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On the relevance of strategic and tactical asset allocation for portfolio insurance

AI in financial services: mass adoption and beyond

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Risk & Reward

Research and investment strategies

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2020 was widely expected to hold in store more of the same – a fairly average year with interest rates remaining "lower for longer" and only a low chance of recession. But COVID-19 has reminded us that, even after centuries of scientific progress, markets move in cycles that present both challenges and opportunities.

Most of this edition of Risk & Reward was produced before the coronavirus had begun to spread globally. Nevertheless, we believe the research presented in this issue remains timely and relevant. In fact, readers may find our cover story, dealing with portfolio insurance, particularly interesting given the unprecedented volatility that international stock markets have experienced recently.

Other articles deal with factor investing and a recent global study of artificial intelligence in the financial services sector. We believe all these topics remain noteworthy as investors seek to navigate the market disruption related to the spread of the virus, as will the topic of sustainability, which has featured prominently in Risk & Reward many times.

We are convinced that sound research is more important than ever. Invesco is committed to making sure everything we do is focused on meeting our clients' needs. We are therefore pleased to share our insights with you in this most recent edition of Risk & Reward.

We wish you all the best and hope this publication will help keep your gaze focused forward.

Best regards,

Marty Flanagan
President and CEO of Invesco Ltd.

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In focus

On the relevance of strategic and tactical asset allocation for portfolio insurance

By Dr. Martin Kolrep, Dr. Harald Lohre, Erhard Radatz and Carsten Rother

In brief

Portfolio insurance can be an appropriate means to preserve a given capital floor, yet the associated risk budgeting parameters need to be tailored to align with the underlying investment strategy. The main determinants are strategic asset allocation as well as the range and accuracy of tactical asset allocation decisions that would help mitigate downside risk. We evaluate the performance of a multi-asset allocation strategy across a vast number of alternative scenarios using block-bootstrap simulations. Based on a simulated tactical asset allocation model, our framework enables us to gauge the impact of assumed forecast accuracy and the tactical asset allocation range on the ultimate portfolio return distribution under a classic dynamic portfolio insurance risk budgeting framework.

Investors today are looking to take more risks to comply with their return targets despite persistently low interest rates. Yet their propensity to digest such risk is typically unchanged, reinforcing the need for strict and accurate management of the available risk budget. This is where portfolio insurance comes into play.

In previous articles, we discussed ways to assess and calibrate a portfolio insurance strategy to individual risk preferences. We demonstrated that, given the potential for considerable reshaping of the portfolio return distribution, dynamic portfolio insurance strategies should not be benchmarked relative to their underlying.[1] Visualizing the ensuing portfolio return distribution and qualifying its key return and (downside) risk characteristics is key when calibrating the salient portfolio insurance strategy parameters.

Here, we investigate the importance of the underlying investment strategy parameters in dynamic proportion portfolio insurance (DPPI) strategies. The main determinants of a multi-asset investment strategy are the choice of strategic asset allocation as well as the range and accuracy of tactical asset allocation decisions. Ultimately, these features seek to mitigate the downside of the risky investment by altering the risk-return profile, and they can meaningfully reshape the portfolio distribution.

We investigate the importance of the underlying investment strategy parameters in dynamic proportion portfolio insurance strategies.

The mechanics of dynamic portfolio insurance
Dynamic portfolio insurance strategies are based on the classic CPPI (constant proportion portfolio insurance) and seek to achieve exposure to a given underlying risky investment while striving to preserve capital in down market scenarios/ environments. The portfolio insurance strategy relies on the evolution of the cushion, defined as the difference between the invested wealth *W* and the net present value of the floor *NPV(F_T)*:

$$(1) \quad C_t = W_t - NPV\left(F_T\right)$$

With investment exposure e_t, the risky investment $E_t = e_t \times W_t$ is determined in such a way that a chosen floor is not breached within a specified investment period. Hence

$$(2) \quad C_t \geq e_t \times W_t \times \text{MaxLoss}\left(risky\ asset\right)$$

$$\Leftrightarrow E_t \leq \frac{C_t}{\text{MaxLoss}\left(risky\ asset\right)} = m \times C_t$$

In the above formula, *m* represents the multiplier and indicates how often a given cushion can be invested in the risky underlying without breaching the floor while complying with the maximum loss assumption. In the traditional CPPI, the multiplier is static and might reflect a constant worst-case scenario, hence the "constant" in the name of the strategy.

Dynamic portfolio insurance, on the other hand, builds on dynamically adjusting the associated investment exposure through forecasts of the maximum loss at each point in time, e.g. using an expected shortfall forecast. The dynamic adjustment enables reaction to time-varying volatility in the underlying, resulting in higher participation in the underlying during expected low-risk environments and lower investment exposure when expected volatility is high.

The benefits of dynamic portfolio insurance depend on the accuracy of the risk estimates and an appropriate tailoring of the risk budgeting parameters to investor preferences.

Asset allocation and dynamic portfolio insurance
Clearly, the benefits of dynamic portfolio insurance depend on the accuracy of the risk estimates and an appropriate tailoring of the risk budgeting parameters to investor preferences. However, the specifics of the underlying investment strategy also play a key role in the effectiveness of portfolio insurance and in the ensuing portfolio return distribution. The asset allocation framework is typically built around two allocation strategies:

The core framework is the strategic asset allocation (SAA), which targets a given level of expected portfolio return and relies on long-term expectations of the assets' risk and return. The SAA seeks to provide a strategic positioning in the underlying assets over a long-term investment horizon, generally five to ten years. For simplicity, we consider a single-asset allocation strategy which invests in a broad stock market index (here measured using the S&P 500) capturing the long-term equity risk premium.

The second component is tactical asset allocation (TAA), which seeks to generate additional value over the medium-term horizon, generally three to six months. It dynamically deviates from the strategic asset allocation weights to reflect current and shorter-term market fluctuations and takes into account the expected outperformance of the risky asset in different market environments.

We consider two parameters driving tactical asset allocation, namely the *range* and the *accuracy* of the tactical asset allocation decisions. We assess their impact on portfolio performance within a dynamic portfolio insurance framework. By design, DPPI strategies are inherently path dependent, as their performance relies on the specific realized market

setbacks: for instance, a rapid intraday market drawdown, such as the one experienced during the 1987 market crash or the global financial crisis, may lead to periods of de-investment, or even cash-lock positions, despite a seemingly sufficient portfolio cushion. To avoid assessing the performance of the strategy based on only one historical path, we therefore simulate a variety of paths for the S&P 500 index and the short-term instrument and apply the given DPPI-setup. Hence, instead of a single risk and return combination, we derive a full return distribution from 1,000 block-bootstrap simulations. We set the floor level for the DPPI strategy at 85% and the risk estimates required for the computation of the dynamic multiplier are based on a GARCH-(1,1) model. This model captures the main empirical characteristics of stock market returns, such as time-varying volatility, fat tails and volatility clustering.

Range of tactical asset allocations and DPPI

First, we assume that the investment manager has an adequate degree of skill in forecasting future expected returns, which are then translated into tactical asset allocation decisions. One can measure this ability with the hit rate, which represents the proportion of times that the manager correctly forecasts the direction of market returns. Hence, a simple forecasting exercise would be to attempt to forecast only the future direction of the market. However, that would at best be a naïve measure of forecasting skill given empirical evidence that stock market returns are asymmetrically distributed. Indeed, a very high hit rate can still fail to add value to portfolio performance if the manager correctly forecasts the direction of small future returns but fails to predict very large negative returns. Consequently, our chosen measure of hit rate takes into account the ability to forecast the direction of the market as well as the magnitude of the future realized returns. We first simulate an investment manager with a hit rate of 60%, indicating that he can forecast the sign of positive or negative returns 60% of the time. Such a level reflects a portfolio manager with an outstanding degree of market forecasting ability as now widely acknowledged and given a long-term bias in the equity market.

In addition, the investment manager can vary in his range of allocation decisions to tailor the specific riskpreferences of individual clients. We assume the tactical asset allocation decisions to be implemented using a 5-step framework reflecting relative overweight/underweight views on the stock market. These readings are then translated into five possible allocation decisions. For instance, an investor with a moderate degree of risk aversion might be willing to accept some leverage to enhance the risk-return profile. For such a profile, we set a normal allocation range to [0.8, 0.9, 1.0, 1.1, 1.2], indicating that a neutral position involves a 100% investment in the underlying, a bullish overweight view receives a 120% allocation whereas a bearish underweight view is implemented with an 80% investment in the stock market.

Normal TAA range

Under this framework, the simulated portfolio return distribution reveals an average annualized return and volatility of 13.22% and 16.06%, see table 1. The tactical allocations enhance the overall risk-return profile compared to the strategic allocation in the equity index, achieving an extra 1.14% annualized return, a slightly higher Sharpe ratio (0.58 vs 0.52) as well as marginally lower downside risk. The corresponding information ratio of the TAA is 0.51. The dynamic portfolio insurance applied to the SAA significantly contributes to decreasing tail risk, as shown by a reduction in the expected shortfall from 45.3% to 15.7%. Naturally, the lower downside risk comes at an insurance premium as the average annualized return decreases by 1.50% (=12.08%-10.58%). The benefits of the TAA are also confirmed under the DPPI, where the simulated distribution shows a higher annualized return and Sharpe ratio vis-à-vis the SAA-only DPPI strategy (11.29% vs 10.58% and 0.52 vs 0.48) as well as lower tail risk through a reduction in expected shortfall by 0.39%. The TAA information ratio is 0.34.

