2021 JPM Macro, Quantitative and Derivatives Conference

Key Takeaways, Investor Survey on Macro Outlook, Quant Investing, AI/Alt Data, Crypto

J.P. Morgan hosted its 24th Macro, Quantitative & Derivatives Conference on June 11th. The Conference was **attended by ~3200 investors representing ~1500 institutions from across the world.** The conference featured presentations from Asset Management One USA, BlackRock, Blueshift AM, Capstone, CorePoint Partners, Duke University, NYU, DEShaw IM, GMO, HSBC AM, JPMorgan, Kepos Capital, Man Group, Mingshi Investments, PIMCO, Rayliant, Santander AM, UPS and Veritas Pension. **Speakers at the conference deliberated on various aspects of Macro and Quant Investing**: strategic risk management, asset allocation in rising inflation, test for bonds as hedging assets, quantitative strategies in credit, pandemic risk as a quantitative factor, CIO panel on asset allocation and risk premia investing, state of volatility markets, comparison of private equity and hedge funds, stochastic programming approach to liability driven investment, opportunities in China A-shares vs H-shares, single stock shorting in China A-shares, evolution and adoption of blockchain & digital assets, machine learning applications in portfolio management, trading and liquidity research, navigating uncertain markets with alternative data, harnessing alternative alpha, and others. In this report, we have summarized the conference presentations, highlighting the key insights from each talk. **The conference replays are available; please email us if you want to access them.**

An Investor Survey was conducted, incorporating views of conference attendees on a wide range of relevant market-related topics:

- **Macro Outlook**—Investors expect 10yr bond yield between 1.75%-2.25% by year-end (only 13% expect 10yr yield above 2.25% by year-end). Interestingly, only 7% of participants see the US 10yr yield between 1.5%-2.0% posing a risk to equity market/multiple, while on the contrary 17% see risk to equities only at 10yr yield above 3%. The majority (51%) of participants expect to see equity multiple pressure once 10yr yield is around 2.5%-3.0%. Nearly two-thirds (64%) of the investors expect S&P 500 year-end level between 4,200-4,600. Investors expect VIX to average 17.5-20 during this year and Oil between $70-80/barrel by year-end.

- **Major Risks to Market**—Investor response was focused on central bank tapering (43%) and inflation (30%). A third of investors (33%) expect inflation pressure to subside within 6 months and another half (48%) expect it to subside in 6-12 months. Best way to hedge inflation risk is via Commodities (46%) followed by Stocks such as Energy (27%). Significant number of investors thought Cryptocurrency (62%) and Electric Vehicles/Green Tech (17%) were in a bubble. Interestingly, only a few believe bond-proxies (5%) are in bubble territory.

- **Quantitative Strategies**—Largest inflows are anticipated in ESG (38%) followed by multifactor strategies or CTAs (~20% each). Largest outflows are expected from Risk Parity (37%) and selling vol options (16%). However, few (15%) believe ESG will provide best opportunities for Quants. Most see opportunities in Big Data/ML (36%) and EM/China (23%). A majority of investors (77%) expect Value outperformance to continue—as beginning of longer-term Value cycle (54%) vs a short-term bounce (23%).

Global Macro, Quantitative & Derivatives Strategy

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Support our team in the US Institutional Investor Survey in the below categories:

- **Equity-Linked Strategies** – *Marko Kolanovic*
- **Thematic Research** – *Marko Kolanovic*
- **Portfolio Strategy** – *Dubravko Lakos*
- **Quantitative Research** – *Dubravko Lakos*

Request Ballot. Please email us if you need assistance.

Past Conference Summaries

- 23rd Conference Summary
- 22nd Conference Summary
- 21st Conference Summary

Please email us if you are interested in attending our Macro Quant Conference in 2022.

Narendra Singh	US
Arun Jain	US
Peng Cheng	US
Thomas Murphy	US
Bram Kaplan	US
Kamal Tamboli	US
Khuram Chaudhry	EU
Ayub Hanif	EU
William Summer	EU
Dobromir Tzotchev	EU
Rahul Dalmia	EU
Tony Lee	APAC
Mixo Das	APAC
Robert Smith	APAC
Berowne Hlavaty	APAC
Evan Hu	APAC
Twinkle Mehta	APAC
Priyanka Ranjan	APAC

See page 49 for analyst certification and important disclosures.

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- **Portfolio Construction**—On application of volatility scaling/targeting**,** there seems to be a decrease in adaptation with a quarter (26% vs 18% last year) of participants reporting no use. Most popular methodology for vol measure is a proprietary mix (29%) followed by weighted or simple realized vol (16% each). On rebalancing frequency, 45% rebalance on a monthly basis followed by 24% on higher frequency. Investors that are rebalancing monthly are divided on their preference of what time of month they would rebalance.

- **Cryptocurrencies**—Only 10% of investor firms trade in Crypto. Of those that don't, only 20% plan to do so. Investors' view on cryptocurrency's future is very divided: 51% feel it is here to stay or even become an important asset and 49% say it is 'rat poison' or a temporary fad. However, four-in-five (81%) investors expect tighter regulations of Crypto with almost all (95%) believing fraud is somewhat or very much prevalent in crypto world.

- **Adoption of Big Data/AI Strategies**—Two-in-three investors (67%) want to use machine learning techniques to enhance existing quant strategies or portfolio construction/risk management. 30% of responders plan to bulid new quant strategies using big data. The number of practitioners evaluating 1-3 alternative data sources was higher than last year (54% vs 45%). Half of investors have found at least one 'Alternate Data/ML based signal' that yields alpha.

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Research Areas in Focus

With the world enduring pandemic, economic and political crises, Quantitative Investing and Risk Management are facing a challenging environment. The Global Macro Quantitative and Derivatives Strategy team has helped investors with numerous thematic thought pieces in recent months: Retail Participation, Short Squeeze, Rotation into Value, Where are the bubbles and COVID-Green risk, Equity Macro and Quantitative Outlook for 2021, Vaccine Triggers Largest Daily Momentum Crash/Value Squeeze Ever, Vaccine Rotation, Subsiding Risks, Market Nirvana, Likely the best of both worlds for stocks, Election Baskets, Update on overnight developments, Improving Corporate Outlook, Hedging Long-Term Risks, Correlation Shocks, Conditions Increasingly Favor COVID-19 Recovery Candidates, Potential for a Value Rally, Election Implications for Equities, Democrat Agenda Winners and Losers, Evolving Business Models, Quarter-end rebalance impact, Positioning and low risk of new lockdowns justify buying the dip, Market Risk Outlook, Updated COVID-19 analysis: Nursing homes.

Continuing the effort to support clients with the most topical discussions, the conference was targeted around ongoing market concerns. J.P. Morgan hosted its 24rd Macro Quantitative conference on June 11th. The Conference was attended by ~3200 investors representing ~1500 institutions from across the world. The conference featured presentations from Asset Management One USA, BlackRock, Blueshift AM, Capstone, CorePoint Partners, Duke University, NYU, DEShaw IM, GMO, HSBC AM, JPMorgan, Kepos Capital, Man Group, Mingshi Investments, PIMCO, Rayliant, Santander AM, UPS and Veritas Pension. Speakers at the conference deliberated on various aspects of Macro and Quant Investing: strategic risk management, asset allocation in rising inflation, test for bonds as hedging assets, quantitative strategies in credit, pandemic risk as a quantitative factor, CIO panel on asset allocation and risk premia investing, state of volatility markets, comparison of private equity and hedge funds, stochastic programming approach to liability driven investment, opportunities in China A-shares vs H-shares, single stock shorting in China A-shares, evolution and adoption of blockchain & digital assets, machine learning applications in portfolio management, trading and liquidity research, navigating uncertain markets with alternative data, harnessing alternative alpha, and others. In this report, we have summarized the conference presentations, highlighting the key insights from each talk. The conference replays are available; please email us if you want to access them.

In recent years, investors have paid increased attention to Alternate Risk Premia as a source of returns uncorrelated with conventional equity and bond risk premia. Moreover, low global policy rates have inflated the valuations of these traditional assets and depressed the implied premia of several asset classes to decade-low levels, adding to the attractiveness of alternate risk premia. In addition, application of Big Data, Machine Learning and Artificial Intelligence to risk premia investing remains a heavily discussed topic. At J.P. Morgan, we have published extensively on these topics, including detailed guides on Cross-Asset Systematic Strategies, Cross-Asset Momentum and Equity Risk Premia Strategies; a primer on Big Data and AI Strategies: Machine Learning and Alternative Data; US Factor Reference Book: Payoffs, Pitfalls and Analysis of 100+ Equity Factors; and recently: COVID-19 Composite, 2019 Alternative Data Handbook, Automated Machine Learning, The Value Conundrum, Revisiting Value, Equity Risk Premium, Cross Asset Style Timing, Defensive Risk Premia, The quest for pure equity factor exposure, Market-neutral carry strategies, Optimal option delta-hedging, Timing FX short-vol strategies, Skew as a trading signal for macro assets, Inflation Expectation Tracking Equity Baskets.

Given the recent growth in Retail Participation, we are also actively researching the field supporting clients with deeper insights and thematic trading strategies – Growing Retail Participation, Follow the Robinhood Money, A (Sub)Penny Saved, Retail Trading in the US Equity Market.

Our team's growing focus area has been on Big Data and ML/AI Strategies – Alternative Data and the U.S. Election: Analysis of state voter registration, Political choices and financial forecast, big data and early indications of US pandemic inflection, Industry Developments in 1H20, Structural digitalization trends, Social Media Analytics for US Election, Identifying themes and selecting stocks via NLP, Applications of Machine Learning in Cross Asset Derivatives, Systematic FX Option Portfolios, Measuring the impact of COVID-19 on guidance statements, Big Data in a Pandemic: Internet of living things – big data can save lives and economies, Applications of Machine Learning in Equity Derivatives.

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Summary of Conference Presentations

Some of the ideas in the summaries below represent the perspectives of the speakers and not necessarily the opinions of the J.P. Morgan research analysts.

Keynote Presentation

The speakers discussed their recent book titled "Strategic Risk Management", in which they emphasize the need in risk management to have an action plan (i.e. a set of strategies to employ) when markets present a particular set of circumstances, rather than to try to predict and hedge the next tail event. The book focuses both on setting up the strategies, with an emphasis on positive convexity strategies, and on having an active strategic approach to risk management, where dynamic portfolio management is used to minimize downside risk. The pandemic illustrated how it can be hard to forecast the next bad event (as few saw it coming), and the importance of having a plan/set of strategies in place—the set of core strategies discussed in the book worked reasonably well to mitigate drawdowns last year. Portfolio rebalancing is an active strategy that buys losers and sells winners, which induces negative convexity and increases portfolio risk. As such, the speakers believe this negative convexity should be mitigated. The speakers noted that equities tended to perform poorly on the whole during inflationary periods, and that there is little evidence cryptocurrencies work as a hedge but they are great from a trading perspective for technical strategies.

Macro/Cross-Asset Focused Presentations

Preparing Your Portfolio for Inflation

Speaker breaks down the topic into 3 parts: (1) Inflation expectations, (2) impact on popular bond-equity portfolios and (3) framework for balanced portfolio for hedging against future inflation shocks. Based on bottom-up forward-looking signals, inflation is estimated to likely return to baseline of 2%-2.5% in short term (i.e. 6 to 12 months). In the longer run, speaker expects fat tails on inflation. Positive bond-equity correlation recently puts the bond-equity portfolios at major risk. Speaker presents an "Inflation Beta Framework"—which estimates asset returns using regression on inflation surprises and growth surprises. Speaker finally concludes with current valuations of various assets. TIPS are fairly priced in the current market and look attractive in rising inflation environment. Gold can be thought of as really long duration (30yr) TIPS and is also fairly priced. REITS are good hedge to rental inflation. Commodities are the main driver of volatility in inflation. Carbon markets can be emerging opportunities for inflation hedges.

Running Low: The 2020 Test for Bonds as Hedging Assets

The presenter discusses in detail whether bonds continue to serve as effective haven assets in the low interest rate environment of 2020. The early 2020 market shock presented a key test from a starting point of low interest rates. The presenter analyzed data from both before and after the market shock to assess the future utility of treasury securities as hedging assets. In 2021, Treasury yields have risen, giving them more room to rally during a downturn. Interestingly, the correlation between treasury yields and equities has dropped, reflecting concerns about inflation risks. The speaker contends that we will probably see some inflation over the next six months but it will be transitory and once the effects of the stimulus bill and other fiscal developments are swallowed by the market, we will probably see some a return to positive correlations, reinstating the favorable hedging properties of treasury securities over the longer term. Bonds passed their test as a hedging asset in 2020 and the speaker believes bonds will to continue to behave that way going forward.

Current State of Volatility Markets

The speaker highlighted the unprecedented amounts of liquidity provided by Central Banks in response to COVID-19 pandemic (~$10 trillion in 2020) and how it has been a continuation of their asset inflation since 2008. Central Banks have artificially inflated the market through balance sheet expansion (~$32 trillion), enriching investors in risk assets, including equities, long-term bonds, credit and real estate by a >$26 trillion windfall. By overlaying the S&P 500 on Central Bank balance sheet size, one can observe the correlation between different asset classes and conclude that the windfall has been once in a lifetime for anyone who has owned risk assets post-GFC. Interestingly, the target allocation of a typical client in pension funds has gone up considerably post-GFC from 55:45 to 75:25 where 25 is in fixed income instruments. According to the speaker, fixed income has lost its utility function as it provides neither yield nor portfolio diversification as it used to. The risk of a Fed misstep is about 15-20% as implied by the inflation options market. This is not an insignificant risk. If

next month is peak inflation, then investors should focus on the intrinsic details of inflation in US and other markets. Clients are hesitant to invest in Volatility Risk Premia strategies based on tough losses due to volatility explosions in Feb 2018 and most recently in March 2020. Currently, inflation strategies can help investors in the diversification of the existing tail risk.

Comparing Flows and Performance in Private Equity and Hedge Funds

The presenter detailed an approach of using cumulative flows into private equity and hedge funds to estimate future returns. Private equity returns are first estimated using a contribution and distribution based cash flow model as fund valuations based returns suppress volatility. The results of the analysis indicate a negative correlation between 5-year cumulative flows into PE funds and their subsequent returns. These results are mirrored for most hedge fund strategies. The presenter concludes that based on recent outflows for most hedge funds strategies, these may offer more attractive returns going forward compared to crowded public and private equity investments.

Risk Premia Focused Presentations

Giving Credit Where Credit's Due

The speaker started the presentation by discussing the issuance, depth, and data in the corporate bond markets and the factors in corporate credit. After the introduction, the speaker dove into what she calls the credit landscape. Although the risk premia for credit has some additional components when compared to the equity space, the speaker still uses some of the familiar risk premia such as value, quality, momentum, and ESG as a source of integrated risk management. Cross Asset considerations were also discussed as well as technology for connecting portfolio management research with trading, and technology for incorporating real-time transaction volume and liquidity data into the optimization framework.

Is It Safe to Trade Factors without a Mask?

The speaker discusses COVID as a quant factor. The emergence of COVID-19 has brought a new risk factor. Pandemics are inherently risky and the epidemiology is uncertain and constantly evolving. The pandemic is impacting business models differently; some have been crippled while others are thriving. We study the impact on stock prices and break up stocks into two groups: COVID Names (those hurt by the pandemic) and STAY Names (those that have seen upside due to pandemic). The speaker explains how we detect COVID vs STAY stocks. The talk is titled "Is it Safe to Trade Factors Without a Mask?" and the meaning of this is, "Is it safe to trade traditional factors now as we did before without the type of Covid filtering discussed in the talk?"

