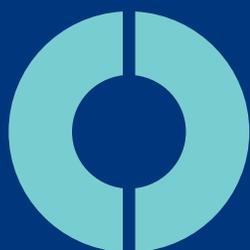


Schroders



# Investment Horizons

Spring 2017

## Research Insights at Schroders:

- ESG and Credit
- Artificial Intelligence
- Rise of the Robots
- The Return of Fixed Income Arbitrage
- Are We Nearing a Liquidity Inflection?
- Extracting Income from Equities

# Perspectives on change

**We are pleased to offer *Investment Horizons*, our perennial compilation of research articles inspired by our global client engagements. This edition focuses on change. As you may have noticed, this brochure is in our new brand: one that we think is sharper, quicker, clearer – a reflection of our commitment to acclimate to the world in which we do business.**

We see change as opportunity, and look to harness it in the form of innovation. This has always been a hallmark of our investment philosophy. Our first article emboldens this view. ESG integration within fixed income credit research is a concept we believe can be quite additive in today's challenging fixed income environment.

Artificial intelligence and robotic labor advancements are other areas that we believe have tremendous investment potential, but require sound fundamental insights in order to navigate their complexity. This edition, we offer two perspectives from James Gautrey (equity) and Alice Leedale (fixed income) – investor and strategist, respectively – here at Schroders.

Our next article is not a new idea, per se, but rather a timely insight through the lens of a well-known alternative asset class amid changing fixed income market dynamics: relative value

fixed income arbitrage (where the direction of yields is not the critical factor). Liquidity is another topic of interest for many fixed income investors. Neil Sutherland and Stephen Sciaraffo of our US Multi-Sector team provide their views on whether or not the markets are nearing a liquidity inflection point.

Finally, our last article is a perspective on solving for a Plan's need to meet its short-term funding obligations – while staying invested in growth assets – through a somewhat novel approach: covered call equity income.

We hope this edition provides some valuable insights and relevance to your long-term objectives. As always, if there is anything you would like to discuss further, please contact your local Schroders representative.



**Karl Dasher**

CEO, North America &  
Co-Head of Fixed Income

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For some, incorporating environmental, social and governance (ESG) factors into fixed income investing may be limited to having a small allocation to green bonds, or not investing in the debt issued by tobacco companies. These efforts are worthy, but only scrape the surface. With an outstanding global debt level of over \$48 trillion, we think it's arguably just as important to consider ESG issues in credit investing as within equity portfolios. This article provides some of our recent credit research efforts in this nuanced realm of ESG integration in fixed income.

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Artificial intelligence (AI) may be one of the most important developments of our time. While most are familiar with the term, few understand the architectures and processes behind it, nor why it is finally to become relevant. Yet to comprehend AI is to gain an insight into the future. The impact will be felt across all industries and aspects of life itself. Its importance should not be underestimated.

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Robotics has moved from science fiction to industrial reality over the last few decades. Recent debate has centered on where robots will invade next. Both low-skilled service jobs and some highly-specialized white-collar occupations appear vulnerable. The pessimists paint a bleak picture of mass displacement of labor accompanied by increasingly wealthy robot owners. Yet the history of technological change offers a decidedly more sanguine long-term prognosis. We are optimistic that, if handled well, the rise of the robots will create neither widespread joblessness nor rampant inequality. But investors still need to develop and maintain a roadmap of how the "second machine age" will affect inflation, growth, interest rates and asset prices if they are to remain ahead of the game.

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Fixed Income Relative Value (FIRV) is back on investors' radar screens thanks to an improving opportunity set following the election of Donald Trump and the perceived baton-pass from monetary policy preeminence to fiscal policy primacy. As market participants more tactically adjust their portfolios in response to this and other market factors, this creates arbitrage opportunities that only a select group of investors can potentially source. What makes FIRV special is that, unlike other fixed income strategies, there only need be identifiable differences and mean-reversion between like securities to pursue total return. While the direction of yields matters much less for FIRV strategies, their performance historically improves with higher rates.

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### **Quick insights: investors should prepare for liquidity inflection point**

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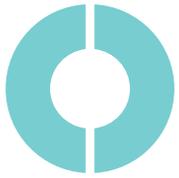
The divergence between financial assets and economic prices has resulted in a shift from excessive stimulative monetary policy toward the use of fiscal levers. It is our belief that we have reached an inflection point in liquidity as central banks transition away from a fully accommodative stance.

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### **Extracting income: making equity work harder for your plan – by Seth Finkelstein**

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In spite of a nine year bull market, many public and union pension plans remain challenged by the need for high returns to improve funding status, and for current income to cover massive benefit payouts. How can a sponsor reconcile these competing objectives? Traditional answers fall short. We've identified a potential solution that has been right under our nose for years: an income-focused covered call equity strategy. Such a solution can convert the anticipated long-term capital appreciation of equity into high and sustainable short-term income which can address the burden of benefit payments while keeping the plan fully invested in equity.



# ESG integration and credit: it just makes sense

**For some, incorporating environmental, social and governance (ESG) factors into fixed income investing may be limited to having a small allocation to green bonds, or not investing in the debt issued by tobacco companies. These efforts are worthy, but only scrape the surface. With an outstanding global debt level of over \$48 trillion, we think it's arguably just as important to consider ESG issues in credit investing as within equity portfolios. This article provides some of our recent credit research efforts in this nuanced realm of ESG integration in fixed income.**



**Jessica Ground**  
Global Head of  
Stewardship,  
Schroders

## **Introduction: Why we do it, how we do it**

Companies do not operate in a vacuum; global industries face social, economic, environmental and industrial changes on a larger scale and faster pace than ever before. The gap between the values of companies on the right or wrong sides of those trends is growing ever-wider as a result.

Profit, growth and other measures of financial strength are firmly in investors' sights, and product portfolios, cost positions and competitive characteristics feature in most researchers' toolkits. Integrated ESG analysis focuses on a company's capacity to develop valuable products in the future, to maintain cost efficient operations and other activities that we believe can help lead to long-run competitive advantages, growth and profitability. Thus we focus on management teams, their track records, their values, and how they employ debt and equity capital, in addition to their product portfolios and profitability. This kind of fundamental analysis into a company is very important, regardless of which part of the capital structure you are investing in.

ESG analysis is central to the work that our credit researchers do. It helps us to build a picture of the sustainability of future cashflows and the resulting ability of the issuer to meet their interest and principal obligations. Researchers use a variety of sources: ESG data providers such as Bloomberg and MSCI, data from issuers, governmental bodies, non-government organizations, consultants and academics, as well as work done by think tanks. ESG information is loaded into Schroders' proprietary research database, which shares knowledge across various asset classes.

Much of the analysis of ESG risks is done by credit researchers at the initiation of a company's coverage. Ongoing identification of emerging ESG issues that can impact the credit is also important as credit researchers assess a company's track record and outlook on this front. This often is the result of collaboration between ESG and credit researchers

to derive a better understanding of changing market dynamics. We use data gathered by external ESG and credit rating agencies as a reference for our fundamental work in this area, but the final conclusions on ESG impacts are made by our credit researchers.

Thematic research into ESG issues is another important part of how our ESG researchers add value to the investment process. The team is tasked with identifying poorly understood issues that can fall between the cracks of sector coverage or get overlooked as researchers focus on producing accurate medium-term company forecasts. Often ideas will originate from the fixed income team, as our case study on sugar shows. Research findings from the ESG team are discussed and debated with credit research teams and often result in follow-up company engagement or analysis. In our experience, thematic research that has the most impact on credit research is that which focuses on unrecognized risks. The team is concerned about the impact of ESG risks on both the balance sheet as well as profit sustainability.

## **Example #1: Collaboration matters, because no one has a monopoly on good ideas**

The credit team identified obesity and nutrition as a major theme in 2013, and began researching the investment implications with analysis that largely focused on the pharmaceutical sector. Believing that the impact could be wider, the ESG team arranged for an obesity expert to speak at Schroders about sugar and its link to metabolic syndrome (a range of conditions including diabetes, obesity and high blood pressure).

Recently, the ESG team published its own report entitled "Is Big Food the next Big Tobacco?" The research suggested that there are a number of similarities between major food and beverages companies ("Big Food") and major tobacco companies ("Big Tobacco"), and identified three catalysts that could result in increased risk for the sector. These were:

- Increased awareness of the health implications of sugar for consumers and public health bodies;
- The rapidly increasing rates of metabolic syndrome sufferers and the subsequent rise in healthcare costs;
- The publication of independent scientific research providing evidence that excessive sugar is the primary cause of metabolic syndrome.

There was convincing evidence to show that the first two catalysts could already have been triggered.

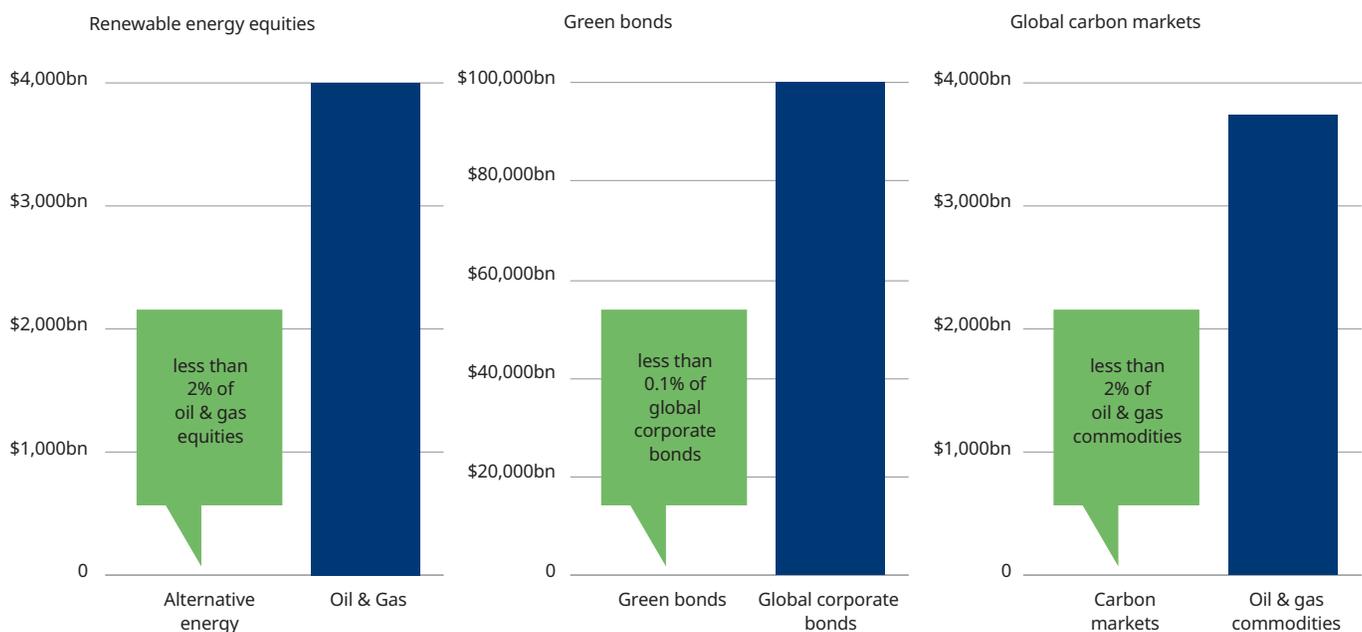
The research points to a tougher backdrop, leading to lower sales growth, higher costs and the risk of large scale litigation for the sector. Companies with high exposure to carbonated soft drinks were identified as the most vulnerable to declining sales and increasing costs. Given their focus on the long-term resilience of companies, the credit team adjusted its portfolio positioning in response.

