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#03

3rd issue 2020

Sins of omission: managing omission risk in discretionary strategies

Responsible investing: common myths debunked

The psychological challenges of investing in real assets

Thematic innovation investing with textual data analysis

Consortium on Asset Management in Cambridge

Risk & Reward

Research and investment strategies

We hope you are keeping well in these tumultuous times. While none of the articles in this edition of Risk & Reward relates specifically to COVID-19, the economic and financial implications of the pandemic are clearly having a tremendous impact on the global financial markets. In this environment, it's more important than ever to take the long view.

At Invesco, we believe our clients are best served by portfolios that include active, passive and alternatives. A comprehensive range of capabilities can offer the best opportunity for clients to achieve their investment objectives across market cycles, which is particularly important now, given the volatility we're seeing in the global financial markets. Even in the new normal, markets continue to be driven by the same fundamental elements: monetary and fiscal policy, investor sentiment, fear, risk aversion, corporate earnings, valuations and others. The old saying that the only constant is change has rarely been more relevant.

So, in this issue, we present five pieces of timeless research:

We discuss the risks and consequences of missing out on the most profitable stocks and how this can be avoided. We debunk some common myths about ESG investing, a topic that is more relevant than ever in the light of the pandemic and the focus on social justice issues in the US and elsewhere. We discuss real estate investing from a behavioral finance perspective. And we show how quantitative analyses can inform increasingly popular thematic investing strategies. Lastly, we are excited to share with you the body of work presented at this year's Cambridge Consortium on Asset Management addressing recent research on fixed income, alternatives and responsible investing.

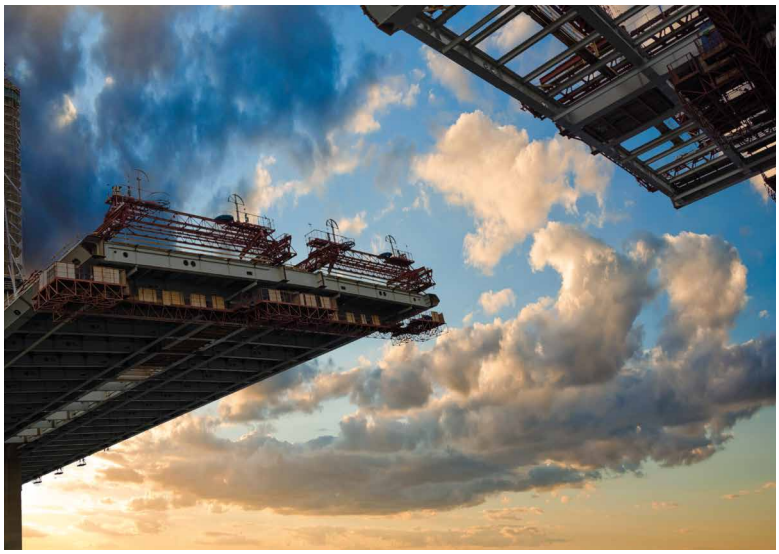
Indeed, even as change is all around us, sound research remains more important than ever.

Best regards,

Marty Flanagan
President and CEO of Invesco Ltd.

Contents

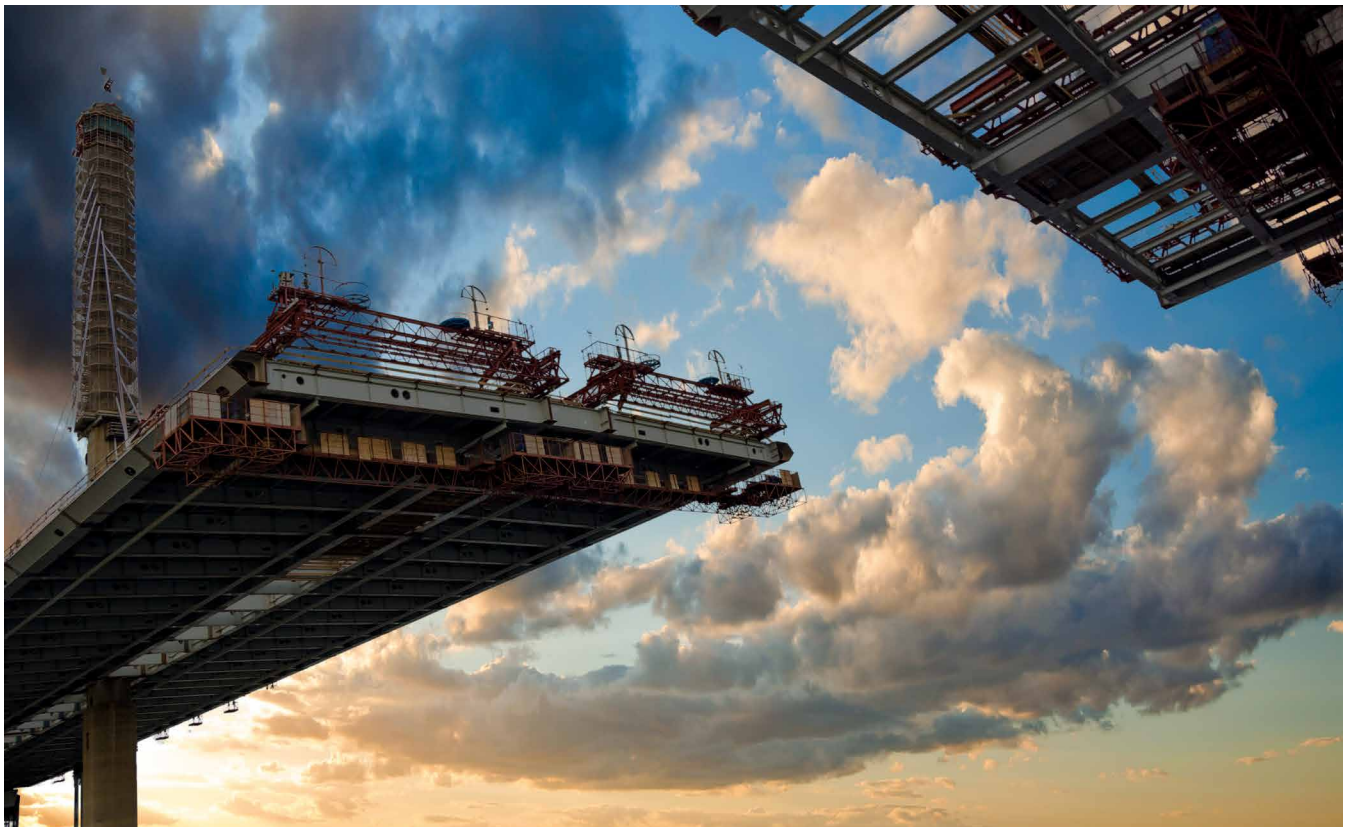
Feature



In focus

Sins of omission: managing omission risk in discretionary strategies

By Luke Montgomery, Jeff Everett and Erik Esselink



In brief

Persistent positive skew in the distribution of returns across index constituents suggests that a successful active equity management program must include a process to mitigate omission risk – i.e. the opportunity cost of missing out high-returning stocks that buoy average benchmark returns.

A bottom-up approach to investment selection often drives more concentrated portfolios, longer investment horizons and a propensity to use absolute criteria in decision making, all of which make discretionary managers particularly prone to the omission risk problem. We believe omission risk can be mitigated by increasing the breadth of comparative decision making, and we discuss several approaches to expanding breadth while maintaining a discretionary orientation.

Portfolio peformance can fall victim to omission risk – the risk of underperformance due to missing out on the "big winners" that drive benchmark returns. This poses unique challenges for discretionary investors focused on bottom-up selection. We show how this problem is conventionally addressed and discuss why we believe these approaches are unsatisfactory. We then explain our approach at Invesco Global Core Equity.

The outperformance of the five "FAANG stocks" has brought increased concern with narrow market leadership.

The outperformance of the five "FAANG stocks" – the US technology companies Facebook, Amazon, Apple, Netflix and Alphabet (formerly known as Google) – over the past few years has brought increased concern with narrow market leadership and its implications for active equity strategies. Ostensibly, the cost of omitting these stocks has been high. For example, over the 3-year period ending December 2019, an index fund based on the MSCI World Index excluding the FAANG stocks would have underperformed the total return of the full index by over 400 basis points. In the wake of the COVID-19 pandemic, FAANG stocks have continued to outperform. As measured by the Herfindahl-Hirshman Index, a common concentration measure, leadership in US equity markets in late April was as narrow as it had been in recent history (figure 1). At the end of April 2020, the five FAANGs together made up nearly 10% of the S&P 500.

Investment managers may be reluctant to omit FAANGs from a portfolio even when their conviction in the stocks is lower or the stocks do not fit well with their investment philosophies. And their hesitance is understandable given the potential for these mega-caps to disproportionately drive returns of capitalization weighted indices, adversely affect relative performance and consume an active risk budget.

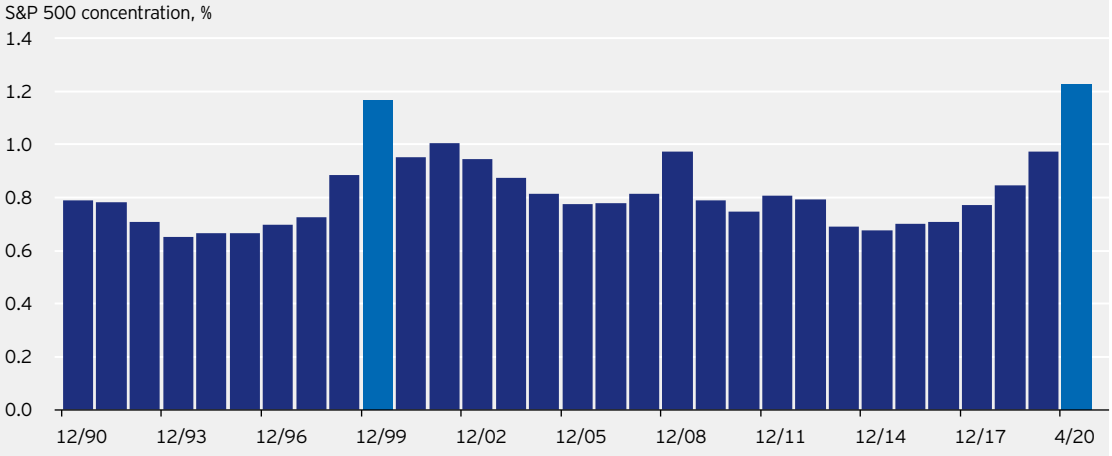
Nevertheless, data indicate the narrow market leadership represented by the FAANGs has been less constraining on security selection than many pundits profess. Even amid the FAANGs' leadership, skilled stock selectors have had ample optionality. Over the 10-year period ending 31 December 2019, almost 700 of roughly 2000 MSCI World Index constituents outperformed the index's total return. Likewise, over the 3-year period ending 31 December 2019, 47 stocks in the MSCI World Index outperformed the best performing FAANG stocks, and more than 600 of 1800 stocks in the index outperformed the index's total return. Over both horizons, a manager with selection skill had numerous permutations for constructing a portfolio that would have beaten the index, without holding a single FAANG stock.

These observations suggest handwringing about the FAANGs is overblown. Yet, the FAANG phenomenon is symptomatic of a real problem known as "omission risk" – the risk of missing higher-returning index constituents. In the next section, we discuss why we regard omission risk as a central problem in discretionary active strategies. We also discuss why the conventional ways discretionary managers have dealt with this problem are unsatisfactory.

Unoriginal sin: omission risk in active strategies

While the FAANGs' outperformance has been pronounced over the last few years, narrow market leadership is hardly anomalous. Positive skew in the distribution of returns across stocks is a persistent characteristic of equity markets and the indices that represent them. As a growing number of studies have documented, a smaller cohort of the best-performing stocks typically pulls an index's average

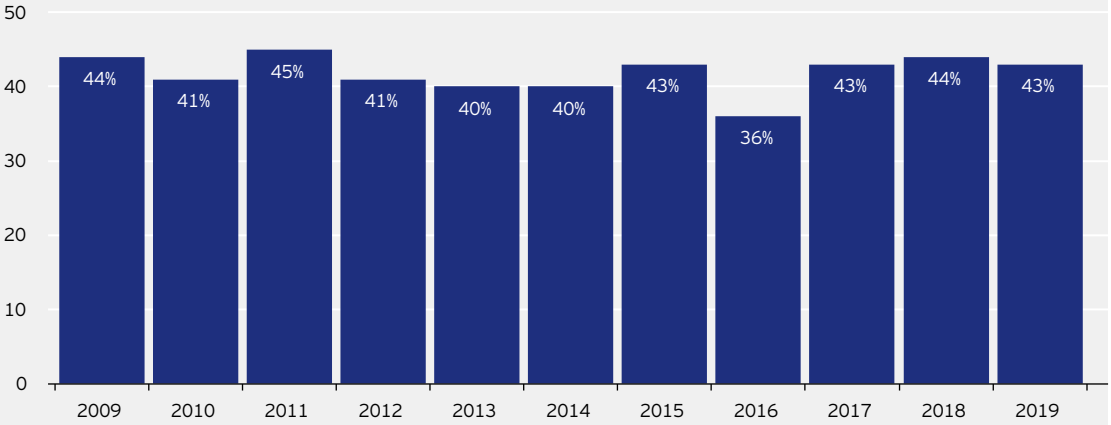
Figure 1
FAANGed!



S&P 500 concentration as measured by the normalized Herfindahl-Hirschman Index (HHI). A value of 1/500 = 0.2% indicates that all S&P 500 constituents have an equal share in the index; a value of 100% indicates that one stock has a weight of 100% and all others a zero weight.
Source: Morgan Stanley QDS, as at 30 April 2020.