CIO Panel on Asset Allocation and Risk Premia Investing

The panelists started the discussion sharing their views on the lessons learnt from the 2020 experience and the permanent changes in the investment landscape. Then the conversation shifted to the challenges for the 60/40 portfolio and whether there is any viable replacement. The role of systematic and risk premia strategies was discussed and conclusions whether they can help with the current macro challenges were drawn. The topic about the risk of unexpected inflation spikes and the adjustments to investment process due to future expected higher inflation had been also elaborated upon. There was a lively discussion on the role of portfolio construction techniques in the investment process and the innovation in the space. Last but not the least, the questions from the public addressed the more sizable allocation to risk premia to maintain risk and avoid unrewarded beta and the role of private equity and crypto for achieving diversification.

Stochastic Programming Approach to Liability Driven Investment

The speaker started with an introduction to stochastic programming which is an optimisation problem in which some or all problem parameters are uncertain, but follow known probability distributions. This framework contrasts with the more common deterministic optimisation in which all problem parameters are assumed to be known explicitly. Thinking about Liability Driven Investment (LDI), which is a holistic investment strategy that tackles not only the asset side of a pension plan's balance sheet but also the liability side, using the stochastic approach the risk and return characteristics which take into account liabilities determine the optimal asset allocation. The results show that an optimal LDI portfolio with key-rate duration-matching bond strategy is superior—this is the best way to minimise funding-status volatility—to both a duration-convexity matching bond strategy and a long duration bond index-tracker strategy.

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Technology Focused Presentation

Blockchain & Digital Assets – Notes from the Trenches

The speaker presented the various steps in the adoption of blockchain at J.P. Morgan. Five years ago, when J.P. Morgan first started researching blockchain, it was considered a curiosity, a technology with a lot of potential to drive cost savings, but probably an overhyped series of proofs of concept. One of the first projects as part of the blockchain program was to essentially fork the public ethereum codebase to add privacy and performance to the code base, and use it for enterprise purposes. Then time was allocated to try to understand new privacy technologies and basically how to share information without actually sharing information. Later, the Liink network was debuted and it is one of the largest blockchain-based networks of cross-border payments. Over 400 banks have signed up to participate in the Liink network, and 100 of them are live. The next challenge was how to transact Value on the blockchain. The bond issuance and syndication process has been automated using smart contracts and with this project also the J.P. Morgan coin was born. US dollar representation on the blockchain was created that has 24/7 365 availability and programmability with all the benefits of being on a blockchain, and connected with J.P. Morgan banking systems. With the new system it has become possible to create a repo trade that matures in hours. JPMorgan is the first bank to test payments by running Ethereum nodes in the satellites along with the ground station to test tokenized payments to not only explore what the future space economy will be but also to understand the outer limits of this new technology.

China Focused Presentations

The Tale of Two Chinas: A-Shares vs H-Shares

The speaker discussed the unique opportunities in China A-shares for global investors. Among the various China exposures, China A-shares offer the best growth opportunities. H-shares have historically been dominated by mature SOEs and hence do not offer a lot of growth opportunities, while ADRs are typically full of companies that couldn't list in China (due to more stringent listing requirements) which leads to some adverse selection. A-shares on the other hand are much more diversified, offering strong growth exposure to many key sectors like consumer, healthcare and industrials. In terms of opportunities for investors, where typically in the US investors looking to capture alpha are trading against other sophisticated investors, in China A-shares, the other side of the trade is most likely to be retail investors. This continues to replenish the alpha reservoir once one has a better understanding of how fundamentals and sentiment work. A-shares are also extremely uncorrelated with the rest of global equities. The correlation between A-shares and US is only 0.39. And this surprisingly falls in times of stress, which is unique as most correlations tend to rise in times of stress. Finally, compared to the size of the market, the allocation of global investors to the China A-share market remains extremely small, proving structural support to the market as financial opening continues.

China-A Single Stock Shorting – Challenges and Opportunities

Shorting single stocks in the China A-share market is generally difficult. For onshore investors, synthetic shorting is less common due to high swap transaction costs and less developed swap infrastructure. And requirements for physical shorting are quite onerous. So there are a 100 million institutional and individual investors onshore and 90% of the trading happens onshore but they mostly do not short individual names. For offshore investors, physical short selling is not easily available (recently started for QFII investors). This leaves the channel of offshore synthetic shorting (via brokers lending Connect inventory on swap) as perhaps the only efficient way to implement a short sell portfolio in China A-shares right now. And given the limited participation in this space, there should be a lot of alpha opportunity. This is a valid premise, but some challenges also need to be kept in mind when implementing a short selling strategy for China A-shares: (1) There is a much higher recall risk compared to US and other DMs. (2) Offshore synthetic inventory is limited outside the large caps. Assuming a 100% appoval of requests (unlikely in the real world) and assuming 90% tracking, only a $100mn size of short book can be implemented on midcaps. Thus, investors are mostly unable to access shorting of really weak stocks as there is no borrow available.

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Machine Learning Focused Presentations

Recent Machine Learning Applications in Portfolio Management and Trading

The presentation covered three machine learning applications in finance. 1) The first is the application of jump models to model regime changes—the advantages of which are more persistent states when compared to alternative models such as an HMM (Hidden Markov Models). 2) The second topic focuses on the use of alternative data in finance—the presenter emphasizes both the tremendous opportunities as well as the potential costs and that valuing datasets can be very difficult. 3) For the final topic, the presenter introduces the Black-Litterman-Bayes (BLB) model which is an extension of the standard Black-Litterman, which allows investors to incorporate views in form of a likelihood function.

Machine Learning Application in Trading and Liquidity Research, a Practitioner Experience

The speaker provides some lessons from their experience in trading and liquidity research. A few useful rules of thumb to consider why and where machine learning can help: 1) making sense of the large volumes of data that have now become available, 2) recognising complex or non-traditional patterns in data, 3) dealing with non-linearity and avoiding from "mathematical" simplifications, and 4) very useful when forecasting models have a lot of inputs. When is ML likely to work? 1) If something can be done in a few seconds by a human, it's likely to be automated with ML/AI; 2) if there are a lot of good examples available (labelled data), ML/AI can likely figure it out; and 3) optimisation: a lot of time has passed since Markowitz, time to refresh your knowledge of the field, but still we need to solve the interpretability problem. Overall we need to find the right balance between hunting for model performance and interpretability.

Alternative Data Focused Presentations

Navigating Uncertain Markets with Alternative Data

The speaker presented various case studies where alternative data such as consumer purchasing intent, sentiment, buzz, short interest, trade flow, etc., are found able to predict share price movements and macro economic factors. Detailed results and charts show the unique power of alternative data in nowcasting and predicting various types of valuable information.

CEO/Founders Panel on Alternative Data in Investing

The panelists introduced their companies and product offerings and presented their views on how post-pandemic norms differ from pre-pandemic, assessing risks associated with meme stocks, topical themes among their clients and the trend of alternative data and data aggregation. The panelists shared how alternative data including short interest and trade flow data, options pricing and volatility data and NLP analytics based on unstructured data are being used in nowcasting the economy, understanding retail flow, assessing ESG risks, predicting market moving events, etc. Data aggregation has become the key as the volume of data keeps growing and the use cases expand from trading and research desks to other lines of businesses. Different sources of information must be brought together and analyzed to get a full picture of an event.

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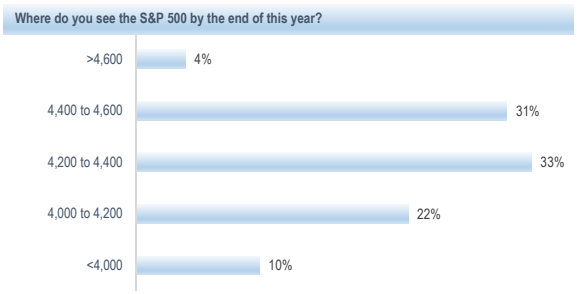
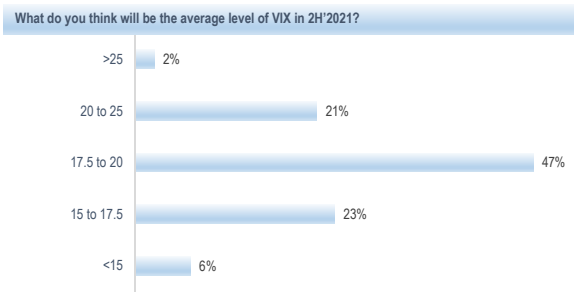
Investor Survey Results

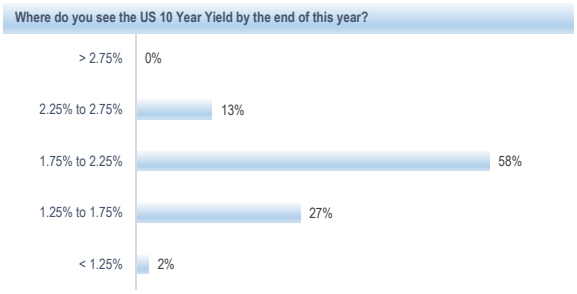
As is traditional during the conference, a survey was conducted on Alternative Risk Premia investing, Big Data, Machine Learning and Macro Expectations. In this conference we expanded the survey to include Risks to Market and Cryptocurrencies to gauge the sentiment of the investment industry. The key findings are summarized below:

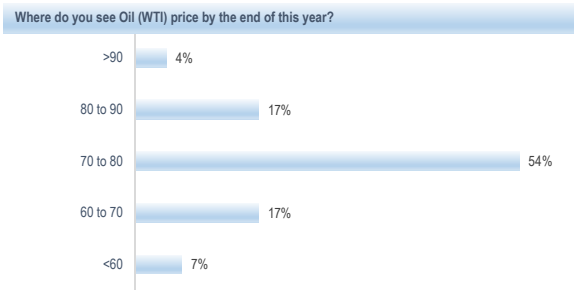
Current Macro Conditions

- Investors' expectations on S&P 500's yearend level is in the range of 4,200 to 4,600 (64%) and a third expect the level to be below 4,200.
- Most investors expect average VIX level in 2H'2021 to be in the range of 17.5-20 (47%); with mostly symmetric view on the either side. Very few investors expect average VIX to go below 15 (6%).
- Investors' expectations on 10-year bond yield by the year end is in the range of 1.75% to 2.25% (58%) with a marginal preference to lower levels.
- Most investors expect oil price by the end of the year to be in the range of 70-80 (54%); with mostly symmetric view on the either side. Very few investors expect average VIX to go below 60 (7%).









Source: J.P. Morgan Macro Quantitative & Derivatives Conference Survey

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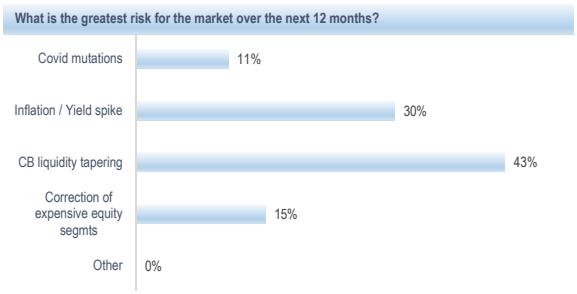
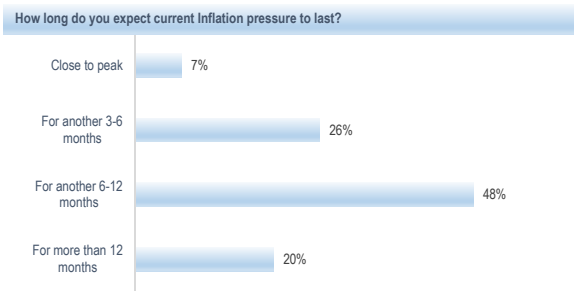
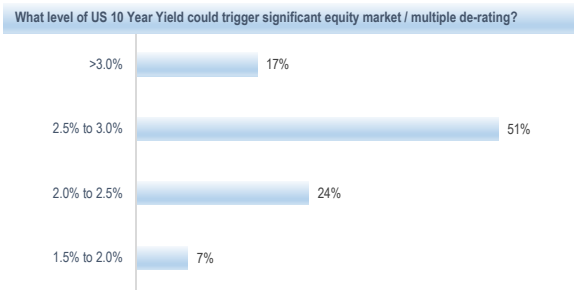
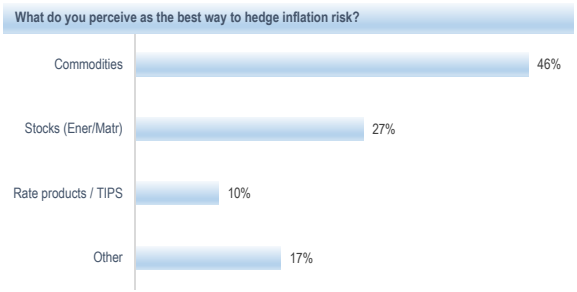
Risks to Market

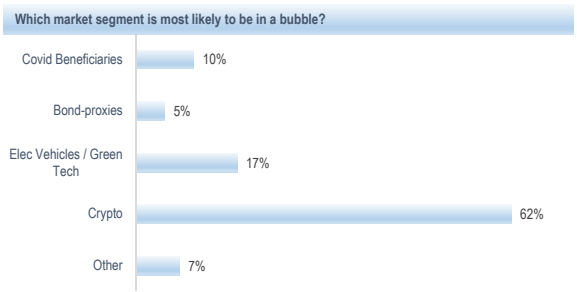
- On the greatest risk to market, investor response was focused on central bank tapering (43%) and inflation (30%). Only 11% cite COVID mutation as the greatest risk.
- A fifth of the investors expect Inflation pressure to last longer than a year. Half of the investors expect inflation pressure to subside in 6-12 months.
- Interestingly on yield risk, only 7% of participants see the US 10yr yield between 1.5%-2.0% posing a risk to equity market/multiple. 17% do not see risk to equities for 10yr yield below 3%. Remaining 75% of participants expect equity pressure around 10yr yield of 2.5%.
- As for Inflation risk, investors have diversified approach for hedging tools—Commodities (46%), Energy/Material stocks (27%) and rate products (10%).
- For market segment in risk, majority see risk in Cryptocurrency (62%) followed by Electric Vehicles/Green Tech (17%). Interestingly, only a few believe bond-proxies (5%) are in bubble territory.











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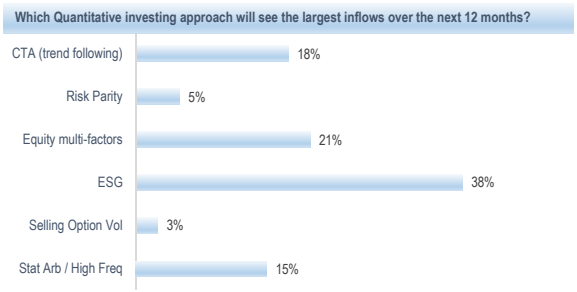
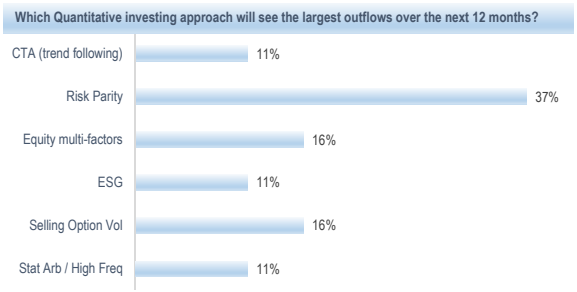
Quantitative Investing Opportunities

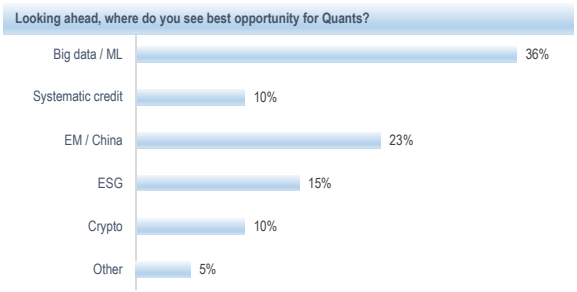
- Largest inflows are anticipated in ESG approaches (38%) followed by multi-factors/CTAs (~20% each). Largest Outflows are anticipated in Risk Parity (37%) followed by Equity multifactor strategies or selling vol options (16% each).