### Example #2: Green Day: do ‘green bonds’ check the ESG box?

Fixed income investors have a role to play in providing the capital to help economies transition towards a more sustainable future, limiting the impact of climate change. As the Governor of the Bank of England, Mark Carney, has pointed out, achieving the Sustainable Development Goals will require investment of \$5-7 trillion per annum. Fixed income investors will play a role in funding this.

We acknowledge the growing interest in Green bonds, as issuance has been growing. But, it still makes up less than 0.1% of the global corporate bond market. In our view, these bonds are often self-labeled, and include a broad list of issuers and uses. There is no consistent definition for “green” and only about 60% of issued bonds have independent verification. We will continue to monitor individual green bonds and may invest in them in our portfolios; however, we do not believe buying a green bond is a panacea for rigorous processes around ESG integration.

Figure 1. Value of selected climate markets, relative to traditional equivalents



Source: Datastream, The Climate Group, Climate Bonds, Statista, September 2016.

### Example #3: Not all research leads to change, but it can nurture other ideas

The credit team carried out a detailed review of energy efficiency measures, in light of the global climate change policy backdrop. They researched and engaged with companies in a range of energy intensive sectors, looking for evidence that investment would need to rise to meet the challenge of climate change.

Overall, they concluded that renewable investment by manufacturing is still some way off. For example, in the extractive industries, even at a company level, overall energy prices had a larger influence than clean technology investment levels. The research on the automotive industry, however, was more insightful. The team was able to identify a company-specific winner that has already successfully invested in their portfolios to reduce CO<sup>2</sup> footprints ahead of new emission targets.

### Don't the Rating Agencies look at ESG?

Some investors believe that it is sufficient to rely on the rating agencies' assessments of ESG factors. Our experience is that rating agencies' methodologies do not effectively operate as an early warning system. Caught between issuers and investors, they rarely address 'might be' issues until they become 'it was' issues. They largely deal with explicit ESG risks in their most formal manifestations on an ex-post-facto basis, e.g. mandatory regulation, product recalls and consumer boycotts. This often is too late to have a positive impact on our portfolio performance.

For example, while the rating agencies acknowledge the long-term issues created by climate change, they will not explicitly incorporate this in their assessments as the horizon for corporate credit ratings extends at most just five years out. Given the acceleration that we have seen in public policy responses in this area (in 1997 only 54 laws were in effect and by 2014 that number had risen to 804), investors clearly need to map the future landscape themselves.

Additionally, rating agencies are more comfortable in a quantitative universe. It is a shield from being caught in the crossfire of a qualitative debate between their investor clients and their issuer clients. The qualitative factors involved in scenario planning, of which ESG factors are very important, represent a real challenge for rating agency output.

Rating agencies have recently unveiled integrated ESG reports. Examination has revealed a singular focus on environmental risks - an important issue but only one of many ESG factors we seek to consider. This self-limiting definition combined with their more backward-looking focus, limits the usefulness of the research.

We applaud those rating agencies that have signed the Principles of Responsible Investment Statement on ESG in Credit Ratings, which aims to enhance systematic and transparent consideration of ESG factors in the assessment of creditworthiness. However, we also believe that there is some way to go before this translates into meaningful guidance for investors. As signatories ourselves, we support progress and seek to be an industry advocate in this area.

## Conclusion

These are just a few examples of some of the benefits we have discovered with our fixed income ESG and sustainability research here at Schroders. As we look back on the work that we have done, it becomes clear to us that the issues we analyze, the tools that we use and the questions that we ask of companies are not very different from that of our equity colleagues.

In our view, it is the deep resources Schroders has across asset classes, combined with the efforts of our dedicated ESG team that truly differentiates our credit process. It has been through the combined efforts of our fixed income, equity and ESG teams that we have been able to effectively interact with companies, stimulating awareness of and highlighting potential solutions for key ESG issues.

For a company to be a long-term holding in our portfolios, we require cashflows that are sustainable across the entire lifecycle of owning a company's security – and sustainable in every sense of the word. Companies do not operate in a vacuum; global industries face social, economic, environmental and industrial changes on a larger scale and faster pace than ever before. The gap between the values of companies on the right or wrong sides of those trends is growing ever-wider as a result. That is why we believe ESG research must be a holistic part of the credit research process, with the objective of finding idiosyncratic opportunities within a segment of the market that significantly dwarfs the global equity markets.<sup>1</sup> To us, combining ESG research with fundamental credit research just makes sense.

<sup>1</sup> AUM source: Bank for International Settlements Quarterly Review, March 2016. International banking and financial market developments.



# Artificial intelligence: a new machine

**Artificial intelligence (AI) may be one of the most important developments of our time. While most are familiar with the term, few understand the architectures and processes behind it, nor why it is finally to become relevant. Yet to comprehend AI is to gain an insight into the future. The impact will be felt across all industries and aspects of life itself. Its importance should not be underestimated.**



**James Gautrey, CFA**  
Portfolio Manager and Global Sector Specialist (Technology), Global & International Equities, Schroders

## Us and Them

Historically, human brains and computers have been built differently. Our “beautiful minds” are made up of billions of neurons and trillions of synapses capable of processing vast amounts of small data packets simultaneously (parallelism). This makes image and pattern recognition, reading and writing, sensory perception and creativity second nature, yet finding the square root of 17,378,969,242,589 almost impossible.

In computers, we observe the opposite. Primarily, this is because they have been designed as “serial” processors i.e. extremely capable of performing single, pre-programmed tasks but completely overwhelmed by inference required to deal with new situations.

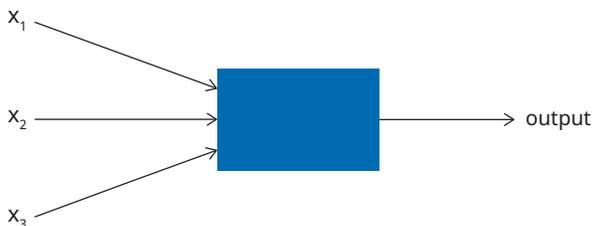
All of this is set to change, however, as computers are re-designed to become “neural networks” emulating the human mind. A key enabler of this has been the addition of Graphical Processing Units (GPU) to Core Processing Units (CPU), enabling machines to better execute both “serial” and “parallel” tasks.

## Neural networks - Welcome to the Machine

Understanding neural networks is to understand AI. First described in 1943 by McCulloch and Pitts, an instructive example was developed in the 1950s by Frank Rosenblatt, tantalizingly named the “Perceptron”.

In the perceptron model, multiple, binary inputs ( $x_i$ ) are used to produce a single, binary output, shown in Figure 1.

**Figure 1**



Source: Schroders.

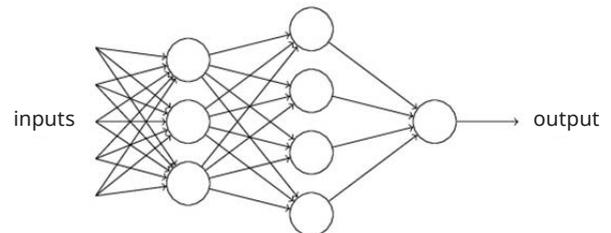
The inputs could be anything, for example questions such as “will an Intel processor run faster than a human brain in 2019?” or “did Google’s net income exceed £10 billion last year?”. Each input is then “weighted” according to user preference. The product of these weights ( $w_i$ ) and inputs ( $x_i$ ) is measured against a “threshold” value ( $t$ ) to determine the output, which might be a question such as “Should I buy stock in Intel?”.

Mathematically:

$$\sum_{i=1}^n w_i \cdot x_i > t$$

Figure 1 showed a single-layer model i.e. one set of inputs and output. However, the model can be extended such that inputs relate to multiple outputs and, crucially, said outputs form inputs for another layer. This is known as the multi-layer model and simplified in Figure 2.

**Figure 2**



Source: Neural Networks and Deep Learning, Michael A. Nielsen, Determination Press (2015).

Furthermore, “Learning algorithms” allow the machine to dynamically alter the weights until the correct output is found. It is the combination of this process with multiple layer models that underpins the basis of AI and what is known as Deep Learning.

By now it should be clear how AI can combine positive attributes of the human mind (weighting evidence based questions) with modern technology (leading edge CPU + GPU) to produce unimaginable results.

Perhaps the best known is Google’s Deep Mind beating Lee Sedol at strategy board game Go in March 2016. In the second game, the machine made a move leaving commentators speechless and forcing Lee Sedol to leave the room. It was a game-winning move later described by a tearful European champion, Fan Hui: “I’ve never seen a human play this move. So beautiful”.

**The Wall (part 1)**

AI models require human input and large datasets in order to learn. This process is computer-intensive (GPU) and known as “training”. Once trained, the systems can begin to answer problems – a process known as “inference” – and generate solutions to both programmed and un-programmed questions.

An excellent example is IBM’s Watson for Oncology (Watson is the name of IBM’s AI engine). The system was trained by oncologists from Memorial Sloan Kettering, one of the world’s leading cancer hospitals, in combination with every academic paper and textbook on the subject (about 25 million in total).

Capable of reading both structured and unstructured data (e.g., a trial database and a doctor’s handwritten note respectively), it also digests the additional 8,000 scientific papers written daily.

In a study of 1,000 cancer patients at the University of North Carolina (UNC), Watson recommended the same treatment as the doctors in 99% of instances. However, in 30% of instances Watson was able to recommend something new based on papers or approvals the human counterparts had not yet had time to read. Interviewed on CBS’ “60 minutes”, Dr. Ned Sharpless of the UNC said: “These were real things we would have considered actionable had we known about it at the time of diagnosis”.

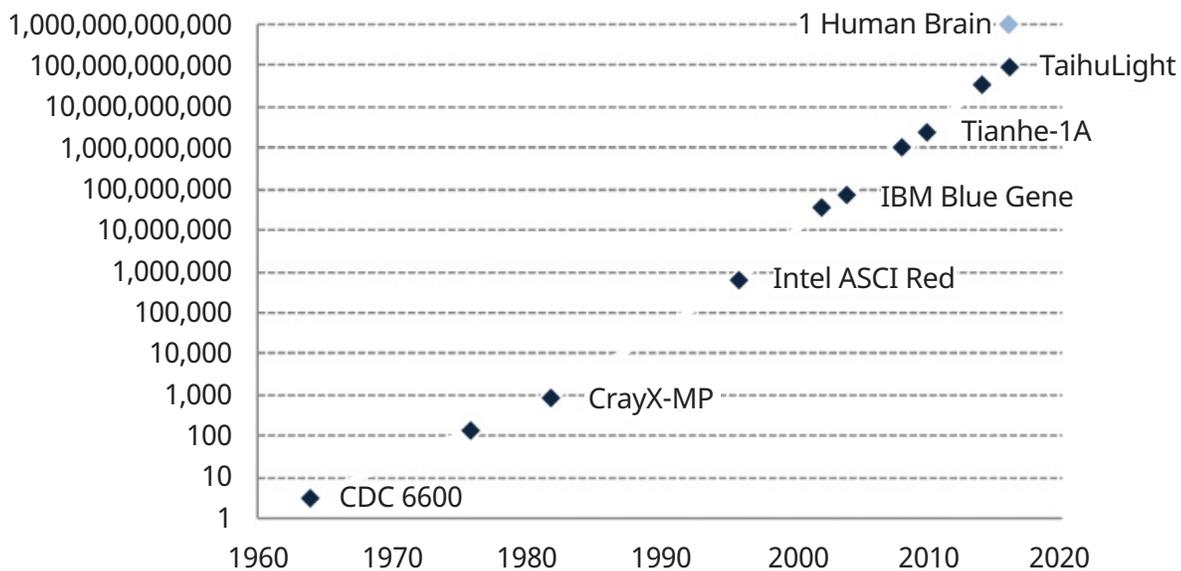
IBM will sell Watson for \$250 per patient, opening the possibility of world-class oncology anywhere (not just the major metropolises) for a fraction of the cost and time to diagnose.