Wide TAA range

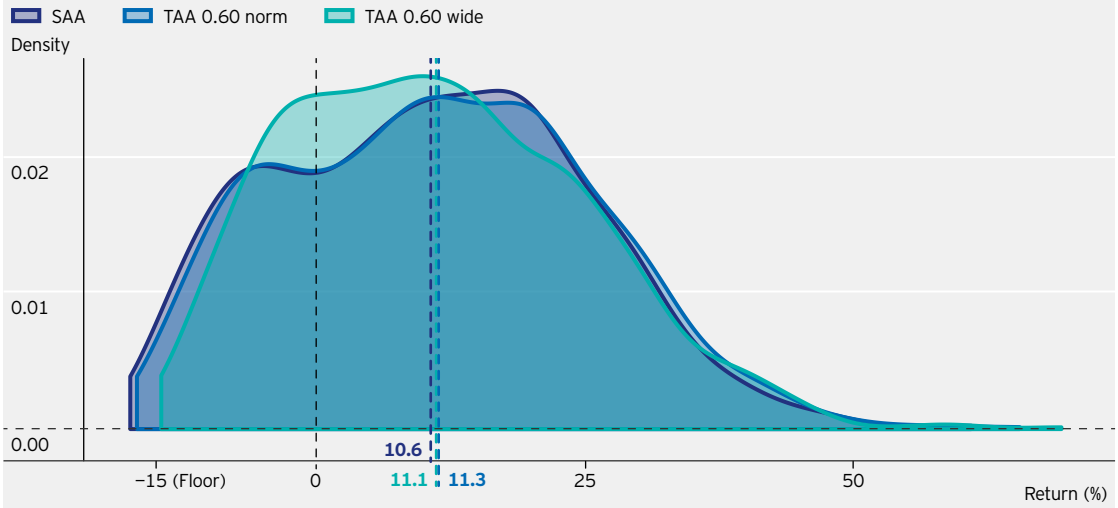
We now allow for a wider range of TAA allocations represented by [0.50, 0.75, 1.00, 1.25, 1.50]. For example, at times, like now, of low or negative interest rates, investors might be willing to accept

Table 1
Performance of various allocation strategies

	SAA			Normal TAA range		Wide TAA range	
	Pure	Cash	With DPPI	SAA + TAA	With DPPI	SAA + TAA	With DPPI
Return	12.08	3.82	10.58	13.22	11.29	14.94	11.10
Volatility	15.99	0.94	14.25	16.06	14.39	16.75	13.67
Sharpe ratio	0.52	0.00	0.48	0.58	0.52	0.66	0.53
MDD	-14.4	0.0	-11.5	-14.2	-11.3	-14.3	-10.2
Participation	100.0	0.0	88.8	100.0	88.6	100.0	83.2
ES	45.29	-1.77	15.69	44.37	15.30	43.27	13.18
IR				0.51	0.34	0.51	0.10

The figures refer to simulated past performance and past performance is not a reliable indicator of future performance.
The table shows simulated performance measures of various allocation strategies: column 1 covers the strategic asset allocation strategy (SAA), column 2 covers SAA including tactical asset allocation (TAA) with a normal TAA range, column 3 covers SAA including TAA with a wide TAA range. Cash returns are based on 3-month USD LIBOR. We also give the information ratio (IR), as well as the downside risk metrics expected shortfall (ES) and the maximum drawdown (MDD).
Sources: Bloomberg, Invesco calculations. Period: 31 December 1984 to 31 December 2019.

Figure 1
Portfolio return distributions: 60% TAA hit rate

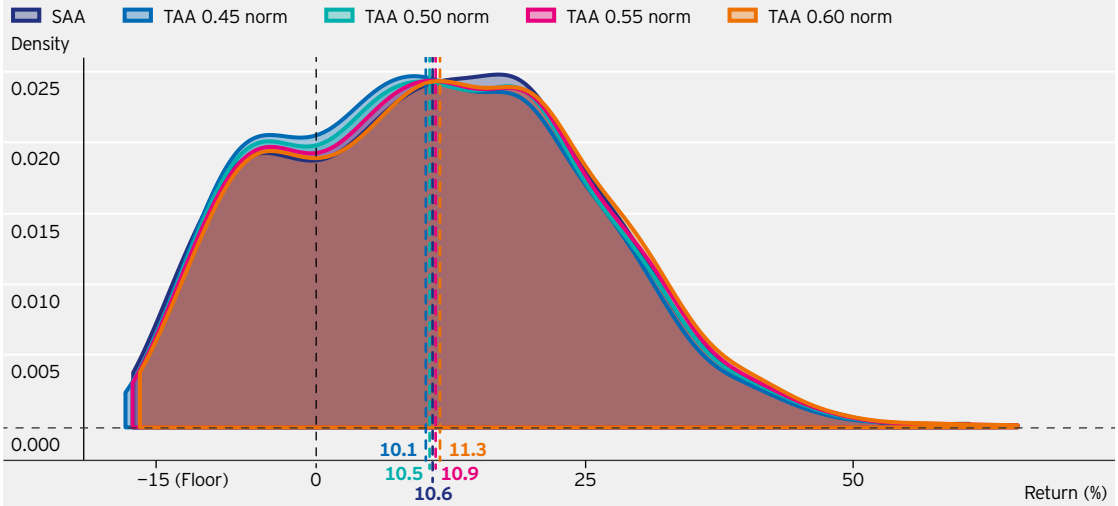


The chart shows the distribution of block-bootstrapped annual returns of the DPPI portfolios using different underlyings: SAA (dark blue), TAA with normal range (blue) and TAA with wide range (green). The floor level of the DPPI strategy is 85%. Below the three density plots we have added the mean levels of the return distributions. Cash is 3-month USD LIBOR.
Sources: Bloomberg, Invesco calculations. Period: 31 December 1984 to 31 December 2019.

higher risk in the search for extra yield and hence tolerate significant active TAA risk, here implemented with a maximum leverage of 150% and a minimum underweight of 50% in the underlying. As table 1 shows, this more aggressive allocation enhances portfolio return (14.94%) compared to both the SAA and the normal allocation range of the TAA through an extra 2.86% and 1.72% average annualized return. Of course, the additional leverage also increases portfolio volatility (16.75% vs 15.99% and 16.06%). Nevertheless, the overall risk-return measure is improved on average (0.66 wide range versus 0.58 normal range vs 0.52 SAA only), and expected shortfall is marginally lower.

However, under DPPI, the outcome is quite different. While the wide TAA allocations result in a longer right tail associated with few large portfolio returns (figure 1), the active allocations imply higher expected risk from the underlying investment, which results in more frequent de-investment, as shown by a reduction in the mean participation rate by 5.6% and 5.4% compared to the respective SAA and normal TAA allocation DPPI strategies. The average return ends up even smaller than what was achieved under the normal TAA range (11.10%), representing an outperformance relative to the DPPI version for the SAA without TAA of 0.52% (=11.10%–10.58%); the implicit IR of 0.1 is considerably smaller than for the normal range TAA (0.34).

Figure 2
Portfolio return distributions: normal TAA range, varying hit rates



The chart shows the distribution of block-bootstrapped annual returns of the DPPI portfolios using TAA at a normal TAA range but based on different simulated hit rates: SAA (dark blue), 45% hit rate (blue), 50% hit rate (green), 55% hit rate (pink) and 60% hit rate (orange). The floor level of the DPPI strategy is 85%. Below the five density plots we have added the mean levels of the return distributions. Cash is 3-month USD LIBOR.
Sources: Bloomberg, Invesco calculations. Period: 31 December 1984 to 31 December 2019.