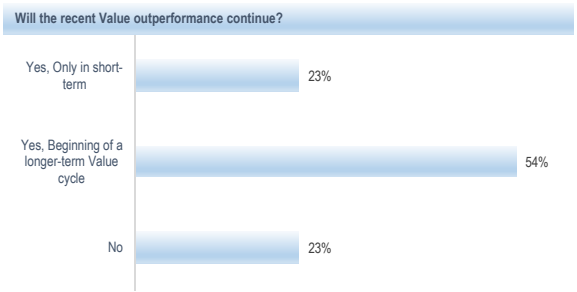
- However, only a few (15%) believe ESG to provide best opportunities for Quants. Most seek it in Big Data/ML (36%) and EM/China (23%).

- Most investors (77%) expect Value outperformance to continue—for short-term (23% vs 50% last year) and as beginning of longer-term Value cycle (54% vs 18% last year).









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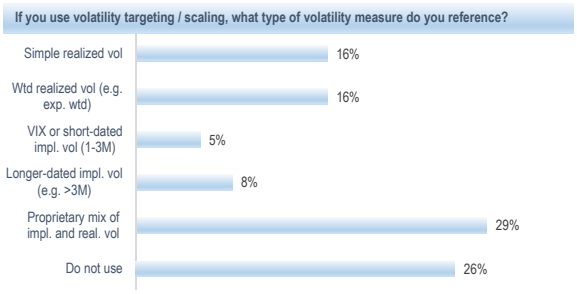
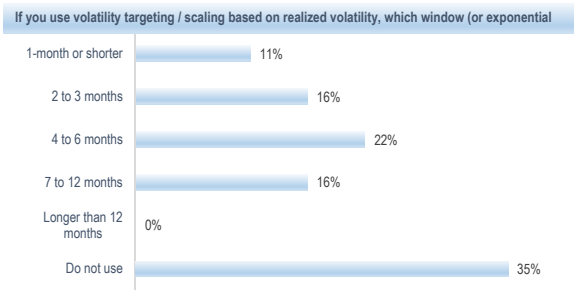
Portfolio Construction

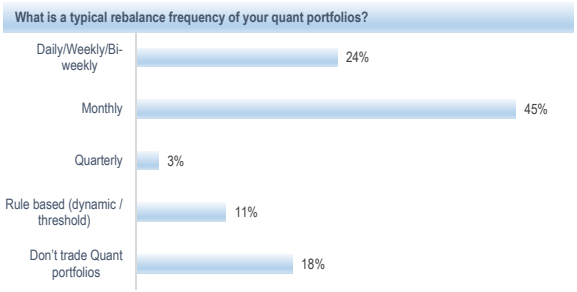
- When asked about the use of volatility scaling/targeting, a fourth (26%) of participants claimed no use, higher than last year (20%). Most popular methodology for vol measure was proprietary mix (29%) followed by weighted or simple realized vol (16% each). Popular Vol measure applied is closest to 4 to 6 months window estimates.

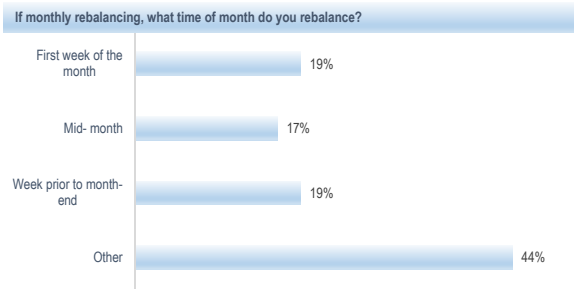
- On rebalancing frequency, 45% rebalance on a monthly basis followed by 24% on higher frequency. Only 3% rebalance on quarterly basis and 11% use some ruled-based frequency. 18% of the respondents do not trade quant portfolios.

- In monthly rebalancing, investors are divided on their preference of what time of month they would rebalance.









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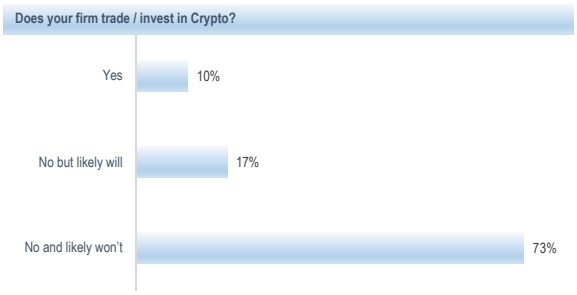
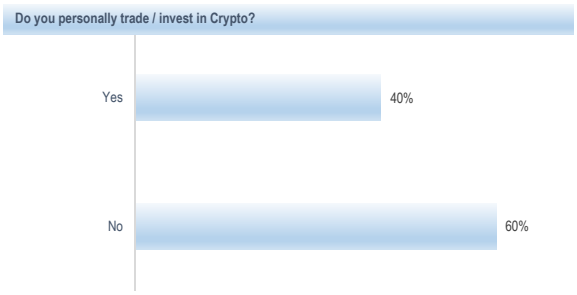
Cryptocurrency

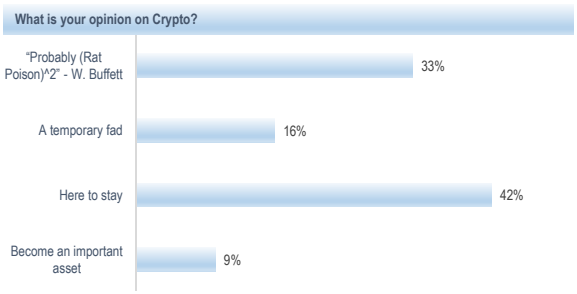
- Few investors trade/invest in cryptocurrency (10%), however most do not (89%). Of those firms who do not invest, most are not likely to start investing/trading in cryptocurrency (~80%). 40% of the investors personally invest in cryptocurrency.

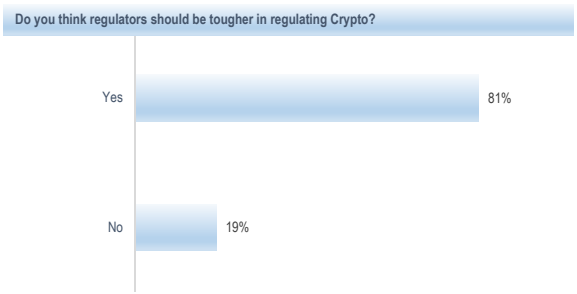
- Perception on cryptocurrency is highly polarized: 51% feel it is here to stay (42%) or even become an important asset (9%), and 49% say it is 'rat poison' (33%) or a temporary fad. Note: Only a few (9%) expect it to turn into an important asset class.

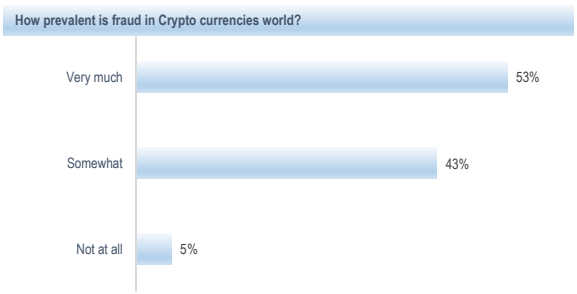
- More than 4/5th of investors expect tougher stance of regulators on cryptocurrency. And almost all (95%) believe fraud in crypto world is somewhat or very much prevalent.











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Big Data/AI Strategies Adoption

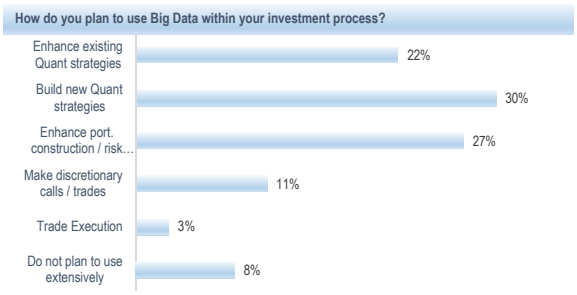
- Investors perceive big data as a tool to build new quant strategies (30%), to enhance portfolio construction/risk management (27%), to enhance existing quant strategies (22%), and to make discretionary call/trades (11%).

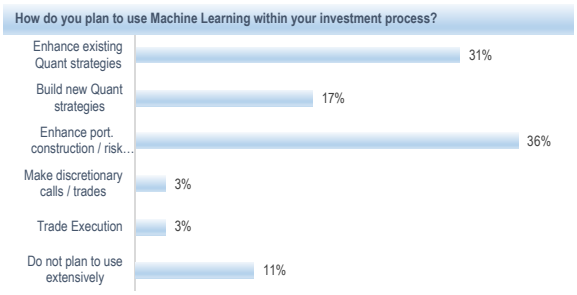
- Investors perceive machine learning as a tool to enhance portfolio construction/risk management (36% vs 23% last year), to enhance existing quant strategies (31% vs 28% last year), to build new quant strategies (17% vs 18% last year) and to make discretionary call/trade execution (3% each).

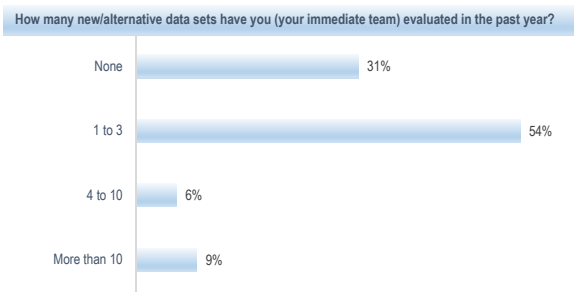
- The number of alternative data sources evaluated by conference attendees (and their immediate teams) remains low. 54% had analyzed between 1-3 new data sets, while 31% had analyzed none at all. These figures show negligible change in evaluation efforts since last year.

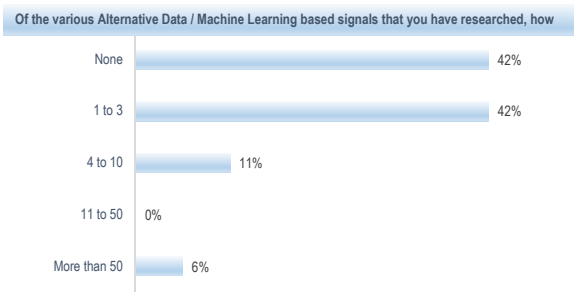
- Majority (~42%) of investors have found no Alternate Data/ML based signals yielding any alpha. 42% of investors were successful in generating few (1 to 3) signals and 11% generated more than 3 signals. These proportions are similar to last year.

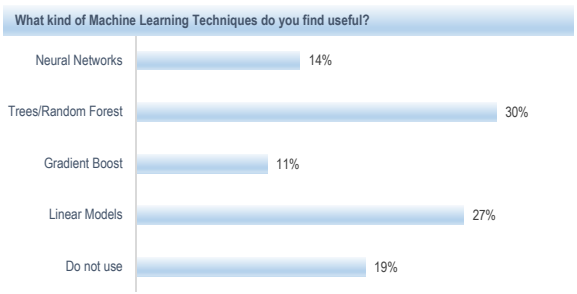
- Most useful machine learning technique rated by investors is trees/random forests (30%) followed closely by linear models (27%).











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Detailed Notes on the Presentations

Keynote

Summary

- The speakers recently published a book titled "Strategic Risk Management". Why did they decide to write this book now? 1) Many asset managers don't do risk management well and do it as an after-thought, but it can be embedded into the alpha process, and 2) managers spend a lot of time thinking about alpha, which is hard, fragile and not persistent, but risk is comparatively easy and persistent, and this persistence is something you can benefit from if you use it well.

- The standard approach to risk management trades off expected return and risk as defined volatility, but we added another dimension: skew. Investors don't like negative skew but do like positive skew. The standard risk models aren't good enough.

- The goal isn't to forecast the next tail event, but rather to have a set of strategies that consider in advance how you would react if markets present a particular set of circumstances.

- The book has two components: 1) Setting up the strategy, with an emphasis on positive convexity strategies, 2) an active strategic approach to risk management, where the dynamic management of the portfolio minimizes downside risk.

- Options are one way to get positive convexity/crisis alpha, but for most people it's too expensive to do over the long-term. The authors thus dug into some other strategies such as time series momentum, which is long gamma/convexity, but doesn't require paying the implied volatility premium. Momentum strategies were found to work well across asset classes, not just in equities.

- The book has a chapter titled 'the best strategies at the worst times' that looks at performance of various strategies during large drawdowns and recessions. Time series momentum and the quality factor performed well, but gold had a mixed record.

- There is also a chapter on rebalancing, which shows this is an active strategy that buys losers and sells winners that induces negative convexity and increases portfolio risk. The authors looked at alternative ways to undo this negative convexity, e.g. by adding positive convexity strategies, or using heuristics/strategies to delay rebalancing such as when momentum signals indicate the market will likely continue to decline.

- A chapter on volatility targeting notes that risk assets become more volatile/levered as they decline (e.g. companies have issued debt, which becomes a larger % of the enterprise value), so volatility scaling is a means to counteract this. They find the approach is thus more suited to risk assets than, for example, bonds. Volatility scaling strategies can have market impact (e.g. as they de-lever into a falling market), but it's possible to control/mitigate it. It's also important to distinguish between temporary and permanent impact—if asset prices deviate from fundamental value, another set of traders will step in to take advantage.

- The book was written mostly pre-pandemic, but the pandemic highlighted how it can be hard to forecast the next bad event (as few saw it coming). But the core strategies considered—strategic rebalancing, controlling your rebalancing depending on the market environment, volatility scaling, and momentum—worked reasonably well during the pandemic.

- There is a chapter on 'man vs. machine', which looks at the performance and risk differences of HFs that are discretionary vs. systematic. To classify the funds, the authors used NLP and found the word "Quant" tended to be associated more often with discretionary managers, implying that we are all quants, i.e. you can't do discretionary management without quantitative tools at your disposal.

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- In inflationary periods, historically, fixed income and equities overall did poorly, commodities and the quality factor did well, as did positive convexity strategies.

- There is little evidence cryptocurrencies work as a hedge (e.g. they sold off during the pandemic, are extremely volatile, and run afoul of societal climate goals), but they are great from a trading perspective for technical strategies.

- The speakers highlighted the following as the main risks over the next year: inflation, valuations (both equities and bonds), the lack of equity diversification (US ~2/3 of global equity valuation, large tech weight), a bond sell-off that could drag down equities, and the risk we don't learn from the pandemic to better manage similar events or new virus variants in the future.

Q&A

- Q: What do you believe is a good PhD thesis topic to work on for the next 3 years?
  A: Decentralized finance, or Natural Language Processing.

- Q: Are you confident of negative correlation between equities and inflation if real rates are kept low?
  A: Depends which part of equities, as some parts of the market are positively correlated to inflation. It's also a non-linear relationship and depends on the starting point for the inflation surge (e.g. inflation moving from -1% to 2% is good, 2% to 5% is bad). However, the paper goes episode by episode and finds that in the 8 detailed episodes of inflation, equities performed poorly in every one.

- Q: Do you expect Hedge Funds to outperform the S&P 500 over the next 10 years?
  A: Risk characteristics are quite different, so it depends whether you run them with equal risk. The speakers would expect HFs to be able to deliver higher than market Sharpe ratios, but you need to be selective on which funds.

- Q: How did time series rebalancing perform in 1H20?
  A: Strategic rebalancing moderately reduced the size of the drawdown, but volatility scaling reduced the drawdown significantly.

- Q: Being prepared for the unexpected requires a contrarian mindset. How does this fit with the momentum strategy that requires the past continuing in the future?
  A: It doesn't require you to be a contrarian, but just to have a plan of what you would do as the situation evolves.

- Q: What is your forecast for the VIX?
  A: The summer is likely to be quiet, which the low VIX is currently reflecting, but the lack of equity diversification suggests structurally higher volatility and that the core risk environment hasn't shifted.

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Preparing Your Portfolio for Inflation

Summary

- Speaker breaks down the topic 'Preparing your portfolio for Inflation" into three parts: (1) What to expect on Inflation in the coming year, (2) Why it matters for your portfolio, to eventually conclude with (3) How to build a balanced portfolio that can better protect from future inflation shocks.

