ALGO MARKET ANALYTICS

Measure, manage and optimize market risk across the enterprise with a leader in risk analytics

Algo Market Analytics provides a scenario-based approach to risk management that delivers accurate and actionable results. For over ten years more than 150 banks and financial institutions around the world have applied Algo Market Analytics within demanding environments to deliver risk insights that support their business strategies. With intuitive interfaces and investigative tools, Algo Market Analytics is accessible to a wide range of end users, and sets the standard for financial risk management.
Algo Market Analytics provides firms with the fundamentals of scenario-based risk management, giving financial institutions a leading solution for measuring and managing market risk across asset classes and geographies. With broad instrument coverage and vast libraries of pricing functions and statistical models, firms can create simulations for testing and optimizing their strategies.

Algo Market Analytics applies the award winning Mark-to-Future framework that offers firms a solid foundation for capturing the interactions between risk types and managing risk as an integrated system across market, credit and liquidity risk.

Financial risk management is more than an end number - it is the process of understanding how data is transformed by models into business insights that drive better decisions. Fundamental changes in risk management approaches are being led by firms that recognize the business benefits of a rigorous and holistic approach to risk and by regulators that are demanding a new level of transparency.

Algo Market Analytics is leading the industry with new developments in advanced risk analytics, valuation methodologies and scenario generation techniques. The award winning Mark-to-Future architecture underlying Algo Market Analytics is asset class and risk factor agnostic, enabling the solution to span all holdings and investment strategies of large multinational trading operations.

Algo Market Analytics offers accepted approaches for portfolio optimization, back-testing, limits management, and on-demand scenario-based simulations. To accurately identify trends, Algo Market Analytics is configured with data services that categorize current and historical securities information on every risk factor used for scenario generation, model calibration, and variance/covariance generation.

The interactive interfaces and reporting options of Algo Market Analytics can be customized by individual users to efficiently deliver risk analysis that meets the diverse requirements of different roles. This tailored approach facilitates effective communication across all levels of the organization, providing actionable insights to decision makers within senior management, risk management, and the front office.

Algo Market Analytics helps to enable better, faster decision support for firms to manage market risk, and establishes the foundation required to support ongoing business needs as risk management approaches are expanded to include credit and liquidity risk across the enterprise.
Algo Market Analytics provides banks with real-time risk insights. Risk managers and traders can define what-if scenarios and monitor limits across all business lines.

Middle office Risk Managers can create automated daily reports that include stress test results with a variety of aggregations on mark-to-market measures and the impacts on VaR. The award-winning Mark-to-Future methodology for simulation-based risk management runs full forward valuations requiring no constraining assumptions or short cuts. Since Algo Market Analytics does not require analytical approximations of risk, the approach helps firms to meet regulatory requirements for the Basel Internal Model Approach (IMA), including VaR, Stressed VaR, Incremental Risk Charge (IRC), and debt & equity specific risk.

Front office traders can assess historical replays and the potential P&L impact of user-specified risk factor movements including shocks to interest rate curves, equity indices, and volatility surfaces. With intraday updates of market data, traders can run real-time reports during volatile market conditions and apply insights from sensitivities to rebalance positions and maintain hedges. Options for more effective hedging strategies can be constructed and compared with instrument level analytics such as key rate durations, key spread durations, convexity risks, industry beta exposures, risk factor exposures, and Greeks.

A working approach to understanding risk
Designed to produce a robust, consistent, and accurate view of the future, the scenario-based methodology of Algo Market Analytics provides an integrated view of risk across multiple asset classes, instrument types, and risk factors, spanning multiple countries and currencies. Risk measures generated by Algo Market Analytics are aggregated from distributions of simulated valuations through time across a wide range of scenarios. The resulting array of valuations generated across multiple dimensions, supports in-depth analysis to better understand the risks within any portfolio. Users can compare VaR results day over day to look for shifts and investigate how positions have been impacted by drilling down through hierarchies and opening context specific views. At each level, a user has options for performing further analysis such as highlighting changes in market data, graphing numerical sensitivities, performing custom stress tests, running historical replays and tabulating probabilistic risk measures.

Because every valuation depends upon the underlying risk factors used to generate the scenarios at each time step. Algo Market Analytics also includes a sophisticated modeling environment for calibrating risk factors and defining risk factor processes.
Industry-Leading Risk Management

Over 150 banks and financial institutions around the world depend on Algo Market Analytics.

Algo Market Analytics provides firms with the fundamentals of measuring risk and reward for risk-informed decision making, and offers a wide range of solutions through extension packages.

Options to meet business needs

**Dynamic strategies** – Improve hedge effectiveness and lower hedging costs with risk management tools for optimizing trading strategies. Simulation results give insights on what is best to trade, how much, and when, based on multiple market scenarios that outline the potential profit and loss impacts.

