

Société Générale corporate and investment banking: How we monitor market risk

Pascal Beurotte and Georges Bory*

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*Quartet FS, 46 rue del'arbre, 75001 Paris, France;
E-mail: georges.bory@quartetfs.com

Pascal Beurotte is Project Director for regulatory programmes at Société Générale Corporate & Investment Banking (SG CIB). In his current role, Pascal looks after several regulatory-driven initiatives, including permanent supervision and reporting obligations to central banks and debt management offices. Until November 2013 Pascal was responsible for the analysis and certification of market risk. Under his tenure, his team designed and began implementing an innovative market risk scoring and monitoring system. Pascal has held various IT and risk management positions at Société Générale, including IT operations manager for the asset management branch, and development manager for new pricing models in the swaps division. With 25 years' experience in IT capital markets, Pascal also has worked for IXIS Corporate & Investment Bank where he was risk manager and business manager. His area of expertise in capital markets covers a wide range including fixed income, equities and credit.

Georges Bory is Managing Director and co-founder at Quartet FS, where he is responsible for the company's product innovation strategy. With over 25 years' experience in capital markets, he is an established veteran in the field of trading and risk management. Prior to co-founding Quartet FS in 2005, he was Managing Director for Western Europe at Summit Systems. At Quartet FS, Georges promotes the company's in-memory analytics technology as a universal framework. This is helping organisations

to build a new generation of applications that solve the operational decision-making needs of users working in time-sensitive and data-intensive environments. This approach has already proven its value in the financial services sector, one of the most demanding industries when it comes to big data analytics.

ABSTRACT

It is no secret that monitoring market risk can vary greatly between financial institutions. For Société Générale Corporate & Investment Banking (SG CIB), this process is centralised, with a team dedicated to certifying and analysing approximately 100 different measures every day, all of which are associated with the scope of market risk. The process involves all types of market risk across geographies — including rates, corporate stocks, inflation and credit — as well as all departments (desks) and all products (vanilla through to exotics). In order to manage their market risk, all financial institutions, including SG CIB, need to consider the impact of market volatility on their open risk positions, with scenarios defined for both positive and negative movements; however, many market risk methodologies hinge their calculated outcomes on extrapolations, which can be prone to errors and inaccuracies. This paper explores why the traditional approaches to monitoring market risk are not best practice in the long term, and the ways in which SG CIB is planning to use Quartet FS's in-memory aggregation and analytical engine — *ActivePivot* — to turn huge



Pascal Beurotte



Georges Bory

volumes of market data into a meaningful understanding of risk exposures, using a dynamic scoring mechanism.

Keywords: *market risk analysis, market risk monitoring, market risk certification, limit monitoring, risk scoring, value at risk, big data, analytics*

MARKET RISK: THE DATA ISSUE

Irrespective of the risk methodology used, every organisation needs to understand the principal issues involved when exploiting market data. Market risk is a definitive illustration of the big data phenomenon, with massive volumes of data running through data capture systems, all of which update frequently. The intense stream of market data means financial institutions require complex and computer-intensive calculations in order to take advantage of it. It is safe to say that financial institutions run the risk of compromising depth of analysis due to the volumes of data being manipulated.

For Société Générale Corporate & Investment Banking (SG CIB), the data considerations are huge when attempting to effectively monitor market risk. The certification of risk covers more than two billion figures every day. In addition, the analysis covers the last ten days of operation, so that a sufficiently broad window of time is analysed to appropriately track volatilities in the market. The total volume of data handled, therefore, represents over 20 billion figures. Furthermore, SG CIB's risk managers work with over 100 indicators, which demand intensive calculations. For example, the calculation of value at risk (VaR) works through 260 scenarios per transaction by modifying several thousand risk factors and generating hundreds of millions of data points as an output. Given the volume and complexity attached to calculating market risk, SG CIB defines quality data output as:

- delivery of extremely accurate figures;
- ability to explain those figures at a very granular level; and
- the fact that all figures have been progressively certified during the current business day.

With the above in mind, what are the best ways to monitor market risk in such demanding environments?