Table 2
Performance of various allocation strategies: Varying hit rates

	Normal TAA range		Wide TAA range	
	SAA + TAA	With DPPI	SAA + TAA	With DPPI
Simulated hit rate: 0.60				
Return	13.22	11.29	14.94	11.10
Volatility	16.06	14.39	16.75	13.67
Sharpe ratio	0.58	0.52	0.66	0.53
MDD	-14.19	-11.27	-14.30	-10.17
Participation	100.0	88.6	100.0	83.2
ES	44.4	15.3	43.3	13.2
IR	0.51	0.34	0.51	0.10
Simulated hit rate: 0.55				
Return	12.70	10.86	13.63	10.18
Volatility	16.08	14.28	16.81	13.36
Sharpe ratio	0.55	0.49	0.58	0.48
MDD	-14.36	-11.31	-14.70	-10.25
Participation	100.0	88.3	100.0	82.4
ES	45.1	15.5	45.0	13.4
IR	0.27	0.13	0.27	-0.08
Simulated hit rate: 0.50				
Return	12.24	10.47	12.48	9.37
Volatility	16.14	14.15	16.97	13.03
Sharpe ratio	0.52	0.47	0.51	0.43
MDD	-14.51	-11.33	-15.08	-10.26
Participation	100.0	87.9	100.0	81.5
ES	46.5	15.5	48.8	13.5
IR	0.07	-0.05	0.07	-0.24
Simulated hit rate: 0.45				
Return	11.69	10.05	11.10	8.56
Volatility	16.18	13.98	17.07	12.67
Sharpe ratio	0.49	0.45	0.43	0.37
MDD	-14.70	-11.36	-15.57	-10.28
Participation	100.0	87.5	100.0	80.6
ES	47.5	15.6	51.8	13.9
IR	-0.17	-0.24	-0.17	-0.38

The figures refer to simulated past performance and past performance is not a reliable indicator of future performance.
The table shows simulated performance measures of various allocation strategies: columns 1 and 2 cover the strategic + tactical asset allocation strategy (SAA+TAA) and the corresponding DPPI strategy, both using a normal TAA range. Similarly, columns 3 and 4 cover the strategic + tactical asset allocation strategy (SAA+TAA) and the corresponding DPPI strategy, using a wide TAA range. Cash returns are based on 3-month USD LIBOR. We also give the information ratio (IR), as well as the downside risk metrics expected shortfall (ES) and the maximum drawdown (MDD).
Sources: Bloomberg, Invesco calculations. Period: 31 December 1984 to 31 December 2019.

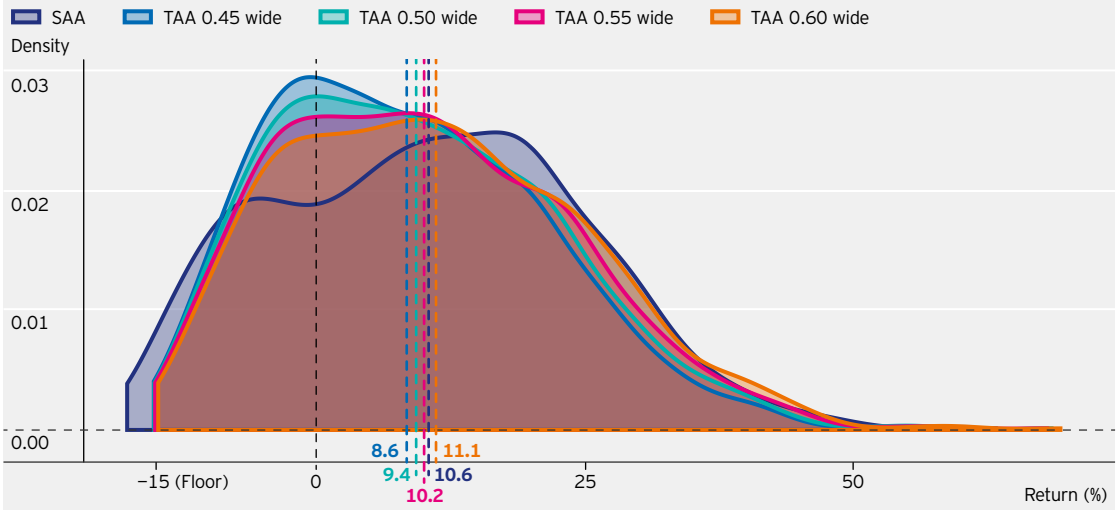
Forecast accuracy and DPPI
Up to now, we have assumed the manager to have outstanding skill in forecasting market returns (hit rate of 60%). We now allow for less-than-stellar levels of forecast accuracy. For instance, a hit rate of 50% reflects a degree of skill which is hard to distinguish from tossing a coin.

Normal TAA range
Unsurprisingly, we observe a gradual reduction in the average return relative to the 60% hit rate base case, see figure 2. At a hit rate of 50% and under a normal TAA allocation range, the portfolio distribution shifts leftwards, resulting in lower average portfolio return (12.24% vs 13.22%) and, in turn, an inferior Sharpe ratio (0.52 vs 0.58), see table 2. The pattern holds for different levels of forecasting accuracy, down to a hit rate of 45%, and is observed also under the DPPI framework. Under the latter, assuming a 50% hit rate, the average portfolio return decreases by 0.82% (=11,29%-10,47%) and the Sharpe ratio from 0.52 to 0.47. A further decrease in average portfolio return of 0.42% is observed for the 45% hit rate. The forecasting accuracy mainly influences the first moment of the portfolio distribution while the maximum drawdown and expected shortfall are only marginally hampered. The bottom line is that even a 50% hit rate in the TAA will leave us worse off relative to a DPPI setting that abstracts from tactical allocation bets.

Wide TAA range
The result is even more striking when implementing a wider allocation range. For example, under the DPPI framework and with a decent assumed hit rate of 55%, the more active tactical positions, as expected, lower the mean participation ratio to 82.4%. As a result, the lower forecasting accuracy contributes to a decrease in overall portfolio return by 0.92% relative to the 60% hit rate, corresponding to a negative information ratio relative to DPPI abstracting from TAA. Indeed, as further illustrated in figure 3, the distribution of returns is now massively reshaped, with more frequent realizations of lower returns. As a result, the higher activity from the TAA allocation is no longer compensated by the portfolio returns vis-à-vis the strategic asset allocation as we are faced with lower degrees of forecasting accuracy.

The effectiveness of dynamic portfolio insurance is sensitive to forecasting accuracy as well as the range of the implementable tactical allocations.

Figure 3
Portfolio return distributions: wide TAA range, varying hit rate



The chart shows the distribution of block-bootstrapped annual returns of the DPPI portfolios using TAA at a wide TAA range but based on different simulated hit rates: SAA (dark blue), 45% hit rate (blue), 50% hit rate (green), 55% hit rate (pink) and 60% hit rate (orange). The floor level of the DPPI strategy is 85%. Below the five density plots we have added the mean levels of the return distributions. Cash is 3-month USD LIBOR.
Sources: Bloomberg, Invesco calculations. Period: 31 December 1984 to 31 December 2019.

Conclusions

A strategic asset allocation aims at harvesting long-term market premia. At the same time, a meaningful tactical asset allocation seeks to exploit medium-term market fluctuations. We have examined such asset allocations within a dynamic portfolio insurance risk budgeting framework which reshapes the underlying return distribution to mitigate downside risk. We have shown, based on simulated block-bootstrap scenarios, that tactical asset allocation can be a useful tool to enhance the risk-return profile over the underlying strategic asset allocation. However, the effectiveness of dynamic portfolio insurance is sensitive to forecasting accuracy as well as the range of the implementable tactical allocations. Both influence the ultimate risk-return profile.

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Note

1 "Theory and practice of portfolio insurance", Risk & Reward #2/2017; "Evaluating risk mitigation strategies", Risk & Reward #2/2018; "The use of equity factor investing for portfolio insurance", Risk & Reward #3/2018.

"It is all about a harmonious triad of strategic allocation, tactical flexibility and risk budgeting."

Interview with Dr. Martin Kolrep and Dr. Harald Lohre

(from left to right) Dr. Harald Lohre and Dr. Martin Kolrep

The Corona crisis has painfully demonstrated to many investors that, even for capital markets, what goes up must come down. But could the losses associated with the sharp market decline have been anticipated and avoided? We spoke to Dr. Martin Kolrep and Dr. Harald Lohre from Invesco Quantitative Strategies on the design of portfolio insurance strategies and whether they have successfully passed this real-world test.

Risk & Reward
Are portfolio insurance strategies a fool-proof way to protect yourself against extreme market turmoil, such as we have observed in the course of the Corona crisis?

Dr. Harald Lohre
Not fool-proof, but certainly an effective building block for managing portfolios with limited risk budgets.

Dr. Martin Kolrep
In our persistent low interest rate environment, investors have increasingly sought out riskier investments in order to meet their return requirements. With unchanged risk budgets, this increased level of risk must be addressed by appropriate risk management. Portfolio insurance is a tried and tested means, but whether the desired result is achieved depends on the precise structure of the strategy.

Risk & Reward
In your article, you describe in detail your approach to construction of portfolio insurance strategies. Can you give us a brief overview of the main points here?

Dr. Martin Kolrep
The key point is that portfolio insurance is not simply an overlay. Rather, the central parameters of the investment process must coordinate with the portfolio insurance mechanism in such a way that the desired return and risk targets can be achieved.

Dr. Harald Lohre
If, for example, you choose a base investment that is too risky given a conservative risk budget, it may indeed work for a while in quiet market phases. Over time, however, the hedging mechanism will likely be activated too often, thus significantly reducing the portfolio's participation in the risk premia of the base investment.

Risk & Reward
Would this result in a cash lock when your defined risk budget is exhausted?

Dr. Martin Kolrep
Exactly. Cash lock is a situation that must be avoided. Ideally, the base investment will run unaffected with the insurance mechanism intervening only in an emergency.

Dr. Harald Lohre
It's like wearing a seat belt when you drive a car. Normally, it allows almost unhindered freedom of movement. But, in the event of emergency braking or an impact, it holds the driver and passengers in their seats to prevent severe injuries.