- Recent inflation spike is a result of (1) base effect due to COVID when the prices fell during COVID and now (2) the Supply bottlenecks. However, expectation is that these pressures are transitory. Based on bottom-up forward looking signals, inflation is estimated to likely return to baseline of 2%-2.5% in short term (i.e. 6 to 12 months).

- In the longer run, speaker expects fat tails on inflation. Secular inflationary forces are (1) de-globalization, (2) coordinated fiscal and monetary policies, (3) revived Phillips curve. Secular deflationary forces are (1) tech innnovations & accelerated digitalization, (2) well-anchored inflation expectations, (3) flat Phillips curve due to structural labor market changes.

- Bond-Equity correlation most positive in 20 years and hence doesn't provide a good hedge and puts the portfolios at risk which are mainly comprised of bond and equities alone.

- Speaker first introduces a simplistic Inflation-Growth based 2-by-2 framework for asset allocation: (1) Low Inflation + Low Growth → Bonds; (2) Low Inflation + High Growth → Equities; (3) High Inflation + High Growth → Commodities; (4) High Inflation + Low Growth → TIPS. In a low inflation environment, one can simply switch between bonds and equity based on economic growth.

- Speaker then introduces a more sophisticated "Inflation Beta Framework"—which is estimating asset returns using regression on inflation surprises and growth surprises. The regression assigns 'inflation surprise beta' and 'growth surprise beta' for each of the assets. These betas can be used to pick the appropriate asset once the inflation and growth expectations are finalized. A scatter plot of the betas gives: (1) Low Inflation beta + Low Growth beta → US fixed income; (2) Low Inflation beta + High Growth beta → High yield, US equities, REITs, EM Equities; (3) High Inflation beta + High Growth beta → MLPs, EM currencies, Commodities; (4) High Inflation beta + Low Growth beta → TIPS, Gold.

- TIPS are fairly priced in the current market and look attractive in rising inflation environment. Gold can be thought of as a really long duration (30yr) TIPS and is also fairly priced. REITS are a good hedge to rental inflation. Commodities are the main driver of volatility in inflation.

- Carbon markets can be emerging opportunities for inflation hedges.

Q&A

- Q: What is your longer-term forecast for inflation?
  A: It is difficult to come up with a longer-term forecast because there is a feedback loop with CB's actions. Highest conviction is of fatter tail expectations and the right tail forces are very real.

- Q: Inflation fears are keeping investors on edge. Any suggestion on dataset or part of inflation basket that can be studied further for better understanding?
  A: Goods prices, shelter, wages are important to watch.

- Q: Are we at the start of Commodity Cycle?
  A: Speaker doesn't believe it is start of a commodity supercycle. A likely commodity supercycle will have to be driven by oil and energy. It seems unlikely with where the oil is now, OPEC has huge capacity and given the push for solar/renewable energy. Industrial metals may have upside. Baseline will be driven by carry.

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- Q: How high do you see oil prices moving in next year or so?
  A: It depends on growth, etc. It is hard for backend to reach $60. Frontend may go from $70 to $80 beyond which OPEC will have incentive to act.

- Q: What real assets would you recommend?
  A: Positive outlook on Carbon. California is speaker's favorite. REITs is another one given its valuation.

- Q: Do you think Crypto can be a strong inflation hedge?
  A: It has behaved as less of an inflation hedge rather as a risk-on asset. If it matures into asset class with grand adoption, it may act as gold; but we are nowhere close to it. Currently it doesn't relate to real yields at all.

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Running Low: The 2020 Test for Bonds as Hedging Assets

Summary:

- The presenter discusses in detail whether bonds continue to serve as effective haven assets in the low interest rate environment of 2020. The early 2020 market shock presented a key test from a starting point of low interest rates. The presenter analyzed data from both before and after the market shock to assess the future utility of treasury securities as hedging assets.

- At the factor level, flows have to be inferred from returns, spreads and correlations of factors. The presentation is based on crowding at the broad strategy level for both hedge funds and private equity.

- Correlation between stock returns and bond yield changes in the US flipped from negative to positive in the late ’90s. The change in correlation was also observed in many other countries around the same time, except in Japan where the change in correlation occurred earlier (early ’90s).

- The graphed relationship between the 10-year yield and the correlation between stock returns and change in yields changed in the early 1990s from negative to positive. Further, this relationship holds in almost all the countries with the curve crossing the X axis at around 5%.

- The speaker concludes that the driving force was not the yield per se, but probably inflation (actual and expected). He asserts that, if the inflation level is controlled by the central bank, the correlation between stock returns and change in yields is positive and vice versa.

- The speaker elaborates his point using a discounted cash flow model and discusses the impact of rate shocks in two different scenarios. In the inflationary world, the denominator is more impactful and the increase in interest rates offsets any rise that may occur in the numerator. Thus, an increase in interest rate leads to negative correlation between stock returns and bond yield changes. In a growth world, the numerator dominates and increasing rates are consistent with an increase in cash flows.

- By analyzing data from before and after market shocks to assess the utility of bonds, the speaker ran a simple regression of yield changes on stock returns with 15 years of data from 2004 to 2019. The regression forecast a significantly smaller yield change than was actually realized in Feb-Mar 2020, which can be explained by the Fed’s pandemic response: reducing the Fed funds rate to 0 and communicating that it would remain at the effective lower bound for some time.

- The speaker noted they could have instead rather run regression on the tails of the historic data, which would better reflect the bond market’s reaction to stressed equity markets. Running the same regression on the data after the market shock, i.e. on data from Apr-Dec 2020, again showed the front part of the curve is strongly anchored.

- Next, the speaker returned to the prior observation that at 5% yield the correlation turned positive, but as yields go to 0, the beta goes to 0 and the curve takes a parabolic shape. We see this pattern in beta between stocks and bonds, empirically, across the world. As yields near 0, there is less room for bonds to rally and the betas shrink to 0.

- Betas are nothing more than the ratio of correlations and volatility. In recent years, interest rates have retained reasonably high volatility levels. As the Fed maintains rates closer to 0 for a protracted period of time, volatility plummets. So, even if the correlation stays at a high level, the betas start to drop.

- A potential approach to hedge risky assets is to move out the curve. There can be questions regarding hedging ability given supply. However, what matters is not so much the supply in notional terms but rather the supply of risk. So even if there has been more aggregate supply in the front end of the yield curve, the amount of risk remained high at the back end due to elevated volatility and expanding duration with lower rates. The potential risks with this approach include continued grind lower in yields and a shift to a less stable inflation environment.

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- In 2021, Treasury yields have risen, giving them more room to rally during a downturn. Interestingly, the correlation between treasury yields and equities has dropped, reflecting concerns about inflation risks. The speaker contends that we will probably see some inflation over the next six months but it will be transitory and once the effects of the stimulus bill and other fiscal developments are swallowed by the market, we will probably see some a return to positive correlations, reinstating the favorable hedging properties of treasury securities over the longer term. Bonds passed their test as a hedging asset in 2020 and the speaker believes bonds will to continue to behave that way going forward.

Q&A

- Q. Could you please discuss the sizing or hedge ratio calculations? Is it like inverse volatility? Do you use regular beta or tail beta? And do you use longer- or shorter-term look?
  A. There are a couple of different ways. One can always go to the implied market and calculate beta and hedge ratios from the implied market. The problem is implied markets are not sufficiently liquid to give us good information. On the other hand, the implied vol markets in treasury and stock markets are decently liquid and you can use the implied metrics for the vol ratio, beta calculation and hedge ratio calculation. For correlations, you may use historic data. We tend to use anywhere between six months to one year half-life in calculating correlations.

- Q. You mentioned 6 months to 1 year half-life. Is there any reason why you don't go for higher frequency or shorter term?
  A. It really depends on the positions you are looking at and the target portfolio you are looking at. If you have a portfolio which has a longer half-life and expectation, then looking at something similar for empirical estimation makes sense. Similarly, if you are trading some very short horizon forecast type portfolio, you may use much higher frequency data. We would generally try to match holding periods with half-life estimators.

- Q. The speaker mentioned term premium model. Could he elaborate a little more on which particular model you favor? Is it r*? Is it Cochrane and Piacenza, et cetera?
  A. I tend to look at the ACM model which comes from the Fed. It is very well distributed and widely known. The papers are very easy to follow.

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Current State of Volatility Markets

Summary

- The speaker highlighted the unprecedented amounts of liquidity provided by Central Banks in response to COVID-19 pandemic (~$10 trillion in 2020) and how it has been a continuation of their asset inflation since 2008.

- Central Banks have artificially inflated the market through balance sheet expansion (~$32 trillion), enriching investors in risk assets, including equities, long-term bonds, credit and real estate by a >$26 trillion windfall.

- By overlaying the S&P 500 on Central Bank balance sheet size, one can observe the correlation between different asset classes and conclude that the windfall has been once in a lifetime for anyone who has owned risk assets post-GFC.

- Interestingly, the target allocation of a typical client in pension funds has gone up considerably post-GFC from 55:45 to 75:25 where 25 is in fixed income instruments.

- According to the speaker, fixed income has lost its utility function as it provides neither yield nor portfolio diversification as it used to.

- The risk of a Fed misstep is about 15-20% as implied by the inflation options market. This is not an insignificant risk. If next month is peak inflation, then investors should focus on the intrinsic details of inflation in US and other markets.

- Post GFC, Central Banks have been trying to push investors towards growth assets, while regulators are trying to prevent another GFC by transferring risk in an orderly fashion.

- The market is now 5-6x larger vs. pre-GFC and liquidity is a fraction of what it was during the GFC. Looser Bank regulation could see improvements in market liquidity.

- According to the speaker, the Fed is going to stay lower for longer and Central Banks will be deliberately late in tightening policy, but FX markets could be a bellwether as traders will be active there for 6-8 months ahead of any big change in the Central Bank policy.

- Clients are hesitant to invest in Volatility Risk Premia strategies based on tough losses due to volatility explosions in Feb 2018 and most recently in March 2020. Currently, inflation strategies can help investors in the diversification of the existing tail risk. The focus is to build cheap and effective diversified portfolio strategies.

Q&A

- Q: Where do you think this Inflation surprise will come?
  A: According to the CPI data, the cost of used cars has increased by 7% in one month and that's an extraordinary amount of inflation within a large segment of the US economy. The probability and possibility of the trend shows that if it continues then it's going to be a problem for Fed. The inflation peak is going to be next month.

- Q: Where do you see VIX averaging this year or next year?
  A: The speaker is expecting the VIX to be around 18.5-19 which is in line with Marko's view of ~17 VIX this year. The slightly higher expectation in VIX is specifically due to fear around the liquidity function in the speaker's models.

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Comparing Flows and Performance in Private Equity and Hedge Funds

Summary: The presenter detailed an approach of using cumulative flows into private equity and hedge funds to estimate future returns. Private equity returns are first estimated using a contribution and distribution based cash flow model as fund valuations based returns suppress volatility. The results of the analysis indicate a negative correlation between 5-year cumulative flows into PE funds and their subsequent returns. These results are mirrored for most hedge fund strategies. The presenter concludes that based on recent outflows for most hedge funds strategies, these may offer more attractive returns going forward compared to crowded public and private equity investments.

- The presenter begins the presentation by highlighting his interest in market crowding, in particular from factor perspective and how to use this type of information to predict how strategies will do. At a factor level flows have to be inferred from returns, spreads and correlations of factors. The presentation is based on crowding on the broad strategy level for both hedge funds and private equity

- Next, the presenter lays out the objectives of the discussion that include ascertaining whether there have been large flows into public and private equity and large outflows from hedge funds. Additionally, he aims to identify how crowded strategies performed compared to less crowded strategies and if so which sectors are now most attractive.

- Citing high levels of valuations for both equities and bonds, the speaker presents an analysis of the subsequent equity returns, when valuations had previously been at such levels. The results indicate that the standard 60/40 (equity/bonds) portfolio is likely to offer poor real returns.

- Private equity data used for the analysis covers over 1,000 funds, 100,000 fund-level cash flows and is based on data from 1970 onwards. Though estimating returns is tricky, reported data are based on fund valuations which significantly downward bias actual volatility. This also complicates factor exposure analysis.

  A recent paper by Ang, Goetzmann and Phalippou (2018) uses the law of one price to infer period discount rates. The speaker presents the model used, which is a factor model adopted from this paper. The key observation is that the expected values of each fund's discounted contributions and distributions are equal. The parameters of the model are estimated by GMM. To illustrate the methodology, the speaker utilizes a stylized example of four funds to demonstrate how PE returns are calculated using this model.

- Next the presenter details the scope of the analysis, which focuses on vintages from 1994 to 2013, using quarterly flows and cash flows up to 2020. Further, the data is split by Buyout and Venture sectors. Three different factor models are used.

  The results of the analysis suggest that Buyout funds delivered superior returns compared to S&P 500 and similar returns to the Cambridge Associates Buyout index, though the volatility of returns is notably larger compared to the smooth Buyout index.

  Additionally, the presenter highlights that the market betas across all three implementations range from 0.58 to 0.63, which is a lower range than expected. Alphas, at almost 10%, appear to be large. Though the majority of cumulative alpha is derived from the period leading up to the internet bubble, the speaker qualifies.

- For Venture funds, the overall results appear more similar to the Cambridge Associates Venture index; in particular, both capture the dotcom bubble spike. The Venture betas are in the range from 1.3 to 1.4, which hare more intuitive values. The alphas are about 6% in all cases, and there is a large negative loading into HML, as Venture funds are buying high-growth names. Similar to the Buyout case, most of the alpha is accumulated leading up to the internet bubble.

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- Analyzing Buyout and Venture sector assets by vintage year, scaled to 2019 USD by using S&P 500 returns, the presenter concludes that the largest assets and flows occurred prior to the GFC for Buyout funds and in 2000 for Venture funds, and current levels for both are at roughly half of peak levels.

- Next, the presenter returns to the question posed at the beginning, as to whether asset raises affect future returns, and concludes that the answer is yes. The correlations between sum of prior 5 years' vintage assets and the following year return are negative for both Buyout and Venture, albeit only Venture was statistically significant.
  The implications for the present conditions are that, based on 5-year assets, the future expected returns will be below average for Buyout funds, and about average for Venture funds.

- Pivoting to hedge funds, the speaker highlights strong recent hedge fund performance, which he contrasts with the falling demand for hedge funds since the GFC. There were about $400b net client outflows since 2015 and the total number of funds is down 46% from the peak of 4,200.

- Further, the presenter discusses various hedge fund strategies. Event Driven funds experienced significant outflows since the GFC, despite strong performance. Equity Long/Short witnessed much more significant outflows over the last 5 years. Macro also saw sharp outflows over the past few years. Relative Value had some of the most persistent returns and highest Sharpe Ratios and some of the lowest outflows. Funds of Funds also observed strong outflows. Risk premia had great performance through 2018 and very bad performance since and as a result flows have begun to roll over. Equity Market Neutral showed strong performance up until '17/18 and then moderated. Systematic Macro with moderate performance over the past 5-10 years.

- Repeating the analysis from the previous section for hedge funds, the speaker illustrates that almost all hedge fund sectors show a negative correlation between prior 5-year flows and following 1-year returns. The exception being Macro and Systematic Marco funds—which he ascribes to the amount of liquidity in the macro space. The relationships appear more pronounced at the sub-sector level.
  Based on these results, the speaker concludes that almost all these strategies are attractive today.

- Finally, the presenter summarizes the presentation, by highlighting the extreme valuations of traditional assets, and the strong demand for private equity. Hedge funds delivered solid returns and all major sectors delivered alpha. In contrast to private equity there have been outflows and very strong returns recently.

  The final point he raises is that traditional equity and private equity share the same principle component which is all clients' portfolios, and adding capital to that exposure is not going to improve risk adjusted returns. In contrast, many hedge fund sectors do not share that principle component. Considering flows, performance and the importance of diversifying away from some of the most crowded and expensive assets, it is well worth diversifying further into hedge funds.

