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Solvency II look-through for risk-premia funds

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23 November 2017



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The risk-premia funds investment style

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Cross asset risk premia strategies

- With today's uncertain markets, **Cross Asset Risk Premia Strategies** can be an attractive alternative to traditional investments
- Risk Premia can be sourced from the following broad categories:
 - **Value** - the cheapness of certain assets ("value assets") relative to other assets ("growth assets")
 - **Carry** - the tendency of investors to demand higher returns for taking risk on longer-term securities as compensation for the greater risk associated with them compared with shorter-term securities
 - **Volatility** - the implied vs. realized spreads that arises from investors' risk aversion
 - **Momentum** – the behavioural anomalies of market operators, such as herding, investor over and under reaction, and confirmation bias
- J.P. Morgan has prepared an example Risk Premia product presentation, focussing on diversification, correlation and construction. Through this presentation, we showcase a methodical selection process, portfolio construction details and analysis of simulated performance, with a focus on recent performance and correlation to traditional asset classes.

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Risk premia investing: the concept

What is risk premia ?

- Risk Premia investing refers to well-known, empirically-tested, sources of return that can be systematically harvested through passive, systematic strategies
- They can be thought of as structural components of hedge fund strategies

A brief history of risk premia

As investment styles, before '90s

- Specific asset managers (stock pickers) used the terminology to describe their investment style.
- Eg, a 'Value' manager picks relative cheap stocks, as opposed to a 'Growth' manager

As Academic references, early 90s

- Fama and French (1992, 1993) introduced the concept explaining 'Size' (or small-cap value) and 'Value' (or cheapness premium) opening up for further developments.
- However, the concept was largely academic, used to explain/attribute portfolio performance.

As Investable Products (2000 onwards)

- Hedge funds and alternative AMs were focussed on market-neutral exposure to Risk Premia styles
- IBs, through Investable Indices, offer similar exposure

- A risk premium 'factor' is an abstract reference to an investment that aims to maximize the exposure to a particular style while being market-neutral.
- The following is a broad classification of such risk factors:

| Carry | Value | Volatility | Momentum |
|--|---|----------------------------------|---------------------------------------|
| 'Holding' premium of high-yield assets | 'Cheapness' premium of undervalued assets | 'Insurance' premium from options | Recent 'Winners' as opposed to losers |

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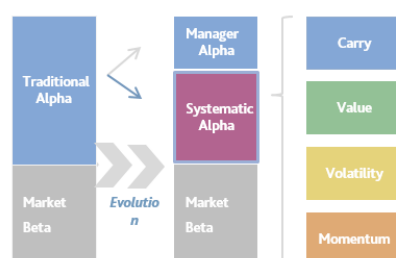
Extracting return from market neutral risk premia

Why invest into risk premia ?

- Over time, the concept has evolved as a re-organized view of 'Alpha', or the value-addition from an investment manager.
- A large chunk of this 'Alpha' is systematic, can be captured through rules based strategies.

Comparison with traditional providers like HF/AMs

| Transparency | Daily Liquidity | Cost Effectiveness |
|--|--|---|
| Algorithm, daily valuation and charges are fully disclosed | As opposed to generally monthly / quarterly offered by HFs | No performance fees, competitive trading costs and product fees |



Clients profile and rationale

- Pension funds, Insurance Co's:** replacing HF allocation with liquid and cost effective alternatives; search for 'yield'
- FoFs / AMs:** Targeted exposure to specific Risk Premia; looking for bespoke and 'cost effective' solutions
- Private Banks, Retail Distribution:** Dual target of yield and delivery format features: capital protection, structured notes, structured Funds

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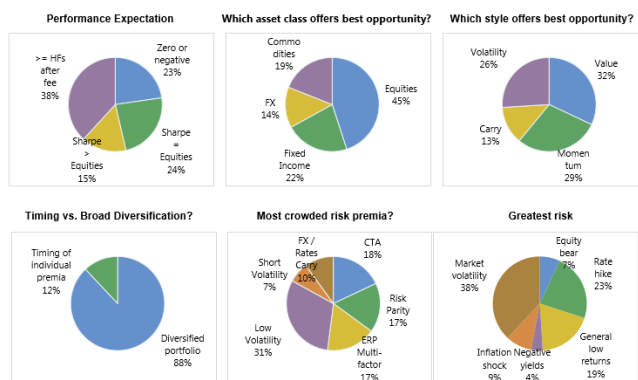
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Risk premia investing: the landscape