Figure 2
Most stocks underperform the index

MSCI World stocks with returns above the index return*, 3-year trailing, %



*Total return of the equal-weighted MSCI World Index. Only stocks still included in the index at the end of the period.
Source: Bloomberg, GCE analysis, as at 31 December 2019.

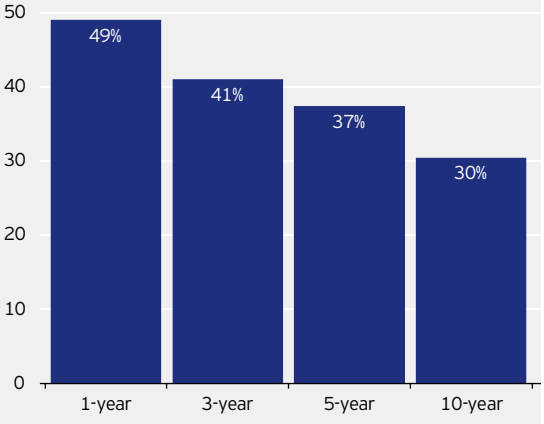
return upward. One study found that, between 1989 and 2015, more than 50% of the stocks in the S&P 500 underperformed the T-bill rate, while the Index as a whole rose 1200%.[1] Cross-sectional skew increases with longer investment horizons; a study of returns between 1926 and 2016 found the entire net gain of the US stock market could be attributed to the best-performing 4% of listed companies (out of 26,000).[2]

Positive skew implies the odds in unskilled security selection are consistently worse than a coinflip (figure 2). To further illustrate this phenomenon with historical data, we randomly selected portfolios from the constituents in the MSCI World Index and calculated portfolio performance from the realized total returns of the selected stocks. Simulating over many trials and for different portfolio sizes, we estimated the posterior probability of outperforming the equal-weighted MSCI World Index with a randomly chosen equal-weighted portfolio. For example, for a portfolio of 60 stocks, before fees and trading costs, we estimated this probability was 46% for the 10-year period ending 31 December 2019, while for a 10-stock portfolio the probability was 42%.

As the investment horizon extends, however, market leadership progressively narrows.

Figure 3
The longer the investment horizon, the fewer stocks exceed the index return

MSCI World stocks with returns above the index return*, %



*Total return of the equal-weighted MSCI World Index. All constituents at the beginning of the period. Cumulative total returns as at 31 December 2019 or until the security was removed from the index.
Source: Factset, Bloomberg, GCE Analysis, as at 31 December 2019.

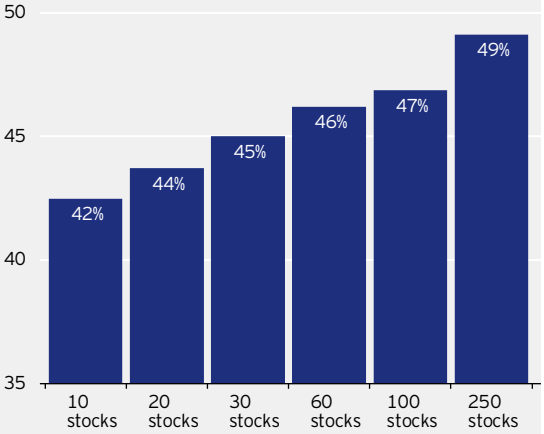
While our sampling exercise assumes no skill, several characteristics common to discretionary active managers suggest the problem of omission risk poses unique challenges for their strategies. These characteristics include a longer investment horizon, a more concentrated portfolio and a propensity to rely on absolute judgements in decision making.

First, many discretionary managers, including Invesco's Global Core Equity team, believe patience is an advantage and invest with a longer horizon to exploit short-termism that causes other investors to undervalue long-term growth or returns. As the investment horizon extends, however, market leadership progressively narrows, the underlying odds in security selection decline and the potential consequences of omission risk become more severe (figure 3).

Second, discretionary managers face resource and time constraints that typically limit how many securities they can continuously analyze with bottom-up research. Among other philosophical and practical motivations, these constraints are a key reason why many discretionary managers hold portfolios that are more concentrated than their index. Yet, all

Figure 4
With fewer portfolio positions, omission risk is a greater challenge

Simulated probability of outperforming* the MSCI World Index with random stock selection, %



* Before fees and trading costs; equal-weighted. Average portfolio return for a simulation with 2500 trials. Results varied slightly across successive simulations but consistently yielded progressively lower percentages with fewer portfolio holdings.
Source: GCE analysis, Bloomberg, as at 31 December 2019.

else equal, omission risk increases with portfolio concentration (figure 4).

Third, discretionary fundamental managers rely on value judgments about information that is often unquantifiable or not easily codifiable. This reliance can manifest discrete decisions informed by absolute judgments (e.g. "XYZ company has good management"), while investing is the discipline of relative decisions.[3] Selecting the "best" investments – reducing omission risk – necessitates comparative decisions informed by expectations about the distribution of risk-adjusted returns available in the opportunity set.

Conventional solutions
The conventional approach to managing omission risk is to increase overlap with the benchmark. This approach seeks to trade off fewer errors of omission for greater errors of commission – for example, attempting to immunize a portion of FAANG omission risk by holding the stocks in proportion to their benchmark weights. The unsatisfactory consequence of this approach is to crowd out investment in higher conviction ideas. This, in turn, can reduce active share and make it more difficult for a manager's excess returns to outrun its fees.

Even less satisfactory for most discretionary managers is shortening the investment horizon by pivoting the portfolio more frequently. While this approach seeks to take advantage of better (but still unfavourable) short-term base odds, it conflicts with a core belief held by many discretionary managers that short-term behavior is a key market condition their strategies seek to exploit. Further, higher turnover increases trading and market impact costs that cut into excess returns. Finally, attempting to chase the "hot stocks" in a benchmark year-in and year-out is inconsistent with a disciplined implementation of most discretionary investment signals.

In our view, omission risk requires an independent solution – one that does not treat omission risk and commission risk as opposite sides of the same coin and does not sacrifice a discretionary orientation toward investment skill. We now discuss how the Invesco Global Core Equity team approaches this problem.

At Invesco Global Core Equity, we believe discretionary managers can mitigate omission risk by expanding breadth in the application of selection skill.

Systematic selection in discretionary strategies
At Invesco Global Core Equity, we believe discretionary managers can mitigate omission risk by expanding breadth in the application of selection skill. By breadth, we mean any activity or process that enhances comparative decision making, which may include – but is certainly not limited to – examining a greater number of individual opportunities. In advocating for a more systematic process, we borrow from the toolkit of quantitative investment managers while maintaining a discretionary orientation toward investment skill. As such, our approach differs from that of a quantitative manager who seeks to compound returns from a relatively small investment coefficient ("signal") by simply increasing the number of independent decisions. Similarly, our motivation differs from the main thrust behind "quantimental" strategies, which seems driven largely by the search for alternative investment signals.

Broadly, a systematic selection process is one that is methodical in procedure and thorough in scope. Others have pointed to overlaps between discretionary and systematic (quantitative) strategies. In our view, however, a discretionary strategy is by definition one that cannot be completely systematic since discretionary managers rely on direct analysis of individual opportunities, and the scope of this activity is not perfectly scalable when research resources are finite.

Nevertheless, mitigating omission risk does not require the same degree of vetting for every security in the investment universe. Instead, we argue for moving directionally toward systematization by adopting processes that increase comparative decisions. We believe discretionary managers can pursue at least three approaches to this end: purposefully cultivating group synergies to scale bottom-up research; using industry research to enjoin bottom-up search; and judiciously applying quantitative tools in support of idea generation and portfolio construction.

Indirectly scaling bottom-up research
More systematic bottom-up fundamental research seeks to ascertain a stock's relative attractiveness

against a fuller array of potential holdings, not just whether the stock meets the minimum absolute criteria for what counts as a "good" investment. We liken the absolute approach to using a penlight to survey the features of an unlit room: as the penlight is cast across the room (the investment universe), it arbitrarily illuminates certain features (stock ideas) that capture the attention (because they fulfill absolute criteria). In contrast, a systematic process exchanges the penlight for a floodlight that illuminates a greater portion of the room and the relative qualities of the room's features.

As mentioned previously, increasing the number of companies researched is the most direct tack to increasing breadth in bottom-up selection. But that is not always possible with limited resources, and it may not be desirable if it means sacrificing research depth. Moreover, under our conception of breadth, it may not be necessary. Most investment teams already examine a far greater number of stocks than they deem worthy of purchase, and more still than are held in the portfolio. Furthermore, surplus information gathering does not facilitate comparative decision-making if independent efforts remain siloed.

Therefore, we envision enhancing breadth by aggregating research insights through effective group processes and technology, with an eye toward building collective knowledge and enabling holistic decision making. This is founded on a database that houses written research, a culture that prioritizes collaboration and cognitive diversity, and group processes designed to facilitate intentional communication. Intentional communication acknowledges that group synergies are not an automatic consequence of working together. Consideration of the procedural aspects of interaction is critical to helping groups share knowledge that is unevenly distributed among team members and neutralize cognitive biases during deliberation. We also believe the choice of a decision-making mechanism is essential. In particular, teams looking to reduce omission errors may be better served by unilateral rule or majority rule, rather than a consensus approach, for approving portfolio recommendations.

Overlaying industry research

A more systematic use of industry research is one executed from the top down. That is, what differentiates it from industry analysis carried out during stock-level analysis is that it precedes and enjoins decisions about which specific stocks to analyze more closely. This approach helps systematize selection in discretionary strategies by deemphasizing or eliminating from consideration many industry segments where sustainable competitive advantages do not attach and identifying segments where they do.

In addition to identifying attractive industries for investment, an industry overlay facilitates subsequent company comparisons by clarifying the logic of sustainable competitive advantage within an industry or sub-industry. This is significant to the problem of omission risk because sustained economic profitability and above-average growth are attributes common to companies whose stocks outperform over the long term. While a competitive forces framework focused on structural barriers to entry is the traditional view, alternative competitive frameworks may provide a more relevant basis for making comparative decisions between companies. For example, although competition in the broader (commodity) semiconductor chip manufacturing segment is characterized by massive economies of scale, relatively smaller manufacturers in the more fragmented analog semiconductor segment enjoy sustained healthy economic returns. A resource-based view highlights the importance of learning and experience advantages in analog chip manufacturing related to complex chip designs, specialized end-market applications and hard-to-train design talent, which help individual manufacturers dominate specific product categories.

Beyond the structural and resource-based views, we use a number of other frameworks, including the relational and the dynamic capabilities views, to articulate competitive dynamics within industries and direct bottom-up research efforts toward more promising areas for investment. We also combine this industry overlay with other decision criteria, including cross-sectional valuation analyses that indicate how appropriately competitive attributes are being priced, in order to more holistically differentiate between investment opportunities.

Quantitative tools for idea search and portfolio construction

Quantitative tools are a staple of systematic processes, not least because they are easily scaled to compare wide swaths of investment opportunities. In a discretionary investment strategy, it is critical that such tools are strongly aligned with the manager's investment philosophy and the decision criteria used in the bottom-up research process. Without this strong connection, there is risk of running two separate investment programs. On the other hand, properly specified tools can help remedy omission risk in a discretionary strategy, with scalable applications for new idea generation and portfolio construction.

> We believe multivariate scoring models are better than "screens".

With respect to new idea generation, we believe multivariate scoring models are better than "screens". While screens eliminate choices and yield more manageable lists of potential opportunities, their subtractive form could tend to institutionalize omission risk. By contrast, a ranking or scoring model is more holistic and allows dynamic interpretation of results, including anticipation of relative changes within the opportunity set. Models with predictive value, demonstrated through out-of-sample back testing, can help validate a manager's investment signals, lending intellectual support to decision criteria used in the bottom-up research process and providing confidence to scale those criteria for idea generation. Additionally, such tools can help identify imminent changes in market regimes, providing a basis for dynamically changing the relative emphasis on a strategy's

different signals and choosing among otherwise attractive opportunities.

With respect to portfolio construction, modern portfolio construction schemes, based on a factor-risk management approach, provide flexibility to manage the risk of omitting more heavily weighted benchmark constituents while controlling overall active risk and maintaining higher active share. At Invesco Global Core Equity, for example, such tools help identify unintended active risk contributions from industry, style and regional factors. They also enable idiosyncratic risks to predominate in our portfolios and allow investment conviction to drive a total risk expression appropriate to our portfolio guidelines and benchmarks.

Conclusion

A handful of big winners, most notably the FAANGs, have driven stock market returns in recent years. Missing out on those may lead to underperformance, but not necessarily so: there are many other combinations of MSCI World stocks that would have beaten the index. Nevertheless, it is important to find the winners, in particular when the portfolio is more concentrated and the investment horizon is longer, since omission risk tends to be higher in both cases. But this is not always easy since the majority of stocks tend to underperform the MSCI World Index.

To us, the conventional approaches to minimizing omission are not always convincing, which is why we have developed our own concept. Essentially, we employ a very broad and somewhat eclectic approach to security selection, based on various comparisons between stocks and industries, using qualitative as well as indicator-based elements and supplemented by a number of safeguards to mitigate common pitfalls.

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Responsible investing: common myths debunked

By Cathrine de Coninck-Lopez, Maria Lombardo and Glen K. Yelton

In brief

There are two common myths surrounding ESG investing. First, it is often claimed that responsible investing is only possible at the expense of performance. Second, it is claimed that implementing an ESG strategy requires large-scale portfolio changes and divestment. We show that both claims are not necessarily correct. There are good reasons for outperformance by companies with sound ESG policies, and there are alternatives to divestment – most notably engagement.