Q&A

- Q: Could you comment on the frequency of the PE data? And does this allow us to pick up shocks, such as the ones we saw during March and April of last year?
  A: The underlying cash flow data is monthly, but due to the insufficient number of funds we have to aggregate it to quarterly and so that is a good point. We will not pick up the full covariance and you miss some of those shocks. You pick up the lower frequency relationships. This would suggest that the betas are underestimated.

- Q: In the correlation calculations regarding fund flows and performance do you suspect you might have materially different results with longer or different time periods? Did you find results varied by size of PE funds (small vs large)?
  A: With regards to the negative flow-performance relationship, I did do both last decade and full period data. In private equity for the last 10 years you do not get much of a relationship, but for hedge funds it is almost the same coefficient. With regards to fund-specific analysis, we haven't looked at that as it is hard to get fund-specific return data, since you

are inferring broad discount rates for the sector. We'd like to be able to do that, but so far we have only been able to focus on sector returns.

- Q: What will it take for the strong inflows in to PE to reverse?
  A: It is interesting that you saw a decline in fund raising after the financial crisis, which was mostly liquidity driven. I do not think that many investors felt they had lost a lot of money in their private equity funds, because distributions didn't happen and fund valuations didn't materially drop. Some investors may have had to exit for liquidity purposes. I suspect it would a period of poor returns for a few years for investors to start rethinking that. Illiquidity is still there in private equity, there are a lot of reasons not to put a lot of capital there. The perception is that returns are very high, and they have been, but it will probably take the next few vintages to cause investors to become less excited about private equity.

- Q: How do funds dropping from the database, subject to closing to investors, impact your analysis?
  A: There is no question that there is some selection bias there. The private equity data does not contain section bias as the data is sourced directly from the fund investors themselves. The hedge funds are self-reported, some funds chose not to report or move into pods which do not report. So there are some big fund complexes which are not included. Unfortunately, this bias is hard to remove. The returns of these indices are equally weighted, so those are less affected, but it does impact the flows. We have not come up with a way to resolve that yet.

- Q: Based on your experience, the work you have done, crowding and the current macro backdrop, what do you think is one of the best hedge fund styles to think about in the coming years?
  A: It is hard to answer that question for several reasons. One is there are a lot of different nuances across all of them. Systematic macro is one that I study quite a bit, is particularly interesting because it has not had these large inflows, its net flows are zero and its correlations are very low. The returns haven't been as good, in part because trend has been a little crowded. Trend itself is not really measured well by the assets in the systematic macro space, because investors are following momentum models and you don't see that in flows. But I am talking my book, so you can discount that.

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Giving Credit Where Credit's Due

Summary

- The speaker starts the presentation by discussing the issuance, depth, and data in corporate bond markets and the factors in corporate credit. In particular, for the factors, she constructs a series of intuitive factors drawing both from credit and equity research. Furthermore, she isolates the sources of alpha in factors by controlling carefully for risk factors.

- After the introduction, the speaker dives into what she calls the credit landscape. She provides a chart which shows the history of the US Long Government/Credit Index by sector.

- So what does this credit landscape mean for someone who wants to build a systematic corporate credit strategy? The speaker simply states that we will just use this landscape as a way to determine which groups of assets we will develop our strategy for and which factors we will use for each group. She notes that it is important to consider that the risk premia in credit can be quite different from the risk premia in equity.

- Some of the credit risk premia that investors are compensated for are 1) Longer dated maturity, 2) Default risk, and 3) Liquidity risk.

- Although the risk premia for credit have some additional components when compared to the equity space, the speaker still uses some of the familiar risk premia such as value, quality, momentum, and ESG as a source of integrated risk management.

- What does Cross-Asset mean in credit? Interdependence between credit and equity markets offers a different lens on the same underlying company fundamentals. Cheap equities may be 'cheap for a reason' and may not be mispriced after accounting for the duration and default risk inherent in the issuer. High momentum equities may be responding to sentiment unrelated to credit momentum.

- Duration and spread are key ways to measure risk in credit. In our systematic strategies we want to make sure that we have a balanced spread and credit exposure across our portfolios.

- The speaker shows the performance of her systematic factor strategies and the results look strong. The factors are then combined and they are weighted in relation to their expected overall alpha contribution.

- After optimization and building a final factor portfolio, the most significantly weighted factor in the portfolio turned out to be the value factor by a large margin.

- The speaker incorporates real-time transaction, volume and liquidity data into the optimization technology, and leverages both trading and implementation innovations—portfolio trading and individual cash bond trades.

- The goal of this technology is to make the connection between portfolio management research and trading as tight as possible.

- The speaker finds that factor diversification is the most important aspect of all of this.

Q&A

- Q: Can you speak more specifically about liquidity in this market and in 2020?
  A: We saw spreads blowing out in almost every sector of the bond markets in early 2020. This was reflective of liquidity. However, we saw the trading costs come back down rather quickly.

- Q: Do you find carry, short vol, and ESG to be valuable factors?
  A: Yes, we are developing our ESG strategies. We find it to be most valuable when it comes to risk management,

especially for tail risk. We see evidence of a low vol premium similar to in equities. We don't see carry as directly relevant.

- Q: Do you go short with cash bonds or do you use CDS, and which is better?
  A: Yes, we find CDS to be better.

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Is It Safe to Trade Factors without a Mask?

Summary

- The speaker discusses Covid as a quant factor. The emergence of COVID-19 has created a new risk factor. Pandemics are inherently risky and their epidemiology is uncertain and constantly evolving. Our ability to manage the disease's vectors of transmission and its related fallout are similarly in flux. The non-linearities are further amplified by politics.

- The pandemic is impacting business models differently; some have been crippled while others are thriving. We study the impact on stock prices and break up stocks into two groups: COVID Names (those hurt by the pandemic) and STAY Names (those that have seen upside due to pandemic).

- The speaker explains how to detect COVID vs STAY stocks. First, create an equal-weighted index for each of COVID and STAY based on market-neutral returns using the union of all stocks within the related group of COVID and STAY curated baskets. Second, measure the beta to each. Remove ambiguity by requiring a distinct beta to either COVID or STAY.

- We fine tune precision of the portfolio with a 'contamination coefficient.' In other words, we vary this coefficient to get a smaller or larger universe of tradable stocks. For a higher level of the contamination coefficient we have more COVID and more STAY stocks in the portfolio.

- We apply these ideas to 'vaccinate' a momentum portfolio. We consider a momentum factor with varying levels of the contamination coefficient. We find that as we further vaccinate the momentum portfolio, in other words, remove those stocks which have a high COVID or STAY influence, we get a better performance.

- Another analytical tool which was used was the Star Plot. The speaker showed figures which plotted a 2-D grid with each point representing a stock on a particular date. The x and y axes were the factor coefficients for either momentum, value, growth, liquidity, etc. The points were then traced through time to show how different stocks moved through the grid during the months when Covid first began.

- Another aspect of this grid analysis included three separate grids, one for each 'regime' where the regimes are defined as 1) Shock (Feb 2020 – April 2020), 2) Response (April 2020 – Nov 2020), and 3) Recovery (Nov 2020 – Present). These grids provide significant insight into the dynamics of Covid across a range of stock types.

- The talk was titled, "Is it safe to trade factors without a mask?" At this point it is clear what this actually means. As explained earlier, we considered a subset of stocks to be 'vaccinated' if we did not include certain stocks which were very sensitive to COVID or STAY. So the title means, "Is it safe to trade traditional factors now as we did before without this type of Covid filtering?"

- According to the speaker, volatility is likely behind us. However, we should still be mindful of latent risk factors lurking in alpha, biases embedded in the benchmark selection, and value in "vaccinating" alphas.

Q&A

- Q: Are your factors sector neutral?
  A: They are not but it does not matter. That is, if you run the same analysis but sector neutral then you will get the same results.

- Q: Can you provide more insight into how you define the COVID vs STAY stocks?
  A: We first look at already available lists from banks, etc., which contain these groupings. Then we try to confirm that stocks are in the right group by looking at their betas to these groups. For example, if a stock has a positive beta to COVID and a negative beta to STAY then we are confident about our choice of group for that stock.

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- Q: Can you provide more color on how you defined crowding?
  A: We look at 13F statements, short interest, implied vol, and many other things but we find that looking at any of these will lead to the same conclusion.

- Q: Can you use this to time factors?
  A: We think this is more valuable as a timing mechanism for whether or not diversification of factors will currently be worthwhile or not.

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CIO Panel on Asset Allocation and Risk Premia Investing

Executive Summary

Dobromir Tzotchev from J.P. Morgan moderated a panel on asset allocation and risk premia investing. The panel consisted of representatives from Santander AM (SAM), Veritas Pension (VP), Asset Management One USA (AMO) and HSBC AM (HSBC).

Q&A

Q: What are the main takeaways from the 2020 experience, what will be the permanent changes in the investment landscape and how have you adapted your investment process?

A: **SAM:** We saw pretty phenomenal amount of stimulus in 2020 in the developed world as well as in emerging markets. It is going to bring about temporary effects both on the supply and the demand side, which in turn have brought a lot of volatility in the macro readings. Permanent effects like low interest rates have really changed paradigm of investing both for savers and for investors. We are trying to think of new building blocks to help us navigate the low level of interest rates like incorporation of illiquid alternatives as well as some multi-asset solutions. In order to gain some returns it is going to be needed to get up on the risk ladder and as a result of that, we also need to take into account that from a portfolio construction perspective you have to be very mindful about the higher risk we are taking for certain return. Basically we are focusing on new building blocks on the alternative world.

A: **HSBC:** We learned a lot about the potential for bonds to protect portfolios on the downside. In Q1 the experience for US and UK investors in gilt market was very different from what we saw in the Bund and JGB markets as we've got quite strong returns on high yielding assets and not a lot in JGBs and Bund. So that brings into question the protection aspect of bonds and maybe as we move towards potentially higher inflation regimes that sort of decorrelation effects of bonds also begins to come into question. It's probably the first time in recent crisis that we saw a fiscal led recovery and monetary policy was kind of acting in support. If 2020 is a guide to future recession financing at least through emerging fiscal policy, it could change the way we think about these outcomes.

A: **VP:** Modern Portfolio theory does not work in this environment. After the global financial crises we know that central bank balance sheets have doubled until pandemic crisis started and have doubled again which means there are huge forces manipulating the market all the time and market is not trading any more with fundamentals. So for investors there's no reason to look at fundamentals. Risk taking is only dependent on the perception how investors are thinking what the liquidity in the market is. And that has replaced the traditional portfolio theory and we really think about asset allocation in a different way now—it's more having risk buckets and what the drivers of returns are in different risk buckets, and whether there is anyplace to hide when everything crashes at the same time—it's really hard to find in this environment and that's why we are adding hedges from time to time to our toolbox.

A: **AMO:** It has been encouraging that the behaviour of most of the quant and factor strategies were consistent with what we expected, like carry lost money and defensive made money. What was kind of different was the magnitude of the behaviours. Certain carry strategies, especially the ones tapping into the liquidity premium, were hit the most and this is a little bit alarming. In carry space, in search for income we are trying to be innovative, and in some cases we are deeply tapping into some sort of liquidity premium, and it gave us second thoughts if it is a good idea. On the other hand, defensive strategies especially Vol long strategies which came in after February 2018 worked pretty well out-of-sample. The first lesson is we need to have more expanded universe of strategies, really diversified portfolio. And by saying diversified perhaps just focusing on carry, value and momentum is not good enough. Risk management becomes much more important, because the volatility changes quickly and data of relation changes quickly. Academic ideas may not work—it's not because the idea itself is wrong but because the estimation problem of the parameters we use is getting much harder.

Q: We probably agree that the 60/40 portfolio to some extent is losing its appeal—we have stretched valuations, decreased diversification. How do you tackle this problem? Is there a viable replacement instead?

A: **HSBC:** I don't think there is a viable alternative to 60/40 Portfolio. We had a perfect storm of good returns with very low risk, but it was wrapped in a very liquid, cheap, simple and transparent package and so a lot of fixes that I think we are looking at will compromise one of those principles. Diversification generally wasn't rewarded in the way you typically

expect so there was a bit of a return drag to try to protect and improve the portfolio. I think looking forward we can do a couple of things on the return side in terms of enhancing our investment universe, looking for alternative forms of beta capture, generally trying to take on bit more leverage and illiquidity in terms of integrating private markets. I'd probably reiterate that all of those strategies will generally trade off against being a bit more expensive and a bit less liquid. There are fixes but they all come with some caveats and drawbacks.

A: **SAM:** One of the limitations of the 60/40 is to some extent less diversification. We have been trying to add additional sources of returns in order to complement exposure to traditional equities and bonds. Perhaps a more pertinent question will be, the role of government bonds in the 60/40 portfolio. There are mainly two aspects to consider. On the one hand, the return generating aspect of bonds and the second aspect is the correlation aspect. From the return generation aspect it is very difficult to argue in favor of exposure to bonds due to very low interest rates. A lot of Nordic colleagues rely more on private markets in order to substitute part of the fixed income exposure that I think is good for long-term investors. Correlation of fixed income assets has proven to help quite a bit during the COVID crisis. Nevertheless, it's true that the correlation is turning positive these days so we want to remain very vigilant on how the dynamics of correlation breaks and changes over time. So rather than relying on a statistical relationship which is the one that we've seen with bonds and stocks for a long time, thinking more about a mathematical correlation which you can implement through the use of the derivatives. These are the types of things that we're thinking about as replacements or as compliments of the bond exposure while relying on a lot of alternative building blocks as I mentioned at the beginning.

A: **VP:** High-quality government bonds had a negative correlation to risky assets during the crisis. It's quite clear why we should have 60 to get returns on the longer run, but why to have 40 and what should be there? As rates have been really low for some time already investors are forced to hunt for yield and for more risky bonds and they are running to high yield or emerging market or any private debt side for yield. Which means that you don't invest into 40 to get diversification, if you are hunting for yield at the same time. Overall, it's questionable what there should be in 40 part of the portfolio—do you want diversification? If there's no diversification available, what is the role of 40 to get some other sources of return?

Q: What is the role of systematic and risk premia strategies and can they help with the challenges currently posed by the macro environment—lack of safe havens, diversification and low yields. Which strategies and approaches are the best fit, and how to balance the allocation between the systematic strategies and the rest of the portfolio?

A: **AMO:** Risk premia can be separated into three different groups. First, there are the strategies which give access to cyclical exposures like volatility carry—it is kind of a cyclical component, more like a directional component, and it helps us to have a diversification on the upside—for example, equities are not going up but volatility carry can be profitable. The problem is that the two strategies still share the same downside. Now the second and third group are more like traditional risk premia. So one part of the risk premia is relative value—the beauty is the first order risks like beta and durations are offset so at least we can count on diversification. The last group of risk premia strategies is more directional, trading strategies. Trend following strategies have directional positions but they can go long or short which means the average correlation can come close to zero. However, by going with risk premia, either on a time domain or cross-sectionally, we are guaranteed to have a risk diversification and we can focus on debate whether those strategies can bring in a better performance or not. In order to achieve the same level of the risk naturally we need to have leveraged portfolio in a gross notional sense. So, we should be very cautious how much we allocate to the risk premia and the amount should be dictated by stress testing and our estimate of the downside and how much leverage and how much structural risk we can allow to have in the portfolio.

A: **SAM:** I think the answer is yes as long as we are not repackaging interest rate risk. We know that some of the strategies we consider have duration risk in some shape or form. So it's important to distinguish which part is duration risk and which one is not. If we take interest rate differential like FX carry or rates carry in an environment in which you have very compressed interest rate differential, the potential for returns of those types of trades will be very limited. Again one of the things that we tend to favour are defensive strategies, and in some cases systematic hedges that work as a diversifier across the equity risk that we have.