**The Wall (Part II) – Moore’s law a gating factor?**

Multi-layer models – capable of auto-tuning, natural voice and image recognition – offer enormous scope of application. This will only widen if processors and technological architecture continue to progress as they have done in the past. Figure 3 shows the processing power of the world’s faster supercomputer in the last 50 years, increasing at a compound annual growth rate (CAGR) of 59%. At this rate, an “exaflop” of processing power will be realized by 2021 – equivalent to our best estimate of that of a single human brain.

The observation made in 1965 by the co-founder of Intel Gordon Moore, known as Moore’s law, that the number of transistors per square inch on integrated circuits has doubled every year since their invention, has gained increasing prominence in recent years.

**Figure 3: Megaflops of world’s fastest computers 1964 – 2016 (log scale)**



Source: Schrodgers. Megaflop refers to a measure of computing processing speed, in terms of floating-point operations a second.

Critics, however, might point out that Moore’s law has been slowing in recent years with the delay of Extreme Ultra Violet lithography (EUV) and that problems of quantum tunneling will impact further in the next few years. However, Moore’s naysayers have been around as long as Moore’s law itself, in fact it is sometimes quipped that the number of people predicting the end of Moore’s law roughly doubles every 18 months.

Further, it is worth noting that while Moore has slowed for CPU, the addition of GPU (an architectural change to supercomputers) in 2010 has actually accelerated progress. Since 2010, the processing power of the world’s faster computer has grown at a compound annual growth rate (CAGR) of 83% (vs. 59% for the past 50 years).

## Investment implications – ex Technology

While natural to ask which industries and jobs will be affected by AI it seems more appropriate to ask which will not.

Initially, one of the gating factors is the availability of large datasets. AI models require these to produce optimal results hence their importance. It's no accident that early industry impacts are observable in video, image recognition and medicine – all fields with vast amounts of relevant, available data.

With sufficient data, successful early adopters will enjoy competitive advantage based on lower costs, time to market and insight. New entrants may even emerge if an industry is not moving fast enough. However, sustainable competitive advantage may need to come from proprietary solutions developed by in-house. If all solutions are merely bought from external vendors such as IBM or Google, speed of adoption would be the only differentiating factor. Internally developed or perhaps highly customized software may provide something more permanent. Winners could enjoy virtuous-circle benefits as the system improves with larger amounts of data. Data is scarce but Boeing, Toyota, Manulife and SEB (see below) are amongst a growing number of non-tech companies experimenting on their own in AI.

Nordic bank Skandinaviska Enskilda Banken's (SEB) adoption of Amelia – pitched by creator IP Soft (privately listed company in New York) as “Your First Digital Employee” – is an interesting example of the early adopter advantage. Figure 4 shows SEB's press release late last year:

### Figure 4: Amelia to join SEB's customer service

06 Oct 2016 08:08



Amelia, a new digital employee at SEB

SEB would like to introduce Amelia, a new digital employee at the bank's internal IT support. By mimicking the human process of learning and conversation, the technology can be used to perform assignments and provide information. The next step is to let the bank's retail customers benefit from Amelias' skills as a complement to other services.

Source: SEB Corporate Website.

Amelia is a cognitive and emotive engine. This means “she” is capable of learning and reacting to different emotions in real-time (neural nets altering weights dynamically). If a customer is angry, her responses can change in real time to adapt accordingly. If she does not know the answer to a question, it is diverted to a human employee and the process learnt for future reference. It is estimated within three months Amelia will handle 60% of all incoming calls to the bank. Could she handle 99% within two years?

It will be instructive to see how Amelia benefits SEB in time. In theory, costs should fall considerably with similar or improving levels of customer satisfaction. Proven out, SEB would enjoy a material advantage forcing competitors to rapidly catch up. This dynamic is likely to recur throughout the world, especially in labor-intensive, white collar jobs with a high degree of standardization. Financial services would seem a strong candidate.

AI should not be thought of as the end of human labor, however, at least not yet. AI can free up human effort for more productive, creative uses which, combined, could materially enhance corporate and social prospects. IBM does not see Watson as a replacement for oncologists, for example, simply as “augmented intelligence” enabling doctors to spend more time on care and research.

The impact of AI, therefore, will not be generic. In many instances, implementation will enhance corporate profits and social impact. In other cases, the existing business model looks increasingly uncomfortable and the adoption process will be painful. An example might be the IT Services firms Cognizant and Infosys which both employ over 200,000 people each. While both are embracing AI and developing internal solutions of benefit, it is hard to believe the employee count is now optimal for the long term. As ever, we think they will face the perennial corporate problem of embracing change at the expense of the existing business.

## Investment implications – Technology

Given industry nascence, it is hard to judge how software companies are positioned. We know Google was one of the earliest drivers dedicating significant resource (one of two quantum computers on the planet is dedicated to AI at Google) along with leading talent (Ray Kurzweil is Head of AI) and acquisition (Deep Mind). They would therefore seem very well placed though hard, tangible evidence beyond the Autonomous Vehicles and Alpha Go successes are not yet visible.

IBM appears to have the greatest lead in the corporate space, a position which largely remains unchallenged today with competitors focusing on the consumer instead. In time, IBM could own one of the most valuable assets in technology but we believe investors have two issues to consider:

- IBM will need to cannibalize some of its existing business – historically, its record here is poor
- IBM will spend a lot of cashflow buying expertise to train Watson. In 2015, it paid \$2bn for the Weather Company and many more are likely to follow. While this may prove sensible investment in time, the amounts are significant and create a wide range of success/failure for the investor

Silicon offers investors perhaps the most tangible opportunity to participate. The addition of GPUs to server architecture for AI training is creating a significant boon for industry leader, Nvidia and its foundry partner, TSMC. Revenues from chips to data-centers grew 193% year on year (yoy) to \$240 million last quarter and industry estimates put GPU penetration below 1%. In time, this figure will likely grow to at least 10% based on commentary from the hyper-scale web companies, implying >10x unit growth opportunity.

Nvidia's momentum may therefore continue unabated for the next few quarters. With the stock on 24x (enterprise value, on net operating profit after tax for calendar year 2017), the stock can still attract buyers, assuming the gaming division (63% sales) maintains momentum.

While Nvidia and TSMC propel the GPU market with experts believing they have a one or two year advantage, Intel has formulated its response. The new Xeon Phi architecture is specifically designed for highly parallel workloads and in H2 2017 will integrate ASICs (Altera acquisition), 3D X-Point (proprietary memory) and Nervana (software allowing silicon programmability for AI). It has promised 10x outperformance of GPU solutions by 2020 based on this architecture.

With Intel stock currently unloved, a successful rebuttal of the Nvidia challenge could make it one of the best performing large cap tech stocks in the next three years. Intel is trading at the lower end of its 10-year relative PE (13x absolute PE) and margins are potentially depressed from reinvestment (Intel earns operating margins 10% points lower than peers, TSMC and Texas Instruments). History and most of the world's software (written for x86) is on your side, too.

It is hard to compare chips properly – all silicon companies have their preferred benchmarking which always shows their solution in a positive light. But it does seem like Nvidia may have left something of a pricing umbrella for Intel to compete with. GPUs are the only solution today but typically cost \$6,000 each. Adding four to a server for AI therefore adds \$24,000 to the cost compared to perhaps \$2,000 for the CPUs. This pricing gap may explain why Nvidia is valued at \$57 billion yet accelerator penetration is less than 1%.

Hyper-scale web companies may also chip away. Where cost will become prohibitive using third party solutions they have tended to invent their own (switches, routers, servers, storage, databases etc.). Indeed, Google has already invented a processor called Tensor while Amazon bought Anapurnalabs (an Israeli chip designer) in 2015. Google has also begun optimizing machine learning in recognition of the training intensity phase.

### Comfortably numb

AI heralds a new era as prior distinctions of human and computer expertise begin to fade. The impact will not be homogeneous or necessarily detrimental. In our view, early adopters can benefit where sufficient data already exists while some labor intensive business models may face serious challenges.

The Bank of England's Chief Economist, Andy Haldane, said the third machine age may result in 15 million UK job losses (50% of employment) and a further widening of inequality. His latter point is well taken and government interference at the will of the people should not be discounted. However, technological progress has generally resulted in higher standards of living across the population and AI shows remarkable promise in fields such as terminal disease.

Likely to become one of the defining themes of our age, investors can ill afford to ignore its impact on any and every industry which they assess.

### The AI basket

|        |  |
|--------|--|
| Intel  | 13x PE, depressed margins, entrenched technology and software, may dominate AI anyway                    |
| Nvidia | 24x EV NOPAT, trading idea as momentum continues for 2017, worried beyond that...                        |
| TSMC   | Nvidia's partner, also likely to manufacture for Google, Amazon, Apple etc. etc. 12.4x EV NOPAT          |
| Google | Frightening resource, willingness and ability, 20x EV NOPAT (incl. \$3bn losses "other bets")            |
| IBM    | Controversial given a troubled legacy but look like dominating the enterprise AI software space, 12x EPS |

Companies shown are for illustrative purposes only and do not serve as any recommendation to buy or sell.



# What does the rise of robotics mean for asset prices?

Robotics has moved from science fiction to industrial reality over the last few decades, with many asking which parts of the labor market robots will invade next. The pessimists paint a bleak picture of mass displacement of labor accompanied by increasingly wealthy robot owners. Yet the history of technological change offers a decidedly more sanguine prognosis. We are optimistic that, if handled well, the rise of the robots will create neither widespread joblessness nor rampant inequality in the long term. Even so, labor market disruption in the coming decades could still be sizeable. Investors will need to develop and maintain a roadmap of how the “second machine age” is likely to affect inflation, growth, interest rates and asset prices if they are to remain ahead of the game.



**Alice Leedale, CFA**  
Fixed Income Strategist,  
European Global Aggregate,  
Schroders

## Understanding the techno-pessimists

Both “techno-pessimists” and “techno optimists” agree that robotics and automation should boost the combined output of capital and labor. The controversy centers on how the gains are distributed. Techno-pessimists typically predict a period of intense job destruction, with the extra wealth created by higher productivity narrowly distributed amongst those who own the new technology. Moreover, they argue that any new jobs will be reserved for highly skilled tech-savvy workers, further skewing the income distribution.

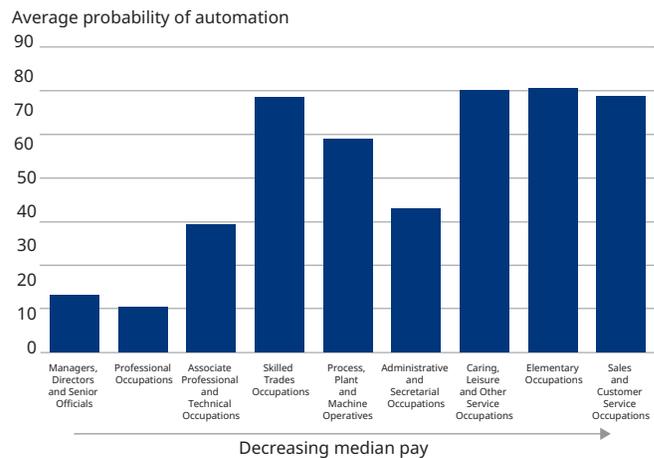
There is certainly evidence to suggest that the “fourth industrial revolution” will bring about significant labor market disruption. Studies by the Oxford Martin School have estimated that around a third to half of jobs in developed countries such as the UK, US and Japan could be at risk of automation, the majority in the low and middle skilled brackets.<sup>1</sup> This is reflected in work by the Bank of England applying the study’s approach to UK data (Figure 1).

Meanwhile, a recent theoretical study by the International Monetary Fund which modifies their standard macroeconomic model by adding robots as a form of capital, concludes that in virtually all scenarios where robots become more effective substitutes for humans, labor loses out to capital and inequality goes up.<sup>2</sup> At best, even if greater labor productivity does ultimately outweigh the effects of job destruction, it could be 20 years before wages start to recover.