Client Survey Results: JPM Macro Quant Conference on Risk Premia Investing; London, Nov 2016



Full report can be accessed from: <https://jpm.com/research/content/GPS-2186270-0.pdf>

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Risk-premia fund look-through SCR: project report

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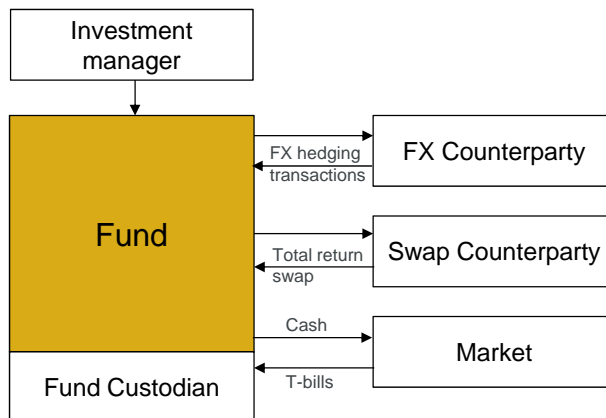


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Overview of the fund structure



- Fund providing exposure to multiple types of risk-premia trades spanning across **Equity, FX, Rates, Credit**
- **Leveraged** "index-based" notional trades rather than physical trades
- **Use of both cash and unfunded instruments** (for example, futures)
- No exposure to property risk, **no direct bonds exposure**
- Negligible counterparty risk



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Market risk SCR under the SII Standard Formula

- Fund originally designed for life insurers reporting under Solvency II but with the Standard Formula only, hence the project conducted by Moody's Analytics originally centred on the **calculation of the standalone SII SF market SCR**
- **Challenges:**
 - Comprehensive coverage of the investment space
 - Use of leverage
 - Use of both long and short trades, **in particular a L/S portfolio of individual equities**
 - Use of both cash instruments and unfunded derivatives
 - Sophisticated use of "risk-mitigation" structures
 - Exposure to risks not covered by the SII Standard Formula
 - **Extensive need for SII Standard Formula interpretations**
- **Naturally the IM/PIM space of Monte-Carlo based SCR estimations**



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Look-through approach for funds investments

- Solvency II capital treatment for investments into “collective investments”. Article 84 of the original version of the Delegated Acts: *“The Solvency Capital Requirement shall be calculated on the basis of each of the underlying assets of collective investment undertakings and other investments packaged as funds (look-through approach).”*
- **Advantages**
 - The alternative capital treatment is that of Type II equity a.k.a “bad news”
 - More accurate assessment of the capital requirement
- **Drawbacks :**
 - Requires extensive data of the underlying trades
 - When using the SF...
 - The SF guidance was not designed to cover all the complex dimensions found in the AM/hedge funds space whether for risk coverage, leverage, use of unfunded instruments, Long and short trades
 - The boundary between capital generating trades and risk mitigating trades in the SF world becomes rather fuzzy in the risk-premia trades world



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Risk-mitigation technique “RMT”

Level I & II text

- Risk-mitigating technique is the SII Standard Formula lens to look at what the investment world calls **hedging**
- Candidate RMT trades in a particular SF scenario, a trade that generates a profit
- The candidate RMT trades also need to meet several strict conditions to be eligible as RMTs:
 - Various qualitative features such as contractual and legally enforceable
 - Permanency over 12m otherwise replacement frequency limited to once every 3 months
 - The residual “basis risk” must be immaterial

Further guidance from EIOPA

- “Guidelines on Basis Risk”, EIOPA-BoS-14/172 EN
- “Guidelines on the treatment of market and counterparty risk exposures in the Standard Formula”, EIOPA-BoS-14/174 EN