Over the past 15 years, the contemporary definition of investing through the lens of environmental, social and governance (ESG) principles has evolved from a United Nations policy paper[1] to a reputable strategy representing about one-third of all global invested assets.[2] The meteoric growth of ESG investing has fostered a great deal of misinformation, misconceptions and fake news. We have examined two of the more commonly encountered "myths" surrounding the strategy.

We at Invesco view ESG investing as a process that exists along a continuum.

We at Invesco view ESG investing as a process that exists along a continuum.

At one end is ESG integration, meaning that, alongside traditional financial analysis, relevant ESG factors are used to evaluate investment risk and opportunity. We believe ESG considerations will eventually be fully integrated not only into investment analysis, but into all areas of the investment process.

Next comes negative screening, where ESG criteria are applied to eliminate "undesirable" companies or industries.

Moving further, we encounter so-called "sustainability focused solutions", which apply ESG factors to identify companies with positive or improving ESG performance. Examples are best-in-class strategies (which for example can focus on the most ESG-friendly companies within their industries), thematic investing (where preferred industries like clean energy are identified) and ESG tilt strategies (where ESG factors are used to adjust the weighting of securities in a portfolio particularly used in passive strategies). Socially responsible outcomes are part of the overall investment objectives of these sustainability focused solutions.

Finally, at the far end of the continuum, there is impact investing. Although currently the smallest piece of the ESG pie, these investments specifically target desired social or environmental outcomes that measurably change the playing field.

Separating ESG fact from ESG fiction

Whenever a viewpoint, movement or product captures the zeitgeist, there will be skeptics. Increased publicity leads to increased scrutiny, and different people will arrive at different conclusions even when presented with the same body of evidence. ESG is no exception. In our view, two common ESG myths in particular deserve closer consideration.

Myth #1:
To invest responsibly one must sacrifice returns

ESG has often involved the exclusion of certain sectors and limitations of the investment universe. This is why ESG investing was typically associated in the past with poorer performance. In reality, however, this would only apply to negative screening, if at all. Indeed, there are many convincing arguments debunking this myth: some supported by logic, others by data – and some supported by both.

Logically, it makes sense that, as ESG integration becomes more ubiquitous, laggards will be penalized. As customers of all ages increasingly prefer ESG-friendly alternatives, this penalty could take the form of declining sales. More importantly, neglecting ESG risks and opportunities makes a company less ready to sustainably overcome adversity. Companies that do not have visible ESG policies could therefore be considered high-risk, causing investors to potentially avoid buying their shares, thus reducing their market value. This is not a new hypothesis: back in 2012, Deutsche Bank published a review of more than 100 studies on sustainable investing.[3] They found that, in 100% of cases, high ESG ratings corresponded with lower costs of capital and with market-based outperformance in 89% of cases.

Investors were willing to pay USD 0.70 more per share for a company exhibiting positive ESG behavior.

More recent data also supports these findings. A January 2020 study by US and French academics showed that investors were willing to pay USD 0.70 more per share for a company exhibiting positive ESG behavior, and USD 0.90 less per share for those that were ESG-neutral (all else held equal).[4] In an Institute for Sustainable Investing report, Morgan Stanley found 65% of sustainable funds ranked in the top half of their respective Morningstar category in 2019, with nearly half of the large cap blend sustainable funds beating the S&P 500.[5] This is nearly double the result of the traditional large cap blend fund universe, where just 26% typically beat the market benchmark.

ESG and Invesco Quantitative Strategies

Combining ESG with the Invesco Quantitative Strategies (IQS) multi-factor approach, our investment team creates risk-controlled portfolios designed to outperform their benchmark while enhancing ESG profiles. For more than 20 years, IQS has been at the forefront of customized multi-factor ESG solutions, with ESG considerations playing an integral role in our standard multi-factor process for all IQS portfolios since 2017. The thoughtful integration of ESG measures into our multi-factor approach, which builds on the proprietary factors Quality, Momentum and Value, seeks to outperform while improving the ESG characteristics of a portfolio.

In 2019, IQS developed a bespoke low carbon solution for a client, with the aim of reducing the overall carbon emissions of an existing multi-factor strategy to levels significantly below the FTSE All Share ex IT Index. Our IQS investment team, along with the client, outlined several project objectives, including stable and predictable carbon emissions reductions over time, minimal impact on expected performance and the ability to quantify the low carbon impact on portfolio risk and return. By integrating ESG criteria into the multi-factor equity strategy, we had a significant impact on the portfolio's ESG profile while maintaining risk and return characteristics similar to conventional factor strategies.

Given the pandemic-driven market activity in early 2020, IQS has reviewed how securities exhibiting attractive ESG features have held up compared to those with poor ESG scores. As the crisis spread and equity markets declined, securities highly ranked on ESG criteria exhibited outperformance and buffered losses. The evidence suggests that integrating ESG criteria into a portfolio can help mitigate drawdown risk. And this observation applies across a spectrum of considerations including ESG, carbon intensity, human capital and tax transparency. While this short-term result should not be overemphasized, investors who take the long-term strategic approach of applying ESG criteria to their portfolios could well find themselves better positioned during a crisis.

Empirical Research Partners has been evaluating and monitoring 60 ESG factors for US stocks since November 2014, finding that companies with better ESG scores outperformed those with lower scores.[6] And, in one of the largest studies to date, Morgan Stanley analyzed thousands of exchange-traded and open-ended funds for the period of 2004 through 2018.[7] They could discern no return detriment for sustainable funds versus traditional funds, and point out lower downside risk for the former. Clearly, investors haven't had to sacrifice performance to invest in ESG strategies.

Investors don't have to make a clean sweep of their portfolios when adopting ESG principles.

Myth #2:
Adopting ESG investing principles will require divestment of assets and business disruption
Investors don't have to make a clean sweep of their portfolios when adopting ESG principles. However, based on numerous studies and surveys, it is clear that a company's ESG principles and related actions are becoming more and more critical to investment decision making. While the number of companies and individuals embracing ESG investing has increased dramatically in a very short time, there is still a long way to go. And there are different approaches – divestment of companies that fail to meet ESG standards is one of them, engagement with companies on ESG matters is another.

Invesco prefers engagement over divestment, as engagement may preclude the need to divest. For instance, we recently used our influence as a shareholder when engaging with an Australian energy company – an industry typically excluded from ESG portfolios. Our Global ESG team met with the CEO and head of investor relations before the 2020 annual general meeting to discuss a shareholder proposal calling for the company to disclose scope 1, 2 and 3 green house gas (GHG) emissions. Although the company opposed the resolution, believing that they were already contributing to the energy transition as a significant producer of liquified natural gas (LNG), we felt the vote was justified due to the high GHG emissions of their operations. The resolution went on to receive a slim majority of support from shareholders, with 50.1% of votes in favor, underlining the value of engagement and active stewardship over divesting from controversial sectors.

Our Global ESG team also engaged with a British multinational investment bank and financial services firm's chairman to discuss the company's plans to address the climate crisis. In recent years, it has become increasingly apparent that financial institutions are potentially exposed to huge balance sheet liabilities as a result of climate change risks. As the largest lender to fossil fuel projects in Europe, a shareholder proposal calling on the company to phase out fossil fuel investment was tabled at the company's 2020 annual general meeting. The management responded with a counter-resolution which set a target for the company to become carbon neutral in its lending practices by 2050. The chairman of the bank made clear that he understood the risks associated with financing fossil fuel projects and, although the company was not yet prepared to ban certain lending activities, they would continue to work with borrowers to reduce their carbon emissions. Following this engagement, Invesco's Global ESG team recommended voting against ShareAction's shareholder proposal and supporting the management proposal.

Companies adopting ESG principles early on will have a head start in preparing for the inevitable business disruption that will come as a result of regulatory environmental policies and changing consumer demands. Investors and companies need to stay proactive to remain ahead of the curve. For example, engaging with companies on the energy transition to renewables or with automobile companies on the adoption of electric vehicles can ensure a smoother transition with minimal business disruption. In a final example on this topic, we recently engaged with a major automobile manufacturer which had unveiled details of their vision for electrification at their 2020 investor day. They emphasized that the valuation of a leading competitor underscored the need to develop an excellent electric vehicle strategy in order to be ready for the significant regulatory and consumer demand shifts the industry will face in the coming years. Our Global ESG team also discussed the shareholder proposals tabled at this year's annual general meeting, one on creating a human rights report and another requesting greater disclosure of the company's lobbying activities. Our Global ESG team thought that both proposals should be supported since this automobile manufacturer had previously attracted negative headlines for pro-fossil fuel lobbying and human rights issues in their supply chain. Producing these reports would provide customers and investors with assurance that the company has a genuine commitment to reform and would help steer the company towards its vision of a sustainable electric future.

These engagements illustrate that divestment is not necessary to be an effective ESG investor. Indeed, engagement with companies – which requires an investor to continue holding a position in the firm in question – promises to yield more positive ESG outcomes.

Conclusion
Because of the increasing interest in ESG, there have been countless studies on the performance of socially responsible portfolios versus traditional counterparts. Time and again, the data suggests two conclusions: you do not sacrifice return with an ESG-focused portfolio and you are likely to outperform

Markets are slowly attributing less risk to companies embracing ESG.

the broader market. Perhaps most important is that markets are slowly attributing less risk to companies embracing ESG. Clearly, the idea that corporate and investing behavior can positively impact society (and the planet) is not a fad or a marketing ploy. It has been nearly universally adopted to some extent by 86% of S&P 500 companies.[8]

Although it is still too early to assess how company responses to COVID-19 may impact ESG plans, the global scope of the pandemic all but guarantees that any actions (or non-actions) will be heavily scrutinized going forward. Given the flexibility of approaches on the ESG investing continuum, it is undeniable that there are a variety of ways to engage and make a difference without sacrificing performance or divesting.

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Notes

1 The Global Compact (2004).
2 Global Sustainable Investment Alliance (2018).
3 DB Climate Xhange Advisors, Deutsche Bank Group (2012).
4 CNBC (2020).
5 Morningstar (2019).
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7 Morgan Stanley Institute for Sustainable Investing (2019).
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The psychological challenges of investing in real assets

By Mike Bessell

In brief

We highlight how cognitive biases can influence real estate decision making, for both real estate specialists and – especially – generalist investors, and we examine the reality behind some of the key simplifying assumptions used by market participants. We then show how Invesco Real Estate seeks to mitigate risks, including how our specialized approach to listed real asset securities works to balance the often-conflicting influences of the markets for listed and unlisted real estate.

People are uncomfortable with incongruous ideas and tend to interpret things in such a way as to minimize inconsistencies. Psychologists call this unease cognitive dissonance.[1] This phenomenon affects all investment markets,[2] and for real estate markets the inherent heterogeneity leads to over-simplification as a further hinderance to objective decision making.[3]

Physical property assets are illiquid and heterogeneous. Transactions in the space rely heavily on a small number of pivotal intermediaries. The result is an opaque and esoteric market – there are no Bloomberg screens for real estate. As such, the growing understanding of behavioral finance to challenge traditional investment theory will benefit investors.

To mentally process the infinite differences between individual real estate investments, investors need to simplify. But this risks introducing subjective analysis and idiosyncratic nomenclature. In addition, real estate is an institutional asset class in both listed and unlisted forms, yet market participants interpret unlisted real estate through the lens of listed real estate securities, giving further significant scope for cognitive dissonance.

We need to be mindful of the limitations such shortcuts place on decision making. But they also create a somewhat inefficient market, which can be exploited by organized and diligent investors – by professional, active, investors utilizing detailed local information and expertise.

Behavioral finance theory in a real estate context

Market investors, at least a significant minority of the overall set, are subject to behavioral biases that result in some financial decisions being less-than-fully

Market investors are subject to behavioral biases that result in some financial decisions being less-than-fully rational.

rational.[4] Of these various behavioral investment traits, certain ones have particular relevance to real estate investing:

- *Confirmatory bias:* selecting examples which suit an existing narrative while dismissing as aberrations those which challenge current thinking;
- *Representativeness:* the use of generalizations to draw overall conclusions. An example is the all-too-common, but incorrect, simplifying assumption that real estate trades as a bond proxy;
- *Extrapolation from small historic samples:* one example does not evidence a trend, but lone examples are often extrapolated to a broad conclusion. Also, whereas we need our most careful analysis in times of change, small sets of historic evidence provide a deceptive sense of comfort;
- *Anecdotal evidence:* good anecdotes are examples that stand out and are therefore exceptional rather than reflecting the norm. The reverse of this is ignoring examples which do not support the current thesis, risking the disregarding of crucial information, particularly around turning points;
- *Narrative fallacies:* heterogeneous assets like real estate are particularly susceptible to the "story" overriding factual data, leading to sub-optimal outcomes as a result of emotive rather than objective considerations taking precedence;
- *Anchoring and framing biases:* perception of new information can be skewed by how this relates to existing views or previous information (anchors), or how the new information is delivered (framed);
- *Overconfidence:* there are many successful turnaround stories in real estate, but the sector is also littered with examples of less diligent investors who have tried to better the previous owner's efforts, and failed;
- *Conservatism:* a trait exhibited in the direct real estate market in several ways – for example, differences in the extent to which different markets factor the most recent transactional data into valuations;
- *Regret aversion:* often witnessed in listed markets in the form of momentum trades and reluctance to divest underperforming assets, these tendencies also pervade the markets for real assets.