<sup>1</sup> See for example “The Future of Employment: How Susceptible are Jobs to Computerisation?”, Carl Benedikt Frey and Michael Osborne, *Oxford Martin School working paper*, September 2013.

<sup>2</sup> “Robots, Growth, and Inequality”, Andrew Berg, Edward F. Buffie and Luis-Felipe Zanna, *Finance & Development*, vol 53, no 3, *International Monetary Fund*, September 2016.

**Figure 1: Low-paid jobs are more at risk from automation**



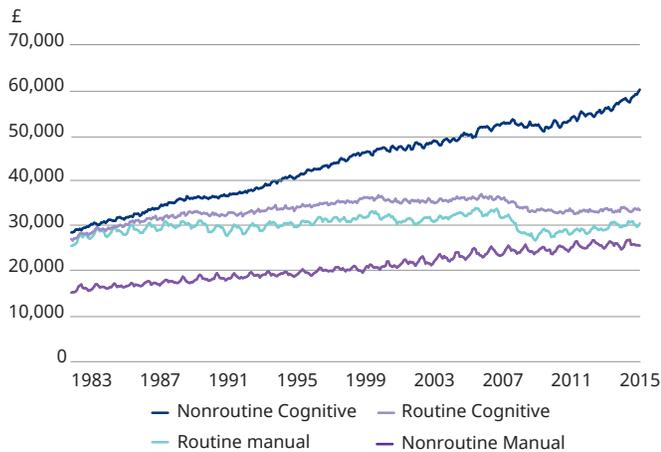
Estimated probability weighted by UK employment. Source: “Labour’s share”, Andy Haldane speech, Bank of England, November 12, 2015; UK Office for National Statistics data, Frey and Osborne (2013) and Bank of England calculations

## Automation becomes “blind to the color of your collar”

Rising inequality can have a negative impact on politics, often precipitating a lurch towards populism. Many would argue this is evident in the US, where recent decades have seen a “hollowing out” of manufacturing employment, driven by

technology and globalization.<sup>3</sup> But now the jobs that have been a fall-back option for many displaced manufacturing workers, predominantly low-skilled services roles such as retail and food preparation, could also be at risk from an invasion of robots. Furthermore, artificial intelligence is making rapid progress in “non-routine cognitive processing”, encroaching on knowledge-based professions such as medicine, law, and finance, which currently remain the preserve of highly-skilled white collar workers. Displacement here would be particularly disruptive for developed countries. In the US for example, non-routine cognitive-type work has created most of the jobs growth in the past 25 years (Figure 2).

**Figure 2: Jobs involving non-routine tasks have driven employment in the US**



Source: Federal Reserve Bank of St. Louis and US Current Population Survey, data as at March 2016

### Technology remakes work

On the face of it, the case for an extended period of labor market disruption does seem compelling. However, we are not convinced that in the long term the techno-pessimists’ dystopian vision of the future will win out. The history of technological change offers plenty of hope that technological revolutions can be successfully accommodated, even though there is typically a period of adjustment.

Indeed, over the course of the 20th century, not only has technology led to huge productivity improvements that raised living standards for all, we would argue that it has also created more jobs than it has destroyed, particularly via new markets and industries. As Deloitte points out in a 2015 study, the technology debate is unduly skewed towards job destruction partly because the creative process is inherently so unpredictable.<sup>4</sup> However, just because we cannot yet imagine the jobs of the future does not mean we should assume that there won’t be any.

There is room to be optimistic for other reasons. An automation revolution should bring a much-needed boost to productivity growth, raising trend growth rates. There is already some evidence of this taking place. Academics at the

<sup>3</sup> See for example “Rising Income Inequality: Technology, or Trade and Financial Globalization?”, Florence Jaumotte, Subir Lall and Chris Papageorgiou, *IMF Economic Review*, 61(2), June 2013.

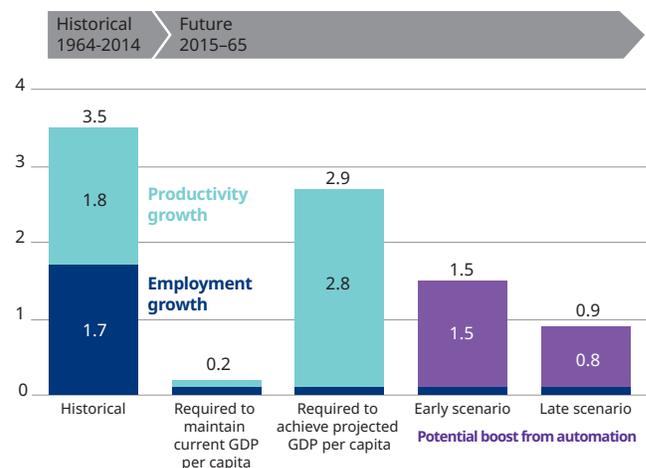
<sup>4</sup> “Technology and people: The great job-creating machine”, Deloitte, August 2015.

Centre of Economic Performance found that on average the use of robots contributed around 10% of the total growth in developed economies in the period 1993-2007.<sup>5</sup> Such a fillip would not only help reverse recent poor productivity growth, but could also offset downward pressure on trend growth from deteriorating demographics.

The Oxford Martin School and investment bank Citi estimate the headwind from demographics in advanced economies could be 0.2 percentage points per annum over the next 20 years.<sup>6</sup> But if forecasts by McKinsey prove correct, that would be more than made up for by productivity gains associated with automation. Looking at a larger group of countries (the G19 group plus Nigeria), the management consultant predicts that the “second machine age” could boost economic growth by 0.8-1.4 percentage points annually until 2065, depending on the pace of adoption.<sup>7</sup> Clearly, at that rate, automation could go quite a long way to meeting longer-term growth expectations for these countries (Figure 3).

**Figure 3: The next industrial revolution could help offset “demographic drag”**

GDP growth for G19 and Nigeria (compound annual growth rate %)



Source: “A future that works”, McKinsey Global Institute, January 2017, The Conference Board Total Economy database and the United Nations Population Division

### The effects of automation will be uneven

If the adoption of automation and robotics in an economy helps to offset deteriorating demographics, it could challenge the conventional wisdom that developing countries with large, young populations have a significant demographic advantage over developed economies. This is particularly pertinent given developed economies are more likely to have the resources and expertise to be early adopters of robotics and automation (although China and South Korea, where robots are in high demand, are major exceptions<sup>8</sup>).

<sup>5</sup> “Robots at Work”, Georg Graetz and Guy Michaels, *CEP Discussion Paper No. 1335*, March 2015.

<sup>6</sup> “Technology at Work v2.0: The Future Is Not What It Used to Be”, Oxford Martin School and Citi, January 2016.

<sup>7</sup> “A future that works: automation, employment and productivity”, James Manyika, Michael Chui, Mehdi Miremadi, Jacques Bughin, Katy George, Paul Willmott and Martin Dewhurst, McKinsey Global Institute, January 2017.

<sup>8</sup> “World Robotics 2016: Industrial Robots”, International Federation of Robotics.

Furthermore, if unskilled labor does become less attractive compared to robots, then the growth aspirations of many lower income emerging economies could be called into question. Countries such as India and the Philippines may find that their “demographic dividend” of cheap labor no longer provides a major competitive advantage.

### Smoothing the transition

Both the history and the potential for productivity improvements suggest to us that the long-term benefits from the second machine age will be substantial. However, in the shorter term there is clearly a risk that automation initially raises joblessness and inequality before labor markets have time to adjust, particularly if the pace of technological innovation and subsequent adoption is rapid. In the absence of a proactive public policy response there could be widespread social dislocation. Clearly, policymakers have an important role to play in ensuring that things don’t get worse before they get better.

Potential solutions to rising “techno-inequality” could be direct, including large-scale government redistribution schemes, such as a universal basic income or negative income taxes, or could be indirect through public works programs, better education and training, or even wider distribution of capital. However, none of these options are free from difficulties. Many are controversial and most are expensive: the owners of the robots would likely be required to pay higher taxes to help compensate those who have lost out.

### The outlook for investors

The most obvious macroeconomic consequence of an automation revolution is disinflation, as technology typically increases productivity and decreases the cost of goods and services on a quality-adjusted basis.<sup>9</sup> Moreover, if the techno-pessimists are right, weak consumer spending means overall demand could rise less than supply. In this case we would expect even more downward pressure on inflation and for monetary policy to stay accommodative for longer.

Other conclusions are less clear. Given the huge uncertainties, we prefer to look at a range of potential outcomes between two extremes: “techno-dystopia”, in which high unemployment and rising inequality prevail, and a “positive productivity shock”, where automation facilitates a widely-distributed productivity boom (see table to the right). Of course, sequencing matters: we may shift closer to techno-dystopia first before policymakers and labor markets have time to adapt. To assess how events are unfolding, we will

<sup>9</sup> Although this is not often captured in official inflation data: see “Is inflation overstated?”, Investment Horizons, Issue 5, 2016.

be monitoring both the advancement of the technological frontier and the pace of adoption of new technology into the mainstream. Labor market changes and income distribution markers will also be closely watched.

From an investment perspective, techno-dystopia represents a world where many of the issues that have been facing the global economy – weak demand, subdued inflation, low wage growth and inequality – are intensified. Developed world bond yields would likely fall further, despite deteriorating public finances, with inflation premia becoming structurally impaired. Carry trades, particularly corporate credit, would remain in vogue, although flare-ups of populism and political uncertainty could see risk assets suffer periodically, especially in emerging markets. Interestingly, we believe developed equities could still perform reasonably well in this scenario as the capital share of income should rise further.

If the future is brighter, and automation helps the global economy emerge from its current malaise, developed bond yields should finally break out upward from their five-year range, and improved sentiment could even drive buoyant, demand-driven, inflation. In a sense it would represent an amplification of the nascent “reflation trade” we have witnessed recently. This should be a very good environment for developed world risk assets, with commodities and inflation-protected assets also doing well, in our view. One could also surmise that this may warrant an underweight (or short) position in developed world bonds.

| Macro Driver/Asset Price     | Techno-dystopia   | Positive Productivity Shock |
|------------------------------|-------------------|-----------------------------|
| Trend growth rate            | Moderately higher | Higher                      |
| Consumer demand              | Weaker            | Stronger                    |
| Wage growth                  | Weaker            | Stronger                    |
| Fiscal dynamics              | Deteriorate       | Improve                     |
| Inflation                    | Lower             | Initially higher            |
| Monetary policy              | Looser            | Tighter                     |
| Higher long term real rates  | Remain low        | Rise                        |
| Higher long term bond yields | Remain low        | Rise                        |
| Sovereign risk               | Prefer DM over EM | Prefer DM over EM           |
| Equities                     | Prefer DM over EM | Prefer DM over EM           |

Source: Schroders. The views and opinions stated above are those of the Schroder Global Fixed Income team and are subject to change over time.

## Conclusion

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It is clear that robotics and automation will see old jobs disappear and new ones emerge. Whether this leads to a new age of prosperity or a “techno-dystopia” of mass un- and under-employment, glaring inequality and widespread social upheaval is not clear at this stage. However, we would argue that in the long term history is firmly on the side of the optimists. Over the last 200 years, more new jobs have been created than destroyed by technological progress, and mankind has largely successfully adapted to some of the most profound technological changes ever seen. Moreover, any boost from automation could be particularly helpful for more developed,

aging economies. Developed market equities may be a good way to ride the technology wave whatever happens, but investors need to be aware that the outlook for bonds and other assets will depend on how the new machine age unfolds. There remains the risk of short and medium term labor market disruption and concerns about inequality may linger for some time. Investors will therefore need to keep a close eye on how policymakers and individual beneficiaries of automation rise to the challenge of spreading its financial benefits widely throughout society.



