



StarQube

INVESTMENT DECISION IN A BOX

Risk modeling with StarQube



Everyone knows: investing is a trade-off between return and risk. All financiers have learned this cardinal principle of never “putting all your eggs in one basket” but rather diversifying your risks. Gone are the days when the return was the only thing that mattered; all portfolio managers (PMs) are now evaluated on their ability to generate a risk-adjusted performance.

And yet, how many PMs today continue to put all their energy into generating ideas and alpha, ignoring the risks and correlations of their portfolios that are observed ex-post? For some, this is due to a lack of knowledge of risk calculation techniques; for others, it is much more exciting to look ahead and attack than to look in the rear-view mirror and defend. However, poor risk management inevitably leads to deteriorating investment performance for all.

StarQube is a modular platform supporting investment decision. Perfectly integrated with the other tools available to the user, the risk module offers unique and powerful portfolio risk modeling possibilities, accessible to all PM profiles.

1. Building risk models with StarQube

The StarQube risk module offers multiple advantages to its users, which we detail in the following paragraphs: (1) simplicity in the construction of risk models, (2) exhaustiveness of the methods proposed, (3) ability to combine several methods within the same model and (4) possibility to enrich the models with qualitative inputs when the PM’s expertise leads him/her to consider that historical volatility calculations are misleading.

Simplicity :

The construction of risk models in StarQube is done by simple parameterization of:

1. The historical depth and frequency of returns to be used to calculate the portfolio risk
2. The factors to be used to calculate and decompose the portfolio risk. Several types of factors can be used—historical regressions, factors defined by security exposures, principal component analysis
3. Substitutions to be made in case of special situations

The parameterization of the models is very simple as it is guided by the risk module; at most, it is necessary to call some FQL (StarQube’s proprietary language) functions whose level of complexity is equivalent to that of Excel formulas.

Exhaustiveness of the methods proposed:

Three families of factors can be used to calculate and decompose the portfolio risk:

1. Historical regression: users specify the list of explanatory variables they wish to use to calculate and analyze the risk of their portfolio; these are typically indices, macro-financial variables (interest rates, exchange rates, commodity prices), etc.
2. Exposure factors: users specify the list of factors they wish to use to calculate the risk of their portfolio but must also specify the exposure of each security to these factors. The exposure can be binary: belonging (yes/no) to a country, a sector, a currency, a style. The exposure can also be proportional: the “value”, “quality”, and “green” proportion of each security. The risk model will then calculate the fraction of the portfolio’s risk explained by each of the selected factors.
3. Principal component analysis: users have no preconceived ideas about the variables that explain the risk of their portfolio and lets the tool determine the factors that best explain the risk. The principal component analysis will verify if there is a concentration of risk for a small number of factors and in what proportion.

USE CASE: Building a risk model for top-down equity management

Risks: the risk team develops a risk model to facilitate the understanding of the risks borne by the portfolio of top-down US equity PMs. It is based on a historical regression model with the following explanatory variables: (1) the S&P 500 index to capture market direction, (2) 3-month USD short rates to capture the Fed’s monetary policy stance, (3) the slope of the US 2/10-year yield curve to capture inflationary expectations and (4) the price of gold as a proxy for investors’ risk appetite.

Portfolio management: the PM team will be able to measure the exposure of its US equity portfolio to these risk factors on a daily basis and adjust its investment strategy according to its macro-financial expectations.

Combining risk factors:

The StarQube risk module offers the unique possibility to combine the different methods presented in the previous paragraph in one model; users can, for example, build a risk model in two steps:

1. First step: the model uses a few exposure factors (or explanatory variables in the case of historical regression) to explain the portfolio risk.
2. Second step: the model uses a principal component analysis to explain the residual risk of the model and to complete the portfolio risk perception.

USE CASE: Optimizing the environmental impact of an equity portfolio

ESG Research: the ESG research team defines for a universe of companies the proportion of activity with a positive (“green”) environmental impact and the proportion of activity with a negative (“brown”) environmental impact.

Risks: the risk team builds a risk model using exposure factors, which calculates the exposure of portfolios to “green” and “brown” risks. The risk model may be complemented by some principal component analysis factors.

Portfolio management: the PM team builds an investment strategy that optimizes the ratio of “green” to “brown” risk in order to maximize the environmental impact of its portfolio.