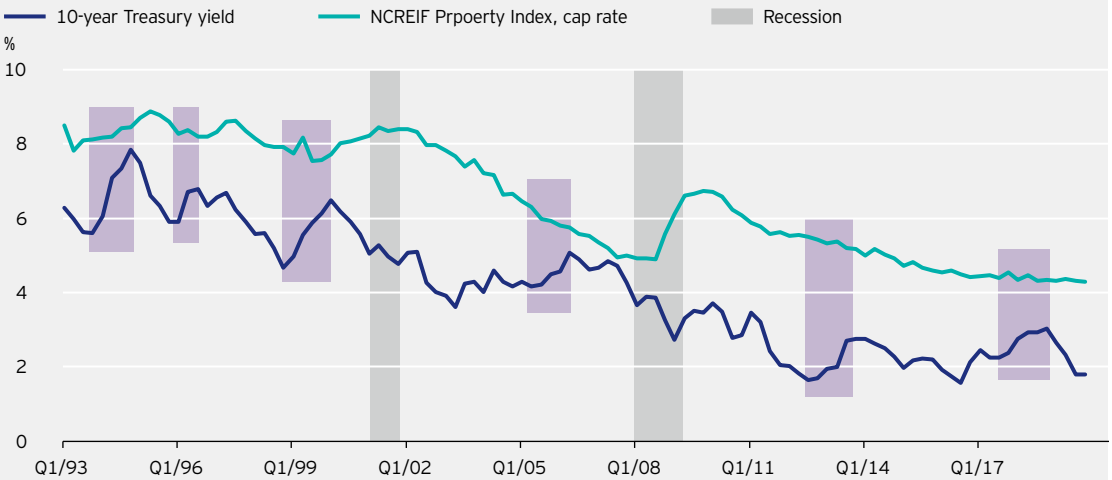
These behaviors are not mutually exclusive. For example, the classic reluctance to cut a loss-making investment draws on regret aversion (not accepting a loss), but would also include narrative fallacy (continuing to believe the story instead of the performance), anchoring bias (giving greater weight to the initial view than to new information), and overconfidence.

Myth #1: Real estate values are driven by interest rates

Rising interest rates do not necessarily mean lower total returns for a commercial property. The relationship between rates and real estate capital values is dependent on a range of factors, such as the global economic environment and relative allocations across asset classes. As such, we have clear examples of a rising interest rate environment being one which drives strong real estate returns.

Over the time shown, there have been five periods where 10-year US Treasury yields moved higher for at least three consecutive quarters. In only one of these periods did real estate cap rates move higher, while in the other four periods of rising Treasury yields, cap rates declined as bond yields expanded.

Rising interest rates have not always resulted in rising cap rates



Source: Invesco, using data from NCREIF and Moody's Analytics. Data as at Q4/2019.

The manifestation of these behavioral trends is also evidenced by the use of certain pieces of imprecise, subjective, and even emotive terminology.

When terminology adds to subjectivity
The manifestation of these behavioral trends is also evidenced, and arguably amplified, in real estate by the use of certain pieces of imprecise, subjective, and even emotive terminology. Two key examples of this are the categorisation of asset quality and discussions of a real estate cycle.

Prime metrics vary in quality
As an example of the first of these, most readers will have heard of real estate assets being described as "prime" or "secondary". But despite the common use of such terminology, the reality is that the categorisation of prime or secondary assets is fraught with potential for misunderstanding.

Most real estate markets make reference to prime rents and yields. These are calculated from an average of the highest priced leasing and investment transactions that have been conducted in the open market at arms' length, i.e. no related parties nor any duress. Taking an average across a number of transactions reduces the skew from single, high outliers. However, across commentators, the reported prime metrics vary and inconsistencies result from two main issues: first, different agents use different sample sizes to define "prime" and, second, not all information is public so not all agents have access to the same evidence.

Adding to the opacity is the issue that the prime sample continually changes. The long-term nature of real estate leases and the long average holding period means that an asset contributes to the calculation of prime for only a short window before the evidence is too dated. This contrasts with equity market categorisations of, e.g. "quality" stocks, where the set sees limited change over time.

At the very top end of the pricing evidence, certain transactions appear emotive rather than purely rational. There is a minority of deals where returns are sacrificed for perceived status, so-called "trophy assets", where a premium is paid for certain properties (i.e. lower return) over similar, but less iconic, assets nearby subject to similar fundamental trends. Such deals are a particularly strong behavioral combination of overconfidence, narrative fallacies and frame dependence. The same kind of issues exist with definitions of assets as Grade A or Grade B, or categorisations of shopping malls into various types, etc.

While many assets fit set definitions, a significant number fall into subjective grey areas. The resulting scope for confusion is why professional investors focus on the business plan and the investment cash flows, rather than the story and labels.

Cycles need to turn full circle
Property is a cyclical business, and as in all cycles, there is a trend to mean reversion. However, many direct and listed real estate investors have tendencies to overestimate cycles, particularly in the face of the current QE-driven interest rate environment. These beliefs encompass conservatism and regret aversion.

Professional literature on real estate regularly sees commentators referring to "the cycle". Some go so far as to ascribe a defined periodicity to the cycle. The problem with this terminology is that cycles go through their phases in order, like the seasons. The use of this terminology to describe fluctuations in returns carries a subconscious notion of these movements being in some way preordained, and often such commentators then engage in confirmatory bias, seeking evidence to support the next movement being in keeping with the cyclical direction rather than maintaining objectivity.

The result is inefficiencies in real estate pricing
Financial theory suggests that irrationality in pricing should drive arbitrage opportunities. The challenge when it comes to generating arbitrage in real estate, be it in direct property alone or between the direct and listed markets, is the illiquidity of direct assets and the high frictional costs involved in trading physical property. Listed real estate equities do not perfectly correlate to either the underlying real estate markets or to the broader equity markets. Pricing disconnects do appear, but illiquidity in the direct market can make these difficult to exploit.

Generalist investors face additional cognitive dissonance challenges over and above the broader real estate themes discussed. Listed real estate offers a small window into the real estate asset class, and the real estate sector is but a small part of the overall securities market. Both factors limit the time generalists will invest in understanding the underlying sector, which manifests itself in a few ways.

1. Limited personal basis for reference
Most individuals have limited personal interaction with commercial real estate, certainly at the fundamental level. The result is that real estate metrics are often discussed in abstract terms with little concrete evidence for investors to compare against. Some even conflate personal experience in housing markets with expertise in commercial real estate investment markets.

2. Failing to balance the micro and the macro
Another behavioral trend in listed markets is an often contradictory selectivity bias, where the drivers of certain asset classes are over-localized, while others are over-globalized. Real estate, at the fundamental level, is a local business as ultimately the assets are immobile. This is unlike, e.g. manufacturing, where the product can be distributed for sale or production shifted. However, real estate also has overarching global drivers, such as capital returns and secular trends that affect real estate occupancy rates. Investors in real estate need to balance these macro and micro drivers, and they must avoid overemphasis of one over the other.

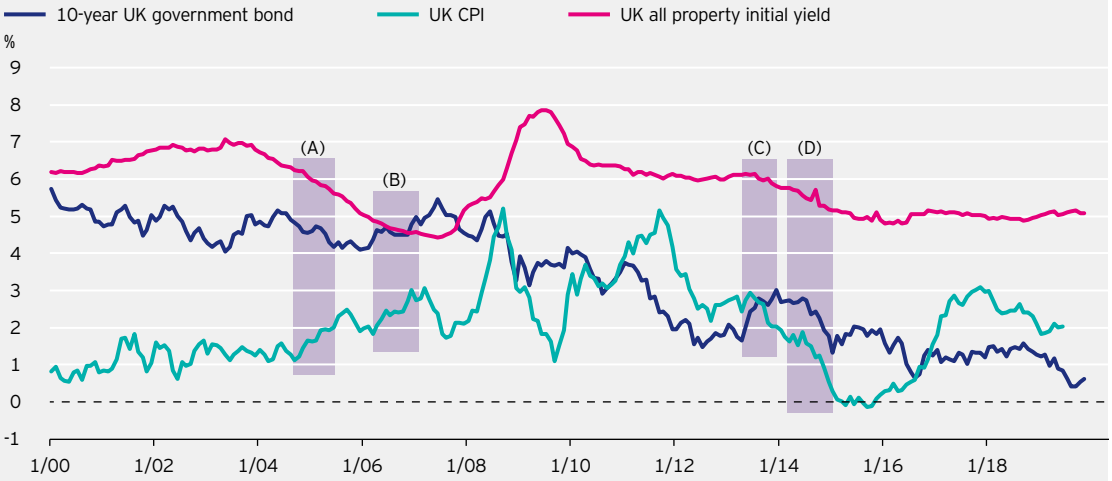
3. Cycles are a guide, not clockwork predictions
The belief in mean reversion is deep-rooted. Like the varied drivers of yields, each cycle is driven by

Myth #2: Real estate returns are inflation-linked

Bond yields have limited bearing on real estate pricing. Interest rates move for different reasons over time, variously to counter inflation or to control economic growth. These two factors are often linked, but not directly related, and are not necessarily contemporaneous. If economic growth is running ahead of inflation, i.e. real growth is increasing, then real estate will typically perform strongly.

In the figure below, we see UK real estate yields tighten in (A) when inflation (CPI) is rising but government bond yields are falling; (B) when both inflation and bond yields are rising; (C) when inflation is falling but bond yields are rising and (D) when both inflation and bond yields are falling.

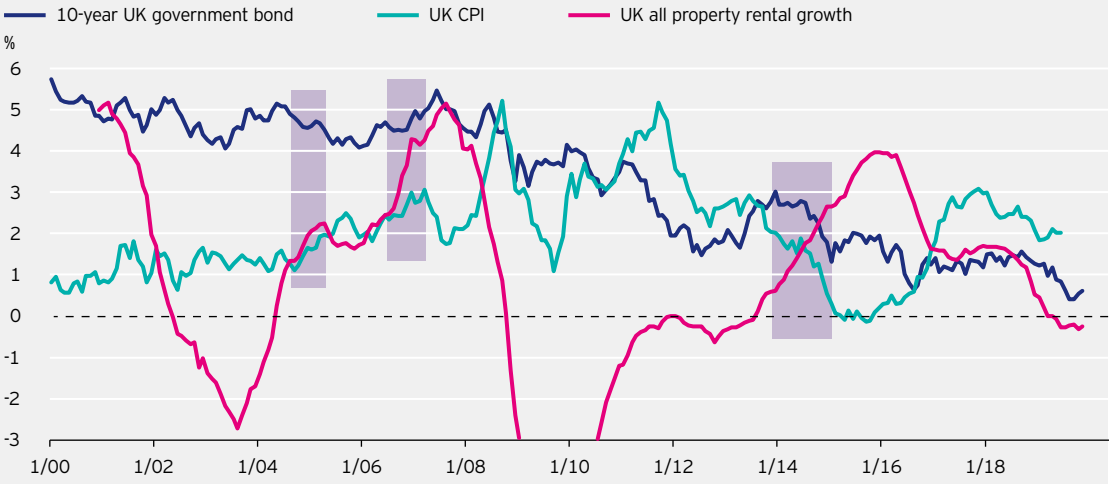
Real estate yields tighten whether CPI and bonds are rising or falling



Source: Invesco, using data from Macrobond and CBRE. Data as at November 2019.

In addition, the figure below shows that UK real estate has seen periods of acceleration in rental growth both when inflation has been rising and when it is falling, irrespective of movements in bond yields.

Rental growth is independent of inflation and bond yields



Source: Invesco, using data from Macrobond and CBRE. Data as at November 2019.

Even in markets where indexed leases are used, the underlying lack of linkage between real estate income and inflation is clear, resulting in leases fueling artificially generated rental growth in certain periods.

different fundamental factors. Take as an example the growth of real estate values in the 2005-7 period, driven by asset prices being pushed up by increasing leverage. This was then followed by a collapse in the lending environment as a result of the Global Financial Crisis (GFC), causing a correction in values in 2008-9. By contrast, real estate leverage today is starting from a lower base, and the lending environment is more robust thanks to increased regulation.

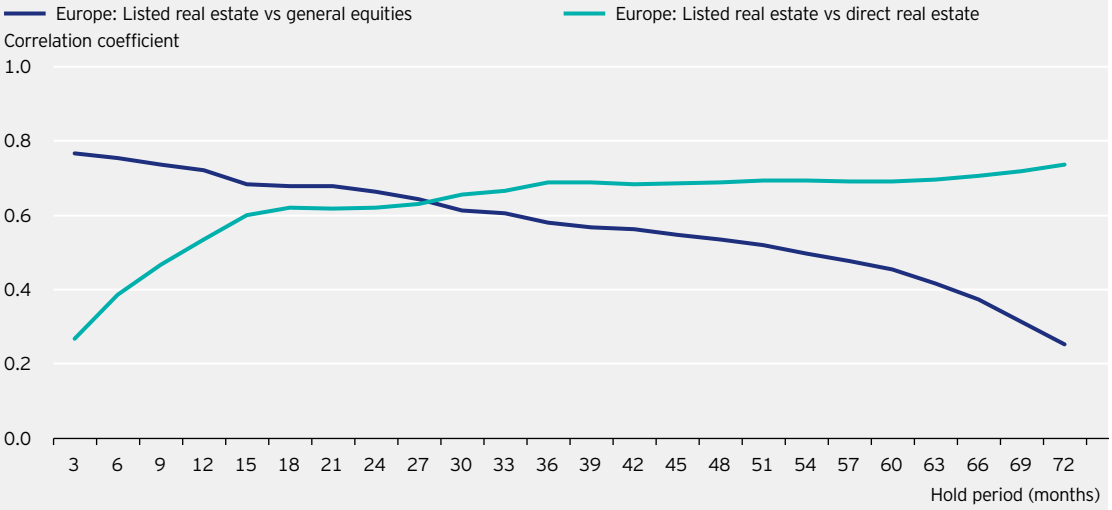
4. The market knows best

Listed market prices are an aggregate of a large number of buy/sell decisions, and investment theory holds that these will factor in the latest relevant information to derive the underlying value. However, in periods of stress, price volatility increases to reflect greater uncertainty rather than any change in long-term value.