# Fixed Income Relative Value: a timely revisit to a truly unique strategy

**Fixed Income Relative Value (FIRV) is back on investors' radar screens thanks to an improving opportunity set following the election of Donald Trump and the perceived baton-pass from monetary policy preeminence to fiscal policy primacy. As market participants more tactically adjust their portfolios in response to this and other market factors, this creates arbitrage opportunities that only a select group of investors can potentially source. What makes FIRV special is that, unlike other fixed income strategies, there only need be identifiable differences and mean-reversion between like securities to pursue total return. While the direction of yields matters much less for FIRV strategies, their performance historically improves with higher rates.**



**David Gottlieb**  
Senior Portfolio  
Manager,  
Alternative  
Rates Strategies,  
Schroders

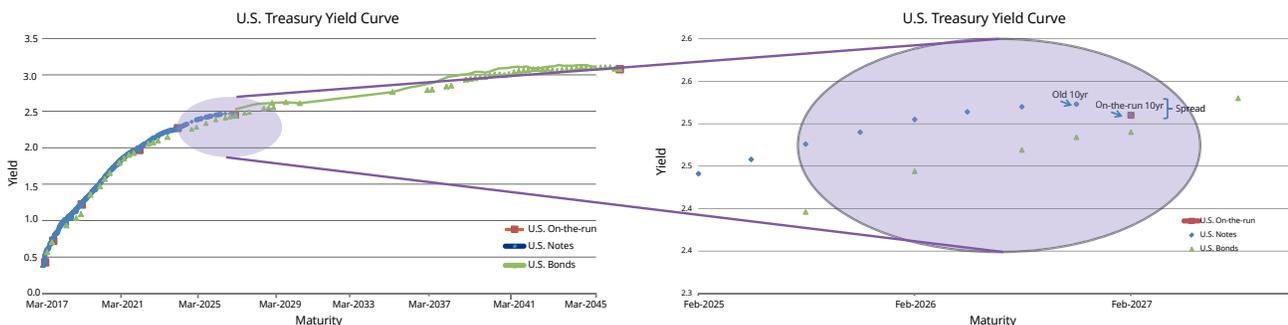
## Why Relative Value: An introduction to a timely, niche strategy

As one of the longest standing hedge fund strategies, FIRV – which is a 'market-neutral' or an 'absolute return' strategy – can utilize a broad set of trade constructions intended to exploit valuation discrepancies between fixed income securities. These constructions can include yield curve arbitrage, swap spread arbitrage, mortgage arbitrage, volatility arbitrage, and credit arbitrage. To generate returns, a portfolio is constructed with the intent of exploiting specific market inefficiencies and pricing anomalies along the yield curve. What investors generally find attractive about FIRV is that it can offer positively skewed returns with little correlation to other asset classes. This is due largely to the fact

that the direction of yields matters very little: it's the inherent idiosyncratic differences in relationships between comparable or 'like' securities which drive performance with this approach, and these can be created just by higher volumes and wider interest rate ranges.

To help illustrate this point, consider a 'standard' yield curve reflected in Figure 1. From a high-level perspective, the curve appears relatively uniform. However, upon a closer look (Figure 1b) the same yield curve appears much less uniform as securities with similar maturities, but different issue dates, coupons and liquidity profiles trade with different yields. These anomalies can exist in liquid markets due to market participants having different mandates, market objectives and liquidity needs.

**Figure 1a, b: Relative Value is both Art and Science, requiring a trained eye to implement**



Source: Schroders. For illustrative purposes only. On-the-run generally refers to the most recently issued U.S. Treasury bonds or notes of a particular maturity. Off-the-run generally refers to securities that have been issued before the most recent issue and are still outstanding.

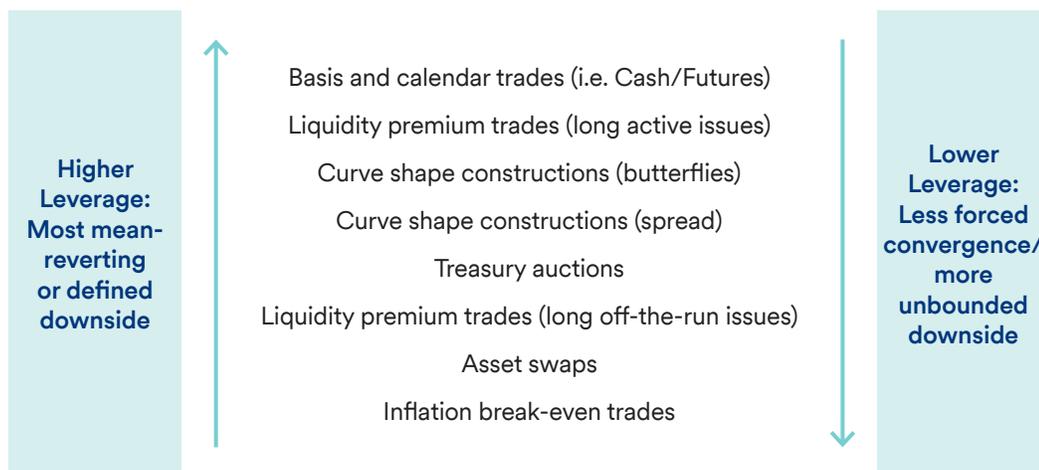
In our view, identifying cheap and rich securities is only the beginning of our process. The difficult part is deciding which pricing discrepancies have near-term catalysts to move these valuation anomalies back in line. Historically, known catalysts have taken the form of:

- Treasury issuance (auctions/maturity of debt)
- Futures cycles (delivery and calendar rolls)
- Issues rolling from one maturity basket to another (on-the-run/off-the-run)
- Federal Reserve meetings/policy/balance sheet (changes in interest rate policy)
- Asset swaps (the yield spread between UST and matched-maturity swaps)

### Leverage and FIRV: An important instrument...if used properly

Because the mispricings that FIRV is attempting to exploit are smaller in nature, leverage is a component of this approach. As described above, the approach is not attempting to lever 'carry', but is intended to use leverage to reduce market risk and replace it with spread risk. The amount of leverage used is primarily dependent on the nature of the opportunity, and the proximity and reliability of the catalyst that is expected to return a perceived mispricing to fair value. In the case of a judicious FIRV approach, the amount of leverage is not determined by seeking to achieve bigger 'bets' or a higher return. The strategy is more likely to employ higher levels of leverage in more tightly constructed trades which typically have the lowest level of volatility. Cash vs. futures trades represents the tightest trade constructions and the purest form of arbitrage which would likely have the highest level of leverage applied. With the types of recurring investment opportunities mentioned previously, we can visually see that the amount of leverage applied and risk tend to go in opposite directions.

Figure 2: A typical sliding scale illustration of how varying degrees of leverage may be used within an FIRV strategy



Source: Schroders. For illustrative purposes only. Strategies and technique opinions herein are those of the author, and do not reflect any actual portfolio. Butterflies refer to a strategy that seeks to exploit the relative-value of the 'belly' versus the 'wings' of a three-pronged position. These relationships are less market-directional, especially when deployed using narrower maturity construction.

Determining and subsequently applying the right amount of leverage to each opportunity and trade construction is one of the key investment and risk management decisions within the FIRV strategy.

### Why Relative Value Now: Trump and Central Bank Limits as Game-Changers

The press has written extensively about the changes in market liquidity under the Dodd-Frank (Wall Street Reform and Consumer Protection Act of 2010) and Volcker Rule therein (prohibits a bank or institution that owns a bank from materially engaging in proprietary trading), both of which have had a profound impact on the fixed income markets. Primary Dealers in the U.S. Treasury market are executing a smaller share of daily trading activity, proprietary trading desks largely no longer exist, and there has been a large increase in the demand for the liquidity of futures contracts and other off-balance-sheet instruments. All of these factors have led to structural changes in position sizes and pricing relationships, resulting in what we consider attractive

arbitrage opportunities – despite historically low yields. The results are perhaps most striking in swap spreads which have gone and stayed negative in long intermediate treasuries. While it is unknowable what regulatory changes may be in store in the new administration, anything that fundamentally changes the ability of banks/dealers to hold more treasuries on their balance sheet for liquidity purposes may be a game-changer for the current level of swap spreads.

Another game-changing result of the election is in the level of term premium which can be defined in many ways but which we use to represent the 'appropriate' steepness of yield curves. In a QE/Central Bank balance sheet- dominated environment, term premium becomes compressed as central bank purchases depress the market level of interest rates. When the baton is perceived to be passing from monetary to fiscal policy primacy and the market perception of a more 'capitalism friendly' administration, we can see how markets react, as previously depicted in the term-premium chart in Figure 1.

Figure 3. An example of how term premium reacts to market events



Source: Bloomberg 1/30/17. For illustrative purposes only. Term premium refers to the extra yield investors tend to expect to hold on to a long-term bond in place of a series of short-term bonds. The Crump & Moench 10-year Index is a widely used proxy for term premium in the US Treasury market.

What the above suggests to us is that the last five years of central bank balance sheet expansion brought term premium negative (which the Fed defines as how much lower 10-year yields are because of their activities). While term premium jumped to a positive number after the election, we can see that we are well over 100bp away from levels that existed

just two years ago, and almost 200bp away from levels that existed five years ago. Simply stated, higher term premium historically has meant higher levels of long-end rates and higher levels of volatility, a favorable environment for a relative-value approach that can potentially thrive during more volatile periods.

## Conclusion

Some of the more recent opportunities are likely a function of the new market regime which includes less sell-side capital, an increased demand for liquidity, and tighter balance sheet requirements. The result of stressed dealer balance sheets may be larger, recurring idiosyncratic dislocations.

The existence of opportunities for FIRV strategies are merely the result of market participants with different mandates and investment restrictions. As those participants adjust their portfolios more actively, it creates opportunity. FIRV strategies, therefore, can be deployed when there are identifiable differences in yields between like securities, potentially leading

to non-correlative returns. The path of yields, for the most part, matters much less, making this approach a potential complement to an asset allocation model.

Of course, FIRV can be a complex investment strategy; one in which only a few market participants can skillfully engage. However, given the variety of factors at play within the fixed income market, we believe now may be the right time to consider a dedicated relative-value fixed income approach, especially for those investors seeking a truly diversified source of alpha potential.

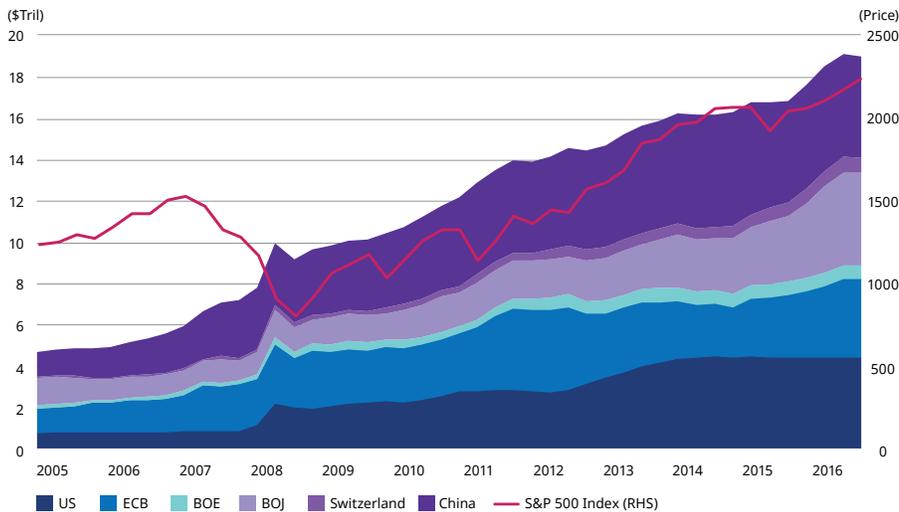


# Quick insights: Investors should prepare for liquidity inflection point

Global central banks have undertaken arguably the largest financial experiment in history as a response to the financial crisis.