A: **HSBC:** Yes, systematic strategies can help and market-neutral strategies by construct give you a way in. We think about it as a sort of factor completion on a classical multi-asset portfolio so that leads us to look at things such as trend-following strategies. If inflation narrative persists, these strategies historically have been okay in such times so there is a bit of macro

support for their inclusion. Equity quality probably is an area within equity markets which is quite attractive and is slightly more defensive so if you're not getting your protection from your bonds you can certainly reset your factor exposures elsewhere to try and offset that loss of diversification.

Q: Have you adjusted your investment process to future expected higher inflation, and also the risk of unexpected inflation spikes?

A: **VP:** Based on the yesterday's market reaction one could have drawn the conclusion the best way to be prepared for inflation is to have a long duration. We are cautious with inflation and of course it's possible that it's transitionary like market seems to price it at the moment. If we don't expect government bonds to have a positive return in the future and we don't expect them to have a very high diversification effect but to entail a huge inflationary risk, then we can replace the high quality bond allocation with other type of investment as mentioned earlier like defensive strategies and hedges.

A: **HSBC:** We have widened the investment universe to have a more active role for inflation sensitive assets like gold, commodities and infrastructure. They're not hedges per se and the statistical relationship between gold and inflation is a little unreliable. On the investment process side one of the things that we look to do is introduce the concept of macro factors to our portfolio and see what our exposure is to growth and inflation, and that gives an idea as to how you may go through inflation environment. We've not been through a high inflation regime for so long that certain new asset classes and new strategies, have never really been tested. So there's a little bit of caution in making the inferences.

A: **AMO:** I'm not 100% sure, whether we can capture inflation risk premia as a source of alpha or not. I would rather prefer to see these inflation discussions as a way to enhance risk management. There is limited data which covers inflation period. So we have to give more thought on the estimation problems of correlation and covariance during inflation periods and on the additional techniques to stabilize and come up with a robust estimation for portfolio construction purposes. Rather than that, overall we see inflation as a risk factor, we don't necessarily see it as a bad thing and we think it's under control.

A: **SAM:** As a base case scenario, we believe that inflation spikes that we're seeing are going to be temporary, mainly because of the disruptions on the supply and demand side. So, on the one hand, we underweight the exposure that we put on sovereign bonds and as replacements we have exposure to high beta with lower sensitivity to interest rates. We are concerned that our base scenario might not be correct and it could very well be the case that governments try to produce more inflation and reduce the debt burden. So that could potentially bring long-term inflation into play. We do believe that if inflation is going to play out, it will have implications in terms of the market with negative behaviour. In order to cover for that scenario we're implementing some hedges, with out-of-the-money puts. There could be some systematic strategies that you could potentially use in order to play the inflation theme, and we are considering them as well. But in general, our view is that of a transitory part of inflation.

Q: 2020 brought back the questions about tail risk and hedging by different implementations. And here I would like to distinguish between two types, let's call one contractual where we basically buy put spreads, collars and the other statistical, more widely known as defensive risk premia strategies. Do you favour one or the other and what is the right mix?

A: **SAM:** I think that in general investors (and also savers) have to increase the level of risk they're taking in order to get some returns in this environment. The problem with strategies like put spreads, collars are the negative carry implications and are always a tough sell. No crisis is the same as before so the configuration that you make with the strikes, maturities and instruments could very well not play out in the way that you're expecting when you have already paid for negative carry. We do explore them but it is more difficult to implement. Defensive strategies have a lot of merits so you can come up with something like momentum strategies, intraday momentum and dispersion strategies and so on, in which basically you're going to capture an effect that is related to the crisis and potentially you can also reap some returns out of that strategy. So we're looking more into the second class of strategies.

A: **AMO:** There are wide varieties of defensive strategies, and every tail scenario is different. For that reason picking one approach is not a good way to go because we don't know in advance. We have to choose one side effect from the three different kinds. One is a negative carry; can we accept negative carry or not? Second is relative value risk; buying an option and selling an option at another place involves relative value risk. Third is the timing risk; there are certain types of

strategies buying volatility based on either systematic or discretionary timing. We cannot say which approach is going to do better and it is kind of healthy to have different strategies. Some strategies have negative carry but are more reactive, some strategies take a relative value risk, but most of the time work providing convexity, some other strategies come with a timing risk. There are many that worked pretty well in 2020, we just have to have a diversification within the methodology, knowing that we need to be exposed to either negative carry or relative value risk or timing risk.

A: **VP:** It's important to have many different kinds of hedging or defensive strategies in your toolbox. For long-term investors, it's not optimal to have hedges all the time because it's too expensive. Intraday trend strategies have worked well, but whole investment community knows that there are a lot of intraday trend strategies in the market and that means it's always possible that some statistical hedges or behavioural hedges will disappear over time. I would be very careful with any kind of statistical hedges, if they are backtested in the history because I think market behavior has changed over time and the effect can be much weaker and more based on the liquidity provision. Then we also have to remember that all the systematic strategies are backtested in the last 40 years, where we have only seen structurally declining rates. We haven't ever backtested strategies in the increasing rate environment which means you have to find toolbox to diversify your hedging strategies, to find the right combination for each of the moments you have. And don't forget to have an active risk management. Investors are forced to take more risk in a low rate environment, and that's why we have to be active with risk management in this kind of world.

Q: What is the role of the portfolio construction techniques in your investment process? Are you happy with the level of innovation in the space and do we need more innovation?

A: **AMO:** In portfolio construction we focus primarily on the risk management and how to construct a diversified portfolio. As market is changing very quickly, correlation between rates and equities could change and there will be issues of estimated and ex-post realized parameters. Even estimations and implementations could be an issue. So even though we are using the same kind of framework like mean variance optimization we have to understand that noise in the input data like covariance matrix and expected returns is much higher. Data science and the machine learning communities are bringing in new ideas for robust estimation and new kind of technologies which will allow biases, but will have more stable estimation. We already know about noise issues and have traditional techniques, but by using data science and by including robust optimization there are new methodologies which we can implement in the portfolio construction processes. So it's same framework but much better implementation. I mean, it is going towards what we are chasing for and that we have a chance to improve.

A: **VP:** I think there are already innovations and we've studied some of the new ways—to mention one is a hierarchical risk parity approach, which is based on statistical clustering. But I wouldn't like to rely on simple correlation—instead I would like to think about portfolio with a different function. We can even talk about functional portfolio theory to have some factor-based functions for different asset classes or ARP strategies—and they can fall through the same statistical characteristics which are quite similar and when you are constructing your portfolio you are allocating with different statistical functions and try to map your portfolio. I think it's quite different compared to the traditional modern portfolio theory.

A: **HSBC:** Portfolio construction process is very much at the heart of our investment process because it speaks a lot about our investment philosophy. Different products and solutions that we offer have different construction techniques depending on underlying principles. If you're using a risk-based portfolio construction it means you are having implicit views on return expectations, whether or not you want them. I think some of the more enhanced techniques that are quite useful for asset allocation are the hierarchical setup which seems to work quite well in terms of grouping different asset classes and also risk factors as well so I think that's a good innovation. I think machine learning generally works a bit better in more granular investment universes so that's probably not as relevant for asset allocation decisions.

A: **SAM:** Asset selection is the most crucial thing and we are also working on hierarchical clustering and it seems to be good innovation relative to normal risk parity. Where I would like to see more innovation is getting better estimates with lower sample sizes. As we have constant structural breaks environments, the parameters that we use for the past will no longer be relevant for the future and robust estimation is a good way of incorporating model uncertainty.

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Q: The lack of diversification available in the 60/40 portfolio is driving risk higher. What does the panel think of allocating more to long/short on a more highly leveraged basis in order to maintain risk and avoid unrewarded beta?

A: **AMO:** Risk premia is essentially not taking the first order risk but focusing on a relative value/second order risk. So, it is a necessary condition to offer diversification and we have to inspect each kind of factor if there is factor efficacy or not. There are certain kinds of risk premia strategies which are promising for the future and they could be long/short and could have diversifying effect. To the extent we are comfortable with the level achieved and we have a proper risk management in place we can allocate certain amount to those strategies.

A: **HSBC:** I think, for a 60/40 type of investor it does make sense because within the 40 you have embedded leverage in the bond markets. You can move from 60/40 to 60/20/20 and you can still have the same duration exposure in the reduced 20 on bonds by just buying longer maturity bonds. So you're able to maintain the duration exposures, alongside including long/short risk premia strategies into the portfolio. You can protect macro factor exposures, alongside harvesting the risk premia.

A: **SAM:** Pretty much supportive of overlay strategies and the long/short strategies as long as we have the proper controls in order to make sure that we are not in excessive leverage and we are also able to test all possible scenarios. It is an innovation we want to be able to extract especially in the context of very low interest rates.

Q: Is it still possible to obtain sufficient diversification inside the portfolio, maybe considering some other asset classes, crypto or private equity, due to the lower yield from bonds?

A: **VP:** Correlation of private equity index against listed equity markets index is relatively high. But if we take three-month lag in the reported returns the correlation is zero which gives good diversification for instant market shocks. For bitcoin it's questionable as it might start to move the markets like some tech companies. That means that even if fundamentally there has been some kind of diversification effect, it might disappear over time. Trading irrationally or without a plan also brings a diversification.

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Stochastic Programming Approach to Liability Driven Investment

Summary

- The speaker started the discussion by defining a stochastic program as essentially a systematic approach to handle uncertainty. Liability Driven Investment (LDI) is a holistic investment strategy which tackles not only the asset side of a pension plan's balance sheet but also the liability side. Consequently, the risk and return characteristics which take into account liabilities determine the optimal asset allocation.

- So why would you consider a stochastic programming approach? Recent low rates and volatility of global markets have impacted institutions that manage assets to fund liabilities. Moreover, the real-world is far different from the theoretical world of mean-variance analysis. Essentially, distributions are not normal and are typically fat-tailed.

- Some of the benefits of stochastic programming optimisation include: tail events can be easily included, scenario-dependent correlations between assets, asset/liability applications can be modelled well in the multiperiod stochastic programming approach, derivative positions can be modelled, and model output is easy to understand.

- There are a number of choices for stochastic programming optimisation. These include the chance-constrained optimisation model which restricts the feasible region thus increases the confidence level, and a multi-stage recourse model. To setup the optimisation you need to set the objectives, e.g. funding ratio, contributions, expected return on assets, and downside risk (i.e. shortfall). Once prepared, you then create the scenario analysis where stochastic optimisation problems modelled in discrete time allow for asset/liability management over time. There are a number of models used to create scenarios including the use of scenarios formed by sample-moment information (which aggregates many scenarios into smaller sets of scenarios), historical data and expert experience.

- A question arises on how a stochastic approach compares to fixed-mix with rebalance? The data indicates for any given fixed-mix strategy, there is a dynamic strategy that has either the same expected wealth and lower shortfall or the same shortfall cost and higher expected wealth. The stochastic approach allows you to take advantage of the opportunities to adapt to the environment.

- The speaker has defined an optimal liability driven portfolio for a defined benefit closed plan. The strategy invests in global assets, including equities, hedge funds, bonds, real estate, private equity and credit. They assume the pension contributor would like to minimise contributions and maximise wealth over time. The model is solved numerically using a multi-stage stochastic program. It enables them to manage transaction costs and investment manager fees.

- The results show that an optimal LDI portfolio with key-rate duration-matching bond strategy is superior—this is the best way to minimise funding-status volatility—to both a duration-convexity matching bond strategy and a long duration bond index-tracker strategy. Some observations of the strategy include: private asset sales are delayed because of their illiquidity, investment in real assets is brought forward on average in the optimal LDI portfolio. The lag between investment decisions and transactions caused by illiquidity creates higher downside risk, but it remains optimal to hold real assets in terms of the overall pension fund objectives, i.e. minimising of volatility mark-to-market.

- By allowing the stochastic program to load on factor exposures there was a substantial loading to the min-vol portfolio being included in the optimal LDI portfolio. Its bond-like characteristics (correlation to the liability) coupled with the higher relative expected returns to corporate bonds was a significant benefit to the portfolio.

- The optimal portfolio also had a significant loading to inflation exposure (to real interest rates) even absent the modelled liability having any cost-of-living adjustment: there is implicit inflation in wage growth modelling of the liability. Pension assets are exposed to inflation and it would appear relative value of inflation-linked bonds compared to nominal bonds is related to the business cycle and/or level of interest rates in the same way corporate spreads are but crucially without the default risk.

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- Next steps and advancements include build a testing model for the scenarios, incorporating empirical volatility surfaces from historical data to create regime distributions, incorporating conditional heteroscedasticity (GARCH) and incorporating Kelly strategies with downside constraints (beneficial to long-term horizon).

Q&A

- Q: How many assets are part of the optimisation?
  A: We have ~8 asset classes and we have loaded a number of factor exposures and derivatives overlay strategies so ~35-40 exposures are loaded.

- Q: Can the methodology scale to hundreds of different assets and multiple horizons?
  A: The beauty of the strategy is that it can be scaled. It is compute intensive though through, for example, cloud computing these limitations can be overcome. It can be broken down to a discrete/linear program if you use finite discrete methods.

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Blockchain & Digital Assets – Notes from the Trenches

Summary

- Five years ago, when J.P. Morgan first started researching blockchain, it was considered a curiosity, a technology with a lot of potential to drive cost savings, but probably an overhyped series of proofs of concept. Today enterprise blockchain is live, and is production grade, and it's transferring billions of dollars of value in collateral a day and enabling new financial products not possible before.

- Ethereum blockchain has interesting features rather than just being focused on peer-to-peer value transfer. The idea of having smart contracts, the ability to program value transfer and enable interesting business logic was really intriguing. One of the first projects as part of the blockchain program was to essentially fork the public ethereum codebase to add privacy and performance to the code base, and use it for enterprise purposes. Additionally, there was the vision of public infrastructures connecting with permissioned and private infrastructures, similar to the public internet today—some companies would have a permissioned or private intranet and you can connect to both with your browser.

- The second thing on which time was spent was trying to understand new privacy technologies and basically how to share information without actually sharing information. This was important as public blockchains do not have privacy built in and privacy is required for use in an enterprise setting. J.P. Morgan was actually one of the first banks to experiment with zero knowledge proofs and partnered with the Zcash Company, which is a team that has developed a more private Bitcoin.

- After an enormous amount of time was spent clearing regulatory, compliance and cybersecurity hurdles, the Liink network was debuted. It has been one of the largest blockchain-based networks of cross-border payments—banks connected together to exchange information directly with each other to resolve cross-border pain points such as sanctions, exceptions resolution, and accounts validation before making payment to prevent fraudulent payments, as an example. Over 400 banks have signed up to participate in the Liink network, and 100 of them are live. More significantly, those banks brought even more interesting ideas like what can be done with network like Liink. J.P. Morgan has built the Liink network but actually can't see anyone else's information unless J.P. Morgan is a part of the transaction—it is almost a model where people can own their own information, and then commercialize it.

- The next challenge was how to transact Value on the blockchain. The bond issuance and syndication process has 160 steps in over 40 systems. Using smart contracts everything was automated: the creation of the bond, the syndication, the settlement, interest payments over the course of a year including the maturity payment. 150 million blockchain bonds were issued with the National Bank of Canada back in 2017. With this project also the J.P. Morgan coin was born.

- After a long time was spent figuring out regulatory and legal treatment, a US dollar representation on the blockchain was created that has 24/7 365 availability and programmability with all the benefits of being on a blockchain, and connected with J.P. Morgan banking systems. J.P. Morgan has completed billions of dollars of transactions in JPM coin and balances in J.P. Morgan coin have the same legal treatment as any deposit at JPMorgan Chase Bank NA. In parallel there was a huge generation of what are called US dollar stable coins, basically the representation of US dollars on the public blockchain space, either backed by US dollars in deposit at Reserve Base, or some sort of algorithmic stable coin that was priced balanced through math and code.

- One of the key things that was learned in this journey was that there wasn't necessarily a business case to just take existing products and services and then just put them onto a blockchain. It was rather the new opportunities where there was no infrastructure before and where there was a scope for new financial products.