Myth #3: Listed real estate returns are not equity market or real estate returns

Two different views are often expressed regarding listed real estate equities. Both have some grounding in truth. The European evidence here shows that listed real estate equities are more correlated with equity market returns in the shorter term but, over the longer term, the correlation becomes more closely aligned with direct real estate.

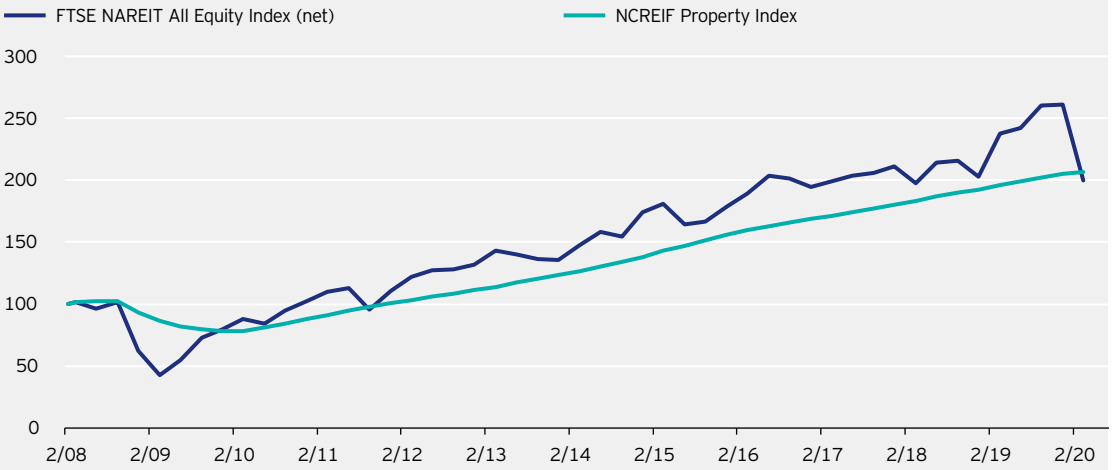
Listed real estate shows changing correlations to other assets



Listed real estate is represented by the net total returns on the FTSE EPRA NAREIT developed index; general equities is represented by the net total returns on the SXXP 600 index; direct real estate is represented by the net total returns on the MSCI Pan-European Funds Index. Source: Invesco, using data from Morningstar and Macrobond since Q1 2004.

Looking in more detail at North American real estate markets, we can clearly see both (a) the shorter-term volatility of the listed real estate returns compared to direct market returns and (b) the alignment of the longer-term trends

Returns for listed and non-listed real estate track closely long-term



Source: Invesco, using data from Morningstar. Data as at March 2020.

Defending against these behavioral traits

Invesco Real Estate remains cognizant of the issues discussed in this paper, and a number of measures are in place to reduce these risks in direct real estate business and among the listed securities team.

Two key elements that are central to our regional direct business are the Investment Strategy Groups, responsible for our "House View", and Investment Committees, responsible for our execution decisions. Our Investment Committees incorporate senior team members from across the relevant regional business in order to diversify perspectives. Decisions require unanimous approval, ensuring that any concerns are not outvoted.

Overseen by the Investment Strategy Groups, the preparation of our House View is led by our research teams, also drawing heavily on feedback from all local practitioners so as to fully incorporate bottom-up market evidence with a top-down forecasting approach. In addition, our research function has been deliberately established as a global team, to benefit from the cross-fertilization of best practice around the world, but also to ensure impartiality.

The Invesco listed real estate securities team keeps a clear focus on the long-term real estate outlook, where the correlation trends to that of physical real estate. However, consideration is also given to the shorter-term behaviors of other market participants, as these drive deviations away from real estate fundamentals and towards those of broader equity markets.

Conclusion

It would be a mistake to pretend that investors will ever develop the ability to compute the complete information set available on every subject. To improve the ability to analyze fundamentals objectively, investors need to start with an awareness of these limitations, and to screen for potential biases. Increasing understanding of these pitfalls reflects in investment performance.

In a world where structurally declining interest rates in developed economies have been exacerbated by monetary stimulus, and with economic growth now slowing, it is important to understand the specifics of the current situation. The famous idiom states, "Never say it's different this time." Actually, it is different every time, and investors should focus as much or more effort on analyzing differences as on drawing out similarities.

Fundamentally, inefficiencies in real estate markets create opportunities to generate investment performance. Correctly identifying the causes of these inefficiencies enables our investment strategy to overlay market sentiment with a detailed and objective understanding of factors, such as current supply and demand patterns, and combine our global reach with detailed local information and expertise.

Fundamentally, inefficiencies in real estate markets create opportunities to generate investment performance.

About the author

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Mike Bessell is the European Research Strategist and Head of the European Research team at Invesco Real Estate, which invests in direct real estate and publicly listed real estate securities worldwide. Mike's team of analysts and strategists produces research and forecasts across the European real estate markets and assist in the formulation of fund and asset class strategies. Mike is a member of Invesco Real Estate's European Core Steering Committee and co-Chair of the Investment Strategy Group.

Notes

1 L. Festinger (1957), A Theory of Cognitive Dissonance introduced the concept that humans are uncomfortable with conflicting ideas and will take mental action to bring consistency.
2 See inter alia: G. Curtis (2004), Modern Portfolio Theory and Behavioral Finance; C. Antoniou, J. Doukas and A. Subrahmanyam (2013), Cognitive Dissonance, Sentiment, and Momentum.
3 See inter alia: G. Curtis (2004), Modern Portfolio Theory and Behavioral Finance; C. Antoniou, J. Doukas and A. Subrahmanyam (2013), Cognitive Dissonance, Sentiment, and Momentum.
4 For a more detailed discussion see: A. Byrne CFA and M. Brooks (2008), Behavioral Finance: Theories and Evidence.

Thematic innovation investing with textual data analysis

By Georg Elsaesser, François Gardin, Dr. Martin Kolrep and Michael Rosentritt

In brief
We show how thematic investing has evolved over the years and compare it to outcome-oriented strategies. Then we develop a thematic approach for investing in innovation, combining the merits of both approaches. Unlike many other thematic approaches, ours does not focus exclusively on technology. It invests dynamically in different themes to ensure diversification and makes use of innovative quantitative indicators derived with the help of natural language processing.

Thematic investing has always existed, whenever there were ideas and topics to focus investment objectives and decisions on, and assets to be invested in. However, the way to execute on this approach in the fund industry has changed rapidly in recent years, and is likely to change more than ever in the future. In this article, after having a look at the development of thematic investing over the past 40 years, we shed some light on the approach taken at Invesco Quantitative Strategies.

By definition, "thematic" relates to a topic of discourse, a narrative, a subject or proposition that is brought forward and talked about openly. Applied to asset management, the notion of thematic investing thus implies dealing with language, defining concepts to address the investment landscape and grasping the future of the economy. The topic in focus could relate to a trend, an industry or a transformation at play, which can eventually lead to the creation of an investable portfolio.

How it evolved
In practice, when applied to the fund industry, one can observe that thematic investing has taken different forms and gone through different phases over time, with multiple redefinitions of what a "theme fund" comprises. Two major phases are readily observable in the evolution of thematic investing.

Thematic investing started to gain traction in the 1980s.

1980 – 2001: Sector exposures and access to expertise

In the global fund industry, thematic investing started to gain traction in the 1980s, and developed further throughout the 1990s. During this period, investment themes were viewed mainly through the prism of sector funds targeting areas such as healthcare, information technology, finance or industrials. For a portfolio manager, the idea was to execute on stock picking skills and address the relevant trends in certain industries. For investors, these funds became a useful tool to manage portfolio allocation and exposure to certain industry shifts, and to gain access to sector-specific expertise. Funds were mostly run on a global basis and industries of focus had to be large enough to alleviate the most obvious constraints, such as size. Sector funds reached their highest relative share at the turn of the century, when equity theme funds represented 11% of the total equity assets held by European funds.[1] The peak of the tech bubble in 2000 also marked the peak of interest in technology sector funds. At the end of 2001, technology themes represented close to 40% of investment in equity theme funds.[2, 3]

2002 – 2020: The rise of idiosyncratic themes, megatrends and sustainability

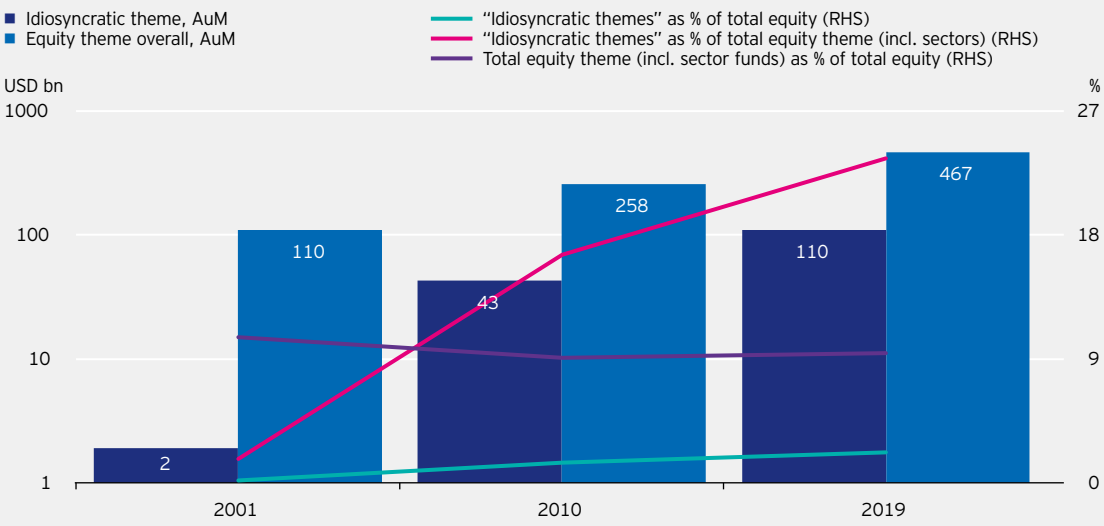
After the bursting of the tech bubble, thematic investing significantly evolved with the rise of thematic funds as a concept distinct from funds investing in broadly defined industry sectors. Acknowledging that themes can be cross or sub-sectoral, evolutive, can aggregate multiple dimensions and be uniquely defined when related to structural shifts in the economy and society (and, as such, "idiosyncratic"), investors have shown growing interest in capturing high-potential themes or megatrends that transcend market cycles. This started before the global financial crisis, and really accelerated after 2016. This trend has been particularly acute in Europe, where idiosyncratic equity theme funds saw a nearly threefold rise in assets under management (AuM) in the last decade, reaching USD 110bn by the end of 2019 (figure 1). This accounts for more than half of all assets in this type of funds globally.[4] These funds also represent an increasing proportion of assets invested in equity themes overall, including sector funds (close to 25%).

Over that period, while assets invested in equity theme funds (including sector funds) have grown significantly in absolute terms, they have remained relatively stable in terms of their overall equity fund market share, at about 10%. In addition (not shown in figure 1), ETFs have taken significant market share from these assets as a way to provide targeted sectoral or thematic access: at the end of 2019, passive funds and ETFs represented 17% of total equity theme funds' AuM (compared to 9% for idiosyncratic theme funds).

An important consequence of this evolution is the progressive anchoring of thematic investing to long-term investing.

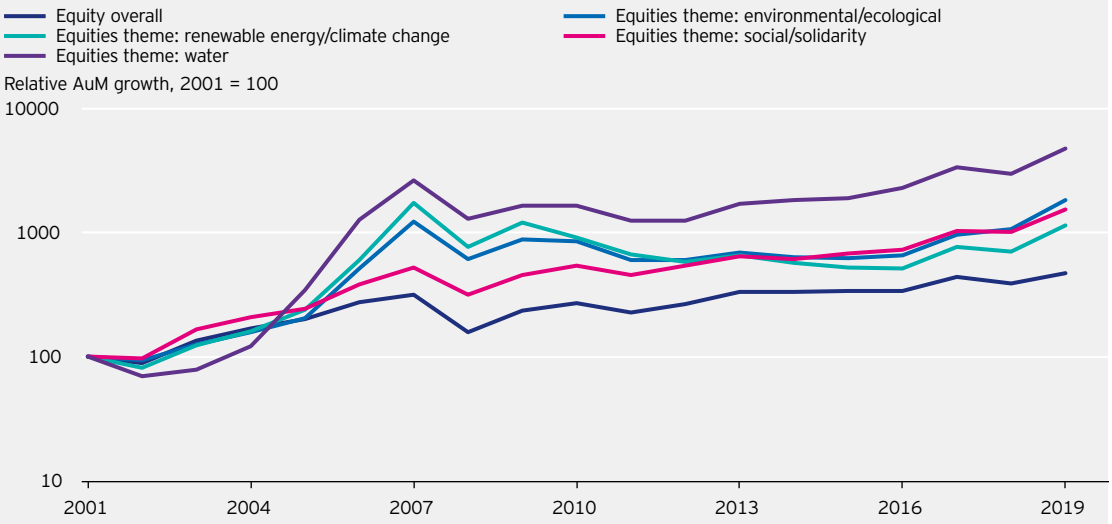
An important consequence of this evolution is the progressive anchoring of thematic investing to long-term investing. This is first and foremost reflected in the type of themes, where funds pursuing trends with a longer-term horizon have gained relative importance.[5] In essence, idiosyncratic theme funds can target structural trends that need to be

Figure 1
The rise of funds investing in "idiosyncratic themes"



Source: Morningstar, Broadridge. European-domiciled equity fund universe. Idiosyncratic theme funds' assets are based on Morningstar direct; the overall equity themes' assets are based on the Broadridge FF database and include mainline sector funds. Data as at 31 December 2019.