Traditionally, the role of central banks was to manage inflation by adjusting the overnight rate, the interest rate which large banks use to borrow and lend from one another in the overnight market. However, to lessen the effects of the economic recession, central banks lowered the overnight rate with the goal of influencing the amount of money and credit in the economy. It was hoped that this would then encourage banks to lend, leading to an expansion of economic activity.

Figure 1: Value of assets on central bank balance sheets vs. the S&P500 Index



Source: Bloomberg as of December 31, 2016. Past performance is no guarantee of future results.

## Unintended consequences

With short-term interest rates at zero and no tangible impact on the economy, central banks resorted to unconventional policy measures including quantitative easing and negative interest rates. The unintended consequence of these actions was the reduction in the supply of financial assets, which forced investors into riskier securities such as equities and corporate bonds (see the graph above).

The debate as to the effectiveness of these policies will be dissected and studied ad nauseam by economists

and academics for years to come. However, what can be ascertained at this point, 10 years since the financial crisis, is that the impact on financial asset prices appears to have been more significant than on lending or the real economy i.e. productivity, wages, inflation, etc. This is seen in the chart on the next page.

US equity markets trade at all-time highs and corporate, investment grade and high yield bond valuations are at some of the most expensive levels we have seen since the global financial crisis.



Neil Sutherland, CFA

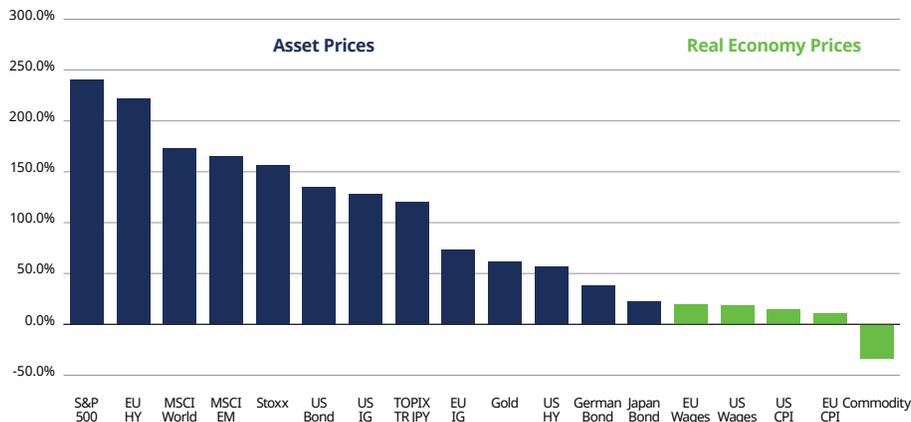
Fund Manager, US Multi-Sector Fixed Income, Schroders



Stephen Sciaraffo

Associate Product Manager, Fixed Income, Schroders

**Figure 2: Total return in local currency since January 2009**



Source: Goldman Sachs; as of February 28, 2017. Past performance is no guarantee of future results. Actual results would vary.

One conclusion we could draw from this is that the divergence between financial assets and economic prices, as a result of this unprecedented monetary policy, has enriched the wealthier households who disproportionately own stocks or other financial products. This is partially responsible for the rise of populism and anti-globalization sentiment that we have witnessed recently in politics.

Excessive stimulative monetary policy is transitioning towards more fiscal levers, and a modest tapering of central bank balance sheets in the US and Europe appears to be underway. Additionally, inflation across most of the developed markets appears to have troughed, which restricts central banks’ ability, economically and politically, to continue to be accommodative.

**Volatility to rise**

Although central bank balance sheets and liquidity will remain large by historical standards, it is the decelerating rate of balance sheet expansion that is significant for markets as we believe this could result in heightened capital market volatility.

It is our belief that we have reached an inflection point in liquidity. While central banks have done a great job in suppressing volatility and encouraging investors to extend further out the risk spectrum, our view is this narrative will be challenged as central banks step back from their accommodative monetary policies.

Additionally, political risk, particularly in the developed world, is prevalent and will be another source of increased volatility.

**Conclusion**

As liquidity ebbs, complacency remains high and valuations approach the most expensive levels in a number of years. We believe investors should be cognizant of the level of risk within their fixed income portfolios, as the opportunity cost of not being invested aggressively in a bond portfolio is as low as it has been in a number of years. As such, we believe it is prudent to maintain ample liquidity in portfolios in order to take advantage of market dislocations and invest capital when valuations warrant an allocation.

Flexibility and proper diversification will continue to be critical components of a bond portfolio when navigating through periods of increased volatility. Expect the unexpected, which is after all what drives markets, and position portfolios to be more liquid and opportunistic.



# Extracting income: making equity work harder for your plan

The majority of institutions are faced with the challenge of making contractually obligated payments to their constituencies at a time when yields remain depressed. Pension plans pay benefits to retirees, endowments spend to support a school’s capital budget and foundations disburse cash in support of their unique mission. High quality natural income is desired to offset a 5-10% drag on assets each year. In this article, we explore this under-appreciated challenge through the lens of public pension plans, and demonstrate how they might benefit from the high income available in a covered call equity portfolio.



Seth Finkelstein, CFA  
Portfolio Solutions  
Manager, Schroders

## Current state of the State

In spite of a nine year bull market, many public and union pension plans remain challenged by the need for high returns to improve funding status, and for current income to cover massive benefit payouts. How can a sponsor reconcile these competing objectives? Traditional answers fall short. We’ve identified a potential solution that has been right under our nose for years: an income-focused covered call equity strategy. Such a solution can convert the anticipated long-term capital appreciation of equity into high and sustainable short-term income which may be able to address the burden of benefit payments while keeping the plan fully invested in equity.

For public and union pension plans, funding status is but one dimension of the fiscal challenge they face. The true challenge is one of paying hard dollar pension benefits, as they come due, without sacrificing the ability to rebuild funding levels and achieve the Expected Return on Assets (“EROA”) over time.

The table to the right provides statistics for the top 160 public pension plans through June 2015 as compiled by the Center for Retirement Research at Boston College. Despite being actuarially smoothed, plan funding levels do tell us one thing: the need for high returns will continue to persist, in spite of this being the ninth year of an equity bull market. We can also observe that plans prudently aim to improve their funding status through a growth-heavy, diversified portfolio and reasonably high contributions.

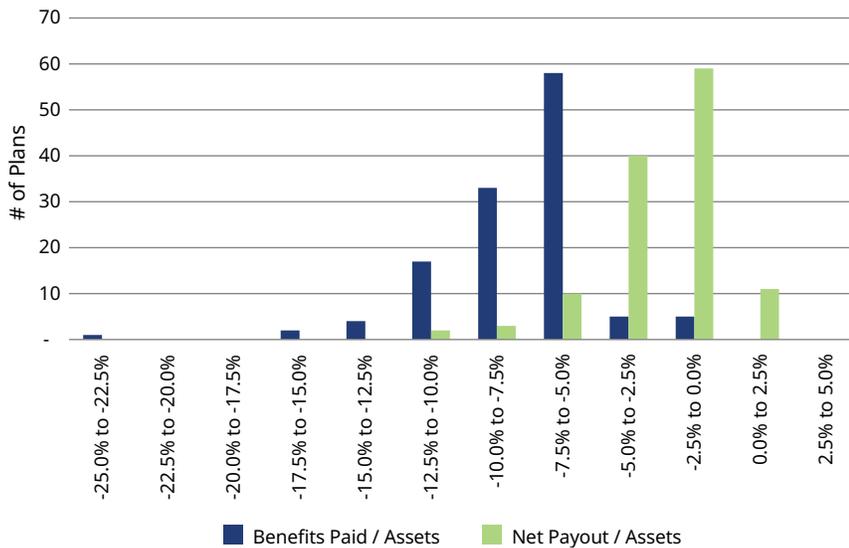
In terms of benefit payments, we found that 9 out of 10 plans pay out more cash in benefits than they make in contributions, putting them in a net outflow position that imperils their long-term viability. Across the plan universe, the average benefit payment is approximately 8% of assets, offset by 6% in contributions, resulting in an average net payout of 2%.

Figure 1: Center for Retirement Research, Boston College

| Public Fund Universe (FY 2015) |                |
|--------------------------------|----------------|
| AUM                            | \$2.8 Trillion |
| # of Plans                     | 161            |
| Average Funding Ratio          | 72%            |
| Expected Return on Assets      | 7.5%           |
| Contributions (as % assets)    | 5.7%           |
| Benefits Paid (as % assets)    | -7.8%          |
| Net Payout (as % assets)       | -2.1%          |
| Equity                         | 52%            |
| Fixed                          | 27%            |
| Cash                           | 5%             |
| Alternatives                   | 21%            |

Source: Schroders, Public Plan Database, Center for Retirement Research, Boston College, most figures as of June 30, 2015. For more information, visit <http://publicplansdata.org/>

**Figure 2: Astonishingly wide spread between benefits paid and net payout across plans**



Source: Schroders, Public Plan Database, Center for Retirement Research, Boston College, most figures as of June 30, 2015.

Importantly, plans that are cashflow negative are often serving a retiree population that is growing in number and longevity. High net outflows are not (on their own) an issue, since the ultimate goal of a pension is to pay benefits. However, for plans that are below 100% funded, the high outflows strain the funding level further. Contributions are large but are made to improve funding and are not ring-fenced or dedicated for benefit payments. For this reason we believe the average 8% in absolute benefit payout ratios represents the true burden plans endure.

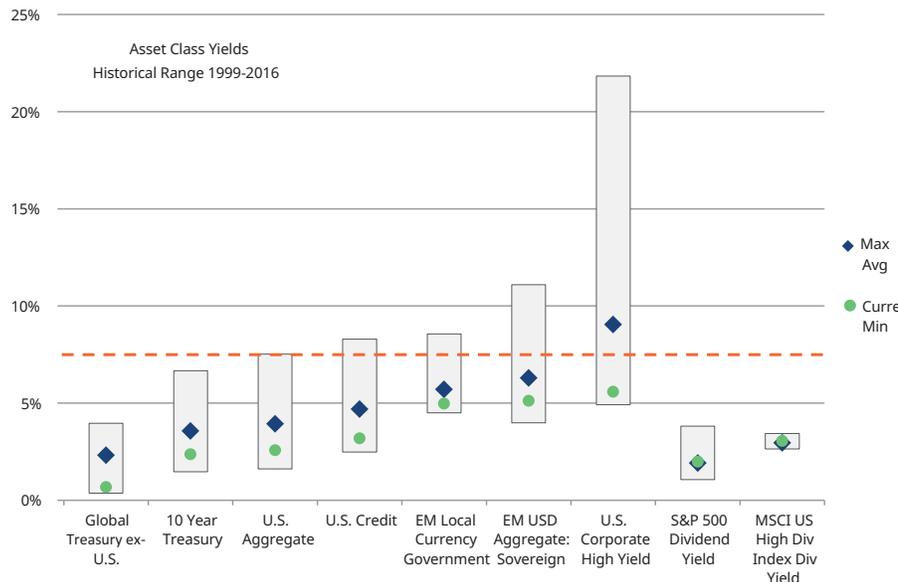
income-producing assets or periodically sell down portions of their liquid holdings. From looking at Figure 3, we observe that the average yield across a broad range of fixed income and equity assets is in the 4-5% range. As such, it comes down to periodic asset liquidations to bridge the gap between investment income and the cash needed to pay benefits.

**Making benefit payments the old fashioned way**

Sponsors fund benefit payments principally by drawing on two sources. They can harvest the cash flows from various

Systematic liquidations can present challenges given the lack of flexibility in their scale and timing. However, sponsors aim to neutralize the timing effects by using asset sales as a rebalancing mechanism. Additionally, some plans hold a short-intermediate term cash reserve fund (5% allocation on average) that they populate by contributions, though the opportunity costs of such allocations are not insignificant.