MONITORING MARKET RISK: THE TRADITIONAL APPROACHES

It is impossible, of course, for the human brain to hold and exploit millions of figures in any meaningful way. Therefore, the certification of two billion figures every day requires an aggregated view of these figures to facilitate the analysis. A common method among today's financial institutions, including SG CIB, is aggregation using a 'top-down' approach, drilling down from a general overview to focus on granular details. This approach means that, when an aggregated measure appears to be unusual, the risk manager can find the origin of the anomaly. The danger posed by the top-down approach is the risk of missing an anomaly, which is not immediately obvious on an aggregated level. One way of avoiding this is to add a series of intermediary 'sample' measures at lower nodes in the analytical framework, which is designed to bring out more details, while keeping data volumes at a manageable level. But this approach is not 100 per cent effective, because there is no guarantee that the added intermediary nodes are pointing systematically towards the right place. Another limit of this approach is that errors are frequently discovered too late. For example, some errors will be due to the delayed correction of anomalies — the system failing to discover them at the moment when they were generated. Even if the correction is detected, the anomaly

itself may be three or four days old by that stage. Finally, the main constraint of working with aggregated figures is the impossibility of exploiting data at the point of error — in their most granular form. Put simply, a risk manager cannot gain access to the ‘raw unit data’ as they are produced by the transactional systems — ie before aggregation — because of soaring data volumes and the computational power required to exploit them to the finest detail.

TECHNOLOGY: HOLDING EVERYTHING UP?

SG CIB realised that the difficulty in exploiting raw unit data could be traced back to a combination of technical and organisational constraints, including:

- The incumbent reporting system was unable to support the interactive analysis of large volumes of data. The system in place only produced a set of static, pre-aggregated indicators, not data in their most granular form.
- Legacy infrastructure challenges meant it was very difficult to evolve processes while keeping others as they were.

Technological constraints like these can limit a company’s ability to analyse its data, rather than freeing it up. At SG CIB, technology required risk managers to work from pre-calculated metrics without giving them the possibility of exploring the data in more detail — either at the level of each individual deal or sensitivity, or by providing them with the means to calculate new metrics on the fly as their analysis progressed. Above and beyond the need to have technologies able to cope with large data volumes, SG CIB believes the management of market risk requires a radical change of approach. The new approach should ensure risk managers are not

restricted by technology and instead have analysis flexibility, ie the ability to analyse any metric when they need to, instead of coping with a narrow analysis scope that is restricted to only a set of static, predefined metrics. It was on this basis that SG CIB launched the AWARE project.

WHY IS THE ‘AWARE’ PROJECT BEST PRACTICE FOR MARKET RISK?

Going beyond the certification of figures

Producing figures is simple; however, producing quality figures is much more complicated. Add to this the need to provide analysis that allows the bank to manage its risk exposure and one is faced with a bigger challenge. By getting the data issue out of the way and eliminating all induced constraints, the aim of the AWARE project (Aim to Validate VaR and Analyse Risk and Excess), is to generate quality figures more quickly, and to create value through analysis, which is, above all, the main aim of the market risk function in any financial institution.

Complementing the top-down approach with a bottom-up approach

One of the AWARE project’s guiding principles has been to provide the ability to run any required calculation on the fly, producing data that are presented at an aggregated level (so that they can be easily consumed) without any depletion. In this way, data can be analysed at a granular level when required. This requirement meant using a system that excluded any constraints from the outset, as opposed to a system exclusively focusing on reports based on pre-aggregated data. The idea was to enable risk managers to take any data ‘as is’, ie data output from each individual deal or sensitivity, before they are used as part of any projection. Ultimately,

this means users can do what they want with the numbers, depending on what they are looking for. Also, this level of freedom demanded the use of a technology that instantly calculates any indicators using large amounts of data. Following that step, the solution needed to add to the aggregated data by producing sophisticated calculations to deliver incremental, meaningful information for greater insight. With this brief in mind, SG CIB adopted an analytical processing system — Quartet FS's ActivePivot — which would perform in-memory aggregation to power a dynamic scoring mechanism.

Market risk best practice: Scoring

Scoring is an intelligent alert mechanism that enables the risk manager to manage by exception, prioritising measures where an anomaly has been detected. For each measure, the system produces a set of specific alerts, indicating precisely where the problem is located. Scoring works by taking each piece of unit information and associating it with an indicator; for example, the difference between today's risk and yesterday's risk, or the ratio comparing daily risk with a market benchmark. It then aggregates the results from the lowest to the highest level. This calculation phase is performed in-memory in order to ensure minimal response times. The measures that result from this aggregation phase are flagged by a number of alerts as soon as an anomaly is detected. For example, if the market has moved, but the measure being analysed has stayed stable, the system would produce an alert. As the calculation is run at the lowest level — at the data point level — there is no risk of missing an error. Since 'too much information kills the information', only meaningful alerts are issued when requested, to prevent risk managers from being overwhelmed with too many unqualified alerts. Therefore, each of the indicators has a limited

number of associated alerts, all of which highlight the location of the problem. The overall impact of this scoring approach is that risk managers have a manageable number of indicators to analyse. This system enables risk managers to immediately correct an anomaly all along the data hierarchy. The ability to update data during the current business day is one of the numerous advantages of using a technology that combines transactional and analytical processing.