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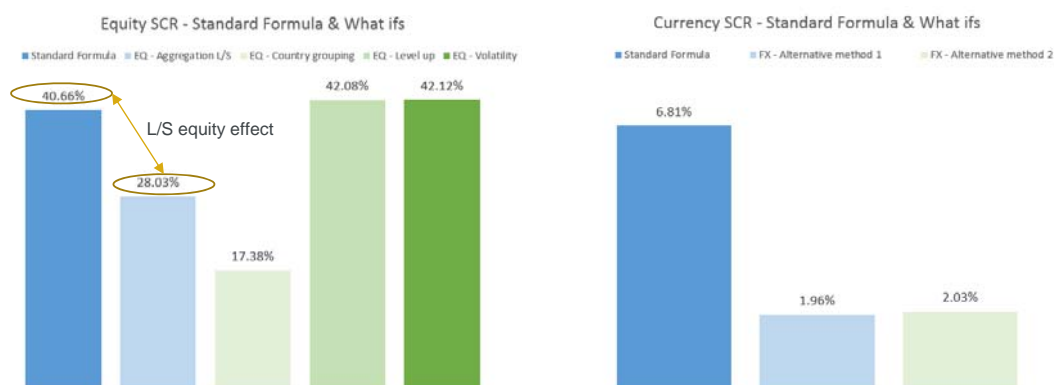
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Exploration of additional scenarios

- Besides the scenarios used in the SF market SCR, a number of additional scenarios were explored:
 - Equity level Up
 - Equity volatility Up & Down
 - Bespoke Rates scenarios
 - Alternative aggregation methodologies for FX
 - Alternative correlation matrix for market SCR components
- This exploration of additional scenarios is already half-way between a Standard Formula approach and a partial internal model approach

SCR variability across calculations explored



Massive SCR difference linked to the RMT recognition of equity shorts

Key findings and further explorations

- Low exposure to rates making the fund a good candidate for diversification of traditional Life Insurance balance sheets
- Methodology used for currency risk in the Standard Formula very punitive for typical trades used in the HF world
- **Attractiveness of the fund under SII is mostly driven by the SCR treatment for short equity positions**
- **Difficult at first sight to build a case for short equity to be eligible as RMT:**
 - The short portfolio is not explicitly designed as a hedge for the long portfolio but as intentional exposure to underlying drivers of equity returns
 - There is a significant uncertainty about the replacement of the short positions given the complex algorithm-based nature of trade selection, making the residual basis risk potentially volatile even over a 1 year horizon
 - The frequency of short positions replacement can be higher than once every 3 months (which breaks a key condition of RMT eligibility)



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Long/short equity structures: look-through and beyond

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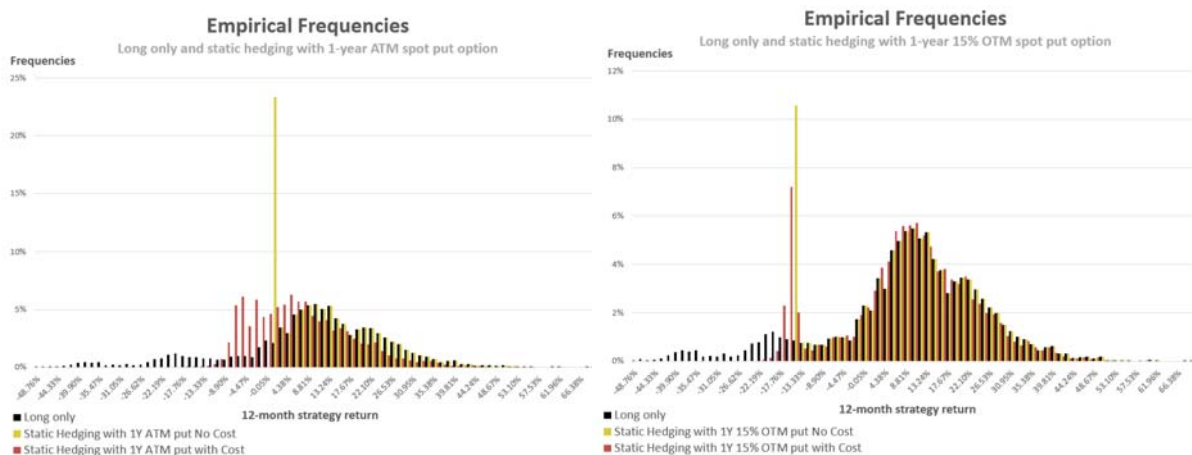
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What are we trying to achieve?