Risk & Reward
Which parameters do you specifically manipulate?

Dr. Martin Kolrep
Essentially, it is all about a harmonious triad of strategic allocation, tactical flexibility and risk budgeting.

Dr. Harald Lohre
The primary objective is to structure a strategic allocation in accordance with long-term return expectations for broad asset classes. Assuming that the forecast used for asset allocation signals is of a high quality, a tactical deviation from the strategic allocation might help to correctly anticipate negative market developments and, in the best case, avoid the need for portfolio insurance to intervene.

Dr. Martin Kolrep
However, forecast hit rates, even for outstanding economists or quantitative models, are rarely over 60%. In this respect, portfolio insurance can act as a third line of defence, preventing the portfolio from losing more than the defined risk budget.

Risk & Reward
And is this triad of strategy, tactics and risk budget determined in practice using a backtest?

Dr. Harald Lohre
Yes. And no. It is of course interesting to see how a given strategy would have behaved in the past. Depending on the history and the forecast quality of the tactical signals, however, this can lead to false conclusions.

Dr. Martin Kolrep
For example, a single backtest could make it seem that the hedged strategy outperforms the base investment. However, portfolio insurance strategies typically entail an insurance premium, so the base assumption should be that they will earn less, on average, than the base investment.

Dr. Harald Lohre
This is why we don't rely solely on the historical path when calibrating portfolio insurance strategies. We simulate thousands of alternative capital market paths along which we evaluate the portfolio insurance strategy. This also enables us to formulate realistic return expectations and avoid the risk of being misled by exceptionally high returns in the past.

Risk & Reward
But how do you condense such an immense range of simulation results to ultimately find the right portfolio insurance strategy?

Dr. Harald Lohre
While it is only possible to determine point estimates of return and risk for a given backtest, the simulation results can be condensed into an expected return distribution, from which probability-based statements can derive.

Dr. Martin Kolrep
For instance, we can estimate asymmetry – i.e. how much upside potential is lost with the chosen risk budget chosen. If the distribution exhibits significant probability mass near the strategy floor, then either a reduction in the risk of the base investment or an increase in the risk budget is called for.

Dr. Harald Lohre
The insurance premium implicit in the portfolio insurance strategy can then be read off directly in comparison to the unhedged base investment, namely as the difference between the two distributions' average return.

Dr. Martin Kolrep
Such information is not only key to the design of the portfolio insurance strategy, but also helps the customer to get a concrete idea of how portfolio insurance works and, at the same time, promotes realistic expectation management.

Risk & Reward
How does your approach differ from the classic analysis of historical scenarios?

Dr. Martin Kolrep
Analyzing historical scenarios can be useful. But every new crisis brings in novel and unknown elements. Otherwise, it wouldn't be a real crisis.

Dr. Harald Lohre
One risk of scenario analysis is that you will calibrate strategies that can cope with the most recent disasters but may be less robust in future crises due to over-fitting to past data.

Dr. Martin Kolrep
Worse still is that a crisis like the global financial crisis of 2008 and 2009 is relatively quickly forgotten and portfolios can subsequently become too offensive. Our approach ultimately takes into account a variety of plausible capital market developments, including rare but possible extreme scenarios such as a global financial crisis.

Risk & Reward
So, were you able to predict the market declines related to the recent Corona crisis?

Dr. Martin Kolrep
We didn't predict it, but we had a realistic expectation of possible market declines. The framework described thus led us to choose a more defensive portfolio allocation in 2019. At the time, we specifically reduced the strategic quotas for stocks, oil and copper. This reduction wasn't in the expectation of the crisis. It stemmed purely from ouranalysis of the simulations.

Dr. Harald Lohre
Given our long-term expectations for the asset classes at the time, the simulations clearly showed that the adjustments would make it much easier to reconcile the expected portfolio returns with potential drawdown risks.

Risk & Reward
From the outset, you were more defensive in your strategic asset allocation. But what ultimately led to the prompt reduction of risky investment exposures: tactics or risk considerations?

Dr. Martin Kolrep
Clearly it was the risk. Few tactical models could have foreseen this sharp market setback. A clear rise in the risk forecast that governs our portfolio insurance strategy led to a rapid reduction in investment exposures.

Dr. Harald Lohre
This is why it's important to utilize a risk model that adequately reflects the characteristic behaviour of international financial markets and their interdependencies. A Copula-GARCH model allows the tail risk of an investment portfolio to be precisely modelled and the investment exposure managed dynamically.

Risk & Reward
So, if the risk estimate drops again, will the level of investment automatically increase?

Dr. Martin Kolrep
Yes, it will. Our strategically defensive positioning and the quick reaction to the market declines kept us safe from a cash lock. With the remaining risk budget, the portfolio insurance strategy can, on its own, lead to greater exposure to the risky asset classes.

Dr. Harald Lohre
Of course, it is crucial that the risk model not only quickly picks up on the risk increase, but also detects the subsequent calming of markets as early as possible. Only in this way can you ensure participation in a subsequent market recovery.

Dr. Martin Kolrep
This is likely to succeed in the current crisis, but it is not yet entirely clear. In the past, this has always been the case when the market recovery was slower than the previous market decline. And, given the profound impact that the shutdown has had on many parts of the global economy, everything speaks for a slow market recovery favouring portfolio insurance strategies.

Risk & Reward
Thank you for yout time.

AI in financial services: mass adoption and beyond

Interview with Lukas Ryll, Mary Emma Barton and Donie Lochan

In brief

Artificial intelligence (AI) and machine learning (ML) are becoming increasingly influential in financial services. A new study by the University of Cambridge and the World Economic Forum, carried out with support from Invesco, suggests that these technologies are already on the brink of mass adoption and could soon encompass every aspect of a firm's overall offering – particularly in the sphere of asset management. Risk and Reward spoke to two of the study's co-authors, Lukas Ryll of the Cambridge Centre for Alternative Finance and Mary Emma Barton of the World Economic Forum. Offering a practitioner's perspective is Donie Lochan, Invesco's Chief Technology Officer.

Surprisingly, despite an abundance of headlines and commentary, empirical evidence of AI's true scale and scope within financial services has been limited. With support from Invesco, the University of Cambridge and the World Economic Forum recently set out to address this shortcoming by conducting a global survey of AI's ever-expanding role and what it could mean for the industry, employees and stakeholders.

Based on a survey of 151 firms in 33 countries, the results were published in January this year in a report entitled "Transforming Paradigms: A Global AI in Financial Services Survey".[1] In the words of Bryan Zhang, Executive Director of the Cambridge Centre for Alternative Finance at Cambridge Judge Business School, the study reveals an industry "undergoing profound digital transformation underpinned by the advancement in AI."

> AI is already on the brink of mass adoption in finance.

"AI is already on the brink of mass adoption in finance," says Zhang. "Firms are leveraging it to revamp existing offerings and create new products and services. It's helping transform practices, processes, infrastructure and underlying business models. It's presenting hurdles to implementation, including access to data, access to talent and regulatory uncertainties. And it's giving rise both to potential and realised risks and to strategic learnings from the current frontrunners."

Risk & Reward
How significant is the rise of AI in general and in financial services in particular?

Mary Emma Barton
AI is a key driver of the fourth industrial revolution. We can already see its impact everywhere – in homes, businesses and even public spaces. It holds the promise of solving some of society's most pressing issues, but it also presents major challenges – including the unethical use of data, the potential for job displacement and the difficulties around explaining "black box" algorithms.

The World Economic Forum's view is that multi-stakeholder collaboration is needed to optimize accountability, transparency, privacy and impartiality as rapid advances increase the scope and scale of AI's deployment across all aspects of our day-to-day lives. Particularly as this technology begins to learn and change on its own, what we really need to understand is how to bring about trust while accelerating the benefits of AI to deliver positive social impact.

For around three years now, our team has been specifically looking at AI's role in financial services. We began by considering AI in this space from a theoretical perspective – how it might take shape and what the effects on the industry might be. About two years ago, we started to focus more on the risks of adoption and implementation and what these could mean for the system as a whole.

We're now in our third phase of work, looking at the different technologies being leveraged in tandem with AI – for example, the Internet of Things, 5G and quantum computing – and where the new value propositions are now and what the next value propositions might be in the future. We see this work as extremely important both in terms of business transformation and in terms of global sustainability efforts.

Lukas Ryll
The application of AI across various industries has grown by leaps and bounds. But there's still very limited empirical evidence about the current state of AI adoption in financial services. So, one of the principal aims of this survey was to go beyond the headlines, the opinion pieces and the hype to shed light on the evolving landscape of AI in this space.

This is only the beginning of a long journey in terms of truly grasping the potential, the current possibilities and the limits of AI in finance. But we now have a global snapshot of a sector in the midst of a massive digital transformation – one underpinned by continued advances in AI – and of the hurdles, risks, impacts and opportunities involved.