Figure 2
Development of sustainability themes



Source: Broadridge FF (European-domiciled funds). Data as at 31 December 2019.

addressed with time horizons that go above and beyond the business and market cycles. This development can be illustrated by the relative evolution of assets invested in funds targeting sustainability trends in Europe (figure 2).

The duality of thematic investing and outcome-oriented investing

As a counterpart to the rise of thematic investing, it is interesting to note that funds designed primarily based on the premise of achieving certain financial metrics and outcomes, as opposed to targeting a given trend, subject or sector, have received much attention over the past decade. In the interest of a more systematic and risk-aware fund distribution process, new types of funds emerged explicitly targeting certain risk/reward profiles (such as absolute return, total return, risk parities). From 2009 to 2019, a meaningful share of the flows has gone into so-called "outcome-oriented" products, with over 10% of the European fund industry's total net flows going, for instance, into liquid alternative fund categories, and as much as 36% when including asset allocation products.[6] A great part of this has stemmed from the need to provide de-correlation and risk mitigation, mainly in the wake of the global financial crisis with interest rates and yield declining worldwide.

Looking at these evolutions and the dual proposition of thematic funds on the one hand (focused on a subject) and outcome-oriented on the other (focused on an objective), investors are faced with the following dilemma: in pursuing their strategy, are they willing to invest in a fund without a subject that they can relate to? In fact, non-financial considerations have come to the fore and there is a greater demand among investors to invest in combination with a set of preferences, including sustainability motives. But thematic investing has a wider scope than merely the desire for greater sustainability. All types of issues that can be related to through the language and news are fair game. At a time where the environment, society and technology are changing very rapidly, ideas and themes can provide a structured way to invest.

Complementary goals

Growing at a rapid pace, thematic investing and outcome-based investing have met two fundamental needs that are complementary to one another: dealing with the future, mainly from a qualitative standpoint, and addressing concrete financial objectives, mainly from a quantitative standpoint. This synthesis implies that an investment manager can create a portfolio anchored to certain ideas and at the same time align with certain financial characteristics based on the investors' objectives, such as excess return or mitigated risk. Accordingly, the ability to systematically identify, combine and weight themes is an important avenue to be explored.

Going back to the initial definition of thematic investing, from the outset it deals with language. The approach endeavors to capture a narrative and address the economic future. Industry-focused funds have been around since the start of the thematic investing journey. However, for a long-term investor dealing with evolving themes and innovation, some key questions need to be tackled, such as: what are the key trends that are emerging? Why is a given theme attractive now? Within that theme, what is changing now? How can companies be identified that are related to these themes and what is the most effective allocation across themes?

The increasing ability to analyze language and data can only be transformational to this field, and to addressing these questions. In this context, natural language processing (NLP) techniques could portend a new era for executing on thematic investing thanks to the ability of NLP to analyze language and news data, and identify themes in a more systematic way. Below, we will demonstrate how, at Invesco Quantitative Strategies, we combine these two complementary concepts to form a coherent strategy.

A systematic approach to capturing innovation – dynamically diversifying across themes

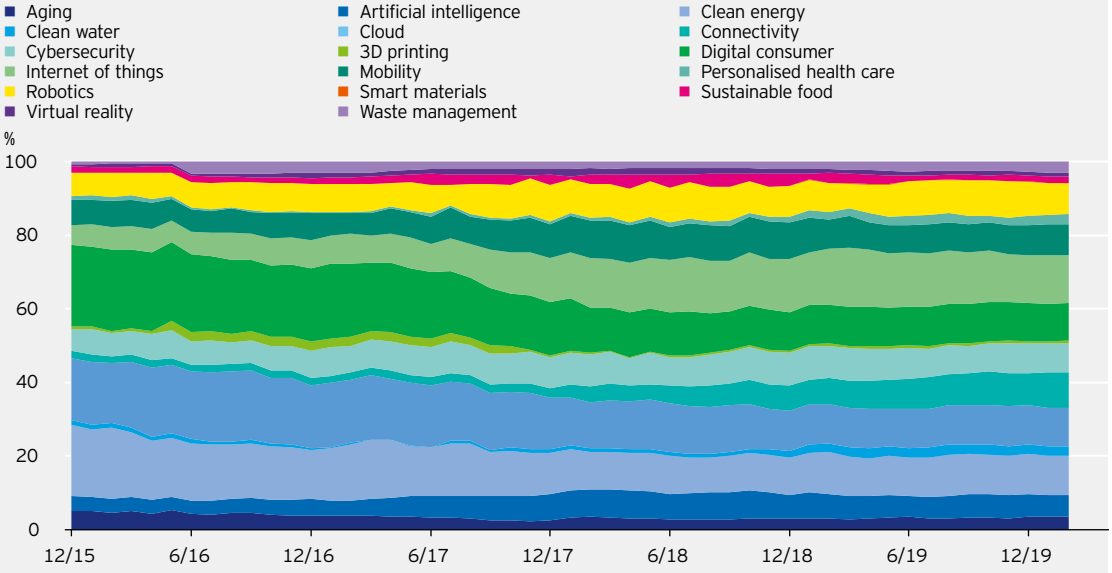
The concept of innovation can be closely related to technology, which fosters innovation by creating new ways to do new things. However, innovation can be

seen in a wider sense to include all new products, services and processes brought into the economy at a given point in time. To that extent, innovative themes involve more than just technology companies. Players across many different sectors can offer innovative products and services. They often do so by investing in and using new technologies, bringing major transformations, even to more traditional business models.

Developing a fund targeting innovation which invests in what is "new" in a broader sense thus implies capturing multiple emerging themes representing new developments above and beyond technology itself (whether or not it plays a role). These may relate to new trends, such as those leading to social or environmental changes, which are typically called "megatrends".

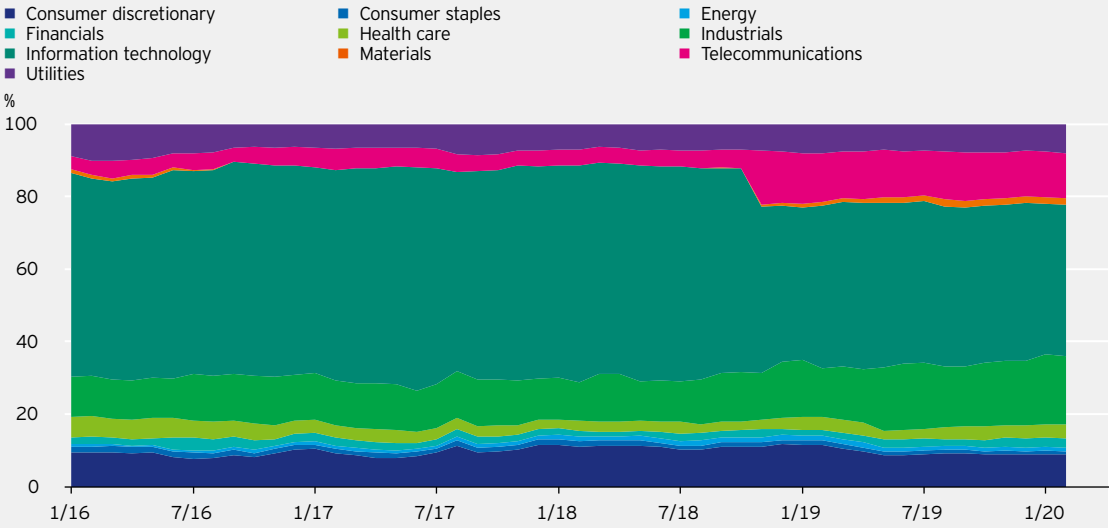
This is outlined in figures 3 and 4, where we see a model portfolio constructed using NLP techniques applied to news data. Figure 3 shows the various themes and figure 4 the sectors. The key observation is that being innovative is not only linked to technology but creates exposure to many different sectors. A strategy focused on innovation should therefore arrive at a broad exposure across many sectors and achieve a higher degree of diversification than a pure technology investment.

Figure 3
Thematic exposures of a model portfolio applying NLP techniques to news data



Source: Invesco. For illustrative purposes only. Data as at February 2020.

Figure 4
Sector exposures of a model portfolio applying NLP techniques to news data



Source: Invesco, for illustrative purposes only. Note: the drop in technology weight in late 2018 is linked to the telecommunication services sector being renamed communication services and including certain companies from the information technology and consumer discretionary sectors.

The information is in the news
The news is in fact a relevant data repository when it comes to identifying what is innovative. One key element is the spread of narratives and their impact on the economy.[7] Evolving themes and megatrends typically spread in a way similar to economic narratives and can therefore likely be captured by analyzing news data.

Developing a fund targeting innovation, however, also implies identifying companies related to these new themes which transform them into actual economic activity independent of their sector classification and financial characteristics. It is important to note that a given innovation can have different impacts on companies of different sizes, with different activities and at different levels of their value chain. The sum of all innovations by companies will eventually translate into economic growth, which can be captured effectively and systematically by investors (figure 5).

As opposed to a static theme, a dynamic allocation towards news-based themes can potentially help deliver smooth, time-sensitive and predictable investability throughout the innovation cycle. It also helps investors avoid the risk of missing certain idiosyncratic trends that may become important in the future. This approach is more likely to evolve over time and capture new trends while reducing exposure to themes that have become less relevant.

Innovation typically follows a continuous growth path in different phases, and there is value to gaining exposure across these, and managing the allocation accordingly. But the narratives linked to innovations often comes in "waves": a topic emerges, builds in importance and, after a time, becomes more and more part of the public conscience. Then it may recede and gets less attention for a period. But a second or third wave eventually emerges bringing new attention to the topic or theme in question. How long these phases may last is unknown beforehand, as is the time between the different waves. A dynamic allocation to themes linked to the narratives is likely able to capture the different waves as they develop over time.

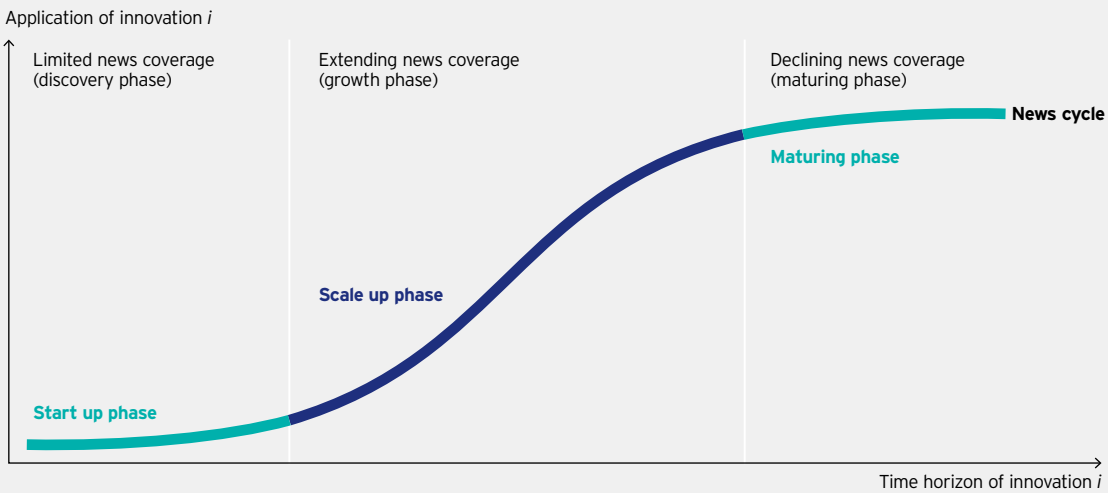
Technology is just a part of innovation
Investing in innovation through multiple themes can thus result in a portfolio which is typically more diversified than a technology fund, providing exposure to different types of industries and companies involved in the relevant innovation themes. This can constitute a unique way to target diversified exposure to growth and capture interesting market opportunities. Over the recent period, technology funds have significantly outperformed global equity and multi-thematic funds. However, over the longer term, they imply a significantly different risk and return profile and factor exposure compared to a thematic innovation fund dynamically investing across key megatrends and themes.

Investing in thematic innovation is a unique way to invest in changes and evolutions at play in the economy.

So, investing in thematic innovation is a unique way to invest in changes and evolutions at play in the economy without solely relying on investments in technology. At a time when society is rapidly evolving, this represents a comprehensive positioning that ensures exposure to significant future developments.

How the quants do it
Alternative data sources, as well as alternative methods to analyze the data for the purpose of security selection, have been a key topic within the area of quantitative asset management over the past ten years. Topics like natural language processing (NLP) and machine learning (ML) algorithms have been used to go beyond the traditional analysis employed to select stocks, e.g. for factor-based investment strategies.

Figure 5
Measuring news is an efficient way of identifying growth businesses as they scale up



Source: Invesco. For illustrative purposes only.

Working with large volumes of data has always been the bread and butter of quants, and hence developing a completely new thematic investment strategy based on the knowledge acquired over more than 35 years managing clients' money was an obvious next step for the Invesco Quantitative Strategies team.