- Typical repo trades are counted from a maturity standpoint in days like overnight repo. With the new system it has become possible to create a repo trade that matures in hours, if not minutes. Basically this is a new tool in the toolkit for those managing intraday liquidity and creating all sorts of new trading interactions intraday by using J.P. Morgan coin, and actually creating a blockchain subledger on top of Bank of New York Mellon tri-party collateral system for securities, like treasuries. Billions of dollars of intraday repos are transacted now.

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- J.P. Morgan is the first bank in space to launch satellites and ran Ethereum nodes in the satellites along with the ground station to test tokenized payments to not only explore what the future space economy will be but also to understand the outer limits of this new technology. It was a great experience to learn in practice if it is believed that this technology will underpin a new payment system for the world or the terrestrial world.

Q&A

- Q: What is DeFi, and what do you think of it?
  A: DeFi refers to decentralized finance and is a technological and innovation movement in the public blockchain cryptocurrency space, specifically around the Ethereum blockchain network. They are a number of public crypto protocols that are enabling financial products and services like collateralized lending, market making, FX price discovery or enabling escrow and margin management systems, but all in the context of just a few lines of smart contract code. All of these developments are open source, so meaning anyone can access the underpinnings of all of these protocols, and in fact what's been really interesting is that even before projects are done other project teams are picking up those code bases copying and pasting them, and then adding others and deploying it into the blockchain. As a result you get this wild compounded innovation that's happening. J.P. Morgan is well positioned to understand the protocols and even cherry-pick the best.

- Q Are NFTs overhyped?
  A: NFT refers to Non Fungible Tokens, which are used to create unique identifiers like ownership stakes for digital art, music and crypto kitties. Recently at a Christie's auction an NFT was sold for $69 million. The concept of an NFT as a uniquely scarce digital item is exciting and actually one of the best use cases for blockchain. In the non-crypto world, if you have a digital picture, you send it to your mom now you have two pictures, your mom sends it to you and now you have like three pictures. The idea around the shared blockchain registry and non-fungible tokens is that one picture has a trail that this is the picture that was sent to mom and mom sends it back and that creates the unique aspect of a digital asset—where previously the internet wasn't able to enable unique digital assets. Definitely digital collectibles is going to be an exciting market, for example NBA Top Shot.

- Q: What is on the horizon you are most excited about?
  A: Digital identity, and specifically self-sovereign digital identity and confidential computing are some of the exciting areas. Not many have been thinking about digital identity because identity is usually not something one thinks about, it's usually just something that kind of happens accidentally. Identity data has been consumed by big technology, big companies own your identity and you don't have control over your identity. With the blockchain technology a digital identity framework is being created where you as an individual or a company can actually own your own identity attributes and control exactly who gets to see your identity attributes and track it. And, in fact, even commercialize your own identity attributes, without necessarily having other people, commercial or other companies commercialize them.

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The Tale of Two Chinas: A-Shares and H-Shares/ADRs

Summary

- China A-shares' inclusion in major global benchmarks has brought a lot of attention to the market—making it an important topic in investors' minds. As global benchmarks add more China A, it is useful to consider how it will impact portfolios. Clearly, by size, the **China A-share market is very big** (second only to US), but global allocations to this market today are very limited.

- Emerging markets were supposed to be uncorrelated sources of growth. Since 2005, while this has been true in GDP, where EM ex China has delivered growth better than US and DM, the same is not true of corporate earnings, where EPS growth in EM ex China has been much lower than in DM. On the other hand, China onshore has delivered better outcomes. China GDP growth grew close to 10% pa and corporate earnings grew close to 15% annually, outperforming US and DM.

- A big reason for **strong earnings growth in China** is a vibrant financial market that has enabled real economy growth to be translated into corporate growth. In China, VC and PE have strongly contributed to the incubatation of new ideas and companies. For instance, 40% of today's unicorns are in China. Most of the rest are in the US.

- Thus, while China is already represented in global benchmarks via H-shares and ADRs, it is important to **look at the inclusion of onshore A-shares differently** for three reasons:

- **Composition:** H-shares have historically been dominated by SOEs as only the biggest and most established companies were allowed to list in HK. So we have the biggest banks, telecoms, insurance companies listed in the H-share space. These companies are generally more mature and thus there isn't much growth there. And ADRs are typically full of companies that couldn't list in China (due to more stringent listing requirements) which leads to some adverse selection. A-shares on the other hand are much more diversified, offering strong growth exposure to many key sectors like consumer, healthcare and industrials.

- **Correlation:** A-shares are also extremely uncorrelated with the rest of global equities. The correlation between A-shares and US is only 0.39. And this surprisingly falls in times of stress, which is unique as most correlations tend to rise in times of stress. Even the correlation of A-shares with China offshore is not very high.

- **Alpha opportunities:** Alpha is a zero sum game. Typically in the US for investors looking to capture alpha, the participant on the other side of a trade is also a sophisticated investor. In China A-shares, the other side of the trade is most likely to be retail investors. This continues to replenish the alpha reservoir. The experience of north Asia EMs shows that retail participation is likely to remain high for many years. Thus, alpha for multi-factor quant factors tends to be very high in China A-shares.

- In these conditions, what are some key aspects of retail trading behavior that one could target to generate alpha? If you sort stocks by the size of trades (heavily traded by retail will have small trade blocks), you will see that retail heavy stocks tend to underperform the other extreme by 18% pa. This is true in other markets too, like in Taiwan. Also, in many cases retail flows can be driven by non-fundamental factors, sometimes even irrelevant news.

- **Some characteristics of fundamental data in China:** The break in **ROE distribution** around zero is very prominent in China A-shares. This was true in most global markets historically. While in recent years this has improved in global markets, in China A-shares this is still the case. But it is important to note that more than half the companies actually manipulate earnings down as well. This is typically done to create buffer for weaker years as reporting losses is frowned upon and brings regulatory scrutiny. Secondly, **subsidy** is a very big component of fundamentals in China and can point to where underlying earnings are very weak. In a similar vein, do state-owned banks have a lot of hidden bad loans? Actually, **good banks can report very large bad loans** to avoid having to do national service. Finally, SOEs are hard to directly identify. One needs to look into bios of management and board. It is also important to **separate SOEs into**

national-level SOEs (that do well) vs lower-level SOEs (that tend to underperform significantly). This is because at city level SOEs, for instance, there may be more governance issues.

- Great deal of concern about ESG overall in China. Governance in particular needs to be incorporated into investment strategy. From Environmental and Social perspectives, Chinese companies, while worse on level, are definitely stronger on trajectory compared to DM.

- Overall, understanding the issues and uniqueness of China A-shares can help unlock the great alpha opportunities in the market. And for global investors, the high growth and lack of correlation with other markets is an added benefit. Thus, an **appropriate investment strategy should involve playing both US markets and China A-share markets**.

Q&A

- Q: How much of futures trading in China is retail vs institutional? Does that change in the future?
  A: In most countries, futures trading would be very institutional and used for commercial purposes primarily, but in China it is different. 75% of futures trading is retail, and this is used as a channel for putting on higher leverage than margin loans can provide. It will probably not change very much in the near future. If you look at some of the more recent contracts that have been launched, it suggests the demand for leveraged speculation has only grown over time.

- Q: Can you talk a little bit about the regulatory backdrop in China? Like in China interent? How does one factor that in a systematic investment process?
  A: Image of regulators as outdated, unsophisticated and arbitrary is misplaced in China. Rather, think of US regulators as Montessori parenting, while Chinese regulators are like Tiger Mom parenting. Regulators in China don't fully trust the market and they want to protect retail investors from self-harm. Regulatory statements can seem interventionist, but should be really seen as a protective stance for individuals. Many of the regulations done by China make a lot of sense, and perhaps should be also replicated in the US and EU.

- Q: Considering the number of retail traders in China vs US, have there been any meme stock like situations in China?
  A: Price discovery in China is not very strong, and this is well understood. So dislocations from fundamental value can be large, although prices do eventually align with fundamentals.

- Q: Any comments on capacity constraints in alpha generation in multi-factor strategies in China?
  A: In China, liquidity is quite flat across the board, so not just concentrated in large caps. Thus China is actually one of the best markets for capacity in terms of factor strategies.

- Q: In this context, is there any point in investing in ADRs?
  A: Admittedly, less so. There is a a lot of price discovery already happening which reduces the alpha opportunities.

- Q: There has been a lot of talk about de-globalization. Some tangible actions on this too. Does supply chain moving away from China impact the China A-share market?
  A: It's a good thing for the global economy if China is becoming more internal focused and becoming a growth engine for the rest of the world. Some of the old industrial companies can also be considered value traps. So if these are removed over time with supply chains moving out, maybe that's a positive development for the A-share market overall.

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China-A Single Stock Shorting – Challenges and Opportunities

Summary

- **Mingshi** is a pure quant firm for China onshore markets. They have more than $2.1bn in their A-share strategy now and have been in business for over 10 years. Recently, 18 months ago, they started offering Long/Short products offshore in HK that use the China-HK Stock Connects for trading. Mingshi is currently one of the **largest players in the single stock short selling market in A-shares**.

- Shorting in the China A-share market is very different for onshore and offshore investors. For onshore investors, synthetic shorting is less common due to high swap transaction costs and less developed swap infrastructure. And requirements for physical shorting are quite onerous. You need to present your list, get approval after around two days, and then the borrow is locked in for 7/14/28 days (and you have to pay the cost for it) which is not suitable for high-turnover strategies. As a result, very few people actually short individual names onshore. For offshore investors, physical short selling is not easily available (recently started for QFII investors). But **offshore synthetic shorting** (via brokers lending Connect inventory on swap) is possible at both the index level and single stock level, and is perhaps the most efficient way to implement a short sell portfolio in China A-shares right now.

- All in all, there are a 100 million institutional and individual investors onshore and 90% of the trading happens onshore. And they mostly cannot short individual names. Offshore, there are maybe 15-20 large players involved in shorting. So there **should be a lot of alpha opportunity**. Indeed, Mingshi estimates that if they could have unlimited access to shorting, short-side alpha could be 3x the long-side alpha.

- But there are some challenges: (1) There is a **much higher recall risk** compared to US and other DMs. This is a big challenge, as even after approvals, brokers can recall the approvals on the same day—before the trade, during the trade or even after the trade.

- (2) Offshore synthetic inventory is limited. Real trading data on borrow availability shows that inventory mostly comes from Connect. Comparatively less from QFII (based on data from the six leading brokers). In 2021 there has been around $14-15bn USD of availability covering around 1,300 stocks. This sounds sufficient, but there is actually **very limited inventory outside of large caps**. Most of the inventory is focused on the top 300 names, even though there are 4,000 names listed onshore. So, assuming a 100% appoval of requests (unlikely in the real world), replication for CSI300 is alright, but it is much harder to replicate shorting baskets for CSI500 (stock sizes 301-800, still mid-caps). Assuming 90% tracking, only a $100mn size of short book can be managed on CSI 500. Thus, investors are missing the profit opportunity in the shorting basket. In particular, one is unable to short the really bad stocks as there is no borrow available.

- Mingshi has been running offshore-based China A shorting strategy since early 2020. The single stock short portfolio was almost $1bn at the peak, and 100% of the short portfolio. This single-stock shorting portfolio's alpha really picked up in Feb 2021 though when the institutional crowding bubble burst.

- Lessons learnt from experience in China A shorting: (1) There is a **big gap between historical availability and actual availability** of stock inventory. The borrowing team of the brokers adjust policy and models often resulting in inconsistent borrow availability. It is hard for brokers to provide the actual amount they can borrow. (2) **High percentage of same-day recall.** Need a model to predict what kind of stocks will get recalled. (3) **Very hard to control risk** without modeling for borrow and recall risks. Mingshi has built a recall model over the past 18 months, which is improving constantly. (4) As a result, **short-selling capacity is actually much smaller** than you expect. Perhaps for Mingshi's portfolio, about a $300mn short portfolio is what can be managed well, instead of $1bn.

- Future of shorting: Positive development on the single shorting size, more institutions lending out their inventory. Shorting will become more attractive in the future. Mingshi is committed to continuing its shorting strategy. Over time, the size of shorting will grow.

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Q&A

- Q: Is there any alpha in tracking outstanding short interest as a factor? Does it work well in combination with other factors?
  A: Short interest data for A-shares is quite scarce compared to short availability. Only the big 20 players indulge in active shorting. So the data would be very valuable but is not available currently.

- Q: Thoughts on the evolution of A-share markets (in light of developments such as ETF indexing)?
  A: A-share market has much more alpha than other markets. 85% of the trading comes from 90 million individual investors. Typically, for the same strategy, one can achieve a much higher Sharpe ratio relative to the US or other markets.

- Q: Risk of short squeezes in A-share markets, like we have seen in the US this year?
  A: Short squeeze always needs to be considered. Mingshi has limits on individual concentration and short positions to control for such issues within their book. Less risk also because of the high recall rates for single stocks.

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Recent Machine Learning Applications in Portfolio Management and Trading

Summary: The presentation covered three machine learning applications in finance. 1) The first is the application of jump models to model regime changes—the advantages of which are more persistent states when compared to alternative models such as an HMM (Hidden Markov Models). 2) The second topic focuses on the use of alternative data in finance—the presenter emphasizes both the tremendous opportunities as well as the potential costs and that valuing datasets can be very difficult. 3) For the final topic, the presenter introduces the Black-Litterman-Bayes (BLB) model which is an extension of the standard Black-Litterman, which allows investors to incorporate views in form of a likelihood function.

- The speaker commences the presentation by tracing the advent of Machine Learning back to Bayes' Theorem in 1760, Markov Chains in 1913 and Neural Networks in 1951. But it has only really taken off over the past 10 years, due to the larger amount of data, availability of open source software and the decline in data storage and computation costs.

- There is a big difference in Machine Learning in Finance today compared to just a few years ago, as more use cases are being identified. New technology is being adopted which can offer a competitive edge and there is a better understanding of alt data.

- Though ML is not a cure-all, the presenter cautions. It can deliver black box risk on steroids and also suffers from lack of interpretability. The presenter highlights a paper, Hutson (2018), which likens Machine Learning to alchemy. And echoes the call for a standardization of approaches.

- The first application of ML to finance the speaker presents, is on the topic of regime detection. The example is based on different volatility regimes for the S&P 500. This type of problem can be solved by hidden Markov Models (HMMs). Though these have some challenges, as they are sensitive to misspecification, which results in HMMs not always being robust to initialization or outliers. HMM states also lack temporal persistence.

- An alternative approach are jump models. These introduce a cost for jumping between states. It is temporal clustering mechanism which is similar to a K-Means clustering model with an added cost function. These inputs are a univariate time series of S&P 500 returns and some statistical transformations thereof. Jump models are fit using a coordinate descent type of algorithm. The output of the model comes in form of models parameters and latent states. These Jump models compare very favorably to HMMs and spectral clustering in terms of both accuracy and speed.

  Additionally, no Markov assumptions are needed.

- Analyzing the results for the S&P 500 example, the presenter concludes that it is evident Jump models are less volatile and do flip-flop between states as the HMM does. Jump models with λ calibrated using cross validation, show more persistent states. Additionally, using intra-day data generates more accurate estimates and increases the robustness of the model. This model can be expanded to include exogenous features, such as sentiment or the VIX.

  In terms of financial applications this model can be used for strategic asset allocation and portfolio construction as well as state identification for limit order books.

- Next the speaker focuses on investing with alternative data and illustrates what constitutes alternative data. Unlike traditional data, alternative data is not sourced from the company that is being analyzed (e.g. SEC filings) or its agents (exchanges).

  Alternative data is used to forecast both GAAP, non-GAAP (e.g. subscriptions) measures and macro signals. One of the key characteristics of alternative data is that there is quite a bit of work involved to (pre-) process the data. For quantitative investors, many alt data sets may not overlap with traditional data sets and therefore provide an additional source of alpha. Though some datasets may have long time lags.