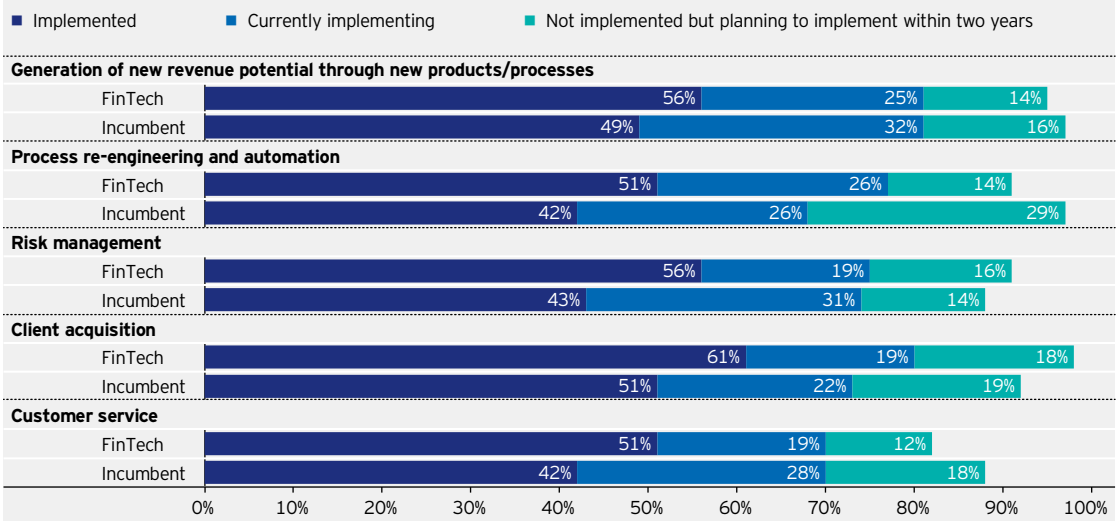
More than 70% of respondents believe AI will serve as a key competitive advantage in the near future.

Donie Lochan
I think the importance of AI from the perspective of the asset management industry is perfectly summed up in one of the survey's main findings: more than 70% of respondents believe AI will serve as a key competitive advantage in the near future. Our industry is undergoing unprecedented change, and this technology is clearly at the heart of that.

Risk & Reward
Was it a surprise to find that AI is already on the brink of mass adoption in financial services?

Donie Lochan
It wasn't really a surprise. Asset management has perhaps been a bit of a laggard in adopting AI and

Figure 1
Adoption of AI in primary business domains by entity type



Source: Cambridge Centre for Alternative Finance, World Economic Forum: Transforming Paradigms: A Global AI in Financial Services Survey, 2020.

machine learning, at least compared to some industries. But that has started to change during the past two or three years. Today, every asset manager should be looking at, experimenting with and even producing use cases that leverage AI and ML – especially in the area of risk and operations, which tends to be where companies initially apply this technology.

Of course, the approach varies from firm to firm. The leaders are typically those companies that set up systematic programmes – what the survey report calls an "AI flywheel" – so they can experiment with and leverage these technologies, proceed at speed and operate a little bit more like a start-up in terms of innovation.

By contrast, the stragglers are typically those companies that read about AI and ML in the media and say: "Oh, we need to be doing something about this." They tend to take a top-down approach, and what often emerges is a small test case that can't be scaled into production. The problem here is that many organizations have a project-based system, which requires a business case and other forms of backing before execution, when what experimenting with emerging technologies really demands is an innovative pathway!

Risk & Reward
Can the latecomers catch up or are the early adopters already too far ahead?

Lukas Ryll
We found an emerging need for experimentation setups, whether in the form of sandboxes or other means of building and developing AI and ML capabilities. A lot of respondents, particularly incumbents, identified this need.

We also found that the leaders in this space tend to follow approaches such as cultivating spinoffs or start-ups within their organizations, in effect replicating the corporate agility that smaller enterprises have. This is likely to become an important issue for incumbents – especially those that want to catch up.

There are obviously certain early-adopter advantages that leaders can harness – not least in terms of establishing the resilient data sources and pipelines which essentially power AI. It's vital to understand that even the most complex and sophisticated algorithms probably won't give you an edge if you don't have the scale, quantity, quality, and maybe even uniqueness, of data for use cases.

The dynamics of AI offer significant returns to scale for first movers.

Mary Emma Barton
Our survey suggests firms of many types and sizes have visions of being AI leaders. But it's apparent that the dynamics of AI offer significant returns to scale for first movers. Our findings show AI leaders experiencing more benefits from their investments in AI than those further down the curve.

So, the companies that establish these virtuous cycles – the AI flywheel – will definitely come out ahead in the race for AI supremacy. But none of this is to say "it's a lost cause" for those lagging behind at the moment. There's always an opportunity to catch up if you adopt the right strategy.

Risk & Reward
Will innovation continue to outstrip regulation?

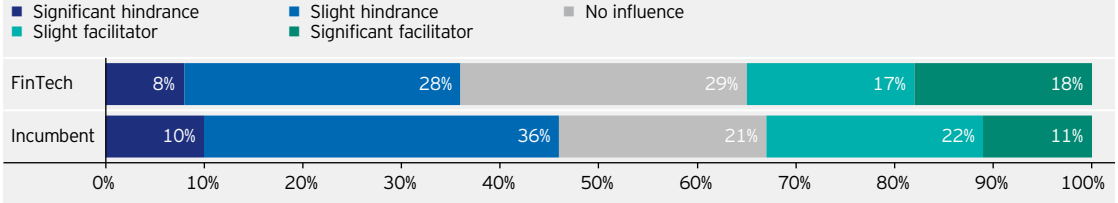
Lukas Ryll
Recent examples of AI regulation demonstrate that issues such as data privacy and explainability are at the top of policymakers' agendas. This is encouraging. But what remains to be seen is the direction these policymaking efforts take.

My feeling is that innovation itself will increasingly provide ways to mitigate issues around explainability, which has become inherent to many ML algorithms. This is actually a very active field in academia right now. On the other hand, innovation could continue to exacerbate the problem of data privacy.

Mary Emma Barton
It's vital for the public and private sectors to collaborate and create policies that not only benefit the stability of the system but also avoid restricting innovation. We need to identify and seize the many opportunities to utilize both the private sector's deep understanding of technology and the public sector's expertise in policymaking.

It's true that, right now, there is a wide array of different regulatory initiatives out there. The hope has to be that we learn from those that clearly work and, just as importantly, that we recognise those that don't. From there we can go on to create something bigger and better.

Figure 2
Perceived overall impact of regulation on AI implementation by entity type



Source: Cambridge Centre for Alternative Finance, World Economic Forum: Transforming Paradigms: A Global AI in Financial Services Survey, 2020.

Risk & Reward
What sort of disruption might we see if tech giants such as Google and Amazon decide to leverage their data and their AI expertise to enter financial services?

Donie Lochan
We view big tech in the same way we view start-ups, universities and venture firms – as opportunities for partnerships. We've already seen this in terms of big tech companies and some of the other industries they've gone after. When they start looking beyond their core business, when they begin considering adjacencies and so forth, that's when the benefits of partnerships come into play. It's another way to tap into everything available.

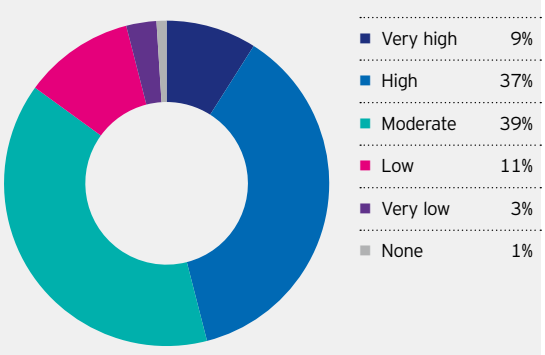
> If everyone is innovating then real success can lie only in out-innovating.

This is why we generally regard big tech companies' interest in the sector as a good thing. Given the enormous resources they have, they can help keep things moving in a positive direction. Of course, this also means that no one can afford to rest on their laurels. As one of my colleagues recently wrote, if everyone is innovating then real success can lie only in out-innovating. Even the leaders have to keep pushing the envelope.

Lukas Ryll
There's definitely a rationale for partnerships, and we've already seen some players go down that route. But it's quite challenging to assess how this might play out a couple of years, or even 10 years, down the road.

Our respondents' opinions reflect that. There's a lot of uncertainty around how the competitive dynamics might evolve. Almost half of all respondents are afraid of big tech companies entering financial services. And at the same time there's considerable uncertainty around what this feared competitive advantage might actually look like.

Figure 3
Overall perceived AI-induced competitive threat of big tech



Source: Cambridge Centre for Alternative Finance, World Economic Forum: Transforming Paradigms: A Global AI in Financial Services Survey, 2020.

Overall, a lot of respondents expect the status quo to prevail. Very few foresee competitive disruption on a large scale.

Mary Emma Barton
What some of the big Chinese tech companies are doing or planning might be a good indicator of the direction things are heading for the rest of the world. Large players have already had a huge impact on China's domestic market. And while big tech companies might lack distribution scale today, there could be future avenues for establishing these.

Risk & Reward
Is AI likely to impact every aspect of asset management?