Qualitative enrichment in special situations:

Every PM has been confronted with special situations in which the future risk of a security cannot be adequately captured by its historical behavior. Some examples:

- IPOs/new issuances: by construction, the security does not have a history at the time of its issuance that allows for the calculation of historical volatility and correlations.
- Companies undergoing a takeover bid and whose share price is fluctuating within a narrow range around the price offered by the buyer—volatility is, therefore, temporarily “crushed”.
- Restructurings/turnarounds: companies that have been massively shorted but have presented a turnaround plan or have undergone a shift in management that allows the PM to anticipate a decrease in the stock’s future volatility.

StarQube’s risk module allows for the replacement of past (or missing) stock’s volatility by the manager’s intuition. For example, users can specify the level of volatility they want to apply to a stock, or replace the volatility of the stock with that of its sector or a related stock.

2. Using risk models on the platform

Once built, the risk models are stored on the StarQube platform as objects. This object-based architecture offers multiple advantages for users:

- Sharing and collaboration: the designer of the “risk” object can freely share it with the users of his/her choice and define for each of them the nature of the permissions (read-only or read/write).
- Replication of risk models: the risk object can be copied and pasted in one click to build a derivation of the first model. For example, the same model structure can be used to build a short-memory reactive model (calculated over 52 rolling weeks) and a long-memory model (5 years of history).
- Risk models, portfolios and StarQube modules: the same risk model can be used by a multiplicity of portfolios and across different StarQube modules.

Calling risk models from SQ Analyzer

SQ Analyzer is the portfolio visualization module of StarQube. It is interfaced in real time with the asset manager’s position-keeping system.

Portfolio managers have a palette of widgets to configure their screen. They can display the risk of their portfolio and its breakdown calculated from one or more models, for example:

1. Decomposition of the portfolio risk from a historical regression model and a principal component analysis model; or
2. Portfolio risk decomposition from a short-memory and a long-memory model.

All outputs of the risk models can be displayed (risk contribution of each security or factor, tracking error, expected shortfall, etc.).

Risk models and SQ Optimizer

SQ Optimizer is StarQube's conic portfolio optimization module.

When a manager wants to run a portfolio optimization using either:

1. an objective expressed in terms of risk (e.g., minimizing tracking error), or
2. a constraint expressed in terms of risk (e.g., volatility below 10%),

he/she specifies in his/her optimization the risk model to be used to calculate the portfolio risk.

Risk models and SQ Backtester

SQ Backtester is StarQube's backtesting engine. It allows the user to quickly test an idea, an investment signal, by calculating the historical performance of a portfolio in which he would have invested based on this signal.

The backtest parameterization allows the user to call an "optimization" object which, in turn, calls a "risk" object in order to control the risk of the strategy throughout the backtesting phase.

This gymnastic where the modules call each other in cascade (a "backtest" object calls an "optimization" object, which calls a "risk" object), may seem complex; it is in fact very simple since all the objects are built by simple parameterization. But above all, this approach:

1. Considerably reduces the risk of programming errors while offering a much wider range of possibilities than an Excel sheet.
2. Promotes collaborative work since objects can be shared with other users. The research team can test an investment signal using the risk model built by the risk team. Once the idea has been validated, the backtest object can be shared with the portfolio management team and immediately put into production. Each team can focus on its core expertise and share it with the other teams.
3. Drastically reduces operational risks as the same "risk" and "optimization" objects are used in backtesting and in production.

Risk models and API

StarQube is an open platform. Like all other objects, risk models can be freely:

- Exported to be used by research teams in their usual working environments (Matlab or Python, for example).
- Imported into StarQube. It is very easy to import into StarQube a variance-covariance matrix calculated on another platform in order to use it in a backtest or in portfolio management.

In summary, building risk models with StarQube:

- Is within the reach of most people, since the models are built by simple parameterization.
- Offers a wide range of possibilities to quantitative researchers and risk experts: all risk calculation methods are accessible and can be combined; models can be enriched with qualitative inputs when simple historical calculations are misleading.
- Significantly reduces operational risks since the same “risk” objects can be called up in backtests and in production.
- Accelerates, for the same reasons, the time-to-market of new investment strategies.
- Encourages a collaborative spirit, as risk models can be shared between different teams.
- Is done in an open framework where models can be imported/exported so that users are never cut off from their usual working tools (Python, Matlab, Excel, etc.).

About StarQube

Established in 2013, StarQube develops a suite of data organization and front-office solutions designed to streamline investment processes, starting from data acquisition, through fast backtesting of client-defined strategies and risk management, all the way to portfolio rebalancing, dispatching of orders and reporting. StarQube provides asset managers with a nimble way to automate each of their clients' bespoke portfolio management processes while saving on structural and data costs. StarQube is particularly well-liked by systematic strategies and socially responsible investments.

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