- Some of the key challenges for alt-data the presenter identifies are: non-homogeneous data sets, data quality, identifier mapping (no direct links between data and tickers) and partially missing data (can cause bias).

  The speaker illustrates these points using an example of healthcare purchasing data, for which a process to map products to tickers had to be created. Further, the data set has months of missing data, where the question arises whether to impute or not.

  Concluding on the topic of alternative data, the speaker highlights both the tremendous opportunities as well as the potential costs and that hence valuing datasets can be very difficult. Though there are now a number of good solutions that automate a number of these challenges.

- The third topic the speaker focuses on is on the Bayesian paradigm in investment management. Bayesian tools have been used in finance for many years. These can be implemented in an ML setting and represent the next frontier.

  Next he poses the question: What makes a good portfolio construction model? It should outperform a simple benchmark. The weights should be sensible and intuitive. Sensitivity of the model to input parameters and model transparency are also important. Finally models should be extendable.

- The presenter introduces the Black-Litterman-Bayes (BLB) model which is an extension of the standard Black-Litterman, which allows investors to incorporate views in form of a likelihood function. The optimal model weights are estimated using expected utility maximization.

  One potential application of this model extension is on incorporating risk premia views into asset allocation. In this instance the Black-Litterman expected returns, subject to factor views, can expressed in closed form. The presenter provides an example by applying the BLB to 2,000 US stocks from 2007 to 2020, using a multitude of common factors (size, liquidity, quality and short interest). The example pits the standard MVO against the BLB using the exact same inputs. The result for the BLB is 1.2 compared to the 0.9 for the standard MVO approach. The difference is attributable to the Bayesian portfolio construction.

- Concluding the presentation, the speaker offers some final thoughts. While the role of portfolio management and trading has not changed, machine learning has allowed us to create more realistic models that can adapt to changing market conditions.

  ML has given us a number of tools to generate alpha—NLP type techniques for example.

  It is important to think about how to best lever ML and alternative data as well as assessing the importance of interpretability. Finally, it is also crucial to ensure that one understands the risks and weaknesses of the models.

Q&A

- Q: In your jump model, one issue with jumps is that they happen very infrequently. Does that make it difficult to calibrate a model because of the small sample size?
  A: Yes, that is the crux. The rarer some phenomenon is the harder it becomes to identify.

- Q: One issue with the Bayesian approach is dimensionality. When you specify the prior, not only does the marginal distribution need to be specified, but also the joint distribution and when you move away from Normal distribution it becomes almost intractable. Is there a way to address that issue for Bayesian methods?
  A: Of course, frameworks like this do depend on how you are setting it up, if you are parametric or non-parametric. The development of sampling techniques in Bayesian statistics made a massive step forward. Many of these modern sampling techniques are able to solve these problems in very high dimensions.

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Machine Learning Application in Trading and Liquidity Research, a Practitioner Experience

Summary

- The speaker's team builds liquidity models, price discovery and validation, similarity/cohort benchmarking and aggregated analytics. They have global and cross-asset coverage depending on the model/functionality. The team uses machine learning tools and technique both in their own work and upstream. A number of these include tree-based approaches. The main applications include portfolio liquidity optimisation, price discovery, trading optimisation, portfolio trades, ETFs, alternative trades and order routing.

- Providing some remarks on machine learning, a few useful "rules of thumb" were provided: why and where machine learning can help 1) making sense of the large volumes of data that have now become available, 2) recognising complex or non-traditional patterns in data, 3) dealing with non-linearity and avoiding "mathematical" simplifications, and 4) very useful when forecasting models have a lot of inputs. When is ML likely to work? 1) If something can be done in a few seconds by a human, it's likely to be automated with ML/AI; 2) if there are a lot of good examples available (labelled data), ML/AI can likely figure it out, and 3) optimisation: a lot of time has passed since Markowitz, time to refresh your knowledge of the field, but still we need to solve the interpretability problem. Overall we need to find the right balance between hunting for model performance and interpretability.

- We must *enable* human users to understand appropriately and trust the algorithms. Interpretability is not about understanding all bits and bytes of the model for all data points (we cannot). It's about knowing *enough* about model behaviour for your downstream application.

- How do data science techniques scale with the amount of data? When speaking with non-experts neural networks, deep neural networks, other artificial intelligence are beneficial when we have more data. To have a clear benefit from a deep learning model you need an embarrassing amount of data. Machine learning is not the objective, it is a tool to help us achieve business results.

- During our journey in machine learning for liquidity and trading, and dealing with interpretability, our modelling approach philosophy: we are not ashamed to roll out 2-variable linear regression models, we like tree-based approaches, we think NLP has a big potential to build news based sentiment, and are doing preliminary testing on artificial neural nets and reinforcement learning. Some principles we use for interpretability: we try and keep the model simple, upgrade the mathematical/statistical tools only if we see a significant performance upgrade, and tend to build very localised and granular models. Finally, automated surveillance and alert of input data quality control and model output is of utmost importance.

- Another area of focus is in creating homogeneity in the overall investment process. Machine learning can help with higher frequency analytics, better integration with portfolio construction and provides a feedback loop for further potential for a machine learning approach.

- Applied to liquidity risk management, liquidity data and analytics are embedded in the risk management and portfolio construction process. The core of this analysis is transaction cost modelling where we build a transaction cost surface transforming a 2-dimentional problem to 3-dimensions: "How much can I sell at a cost at a certain time?" Using this we can embed these transaction analytics to the interconnectivity between assets (similarity/knowledge graph).

- Providing a practical example, the speaker detailed a model of implementation shortfall. It is interesting to note you get different benchmark prices from different providers, this should highlight the planning approach is very important. When looking at transaction costs the goal is the construction of a liquidity model able to control the relationship between size, time and cost. The current model uses a composite of traditional regression and Random Forest (Volume Forecast): out of sample performance is significantly improved though the improvement in costs comes at a cost of impact to interpretability. A consideration for rolling out into a production environment.

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- The Volume Forecast Model is a single security predictive model of tradeable volume for corporate bonds globally. The problem is decomposed into two sub-problems: i) the probability of a trade occurring, and ii) the predicted volume if the bond does trade. Using Random Forest regression, known well for dealing with non-linearity and missing data, allows including a large feature space to capture the heterogeneity of bond markets. Overall the model performs significantly better.

- When benchmarking you want to be able to identify similar assets. This task is useful for modelling—learning from similar assets with data, portfolio construction, and optimal trading. Gradient Boosted Trees as well as matrix-based distance measures are powerful similarity importance methods from machine learning we can use. They perform well in testing and show promise for moving into production.

- A final use case detailed natural language processing which is a way we can identify significant features we can embed into models. The speaker is a big fan of news sentiment indices though we have not seen serious implementations in the industry. If successful it'll be an invaluable tool to plug into liquidity and trading models.

- Hot topics for us include machine learning algorithm interpretability, infrastructure, cloud solutions, security similarity, textual news signals and reinforcement learning.

Q&A

- Q: Did you see any difference in performance in your machine learning models pre/post-pandemic?
  A: We have learnt a lot from COVID. We have learnt how to enhance our models, especially the model surveillance elements which provided a compass for traders and trading where our models were becoming weak and needed attention. Some models suffered as the pandemic set in though we knew why they were suffering and were able to action change.

- Q: If you observe degradation in model performance, when do you decide to switch/retire the model?
  A: Regime change is the way to identify when to switch types of models. On model surveillance we have two core components: 1) when to recalibrate the models and 2) trading market experts.

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Navigating Uncertain Markets with Alternative Data

Summary

- The speaker presented various alternative data case studies.

- **LikeFolio** purchasing intent data has predictive power on Peloton share price. Right after the stay-at-home order came out in March, the dataset immediately noticed a huge spike in social media mentions with individuals saying that they were either planning to buy or just bought a Peloton. Unlike transaction data, which is looking backwards, this is looking forwards.

- Sentiment and buzz data from **BRAIN** also predicted/picked up the Peloton product recall event. The Sentiment has been negative since February (before the CPSC warning issued in April), and the buzz picked up on the announcement of the recall in May. **Danel Capital's** Smart Score also picked up on the recall issue earlier and the Sentiment score finally reacted in late April to the announcements from the CPSC. Short interest data from **S3 Partner** also provides insight of the trading activities around this event.

- The short interest and flow data from S3 Partner also shows insightful trading dynamics of AMC. The sentiment scores based on WallStreetBets show retail are very interested in seeing AMC trading higher, although based on sentiment on Twitter, they are less interested in seeing a rally.

- The point here is you need to have lots of different datasets to piece together the full picture of the market-moving events.

- **Prosper Insights** Datasets based on consumer interviews on their plans over next few weeks/months can show forecasts instead of historical measurements of the economy.

- Using Elastic Regression we can predict CPI with good accuracy based on Prosper consumer intent data 24~30 days ahead of the release of the official data. There are also similar results shown for the commodities portion of the consumer price index, the average hourly earnings of the Manufacturing industry, Midwest housing starts, Civilian Labor Force and Advance Retail Sales.

- Recommendation is to think about this as a completely new set of tools for alpha research. The world has changed—it has become a lot easier to use new data sets and new signals.

Q&A

- Q: Since the pandemic, what are some of the most popular data sets you have seen the clients using?
  A: I think investors are focused on trying to measure revenue and revenue performance. There is renewed interest in forward-looking crowdsourcing datasets based on opinions from thousands of people. These can be demographically normalized to the US and can be fairly good predictors for at least the next couple of weeks. There are also many people who are looking at transaction data because it is getting cleaner, more organized and more granular which allows people to dig into individual companies.

- Q: With so many datasets available, how do you avoid over-fitting? What kind of steps are you taking?
  A: We follow a regimented process. We break out the data into a training period where we do the feature engineering, feature selection and the initial model estimation to settle on the key features that we think can be statistically supported by the amount of data we have. And then we have a test and then a validation period as well. We try and make sure that if we vary the complexity of the model or number of features that we include, it does not cause a fall off of the performance in the test period. In general, we learn as much as we can about the setting as we go, but also have some objective criteria that we have to jump over once we go into the test group.

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CEO/Founders Panel on Alternative Data in Investing

Summary
Peng Cheng from J.P. Morgan moderated a CEO/founders panel of alternative data. The panel consisted of Craig Iseli (COO, SpiderRock), Elizabeth Pritchard (CEO, Bitvore) and Ihor Dusaniwsky (Managing Partner, S3 Partners).

Q&A

- Q: What have you seen your clients are looking for in the post-pandemic new normal and how do they differ from the pre-pandemic norms?

  A: CI: I am not sure the pre-pandemic and post-pandemic has tactically changed that much but it has accelerated things. One thing that has really taken off is the retail trend. With the rise of retail, intraday/higher frequency databases and things that track trade flows and where they're coming from became much more popular through the pandemic. Another trend is that aggregators have become a much bigger piece of the market because it is really about the aggregation of the information and how that gets into a platform that could consolidate it all into a single workflow and lets you pair one asset against another.

  A: EP: 1) Nowcasting data. Investors or more broadly decision makers are much more careful about understanding risk and what is happening now. Data strategy has become more important and leaders want to protect against surprises. 2) Seeing much more data aggregation trend that brings all sources of data together as Craig described. This is happening with fundamental investors as well, not just the highly quant/systematic investors. 3) ESG—the pandemic and the economic crash in the market and in the world, in the perception of what's happening with environmental, social and governance risks. Investors are more aware of these risks and they want those insights before they make decisions.

  A: ID: I have really seen a change in how portfolios are being created and managed. We have changed from pure fundamental analysis, which is probably one of the lead ways of building a portfolio years ago, to quant and momentum based application where you are looking at what is going on now. What investors really want, especially post pandemic, is to act on information that they can get as soon as possible—live short interest numbers, not two weeks old or three week old numbers. And they want actionable analytics because there is so much data coming at their faces and they do not want to waste time cleaning it up.

- Q: How do your products help with identifying and managing the risks associated with the meme stocks?

  A: ID: Both the retail side and the institutional side needs to know what is going on on the short side of the market, because that affects the long side as well. We are having a lot of interest in our data with meme stock names because people want to see both sides of the market. They want to see if the shorts are growing/covering. We have created metrics like crowd indicator and short risk indicator to tell people if a stock is truly crowded on the short side with a high potential for short squeeze.

  A: CI: An element of the trade with the meme stocks is the trading of options. AMC had 4.5 million options traded. To see these trends before they happen, not only short interest is one of the indicators, but also the options trading trends—where is the options buying relative to typical open interest, what is happening to the skew? There are a lot of nuances just like in the short side. We can follow who is buying what, for example, market makers might be buying the stock because they need to cover their gamma. The trade flow databases can trace the source of the trades and the surface database can be used for looking at how pricing in the market is suddenly shifting back and forth.

  A: EP: Take Peloton as an example, if you were looking in the unstructured land around Peloton over the last year, maybe you would have had earlier insight into the event. Generally speaking, what can you get out of unstructured data includes patent litigation, stores closing, privacy breaches, product delays, manufacturing problems, shipping delays... all sorts of insights that you can then bring together with the options data and short interest to form a holistic view. You can also learn about the retail herd before they move from the Reddit blogs. In the ESG space, a company might say we are going to be more sustainable in how we approach our treatment of forests, but the sentiment and the discussion in the

relevant blogs and newsletters or other unstructured texts might reveal they didn't do anything for months. There is quite a bit of lead time with these insights before these reflect in the share price.

A: CI: Looking at social media sentiment alone might yield many false positives but if you can aggregate three or four different perspectives your hit rate is going to go up.

A: ID: With Elizabeth's products, it is giving you an idea of what the theme is, and then when you look at short data you can see what the traders are trading on this theme.

- Q: Are there any other topical themes from your clients?

  A: ID: One of the big things we are seeing now is the EV market and the related stocks. We are seeing some of the biggest short squeeze candidates and biggest movers on the short side of stocks like Nicola, Blink… all these have an ESG property to it. We are seeing this with shorts and derivatives trades on it because the price moves so much that a lot of traders wanted the room to trade off this idea because you can get a lot of leverage.

  Separately, on Archegos, our products try to look at margin and collateral events as well. If I am short or long the stock, I have to make sure that I have enough collateral and to facilitate any changes in prices, which is going to make me put up more collateral. In the case of Archegos, they used the same piece of collateral several times. So there is going to be some fundamental changes in how the brokers look at collateral and their internal policies with extending leverage to clients.

  A: EP: I would talk about the risk use case from the standpoint of unstructured data. and, you know, it's interesting, we're seeing, we're seeing firms, right? We are seeing the expansion of use cases from trading desks and research desks to commercial lending desk, KYC, compliance, vendor risk management, etc., where there is a heightened level of need for understanding the risks around the companies or customers you are doing business with, including reputational risk, operational risk, litigation risk, etc. There has been more seriousness since the shocks last year on understanding of data available in the world that can actually give you insight into where you can find risks ahead of a problem and monitor the risks.

  A: CI: We had liquidity compression, meaning that, we used to trade single stocks and individual names 10~15 years ago, then everything moved down in the rise of ETFs and everything became ETFs. But the last 2 or 3 years we had a shift back to single stocks. We see this improvement in liquidity and market being driven partially by having broader set of information with alt data.

- Q: Can you give us some final thoughts or predictions on future trends?

  A: ID: I think people are looking for more ways to see different parts of the market. For the old data that has been in their hands, e.g. short interest, it will change to be more user-friendly to augment decision making processes.

  A: CI: 1) Good traders have always known that events in regimes create opportunity, but events in regimes are not always obvious. Now with alt data, we have so many more sources to be able to see the environment we are in and so many more abilities to look back. 2) Collapse of historical information and real-time information, although it is very nuanced and very complex to maintain the consistency to avoid false signals.

  A: EP: The trend was consumerization of technology inside the enterprise and now is consumerization of data inside the enterprise. Data aggregation, licensing and consumption model all need to be improved/reinvented to ensure that data can flow from the source to the use case as easily and as frictionless as possible and the user will be able to pay for what they want and how much they need.

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