- Build a lighter yet robust model that would allow to form **Standard Formula style equity SCR estimations for specific long/short equity portfolios**
- Purpose for SF reporting companies to plug directly to their partial internal model
- Key requirements:
 - Incorporate specifics of the long/short portfolio looked at
 - Have less emphasis on the full distribution of equity returns and more in the tail
 - Allow to explore the variability of the SCR across market conditions

Revisiting hedging of long equity exposures

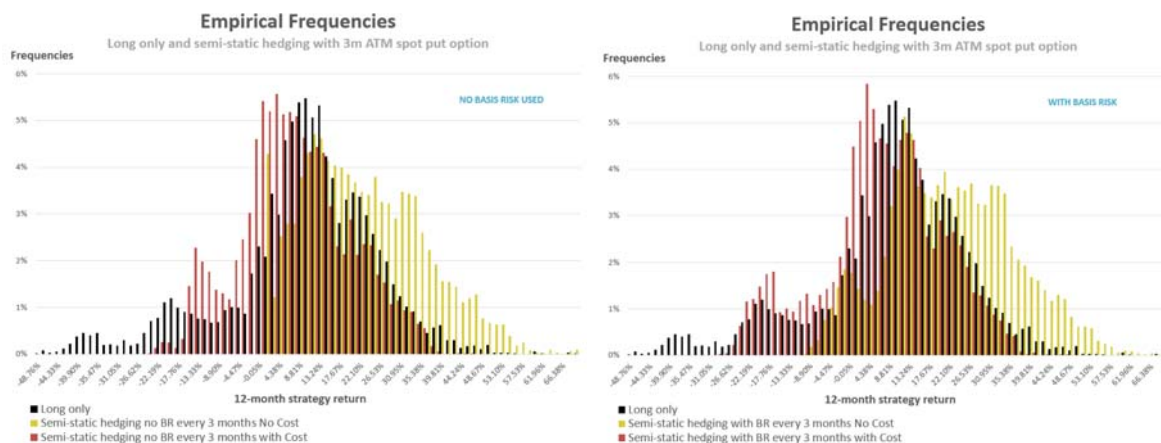
Static hedging with put options



Data: reconstructed S&P500 and VIX data, Jan 1990 – Dec 2016, source CBOE

Revisiting hedging of long equity exposures

Semi-static hedging with put options (rebalancing every 3 months)



Data: reconstructed S&P500 and VIX data, Jan 1990 – Dec 2016, source CBOE



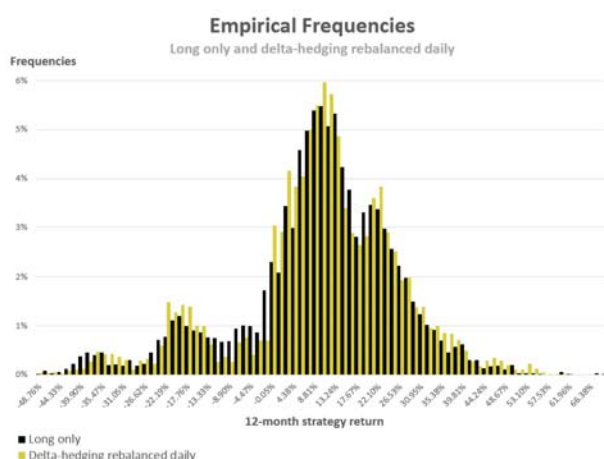
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Revisiting hedging of long equity exposures

Delta-hedging with put options rebalanced daily



Extreme version with high rebalancing frequency and hedge at first order level only

A simplified example showing why dynamic hedging is not eligible as a risk-mitigation technique