Donie Lochan
I don't believe there's any part of the value chain where AI and ML can't be leveraged for an advantage. They can be used to improve the operational side, where a combination of ML and robotics can enhance reconciliation and so on. They can be used to improve investment processes. They can play a role in customer service, with intelligent bots assisting agents in engaging with clients. Advice, financial planning, account opening, portfolio management, distribution – the benefits should be felt everywhere.

Lukas Ryll
There's the question of what constitutes "real" business transformation and at what level of granularity one can accurately make such statements. For example, at the moment, it's still very much a matter of the use case dictating the complexity of the AI that can be applied – rather than the complexity of the AI solution dictating the use case.

But it's true, of course, that many parts of the value chain in asset management represent a very systematic business. And there's potential to generate additional or transformative value by harnessing AI capabilities wherever something is systematic.

Risk & Reward
Does this mean AI could ultimately put an end to human involvement in financial services?

Donie Lochan
No. We're firm believers in the concept of "human in the loop", which is why Invesco is committed to what we call "augmented intelligence" – using AI in a way that supports rather than replaces humans. It should be a case of machines empowering us rather than overpowering us.

Not least, because there are levels of bias in these algorithms, you need human interaction throughout the process. You need humans to establish the

> It should be a case of machines empowering us rather than overpowering us.

parameters, to tweak the models and to scrutinize the outcomes before action is taken. So, AI isn't taking over. The real power lies in an effective combination of human and machine.

Mary Emma Barton
We know that jobs in financial services are going to change as the industry itself changes. Research has suggested the employment impact in this space will be unparalleled by the late 2020s, with only the transport industry experiencing greater change over the longer term.

That said, our survey indicates fears over the extent of job losses might be exaggerated. Responses received across all financial services sectors suggest that 9% of jobs could be replaced by 2030, and that these losses will to some degree be offset by new jobs created through the deployment of AI. Based on responses to our survey, our projection is that the fintech workforce will grow by almost 20% as AI is increasingly adopted over the next decade.

The nature of many jobs in this sector is likely to change – I don't think anybody would dispute that. But there's always going to be a role for humans to play.

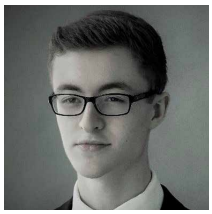
Lukas Ryll
From a purely technological viewpoint, there are certain elements of human intelligence – especially emotional intelligence – missing from current AI capabilities. Deficits also prevail in transfer learning – the ability to effectively apply learnings from one domain to another – which is why current AI capabilities are still very much fragmented and mostly limited to one business function, or even one use case. All of this inevitably demands that humans stay in the loop.

> We still know relatively little about what would happen if systems were to become truly autonomous. So, the future is fairly uncertain in many ways.

It's important to note that we still know relatively little about what would happen if systems were to become truly autonomous. How would this affect interaction? We've already witnessed unexpected or drastic interaction effects of rule-based algorithms in the past, such as flash crashes. And algorithms now are much more complex and less explainable.

So, the future is fairly uncertain in many ways. But, even if we reach a stage where AI becomes truly autonomous, which is most likely still far down the line, I do believe there will always be aspects of financial services that a machine can't fulfil.

About the contributors



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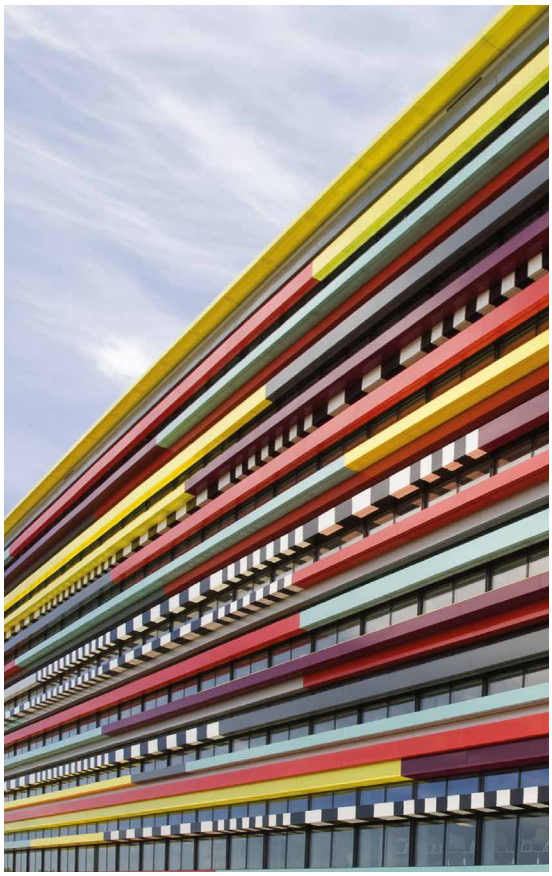
Note
1 The full report can be downloaded by visiting https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/

Know your factors: a case study in fixed income portfolio analysis

By Ward Bortz

In brief

We describe four factors which, in our view, are important determinants of a bond portfolio's performance. In a case study, we then compare the four factor exposures (alongside duration and rating structure) of the iBoxx indices for US investment grade and high yield bonds against the two asset classes' broad universes. We show that performance differences – in both the short and the long run – can be explained by differences in factor exposure.



Financial professionals will recognize the axiom, "Know your customer," from ubiquitous compliance modules. At Invesco Fixed Income, we believe it is also important to, "Know your factors," as we manage our own fixed income portfolios. Just as understanding one's customer can help mitigate risk from a business perspective, we believe knowing one's factor exposure can help mitigate risk in an investment context.

According to our findings, four factors tend to drive risk and return in the fixed income market:[1]

- The **low volatility factor** is the higher risk-adjusted excess return potential, relative to the broad market, of bonds with the most stable prices in the investment universe. These bonds typically have short maturities and low default risk, as measured by their ratings. These securities tend to be good stores of value during times of market stress.

- The **carry factor** is the higher excess return potential of bonds with higher spreads relative to the broad market. These bonds typically have longer maturities, lower ratings and are in sectors with the highest spreads. They tend to be the riskiest bonds in the universe.

- The **value factor** is the higher excess return potential, relative to the broad market, of bonds priced at the largest discounts relative to similar securities. Since a bond's price is a function of its default risk, a natural definition is to identify bonds priced at a discount relative to their historical default rates. The value factor groups bonds with similar historical default rates (bonds with similar ratings) and identifies the cheapest, or highest spread, bonds within those groups.

- In addition, there is also the **liquidity factor**, which is the higher excess return potential, relative to the broad market, of less-liquid bonds. To estimate liquidity, we use characteristics such as bond age or issue size.

How do these factors manifest?

In figure 1, each dot represents a bond from the Bloomberg Barclays US Corporate Bond Index along the dimensions of spread and rating. Low volatility bonds (dark blue dots), which tend to be shorter duration and higher credit quality, cluster toward the left of the chart. Carry bonds (green), which have wider spreads and tend to be of lower credit quality, cluster towards the right. Finally, value bonds (blue),

which represent the highest spread securities in each rating category, span the top of the range. The remaining bonds (grey) do not fall into any of these three categories.

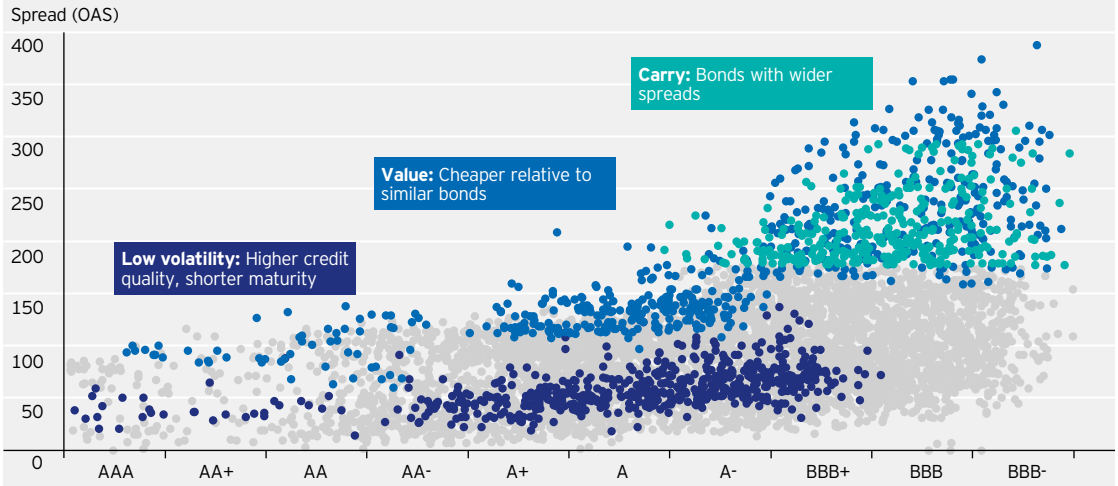
All three clusters of investment grade and high yield bonds had higher historical returns than the market.

As figure 2 shows, all three clusters of investment grade and high yield bonds had higher historical returns than the market.

Assessing a portfolio from a factor perspective
Assuming that, alongside duration and rating, the exposures to these four factors drive a bond portfolio's performance, we now analyze the factor exposures of two example portfolios to find out whether these exposures can help explain their relative returns.