Building on the original idea of developing new stock selection indicators for our multi-factor models, it was not a far stretch to also use alternative data sources and NLP tools to provide the foundation for thematic investing. The challenge was to create a data-driven way to invest in innovative companies and business models.

Big Data creates new possibilities, but also new challenges

Let's start with the term "Big Data". The term is well known to investors, as it has been around for quite some time now – since the 1990s. However, as computational power continues to increase at an ever lower price, investors and researchers have increasing possibilities to gather and analyze large amounts of data. So, what has happened over the course of the past ten years roughly is that:

1) The volume of the analyzed data has grown tremendously. As the amount of available data continues to grow (it needs to be measured in zettabytes, where one zettabyte is equal to one trillion gigabytes), vast computing power is ever more important to analyzing the data.

2) The speed at which new data emerges is immense. Data like social media posts or sensor data is continuously generated. The continuous inflow of new data coming from a myriad of different sources today requires analysis in real-time and is one of the key drivers behind the steep increase of the volume of data.

3) Different sources and types of data have emerged. These range from more classical data sources like balance sheet data in a company's annual report to newly emerged alternative data sources like satellite images, patent data or earnings calls transcripts. Furthermore, the data can be structured (e.g. standardized balance sheet data in an excel spreadsheet) or unstructured (e.g. human language in news stories or earnings calls). Unstructured data requires sophisticated algorithms and tools like NLP for analysis.

4) The quality of the data varies broadly. Is the gathered data really meaningful for achieving the desired purpose or does it contain a lot of noise that may skew the analysis? Data cleansing and preparation is a crucial step in working with Big Data and can be supported with algorithms and machine learning.

For our systematic and quantitative approach to thematic investing, we've found that analyzing news data with the help of natural language processing algorithms is a valuable tool, not only for the identification of investment themes and measuring their relevance on an ongoing basis, but also for the identification and selection of companies that have exposure to the respective investment themes.

Alternative data sources are everywhere

Until recently, investors' focus has been on traditional financial metrics like balance sheet and earnings data, security price data or macroeconomic data. These data types are clearly structured and characterized by low frequency and limited scope.

Nowadays, the rise of alternative data sources and the sheer amount of alternative data available, combined with greater computing power than ever before, gives investors completely new possibilities to analyze companies or economies, and to glean insights about the performance of a security. Alternative data sources often include unstructured data generated at a high frequency and with a less-easy-to-define scope, e.g. text, speech or images. Such alternative data sources can offer completely new and innovative areas for analytics:

- Analyzing social media posts can help companies draw conclusions about customer satisfaction for their own products and help them identify and target competitors' customers that express dissatisfaction about the competitors' products.

- Scanning earnings calls transcripts might help investors draw conclusions about a company's future performance, e.g. by deriving the management board's sentiment from their answers given to analysts.

- Satellite images can help identify the movement of trucks and ships, agricultural activity, utilization of oil depots etc. and hence support conclusions about changes and developments in economic activity or commodity prices.

- Credit card transaction data can serve as a real-time economic indicator, outpacing lagging indicators like unemployment data publication.

- Statistical methods to detect fraud, like Benford's law (the empirical observation that figures in a data set are more likely to start with 1 or 2 than with 9), can be applied not only to balance sheets, but also to alternative data sets like tax declarations or survey data.[8]

Generally speaking, the use of Big Data and alternative data in conjunction with advanced computing power allows for ever-more-sophisticated quantitative and systematic analysis which can be done in almost real time, making it possible to answer questions and make predictions in areas that were either not accessible before (or only with limited accuracy) or where traditional experts were formerly needed to provide a qualitative assessment.

The caveat that comes with these types of data, however, is that the vast quantity of unstructured information can hardly be collected and analyzed by humans. Therefore, innovative tools are needed to gather, process and interpret the selected data. Natural language processing (NLP) algorithms can be of tremendous help here. NLP algorithms have been developed in the area of artificial intelligence and are used to analyze, understand and derive meaning from human language in an automated way. Here are some examples of NLP algorithms applied to speech and text:

- *Automatic summarization* – generates a concise summary from vast amounts of text (e.g. research reports)
- *Translation from one language to another*
- *Speech recognition* – identifies words and phrases in spoken language and converts them to a machine-readable format
- *Relationship extraction* – extracts semantic relationships from a text
- *Sentiment analysis* – interprets and classifies emotions within text data
- *Topic segmentation* – detects different topics discussed in a single text, e.g. in a longer conversation, and parses text into the respective segments
- *Named entity recognition* – identifies "named entities" (e.g. people, places, organizations) as key information in a text and classifies them into categories like company, country, time, location etc. Named entity recognition makes it possible, e.g. to automatically analyze which companies are mentioned in news data

Conclusion: the Invesco Quantitative Strategies approach

The Invesco Quantitative Strategies team combines a vast amount of data from traditional and alternative sources and applies artificial intelligence algorithms like NLP to build a thematic strategy. We do this on the conviction that three overarching megatrends are going to shape our future. In our view, new technological innovations and disruptions will be the driving forces to growth in productivity; changes to demographics and society will have a major impact on consumer dynamics and the way we communicate and interact in everyday life; and protection of the environment and resource scarcity will be essential challenges to solve for the future of mankind.

Our innovative approach to thematic investing can give clients viable access to the forefront of the megatrends and the underlying investment themes. The systematic process of theme identification and weighting with the help of natural language processing algorithms and machine learning techniques can give them an innovative toolkit to remain invested in the right themes at the right times and benefit from a diversified exposure to these themes and companies.

In the next edition of Risk & Reward, we will detail how we approach the Innovation Investment Strategy.

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Notes

1 Source: Broadridge FundFile, December 2001. In the US, sector funds' share of total equity funds peaked at over 5% (source: Morningstar).
2 Source Broadridge. Technology, IT and biotechnology funds combined represented 37% of equity theme fund assets at the end of 2001, compared to 22% in 2020.
3 One can see a similar trend in the US mutual fund market, where technology funds peaked at USD 100 bn AuM in 2000, representing over 50% of the sector funds' total AuM (source: Morningstar).
4 Morningstar: "Global thematic Funds landscape" (February 2020). The definition retained here for measuring idiosyncratic themes: thematic funds defined as those that select holdings based on their exposure to one or more investment themes, above and beyond mainline sectors. These themes may pertain to macroeconomic or structural trends which transcend the traditional business cycle. Examples include demographic shifts or technological advances.
5 This is also reflected in the investment pattern in these sectors. If one looks at the consistency of net new flow rates (measured as punch ratios %, defined as yearly sales/ starting AuM), the flows in thematic equity sectors have been less volatile over the past 10 years than in the respective equity fund sectors overall (standard deviation of 16% vs 24% overall).
6 Source: Morningstar Direct. European fund universe excluding Money market, Funds of funds and Feeder funds.
7 Robert J. Shiller: Narrative economics: How stories go viral and drive major economic events. Princeton University Press (1 October 2019).
8 Kolrep, Martin, Satoshi, Ikeda, Benford's law and financial analysis, Risk & Reward, #4/2017, page 20.

Consortium on Asset Management in Cambridge

By Moritz Brand and Dr. Harald Lohre

In brief

Six papers were presented at the Consortium on Asset Management in Cambridge, two each on: fixed income, responsible investing and alternative investing. Zimmermann concludes that most firms' stock and credit returns are co-integrated, with stock returns taking the lead. Chen shows that the Morningstar classifications of many bond funds assume a too-high credit quality. Zhang finds that the rising trend towards sustainable investing leads to market inefficiencies, and thus alpha opportunities. The stock price effect of failed shareholder proposals on environmental and social issues is demonstrated by Kahraman. Lohre shows how factor analysis can improve commodity portfolio construction. And, finally, Spaenjers estimates gross and net yields for historical real estate portfolios and discovers long-term trends. Such academic engagement helps Invesco to stay ahead of the game to offer customized investment strategies across all major asset classes.

Invesco Quantitative Strategies is a long-standing promoter of academic research, especially research into asset pricing and investment strategy. As part of our close engagement with Cambridge Judge Business School, we participated in the 2020 Consortium on Asset Management held at the University of Cambridge in early 2020.[1]

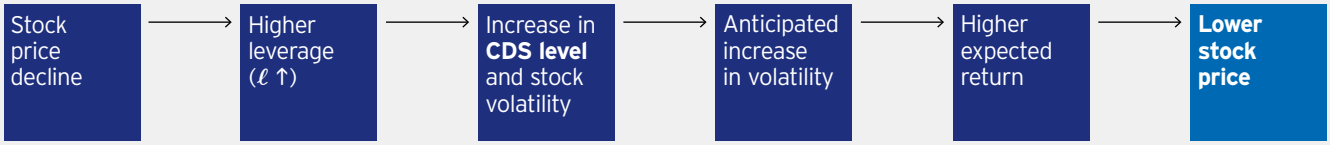
Hosted by the Cambridge Judge Business School's Centre for Endowment Asset Management (CEAM) and the Financial Management Association (FMA), the consortium called for high-quality investment research from young and aspiring researchers. The six selected papers covered fixed income, responsible investing and alternative investing, and the event was rounded off by a keynote presentation by Nicolas Bollen from Vanderbilt University about the impact of psychological biases on investment. The Consortium on Asset Management shined a spotlight on the current thinking and advances in academic asset management research.

Fixed income investing

The role of the leverage effect in the price discovery process of credit markets

Paul Zimmermann from the IESEG School of Management discussed the impact of the leverage effect and the volatility feedback effect on the interaction (or the lack thereof) between equity and credit markets. The leverage effect, first discovered by Black (1976), describes the negative correlation between past returns and future realized volatility, as well as option-implied volatility. Black states that, ceteris paribus, a declining stock price leads to a

Figure 1
The role of the leverage effect in the credit market price discovery process



Source: Zimmermann (2020), visualization by Invesco. For illustrative purposes only.

higher leverage ratio, making the stock riskier and hence more volatile. The volatility feedback effect as described by Bollerslev et al. (2006) postulates the same negative correlation but reverses the causation: i.e. rising volatility is the starting point, making investors demand higher risk premia and thus a higher rate of return, driving the current stock price down.

Most firms' stocks and credits are in fact co-integrated and the stock market generally dominates price discovery.

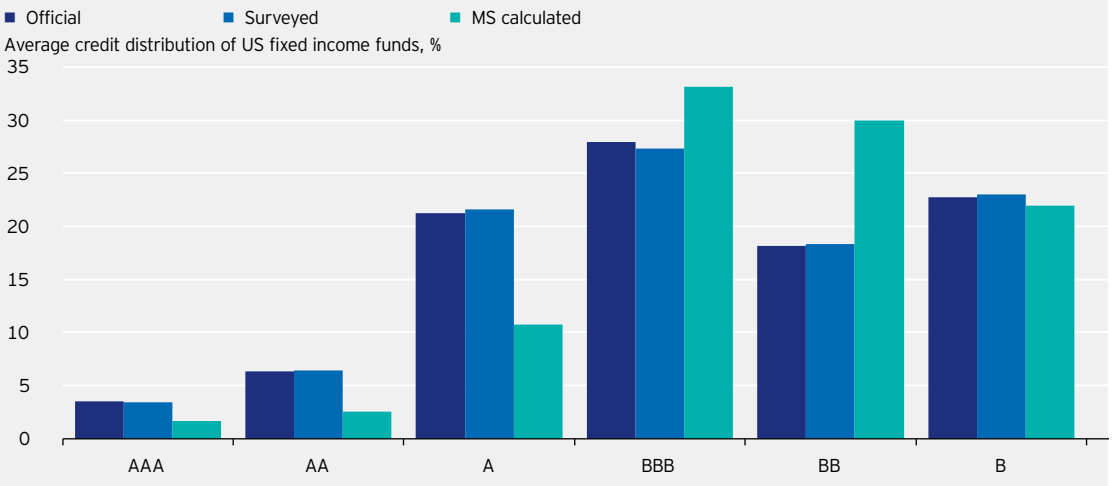
By analyzing data on 204 corporate credits issued by S&P 500 constituents, Zimmermann's paper examines credit-equity elasticity, or the relationship between CDS spreads and stock market returns. He finds a significant impact of corporate leverage on the CDS spreads, uniform across firms and robust to market conditions. In Zimmermann's model, declining stock prices lead to higher corporate leverage (as in Black's leverage effect), which in turn leads to higher CDS spreads. This initiates a negative feedback loop since the widening spreads are seen as an indicator for declining credit quality, making the stock even more volatile. Because stock investors will then demand a higher risk premium, the stock price declines even further (as in the volatility feedback effect). Figure 1 summarizes these relationships. The paper concludes that most firms' stocks and credits are in fact co-integrated and that the stock market generally dominates price discovery, although a small cluster of highly leveraged firms exhibits a dominant CDS market share.

Don't take their word for It – the misclassification of bond mutual funds

A quite different perspective on fixed income investing was presented by Huaizhi Chen from the University of Notre Dame.[2] By comparing surveyed data from fund managers to official SEC filings, the three authors find a strong mismatch between reported and calculated credit quality and yield among listed bond mutual funds classified by Morningstar. Given that Morningstar builds on the data reported by fund managers, the ensuing ratings appear to systematically underestimate funds' riskiness.