**Figure 3: Yields are sparse and lag benefit payout ratios and plans' expected returns (7.5% orange line)**



Source: Schroders, Bloomberg and Bloomberg Barclays Point through December 31, 2016. Past performance is no guarantee of future results. Yields based on widely used index proxies for each respective asset class. Actual yields and results would vary.

We believe plans would prefer more investment income and less liquidation. The first action to consider would be to increase the fixed income allocation, especially considering plans hold only 27% on average. Recent years have seen sponsors diversifying into an ever expanding array of income assets, such as private credit, direct lending, CLOs and infrastructure debt to name a few. While adding more fixed income would produce greater distributable income, it would simply be swapping one problem for another. Moving assets from equities to bonds may rob a plan of the equity-like returns necessary to meet its EROA (7.5% on average). Moreover, if the change were large enough, it might require the plan to ratchet down its expected return assumption, an action sponsors would prefer to avoid.

**Finding precious income in an unlikely place: your equity exposure**

Covered call writing on an underlying equity portfolio is a time-tested, liquid and transparent way of generating income

through premiums from the sale of call options. At its most basic, covered calls are call options sold on an underlying asset when the investor owns the asset. The covered call seller, also known as the option writer, forgoes some or all of the upside price appreciation above a pre-specified level (the strike price) in exchange for receiving an up-front payment called the option premium. The short-term income comes at the expense of unconstrained upside potential.

One can think of covered call writing as a type of return conversion process; the call writer in effect converts the long-term capital appreciation potential of equities into short-term cash flow, yet still potentially earns equity-like total returns over market cycles. We believe such a strategy, when structured to focus on income generation, can help square the conflicting pension objectives of long-term growth and short-term income. Achieving this by drawing on the existing equity allocation opens the door to healthy incremental cash flow.

**Figure 4: Transforming equity into a high income asset class**



Source: Schroders. The chart is meant to illustrate how the return outcomes of an equity investment can be changed from call over-writing in a way that limits the upside in exchange for short term income. Does not reflect live prices or live performance. No investment strategy or technique can offer a guarantee of future results.

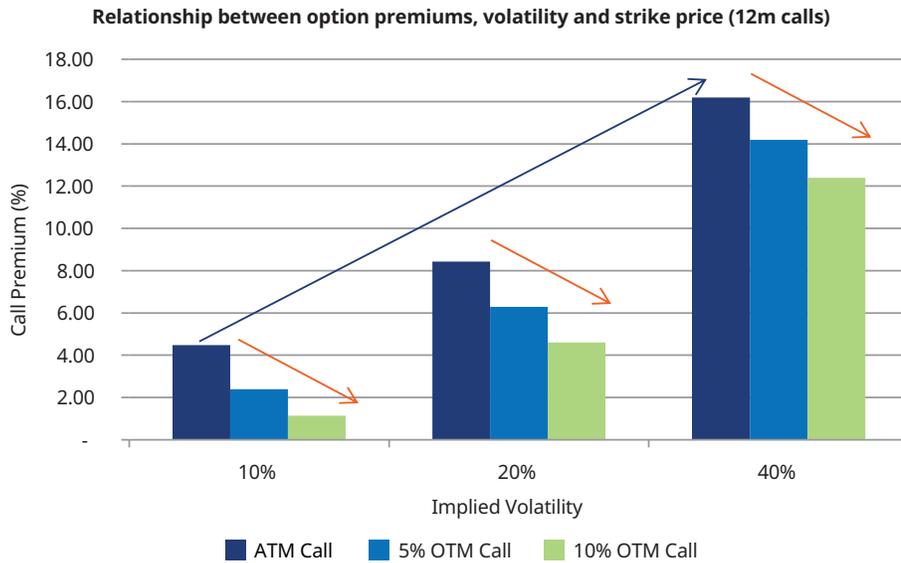
It’s important to note that there are a variety of covered call, and other option writing strategies. For purposes of our research, we compare and contrast strategies based on the degree of equity market sensitivity (“beta”) and the income generated. Strategies that focus more on improving risk-adjusted performance tend to have lower beta, whereas strategies that focus on maximizing equity market participation while delivering income tend to have higher beta.

**The key attributes of equity options strategies: volatility and strike price**

The two main factors impacting option premiums are the implied volatility of the asset and the option strike price.

Implied volatility, which is the market’s forecast of the volatility of an index or stock over the coming period, is positively related to premiums. The kind of covered call strategy that has an investor forego all upside is known as selling “At-the-Money” (ATM) options – these options have strikes equal to current market value (adjusted for dividends). “Out-of-the-Money” (OTM) calls have strike prices that are above current market levels. We can observe from Figure 5 that call premiums are inversely related to the strike price (orange arrows) – higher strike prices on calls generate less premium, but allow for more equity upside participation (blue arrow). ATM strikes offer the greatest premium, but wholly limit upside participation. We can think of the 10% OTM option as allowing for 10% upside capture.

**Figure 5: Volatility and strike prices drive call premiums**

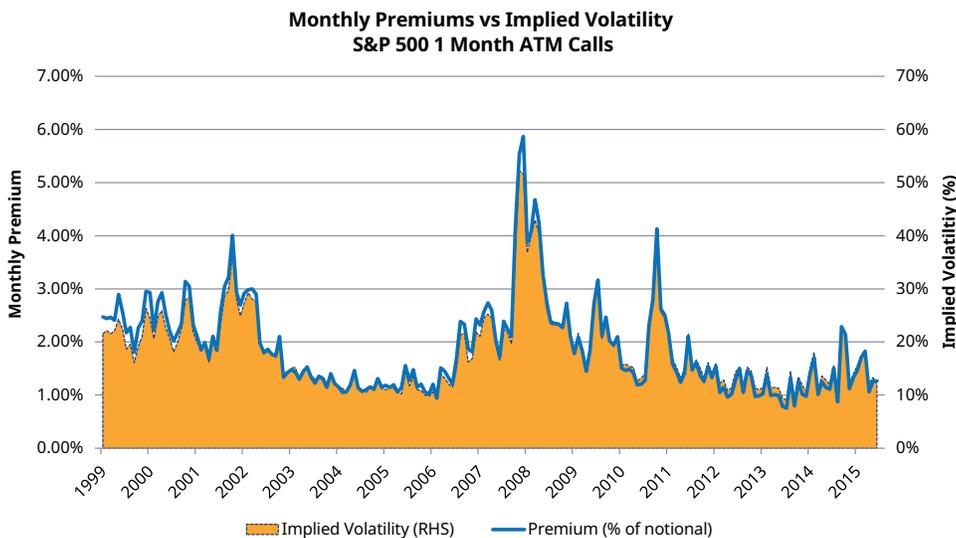


Source: Schroders. For illustration only. The chart is meant to represent the relationship between option premiums, strike prices, and volatility. Does not reflect live prices or live performance. The Black-Scholes formula was applied assuming a risk free rate of 100 bps p/a and a dividend yield of 0%. Past performance is no guarantee of future results.

Many investors are surprised by the size of the premiums on offer in option markets when expressed as a percentage of the underlying asset's value. According to the Black-Scholes option pricing formula used in Figure 5, we can potentially earn an 8.42% premium in exchange for giving up all upside returns for one year by selling a 12 month at the money option with an implied volatility of 20%. If volatility were 40%, the premium would jump to 16.20%. That is a theoretical price. In practice we historically have seen the same dynamic in terms of a high correlation between volatility and option premiums.

Figure 6 shows historical implied volatility and call premiums for 1 month ATM calls on the S&P 500. We see that implied volatility (right hand scale/orange shading) fluctuated over time, and has tended to be highest in market sell-offs. This suggests that one can earn greater gross premiums from selling the same amount of call options in times of high volatility. This is an attractive feature that no other traditional income strategy we discussed herein carries. For instance, the coupons on existing high yield bonds do not increase as markets fluctuate; when markets decline, yields on the bonds go up, but that is enjoyed by the marginal buyer not the present owner.

**Figure 6: Call premiums reliably rise when market volatility rises**

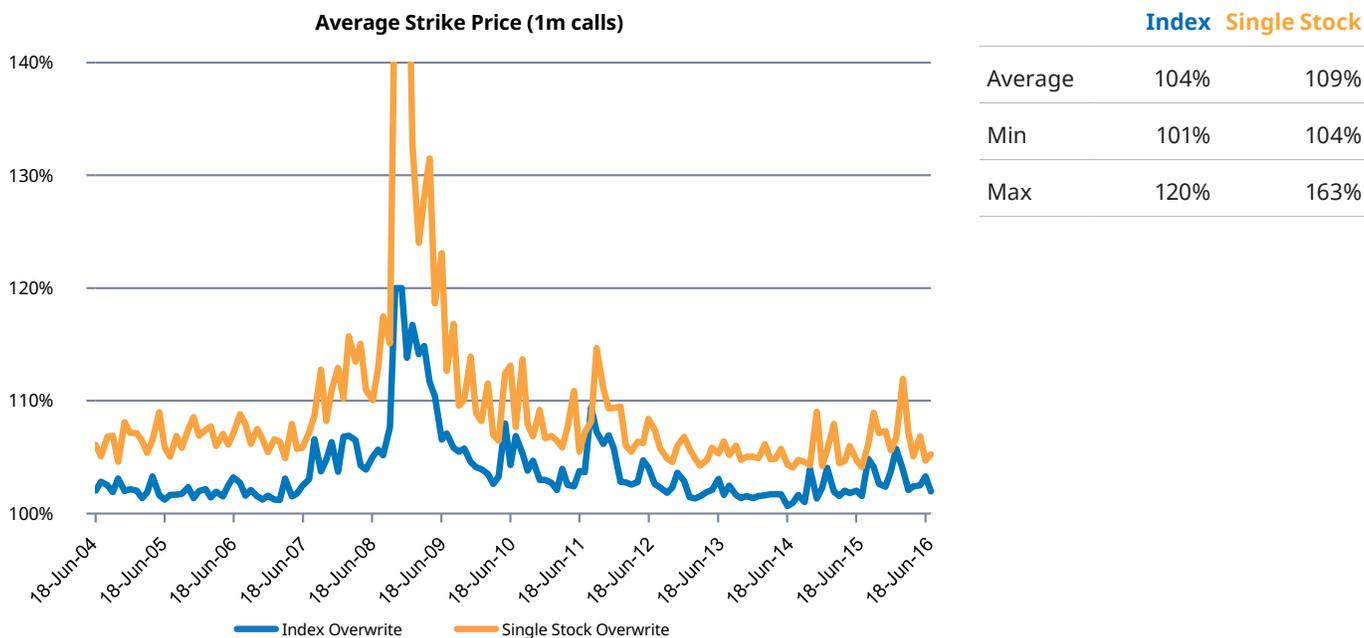


Source, Schroders, Bloomberg, options data from multiple counterparties. Data reflects simulated historical scenario results. For illustration only. Each data point represents the option premium and implied volatility for a contract that expires 1 month hence. For example, the 2.46% premium and 22.52% implied vol on 2/29/00 is the premium a buyer would pay for a 1 month option expiring at the end of March. No management fees are assumed, which would have impacted results. Actual results would vary. Past performance is no guarantee of future results. There could be no assurance that any transactions actually performed in a managed portfolio could have been executed at the times or prices used for the purpose of calculating the performance in the simulation.

Most covered call approaches focus on selling either index options or options on individual stocks. For a given strike price, index options generally offer lower premiums. Given the higher volatility of single stocks, an investor may earn the same level of income by writing fewer calls at the same strike price, or the same level of income by writing calls with higher strike prices. Single stock overwriting generally offers more yield because it comes with greater idiosyncratic risk, or the potential for any number of options to expire in the

money (thus, harming the P&L of such a strategy). This risk may be offset by diversifying across many discrete options on individual stocks, with different strike prices and different maturities. Figure 7 makes clear the considerable differences in strike price (and thus premium) for an index and single stock overwrite approach both targeting 7%. The single stock overwrite, with its higher strike prices, permits greater upside participation.