Scoring in action

One potential scenario that highlights the types of alerts generated by a scoring system is the detection of abnormal risk levels in a portfolio, as compared with previous days. Because the scoring system tells the risk manager exactly where the anomaly sits, they can immediately identify the deal data that are 'misbehaving'. The next step for the risk manager is to run some checks with the back office. Possible explanations for the anomaly could be that a trader has traded a structured product (an exotic option, for example), which was booked with a delay. If this is the case, the vanilla deal that was booked in to hedge that specific structured deal will already have been processed. In this example, the delayed booking of the structured deal could account for any risk abnormalities in the portfolio.

Sensi-weighted VAR

A transactional and analytical processing engine also allows SG CIB to calculate additional financial measures which otherwise would be impossible. A good illustration of this is use of 'sensi-weighted VaR'. This is an ad hoc, SG CIB-specific metric, which complements regulatory VaR measures. The new metric delivers additional insights about trends or errors that cannot be immediately detected through the analysis of regulatory VaR. Sensi-weighted

VaR is an approximate measure based on the set of sensitivities available when a calculation occurs. With sensi-weighted VaR, SG CIB produces a standard deviation, indicating the resulting impact of a sensitivity, in case of a major event. It also gives an indication of any significant deviation from the expected trend.

To calculate the metric, all of the negative shocks and market events detailed in each of SG CIB's 260 scenarios are multiplied by the relevant sensitivity. The official VaR figure is then divided by the sensi-weighted VaR. A linear regression is applied to the result, taking into consideration the results from the previous ten days, which then helps to finalise the standard deviation. Sensi-weighted VaR is used as a basis to trigger well-qualified alerts. Without this sort of calculation, risk analysts would get too many alerts from, for example, exotic products. Instead, by calculating a standard deviation from the linear regression, only meaningful deviations are brought to the attention of the risk analyst through qualified alerts. The nature of the alerts generated from sensi-weighted VaR are twofold:

- The sensi-weighted VaR acts as a checkpoint for the quality of the calculations. It helps to detect if a bad-looking risk measure is actually the result of a calculation error, either when the VaR was computed or when the sensitivities were generated.
- Sensi-weighted VaR helps to detect when there is a change in the behaviour of a portfolio. For example, if a portfolio's sensi-weighted VaR does not perform in the same way as its historical VaR, there is a risk that the portfolio is poorly hedged in times of crisis. It also can be used to reveal a change in strategy on a given portfolio, indicating that traders are going beyond their authorised scopes of action.

Technology plays a key role here. In order for the sensi-weighted VaR metric to be computed, SG CIB needs a system that is able to compute huge amounts of data and complete heavy calculations — notably a linear regression over ten days, with a standard deviation on top. This cannot be done in a reasonable time with tools such as Excel when considering the large number of calculations. Without a transactional and analytical processing engine, such measures could not be produced.

THE EXPECTED RESULTS OF THE 'AWARE' PROJECT

Better-quality figures

By avoiding trial and error, scoring will focus the scope of certification to a specific alert. The risk manager will be able to spend less time on 'business as usual' analysis and, instead, focus their attention on problem areas. If the scoring system has not generated an alert on a particular measure, a risk manager will be confident that all underlying figures in the data hierarchy can be stamped and certified.

More time for financial analysis

Approving by default will save significant time for risk managers. Through AWARE, risk managers will be capable of certifying the figures before noon each day, which will allow them to invest their time in the afternoon on further financial analysis. Hypothetically, they could run complementary analysis on specific risk pools, highlighting significant changes and bringing new value to the figures they certify.

Total freedom

Risk managers will have access to a library of the most frequently used scores but, as they are exploring data, they also will be able to create their own scores. In fact, risk managers will be completely free to define

their scope of work, without being constrained by technology. They will be able to choose the measures that they wish to show on a dashboard, depending on their area of responsibility and scope of exploration (type of rating, country of origin, issuer etc). Once the measures have been defined, the user will be able to see the relevant figures and drill down as low as necessary.

CONCLUSION

Monitoring market risk at SG CIB provides a good example of taking on the challenge of big data. Instead of being constrained by the massive volumes of data, the bank aims to use big data to its own advantage by leveraging innovative

in-memory analytical processing technology to turn these massive volumes into a meaningful understanding of risk exposure. To meet this need, SG CIB has a precise idea of the criteria that need to be met by the technology chosen for the AWARE project. The ability to calculate complex indicators on the fly, such as by using sensi-weighted VAR, using huge volumes of data pulled from multiple sources, and all of this without any pre-aggregation, will be key in achieving this project. By providing an analytical platform that eliminates any restrictions in risk monitoring, the project will prove that innovative big data technologies can break through barriers and unleash users' creativity.