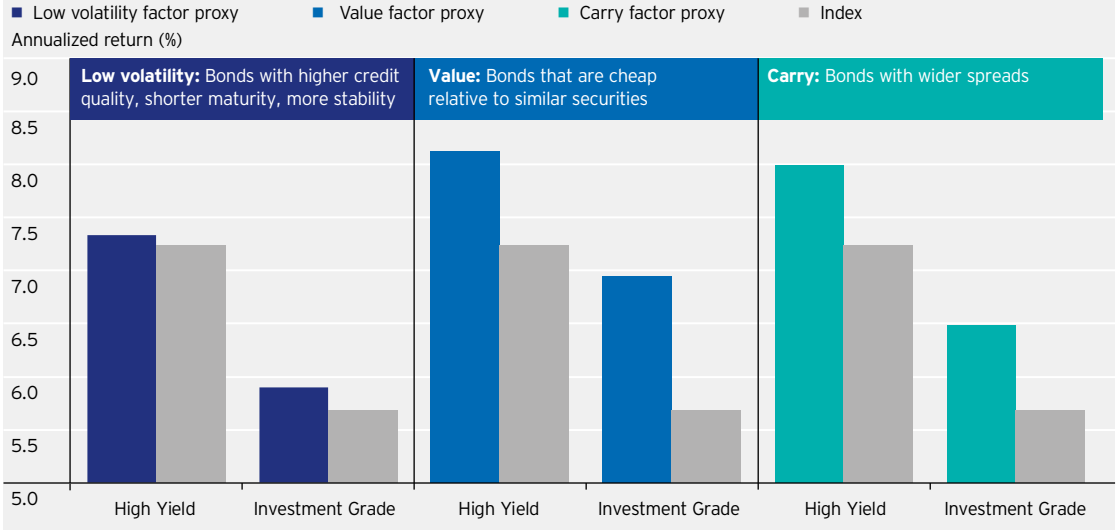
For the purpose of our case study, the two example portfolios are the iBoxx USD Liquid Investment Grade Index and the iBoxx USD Liquid High Yield Index, which we compare to the broader investment grade

Figure 1
Visualizing factors in US investment grade bonds



US investment grade bonds as measured by the Bloomberg Barclays US Credit Index.
Source: Invesco, Bloomberg LP. Data as at October 2019. For ease of illustration, we capped the highest spread at 353 bp (versus the actual maximum of 709).

Figure 2
Factor returns in investment grade and high yield bonds



The index for US investment grade bonds is the Bloomberg Barclays US Credit Index. The index for US high yield bonds is the Bloomberg Barclays US Corporate High Yield Index.
Source: Invesco, Bloomberg LP. As of January 2020 Please see the appendix for more information on the mathematical process that underlies the Value, Carry and Low Volatility factor proxies. **Past performance is not a guide to future returns.**

Table 1
Dividing the iBoxx investment grade index into buckets

	% of universe	Maximum spread	% of portfolio
Bucket 1 (low carry, tight spread)	33.3	68 bps	21.1
Bucket 2	33.3	113 bps	38.5
Bucket 3 (high carry, wide spread)	33.3	709 bps	40.4
Active allocation (bucket 3 minus bucket 1)	0.00	-	19.3

"Universe": Bloomberg Barclays Credit Index. "Portfolio": iBoxx USD Liquid Investment Grade Index.
Source: Holdings from Bloomberg LP. Data as at 31 December 2019.

and high yield universes. The two iBoxx indices utilize a variety of filters to create more liquid versions than the broad market indices. We approximate the broader universes using the Bloomberg Barclays Credit Index and the Bloomberg Barclays 2% Issuer Capped High Yield Index.

The iBoxx indices were chosen for two reasons: first, they are well-known, partly because they are tracked by large ETFs. Second, we observe that investors are often surprised when broad market indices have significant tilts that tend to drive performance differences versus their universe – in the short run, but sometimes also in the long run.[2]

The mechanics – measuring fixed income factor overweights and underweights
To illustrate the mechanics of our analysis, we first measure the exposure of the iBoxx investment grade index (our portfolio) to the carry factor and compare this to the exposure of the broad universe. Later, we extend this methodology to the other factors.

To define a carry bond, we divide the broad universe into three buckets based on spread, such that the third of the investment grade benchmark with the tightest spreads is allocated to bucket 1, the middle third to bucket 2 and the third with the widest spreads to bucket 3. Table 1 shows this breakdown and the highest bond spread in each bucket.

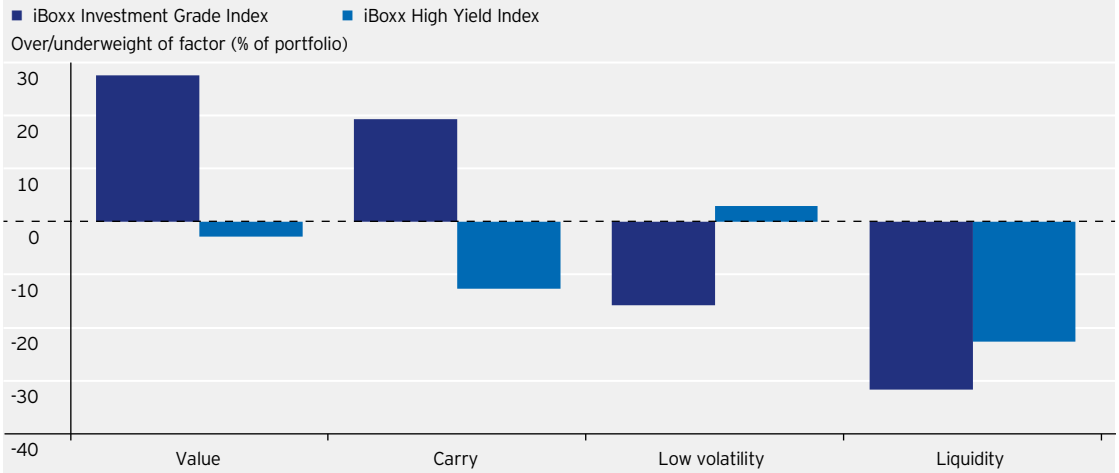
We now determine the factor exposure of the iBoxx investment grade index. Bonds with spreads of less than 68 bps are placed in bucket 1, the low carry bucket; bonds with spreads between 68 bps and 113 bps are placed in bucket 2; bonds with spreads above 113 bps go into bucket 3, the high carry bucket.

Table 1 shows that 40% of bonds in the iBoxx investment grade index are in the high carry bucket and 21% in the low carry bucket, compared to 33% each in the broader universe. By being overweight high carry bonds and underweight low carry bonds, the iBoxx investment grade index has significant exposure to the carry factor relative to the broad universe.

Finally, to calculate the total active allocation to carry of the iBoxx investment grade index, we subtract the active allocation in bucket 1 from the active allocation in bucket 3. This gives credit to the overweight of high carry bonds and the underweight of low carry bonds.[3]

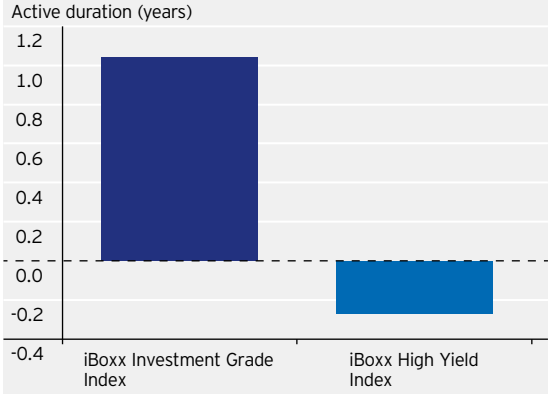
Indices can have factor exposure too
In figure 3, we extend the analysis to high yield, as well as to the other credit factors, using the methodology outlined above. Note that the bar representing iBoxx Investment Grade (IG) carry corresponds to the 19.3% active allocation from the carry example, shown in table 1.

Figure 3
Factor overweights and underweights in the iBoxx indices



Source: Index weights from Bloomberg LP. Data as at 31 December 2019.

Figure 4
Active duration exposure of the iBoxx indices relative to their broad universes



Source: Index weights from Bloomberg LP. Data as at 31 December 2019.

We find that the iBoxx high yield and investment grade indices are both underweight the liquidity factor – which makes sense, given that part of their construction processes includes filtering out less-liquid securities. The iBoxx high yield index is also underweight the highest spread names in the universe (i.e. high carry bonds), and it is relatively neutral in the value and low volatility factors. The iBoxx investment grade index is overweight value and carry bonds and underweight low volatility bonds. Investors are often surprised to discover that indices which seemingly represent the broad market have significant factor tilts.

Traditional bond characteristics still matter (a lot)
Identifying a portfolio's factor tilt helps identify its sources of return. But traditional bond metrics, such as duration and ratings, are also critical when it comes to understanding a portfolio's return profile. Assessing factor exposure does not replace the use of these traditional metrics but is an additional lens through which to view portfolio analysis.