**Figure 7: Different equity upside capture comes from persistent differences in strike prices**



Source, Schroders, Bloomberg, options data from multiple counterparties. For illustration only. Backtest results from June 30, 2004 through June 30, 2016. Data reflects simulated historical scenario results for two strategies: 1) index covered call strategy using S&P 500 options and 2) single stock strategy which goes long the 200 largest stocks in the S&P 500 and systematically writes call options on the underlying stocks once per month, mid-month. The backtests both solve for a 7% target yield which is derived from the combination of equity dividends and options premia. Options are assumed to be settled in cash. Transaction costs of 100 bps in volatility points are assumed. No management fees are assumed, which would have impacted results. Assumes base currency of USD, dividends reinvested and unhedged foreign exchange. Past performance is no guarantee of future performance. There could be no assurance that any transactions actually performed in a managed portfolio could have been executed at the times or prices used for the purpose of calculating the performance in the simulation.

### Comparing covered call strategies

How should an investor go about choosing among options strategies when their goal is to maximize income and retain or grow portfolio value? We can divide the universe of option overwriting strategies (including cash-secured put writing) into two main types:

**Risk-adjusted strategies** – these seek to maximize risk adjusted returns by harvesting the volatility risk premium (i.e., the return premium for providing “insurance” as a seller of options). They swap a portion of the exposure to the equity risk premium for the volatility risk premium by selling closer to the money call options and/or put options. “Put writing” is a strategy similar in objective to covered calls with the difference being the mechanism to earn income is to sell put options and hold cash, but not holding equity and selling calls. We believe the lower beta to equity makes these risk-adjusted strategies compelling portfolio diversifiers rather than true

equity replacement vehicles. To wit: low volatility equity searches have often featured option writing strategies as one of the main alternatives.

**Equity-oriented strategies** – these seek equity-like returns with the ability to support substantial cash payouts over long periods of time. The strike prices on the calls are far out-of-the-money, allowing more of the upside to be retained over time.

To better frame the expected outcomes for each type of strategy, we compare the results in Figure 8 for 1) a passive index option-based covered call index (CBOE BXM index); 2) a similar passive put writing index (CBOE PUT index) (“Risk Adjusted strategies”) and 3) a rules-based backtest of a single stock overwriting approach on a subset of the S&P 500 (“Equity-oriented strategy”). While an extended period is shown in the example on the next page, we recommend an investor examine the same results over different time periods or market cycles.

**Figure 8: How “equity-like” is a strategy should be a key consideration**

|   | Equity-Like      |                                  | Risk-Adjusted        |                      |
|---|------------------|----------------------------------|----------------------|----------------------|
| June 2004 – June 2016                   | S&P 500 TR Index | Simulated Single Stock Strategy* | CBOE Buy-Write (BXM) | CBOE Put-Write (PUT) |
| <b>Annualized Return</b>                | 7.4%             | 7.9%                             | 4.9%                 | 6.7%                 |
| <b>Annualized Volatility</b>            | 16.8%            | 15.9%                            | 11.7%                | 11.8%                |
| <b>Return/Risk Ratio</b>                | 0.44             | 0.50                             | 0.42                 | 0.57                 |
| <b>Beta to S&amp;P 500</b>              | ---              | 0.95                             | 0.63                 | 0.62                 |
| <b>Max Drawdown (in any 12m period)</b> | -43.9%           | -41.1%                           | -32.1%               | -29.8%               |

Source, Schroders, Bloomberg, options data from multiple counterparties. For illustration only. Backtest results from June 30, 2004 through June 30, 2016. \*Data reflects simulated historical scenario results for a strategy which goes long the 200 largest stocks in the S&P 500 and systematically writes call options on the underlying stocks once per month, mid-month. The backtest solves for a 7% target yield which is derived from the combination of equity dividends and options premia. Options are assumed to be settled in cash. Transaction costs of 100 bps in volatility points are assumed. No management fees are assumed, which would have impacted results. Assumes base currency of USD, dividends reinvested and unhedged foreign exchange. Past performance is no guarantee of future performance. There could be no assurance that any transactions actually performed in a managed portfolio could have been executed at the times or prices used for the purpose of calculating the performance in the simulation.

Bringing it back to the challenge at hand, when distributable income is the order of the day, the return needs to be there to support it. A covered call portfolio cannot support a 7% payout over time unless the underlying strategy is capable of earning total returns of 7% over time. The asset that has been most reliable historically in delivering returns at those high levels is equity. So now we can see all the pieces starting to fit together. For public plans, we think all roads lead to owning and keeping equity – they need it to maintain their EROA, they need it to improve funding levels and, yes, we believe they need it to have a highly effective income generating program to help meet benefits.

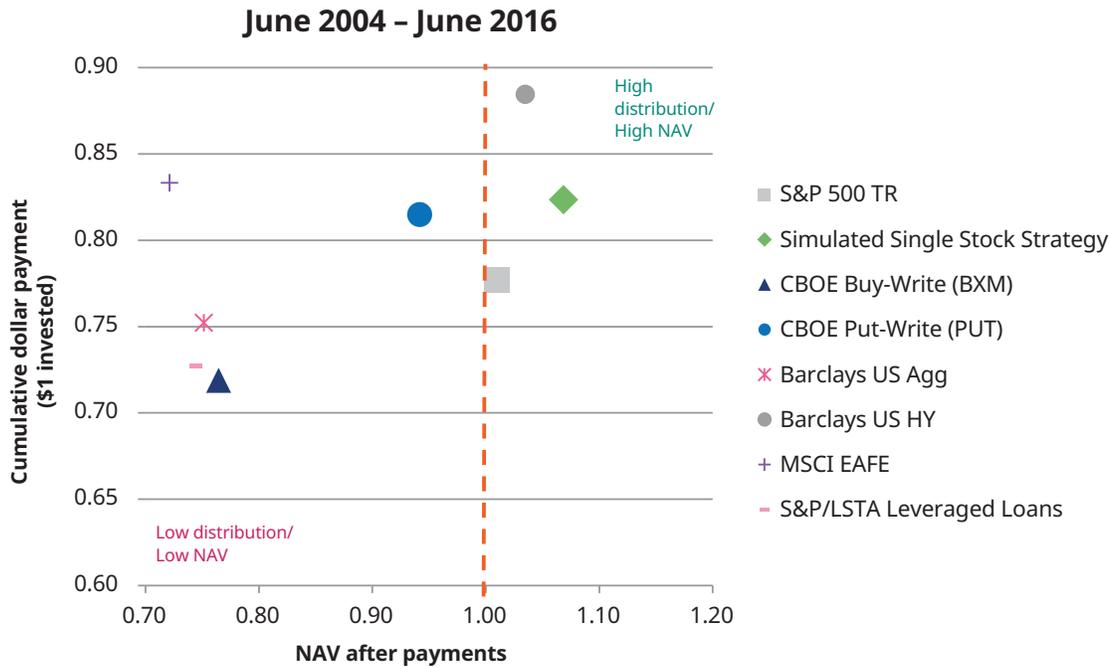
### Comparing income generating ability

The statistics above are important when comparing strategies on traditional risk/return measures. However, for income strategies we need to shift to an outcome-oriented framework that focuses on how efficiently and consistently a strategy can meet the goal of generating and distributing cash flow without eroding the portfolio’s value by paying out of capital over time. Receiving “return of capital” rather than “natural income” is a justifiable concern investors have when considering option overwriting strategies, particularly those which may have a target yield that is unrealistically high relative to the return-generating profile of the underlying

asset. We believe the most relevant historical comparison is that of the cumulative cash distribution paid versus the portfolio’s ending value net of distribution.

Figure 9 compares the income efficiency of several liquid asset classes, the two option writing indices, and the single stock overwriting approach for a 12 year period ending June 2016. The figures assume a 7% per annum distribution paid out monthly and a starting portfolio NAV of \$1.00. The vertical dotted orange line reflects our NAV baseline, thus anything on or to the right reflects the maintenance and/or growth of our capital base. We can see that the Risk-Adjusted option strategies – represented by the BXM and PUT indices – have not successfully met the objective of high cash payout while maintaining capital (placing left of this orange line). Put writing (blue circle) has been a widely accepted strategy, but over the period was unable to meet the 7% required payout without the capital value falling below the initial investment of \$1.00. It finished the period at \$0.94. Worse yet, index covered calls (dark blue triangle) distributed \$0.72 and had an ending capital value of \$0.76, a rather erosive outcome. In contrast, the Equity-oriented single stock call overwrite strategy paid out \$0.82 and had an ending capital value of \$1.07. It is clear that the single stock strategy excelled in this framework due in part to its focus on retaining equity exposure whilst generating income from option writing.

**Figure 9: A 7% payout is beyond the reach of most asset classes without eroding the capital base**



Source, Schroders, Bloomberg, options data from multiple counterparties. For illustration only. Backtest results from June 30, 2004 through June 30, 2016. Data reflects simulated historical scenario results for a strategy which owns the 200 largest stocks in the S&P 500 and systematically writes call options on the underlying stocks once per month, mid-month. The strategy targets a 7% yield which is derived from the combination of equity dividends and options premia. Options are assumed to be settled in cash. The chart above assumes a 7% payout per annum monthly. No management fees are assumed, which would have impacted results. Assumes base currency of USD, dividends reinvested and unhedged foreign exchange. Past performance is no guarantee of future performance. There could be no assurance that any transactions actually performed in a managed portfolio could have been executed at the times or prices used for the purpose of calculating the performance in the simulation.

## Conclusion

The greatest challenge for pension plans today is to reconcile the need for strong returns with the need for high current income to meet benefit obligations coming due in real-time. This tension has led to some plans relying on small fixed income allocations and substantial asset liquidations to raise the cash to make these payments. Increasing the allocation to fixed income is not a viable option given the need to maintain EROA and own substantial equities and other growth assets. Regular asset liquidations may compromise strategic asset allocation and can result in selling assets into down markets.

Fortunately we think we have identified a way to generate high and sustainable current income from a plan's existing equity

allocation by transforming its long-term capital appreciation potential into short-term without sacrificing equity risk premia exposure. In particular, we advocate plans use a specific type of covered call strategy, one that seeks to earn sufficient premium while maximizing participation in equity market upside. This, in our view, should deliver an equity-like beta and expected return profile that plans so desperately need in order to meet their objectives. Furthermore, we think an equity-oriented strategy is best positioned to support high payout ratios without depleting capital over time.

It's time for your equities to do more for your plan than ever before.

### **Simulated returns**

The hypothetical results shown must be considered as no more than an approximate representation of a portfolio's performance, not as indicative of how it would have performed in the past. It is the result of statistical modeling, with the benefit of hindsight, based on a number of assumptions and there are a number of material limitations on the retrospective reconstruction of any performance results from performance records. For example, it may not take into account any dealing costs or liquidity issues which would have affected such a strategy's performance. In addition, gross returns would be lower if applicable management fees and expenses were factored in to the calculation. There can be no assurance that this performance could actually have been achieved using tools and data available at the time. No representation is made that the particular combination of investments would have been selected at the commencement date, held for the period shown, or the performance achieved. This data is provided for information purposes only and should not be relied on to predict possible future performance.

Performance shown reflects past performance, which is no guarantee of future results. The indices shown herein are widely used, unmanaged proxies for their respective asset classes. Actual results would vary. Investors cannot invest directly in any index.

All investment involve risk, including the risk of loss of principal.

**Schroder Investment Management North America Inc.**  
**7 Bryant Park, New York, NY 10018-3706**  
**Tel: (212) 641 3800**

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