The authors' analysis utilizes quarterly holdings data from Morningstar covering 2003 to 2018, as well as bond ratings from all US nationally recognized statistical rating organizations (NRSROs) and applies the standard Bloomberg/Barclays methodology of rating aggregation. They thus reclassify the funds, documenting that the number of misclassifications spiked in 2010, when Morningstar changed from a

Figure 2
Misclassification of bond funds



Source: Chen et al. (2020).

linear to a non-linear rating aggregation system. And that number has grown ever since. This observation is most pronounced for funds in the high and medium credit quality spectrum, of which 31% were overclassified in the period from Q1 2017 to Q2 2019, as shown in figure 2, which presents the credit distribution of US fixed income funds according to different methodologies. The dark blue bar shows the official credit rating on the Morningstar platform and is calculated from surveyed holdings, while the blue bar shows the distribution manually recalculated from the surveyed holdings. The green bar is based on the Morningstar calculation methodology applied to the official fund holdings, and it is evident that the final number of funds in the AAA-A space is clearly overstated at the expense of the funds in the BBB-B credit spectrum.

This can be partially explained by the fact that Morningstar assumes not-rated assets to be of high credit quality, while the authors' research indicates that unrated bonds typically come with higher risk and thus higher risk premia (yields).

Finally, the authors outline the effects of these misclassifications on investors and fund managers: By comparing misclassified funds to less risky and lower yielding funds, returns tend to look more appealing, which allows fund managers to charge higher fees. As investors come to depend on third-party data providers to aggregate relevant information, the self-reporting of fund risk through these same providers has led to substantial investments in verifiably riskier mutual funds.

Responsible investing

ESG preference and market efficiency – evidence from mispricing and institutional trading

In a paper presented by Weiming Elaine Zhang from the Chinese University of Hong Kong, the authors find that the rising number of sustainability-minded market participants is prompting inefficiency in trading signals for sustainable and non-sustainable stocks.[3]

The paper analyzes the predictive power of valuation signals for stocks with a high percentage of socially responsible investors, defined as institutional investors whose portfolios' ESG scores rank in the top tercile. For such stocks, the 3-factor Fama-French alpha tends to be positive if they are underpriced with low ESG scores, and negative if they are overpriced with high ESG scores. Thus, it appears that ESG-minded investors are reluctant to buy undervalued unsustainable companies while at the same time holding on to overvalued ESG stocks (figure 3). The authors further find that this effect disappears when looking at stocks with a lower base of socially responsible investors and cannot be explained by other stock characteristics or limits to arbitrage. Finally, it is shown that this effect is only present in the data since 2004. In the period from 1996 – 2003, when sustainable investing had not yet become an industry trend, no such differences in returns are observed, further substantiating the causality between the phenomena and the growing importance of ESG investing.

ES risks and shareholder voice

The second ESG-themed paper, presented by Bige Kahraman from the University of Oxford and CEPR,[4] discusses the effect of informational content of failed shareholder proposals concerning environmental and social issues ("ES") on potential future risks. On average, 23% of the examined shareholder proposals relate to ES issues. Support for such proposals increased over time, but the vast majority of these proposals failed to pass the vote.

The traditional view on corporate behavior tends to be that, while the government sets the rules, firms will aim to maximize their profits within such boundaries without an intention to self-correct their behavior. But a new view is emerging, in which corporations take more responsibility to self-correct and adhere to environmental and social principles. Analyzing shareholder proposals, the authors discuss whether ES initiatives result in value creation or destruction and whether their support rates show any predictive potential for future stock returns.

Failed ES proposals with high support rates are likely predictors of negative news and subsequent negative returns driven by ES incidents.

The findings are, firstly, that failed ES proposals with high support rates are likely predictors of negative news and subsequent negative returns driven by ES incidents. This result does not hold for non-ES votes. Secondly, this informational content arises only on negative abnormal returns and hence does not simply predict idiosyncratic volatility. Finally, this

Figure 3
ESG preference and market efficiency

Signal \ ESG	Poor	Median	Good
Undervalued	?	Buy	Buy
Fairly valued			
Overvalued	Sell	Sell	?

Too bad to buy...

Too good to sell...

Source: Cao et al. (2020).

predictive ability remains intact when controlling for other influences such as past incidents, past returns and firms' ES scores.

The predictability of support rates in failed ES proposals is largely driven by shareholders who are less prone to distortions such as shareholder or management myopia. The authors suggest that voting differences are more distinct for value-relevant proposals, such as the ones recommended by ISS (a provider of proxy voting services and recommendations in the ESG space) or sponsored by asset management firms. Finally, such voting differences appear more pronounced in ES proposals as compared to non-ES proposals.

Alternative investing

Integrating time series and cross-sectional signals for optimal commodity portfolios

Harald Lohre (Invesco, CEAM at Cambridge Judge Business School, and EMP at Lancaster University Management School) presented his paper written together with Regina Hammerschmid from the University of Zurich / Swiss Finance Institute, advancing optimal commodity factor strategies. The authors combine timing predictors and tilting characteristics from three categories: term structure, trend-following and other signals (basis-momentum as well as growth rate of open interest). When integrating the information from time series predictors and cross-sectional commodity characteristics in a parametric portfolio policy, it is found that the long end of the futures curve and the open interest show significant timing abilities, while the short end of the curve and past returns are relevant for the cross-sectional tilting of commodities. Additionally, as seen in figure 4, the optimal parametric portfolio policy (purple line) outperforms a naïve equal weighted long-short factor benchmark (light blue line). And, while the strategy shows some positive exposure to the carry and momentum factors, it is not fully priced via common commodity risk factors.

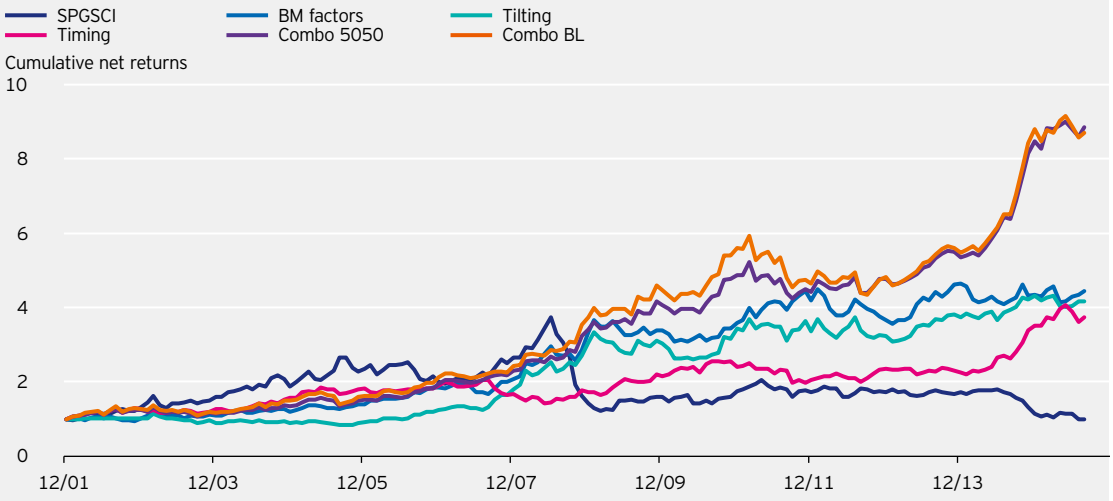
> The long end of the futures curve and the open interest show significant timing abilities.

The rate of return on real estate – long-run micro-level evidence

Finally, Christophe Spaenjers (HEC Paris) presented a new approach to identifying the long-term financial performance of real estate investments.[5] The authors analyze archival records of the Oxford and Cambridge endowments' real estate holdings over the period 1900 – 1970. They include information on the asset characteristics, realized and contractual rental income, holding costs and transaction prices, allowing the authors to calculate a comprehensive real return estimation for the property types: agricultural, commercial and residential.

Digitizing rental and disposition data from transaction ledgers and income data from rent books (as depicted in figure 5), the authors systematically analyze over 50,000 income observations for approximately 3,000 unique properties. They calculate the real rate of return as a function of income growth, yield change and net income yield. The latter two enjoy the substantial advantage of analyzing asset-level data rather than aggregated information: while existing studies typically rely on aggregate cost ratios, the authors had access to realized and asset-specific information. Additionally, the information basis on both contractual and realized rents enables them to

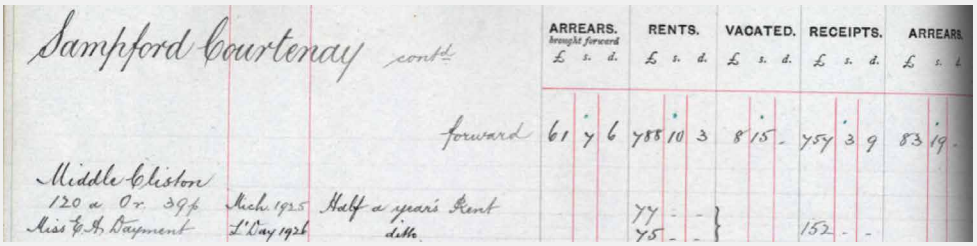
Figure 4
Integrating time series and cross-sectional signals for optimal commodity portfolios



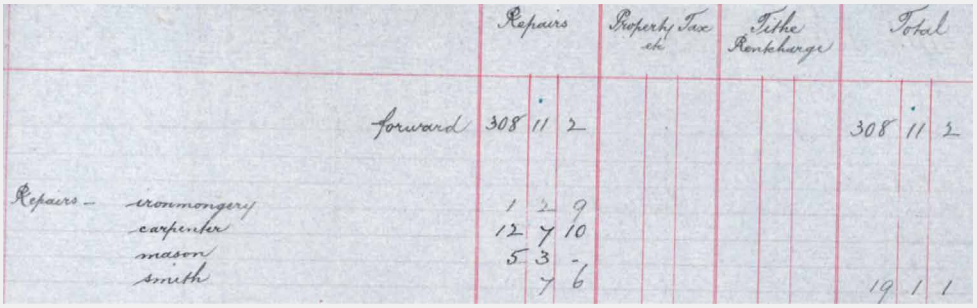
The figure shows the cumulative out-of-sample net performance of different multivariate commodity strategies over the time period January 2002 to August 2015. The green line refers to the multivariate tilting policy, the pink line to the timing policy, the orange line to the Black-Litterman combination (Combo BL), the purple line to the 50-50 combination (Combo 5050), the blue line to the equal-weighted factor benchmark and the dark blue line documents the performance of the S&P GSCI index. **The figures refer to simulated past performance and past performance is not a reliable indicator of future performance.**
Source: Hammerschmid and Lohre (2020).

Figure 5
The rate of return on real estate: Long-run micro-level evidence

Middle Cliston Farm in Sampford Courtenay generated GBP 152 of income in 1926.



In the same year, the property incurred GBP 19 of costs.



Source: Chambers et al. (2019).

precisely calculate net income yields, which have historically been largely ignored in similar papers.

The authors conclude that real income growth is around zero across all property types, while the average gross yield is around 5%. Declining yields in agricultural and residential real estate and increasing yields in commercial real estate lead to a net total return below 4% for all real estate types taken together. Additionally, they caution that large cross-sectional variation in yields and volatility of property-level income streams imply substantial idiosyncratic risks, which should be considered before investing in real estate.

Nicolas Bollen's keynote

The keynote presentation was delivered by Nicolas Bollen from the Owen Graduate School of Management at Vanderbilt University. He elaborated on the role of psychology in the asset management industry, focusing specifically on hedge funds. Bollen presented salient investor behavioral biases, such as overconfidence, which typically leads to excessive trading as investors continuously believe to have found better investment opportunities. Professor Bollen pointed out that hedge funds can typically be characterized as risk seekers.

When comparing hedge fund manager groups based on their facial width-to-height, the group with a higher ratio (associated with a higher testosterone level) realized higher portfolio volatility and hence lower risk-adjusted returns.

On a similar note, he investigated managers with a high relative age (born shortly after cut-off dates for determining kindergarten/school classes), who were thus relatively taller and older than other pupils throughout their school careers. Such managers tend to be more self-confident and can thus attract more capital flows than their relatively younger peers.

Using a variety of illustrative examples, Nicolas Bollen laid out that, even in the hedge fund space, often referred to as the most sophisticated segment of the capital markets, managers are subject to behavioral biases, which makes a thorough due diligence of investment process and key personnel indispensable.

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Hammerschmid, Regina; Lohre, Harald (2020): Integrating time series and cross-sectional signals for optimal commodity portfolios. Available at SSRN: https://ssrn.com/abstract=3504394

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Notes
1 More about the Consortium can be found at www.jbs.cam.ac.uk/2020-consortium-asset-management
2 Co-authored by Lauren Cohen (Harvard Business School and NBER) and Umit Gurun (University of Texas at Dallas and NBER).
3 Co-authored by Jie Cao (Chinese University of Hong Kong), Sheridan Titman (University of Texas at Austin) and Xintong Zhan (Chinese University of Hong Kong).
4 Co-authored by Yazhou Ellen He (University of Manchester) and Michelle Lowry (Drexel University).
5 Co-authored by David Chambers (University of Cambridge) and Eva Steiner (Cornell University).

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Nicolas Bollen is Frank K. Houston Professor of Finance at Vanderbilt University's Owen Graduate School of Management. Since joining Owen in 2001, Nick has published over 20 papers in several journals, including the Journal of Finance, Journal of Financial and Quantitative Analysis, Journal of Financial Economics and Financial Management. Nick's current research agenda is focused on hedge funds. His studies include the measurement of time-variation in their risk exposures, how fund managers report returns and patterns of reported returns that can help identify fraud.

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Bige Kahraman is an Associate Professor of Finance at Saïd Business School and a Fellow of Kellogg College at the University of Oxford. She is a Research Affiliate in the Financial Economics program of the Centre for Economic Policy Research (CEPR) and an Economic Adviser to the Financial Conduct Authority. Bige's research focuses on analyzing sources of market friction giving rise to market inefficiencies and systematic liquidity crises. She holds a Ph.D. in economics from Yale University with specializations in financial economics and econometrics.

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