder returns, REITs average a 0.89% management fee. Combined with superior management incentives in public real estate, private markets fail to keep up.

Private Equity: Overvalued and Overrated? (Rasmussen)
Surveyed investors expected PE to outperform public equity markets by 4% per year or more. Returns have lagged the Russell 2000 by 1% and the S&P 500 by 1.5% per year over the past five years. Several fundamental changes have driven this underperformance. Most importantly, increased capital inflows into PE have led to elevated valuations. To illustrate, in 2007, the average purchase price for a PE deal was 8.9x EBITDA. Deal prices have recently reached 8.9x again and are now up to nearly 11x EBITDA.

Private Credit (Rasmussen, Obenshain)
Although inflows into the private equity sector fueled an increase in demand for corporate debt, banks and traditional lenders have sharply limited their exposure to riskier parts of the corporate credit market. Instead of turning to these traditional institutions, private credit funds have "picked up the slack", providing debt financing to firms which would otherwise lack access to credit. This asset class has grown significantly, from $37B in 2004 to $109B in 2010, to $261B in 2019. On the investor side, these funds offer institutions significantly higher yields relative to investment-grade corporate debt. However, the authors are quick to point out that investing in private credit vehicles may expose investors to riskier companies, especially those whose leverage ratios exceed the 6x debt/EBITDA multiple which regulators use as a benchmark of detrimental.