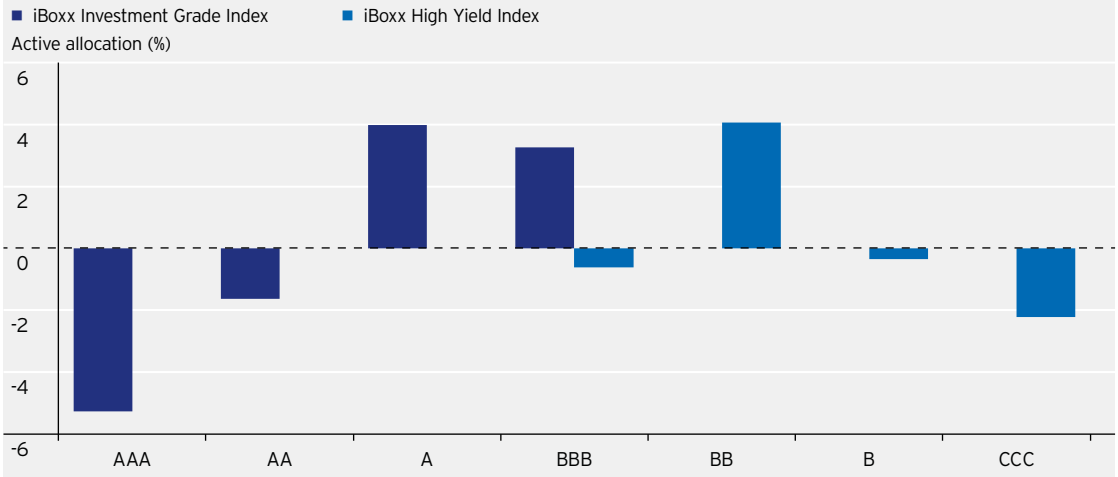
Figure 4 shows the active duration of the iBoxx indices relative to the broad market benchmarks. Duration is the sensitivity of a portfolio to changes in yield. The longer duration of the iBoxx investment grade index suggests that, if US Treasury yields or credit spreads decline, this would likely have a more significant positive performance impact on this index relative to the broad market benchmark.

Figure 5 shows the active allocations of the iBoxx indices and their broad universes to the rating buckets. The iBoxx high yield index is overweight higher credit quality bonds while the investment grade index is overweight lower credit quality bonds.

Active exposure to factors and traditional bond characteristics will likely have an impact on returns.

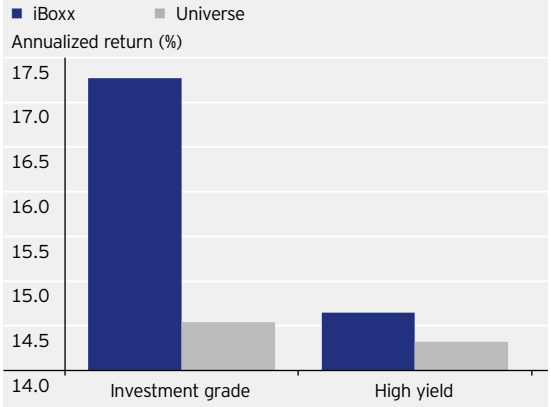
Putting it all together – the impact on returns
Active exposure to factors and traditional bond characteristics will likely have an impact on returns. Figure 6 shows the returns of the iBoxx indices relative to their broad universes in 2019. In the investment grade space, there was a significant divergence: the iBoxx delivered 17.25% versus the broad benchmark return of 14.54%. We estimate that 50% of that outperformance was due to the duration difference, which amplified the impact of both government bond yield declines and corporate bond spread tightening in 2019. About half of the rest was due to the iBoxx index's overweights to the value and carry factors and its underweight to the low volatility factor. In high yield, the iBoxx index performed in line with the broad universe, as factor exposures and other drivers of risk and return (such as duration and rating) offset each other.

Figure 5
Rating allocations in the iBoxx indices relative to their broad universes



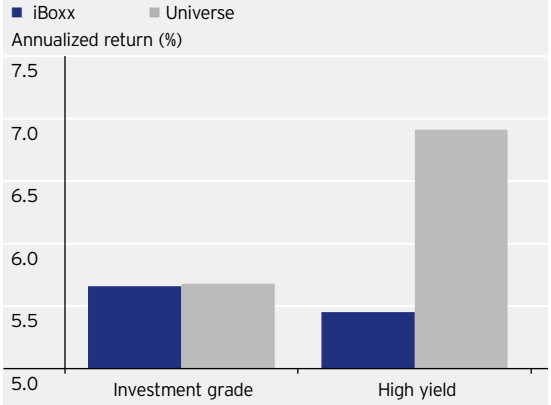
Source: Index weights from Bloomberg LP. Data as at 31 December 2019.

Figure 6
1-year performance of the iBoxx indices vs their broad universes (2019)



Source: Bloomberg LP. Data as at 31 December 2019. **Past performance is not a guide to future returns.**

Figure 7
20-year performance of the iBoxx indices vs their broad universes (1999-2019)



Source: Bloomberg LP. Data as at 31 December 2019. The iBoxx Investment Grade Index and the iBoxx High Yield index launch dates are 31 October 2006. Data prior to that is back-tested index data based on iBoxx methodology. **Past performance, whether back-tested or actual, is not a guide to future returns.**

Figure 7 summarizes longer-term performance over 20 years, during which the performance difference was far more significant in high yield: the iBoxx delivered a much lower return than the broad benchmark, whereas the long-term returns of the investment grade indices are broadly similar. The underperformance of the iBoxx high yield index reflects its lower exposure to less-liquid securities with higher carry, which tend to be associated with higher returns over the long term.

Factor lenses are now available. We have found explanations for the indices' outperformance and underperformance in the short run, as well as the long run.

Conclusion

Understanding the risk and return drivers of a portfolio is important to portfolio managers and investors alike. With the evolution of the fixed income market, factor lenses are now available to help better understand these exposures. In our case study, we applied factor lenses to the iBoxx investment grade and high yield indices compared to their broad market universes. By doing so, we have found explanations for the indices' outperformance and underperformance in the short run, as well as the long run. We believe this type of analysis can help investors more clearly understand the risk and return drivers in their portfolios and have the opportunity to position their portfolios to take advantage of them.

Appendix

In order to proxy factors where standard indices do not exist, the live broad market index data are reweighted utilizing a mathematical process. Below we summarize the mathematical process used to reweight live index data. For high yield, the universe is the Bloomberg Barclays US HY (2% Capped) Index and for investment grade, the universe is the BBG Barclays Corp Bond Index. The period is 2000-2020.

The mathematical reweighting process of the value proxy is as follows: determine option-adjusted spread for each bond in the universe; create buckets based on rating, sector and duration; in each bucket, rank each bond based on its OAS, with high ranking bonds having the highest OAS in that bucket; mathematically reweight the index such that the proxy is the 5% of bonds that have the highest rank in each bucket for investment grade and the 10% of the bonds with the highest rank in each bucket for high yield; repeat when the live, broad market index data are reconstituted on a monthly basis.

The mathematical reweighting process of the low volatility proxy is as follows: determine the time to maturity for each bond in the universe; filter out the lowest credit quality bonds (BBB and below for investment grade and CCC+ or below for high yield); create buckets based on rating; in the filtered universe and in each bucket, rank bonds based on time to maturity with the lowest time to maturity bonds in each bucket having the highest rank; mathematically reweight the index such that the proxy is 5% of bonds that have highest rank in each bucket for investment grade and the 10% of the bonds with the highest rank in each bucket for high yield; repeat when the live, broad market index data are reconstituted on a monthly basis.

The mathematical reweighting process of the carry proxy is as follows: determine OAS for each bond in the universe; rank each bond based on its OAS, with high ranking bonds having the highest OAS in the universe; mathematically reweight the index such that the proxy is the 5% of bonds that have the highest rank for investment grade and the 10% of the bonds with the highest rank for high yield; repeat when the live, broad market index data are reconstituted on a monthly basis.

The mathematical reweighting process of the liquidity proxy is as follows: determine the size of each bond issue; rank each bond based on its size with high ranking bonds having the lowest size in the universe; mathematically reweight the index such that the proxy is the 5% of bonds that have the highest rank for investment grade and the 10% of the bonds with the highest rank for high yield; repeat when the live, broad market index data are reconstituted on a monthly basis.

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Ward Bortz works with investors globally to understand and integrate systematic, low-cost solutions into fixed income portfolios, while also helping to build and evolve investment strategies offered by the Invesco Fixed Income Factors team.

Notes

1 In this piece, we cover factors related to credit. Factors also exist in the currency and sovereign bond markets. Please see the appendix for more information on how one may reweight live index data to proxy a given factor.

2 We compare indices here, but this type of analysis can be performed on any mutual fund, ETF or bond portfolio where holdings are available. This includes ETFs or mutual funds where there is exposure across multiple fixed income sectors, such as mortgages, US Treasuries and corporates, as well as those with derivative exposure.

3 This methodology does not consider risk. We could extend this process to include duration times spread (a measure of risk) in conjunction with the determination of relative allocations, as outlined above.

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