Data: reconstructed S&P500 and VIX data, Jan 1990 – Dec 2016, source CBOE



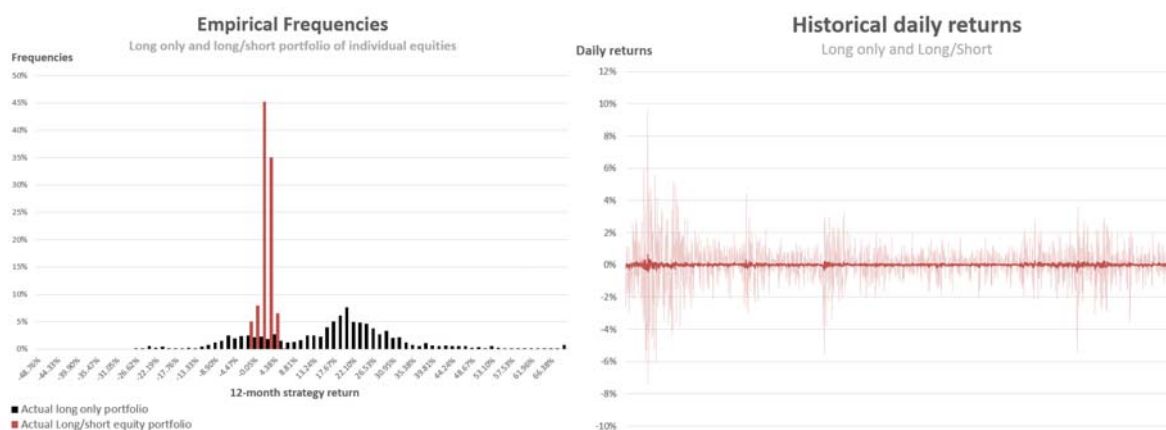
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An example long/short equity portfolio

Overview of historical features



Data: JPMorgan, May 2008 – Dec 2016



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An example long/short equity portfolio

Material or immaterial basis risk ?

- The table below compares several percentiles of historical annual overlapping returns for the semi-static hedging with basis risk presented in the previous slides, the Long/Short portfolio and the Long only portfolio

| Percentile level | Semi-static hedging 3m with BR no Cost | Actual Long/short equity portfolio | Actual long only equity portfolio |
|------------------|---|---------------------------------------|--------------------------------------|
| 0.10% | -9.35% | -2.36% | -27.42% |
| 0.50% | -7.51% | -2.28% | -24.60% |
| 1.00% | -6.45% | -2.20% | -22.22% |
| 5.00% | -1.98% | -1.53% | -8.69% |

- Percentiles around the level of interests for Solvency II for the Long/Short portfolio can typically be similar or smaller in absolute terms than a long exposure with a semi-static put options hedge rebalanced every 3 months that would account for a very small basis risk and implied volatility uncertainty
- The put option hedge is typically eligible as RMT while the equity short are typically not, but **what additional analysis would be required to gain RMT eligibility for the shorts ?**



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Equity modelling: the legacy of modern portfolio theory

- The Capital Asset Pricing Model "CAPM" introduced in the early 60s by Treynor, Sharpe and Lintner is the foundation of modern portfolio theory. The CAPM models the expected return of an individual security and can be expressed as:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f)$$

- Key aspects:
 - The CAPM is a 1 factor model of equity **expected returns** (it doesn't say anything about the other metrics)
 - If R_f is considered as constant it is a regression with a single factor equal to the equity market risk premium
- The CAPM helps contextualize a key objective for typical long/short equity hedge funds, namely to **maximise the alpha of the fund for a specific level of beta**
- The alpha of a particular fund is the excess return beyond that predicted by the CAPM, it is commonly used as a measure of skill because it measures the fraction of the return uncorrelated to the market as a whole

$E(R_i)$ is the expected return of security (or portfolio) i ,
 R_f is the risk-free rate
 $E(R_m)$ is the expected return of the equity market as a whole
 β_i is the beta of security (or portfolio) i with respect to the market as a whole

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Extensions of the CAPM: multi-factor models

- The CAPM was extended many times over, primarily to incorporate further explanatory factors of the equity returns
- 2 key extensions:
 - 3-factor model by Fama & French (1993): **size and book to market factors** on top of market-wide risk premium
 - 4-factor model by Carhart (1997): addition of a **momentum factor**
- The advantage of this type of models is that they are explanatory, the drivers of equity returns are observable factors
- For potential usability for Solvency II type environments these models have **2 critical problems**:
 - They only focus on the expected return – nothing is known about quantiles
 - They are ex-post models, they explain phenomena after the fact rather than "in real time"

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Hybrid models: leveraging quantile regression

- We call hybrid model one that would incorporate features of multi-factor CAPM-like model as well as features of the traditional actuarial approach of probability distribution modelling
- **Quantile regression** is a statistical technique with some similarity to the ordinary least squares regression, but:
 - Quantile regression is a regression of a specific percentile of the distribution rather than the mean
 - Quantile regression relies on a weighted absolute difference measure rather than squared differences
- **Background studies:**
 - Goyal & Welch, 2003: Extension of multi-factor models to ex-ante to test the predictability of mean equity returns
 - Timmermann & Cenesizoglu, 2007: Extension to the testing of equity return quantiles predictability ex-ante with quantile regression

Quantile regression and conditional equity SCR

- General specification of conditional equity return percentiles used in Timmermann's paper:

$$Q_{\alpha}(R_{t+1}) = \beta_{0,\alpha} + \beta_{1,\alpha}X_t + \beta_{2,\alpha}Q_{\alpha}(R_t) + \beta_3|R_t|$$

- As the equation above shows the value of the previous conditional quantile prediction is used as factor for the step ahead and so is the absolute value of the previous equity return (both showing statistical significance at 10% level)
- Generalisation to a any polynomial version:

$$Q_{\alpha}(R_{t+1}) = \text{Polynomial}(X_t, Q_{\alpha}(R_t), |R_t|)$$

$Q_{\alpha}(\cdot)$ is the quantile for level α

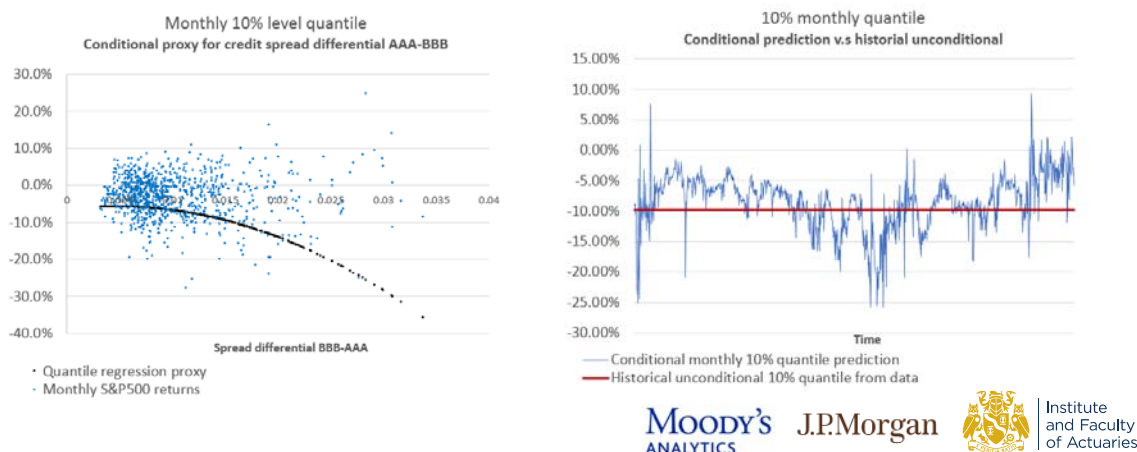
X_t is a vector of explanatory factors at time t

R_t is the equity return between t and $t+1$

$\beta_0, \beta_1, \beta_2, \beta_3$ are the regression betas

Quantile regression and conditional equity SCR

- Example with degree 2 Polynomial 10% monthly quantile:



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Questions

Comments

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