**Optimization** – The patented scenario-based optimization framework allows firms to replicate the characteristics of their enterprise portfolio with a small set of liquid instruments. This gives banks an efficient approach to better understand their risk profile, and supports planning discussions with Chief Risk Officers and the executive management to proactively develop hedging strategies that can be quickly put in place during periods of market turmoil.

**Comprehensive picture of risk** – Construct an enterprise view of risk by integrating the building blocks of Algo Market Analytics with other Algorithmics products like Algo Credit Exposure, Algo ALM, and Algo Liquidity Risk to meet sophisticated business challenges.
Integrates the front and middle office for active management of risk
On-demand risk measures have become a standard requirement from risk managers and front office traders. Algo Market Analytics applies award winning computational speed to perform what-if analysis on portfolio impacts from potential trades or new economic situations.

Provides comprehensive instrument coverage and model support
To address the unprecedented growth of the derivatives market, Algo Market Analytics includes instrument coverage for more than 20 different geographic markets and over 400 financial instruments including fixed income, foreign exchange, equity, credit, energy, commodity, and derivatives markets. It also includes support for structured products such as MBS/CMO/ABS/CMBS. Algo Market Analytics features an extensive library of pricing models that can be adapted and expanded with Risk++, an open language for scripting pricing functions, and can support rapid integration of third party pricing models already in use by firms. Advanced analytics and scenario generation techniques for stress testing over multi-period stress events is also supported.

Ongoing support for new challenges
Led by one of the industry’s largest group of risk professionals, Global Services and Support team includes financial engineers, integration specialists, and project managers. Algorithmics’ support teams utilize a reliable engagement methodology to assist clients in the implementation of Algorithmics’ solutions, and help clients adapt their existing risk systems to meet new challenges.

KEY FEATURES AND BENEFITS

Understand sources of risk
The advanced scenario-based Mark-to-Future framework of Algo Market Analytics provides financial institutions with a consistent forward-looking picture of risk. This approach to risk and reward analysis helps firms to mitigate unexpected losses and maximize returns through more informed business decisions.

Adapts to evolving business needs
Algo Market Analytics is designed to meet the growing business needs of firms as they emerge in the market. The data architecture captures and consolidates positions across the enterprise, with a highly scalable data handling capacity. Algorithmics’ industry leading performance is based on a multi-threading approach that can be distributed horizontally and vertically on to a single multi-processor server or within grid computing farms.

Existing installations can be quickly reconfigured to include new asset classes, business lines, investment strategies, and risk methodologies without interrupting existing workflows or disrupting results.

Promotes transparency and helps reduce regulatory capital requirements
The analysis and risk reporting extracted through Algo Market Analytics promotes dialogue between business lines and senior management regarding the key drivers of risk, and potential strategies that can be initiated to manage exposures. The functionality and reporting framework of Algo Market Analytics has enabled many financial institutions around the world to free up significant capital reserves by achieving regulatory approval of their internal models on market risk and specific risk.
Effectively risk-based decisions rely on risk measures that address both individual positions and their interactions within a broader portfolio. Accurately valuing all open positions within a single framework therefore becomes an important step towards measuring the market, credit, and liquidity risks that those positions create or mitigate. Algorithmics provides a number of alternatives for valuing financial instruments to ensure that the entire book may be incorporated into the risk measurement process. This provides firms with the necessary flexibility to appropriately model any type of position within their portfolio, from exotic, one-off deals to high-volume vanilla transactions.

**Stochastic Pricing Models** are a special class of standard valuation models that facilitate the pricing of exotic derivatives (interest rate, foreign exchange, or equity) using a Monte Carlo approach. Clients can select from a payoff function or specify their own using a straightforward C++ interface.

Examples of standard pay-off functions include:
- Arithmetic Asian on Baskets
- Best-of
- Barriers
- Basket Equity Derivatives
- Reverse Cliquets
- Pendulums
- Best-of/Worst-of (standard, digital, locked, sequential)
- Hi-Low Swaps
- Reverse Podiums
- Max/Min Options
- Forward Accumulators
- Mountain Options

**Dynamic Expressions** provide flexibility in defining valuation functions for non-financial products and risk (e.g., physical assets) by allowing clients to specify arbitrary functions of risk factors and instrument attributes. Extending the example, consider project finance, where one might vary the value of the underlying project using a formula based on macroeconomic factors or commodity prices. In addition to standard functions, dynamic expressions also allow more complex functions written in Python to be incorporated.

**Synthetic Products** allow multiple component products to be grouped into a single transaction or product. For example, two swap legs may be modeled individually then combined into a synthetic product to facilitate the reporting of the risk measures and validation against the source system.

**Custom Pricing Extensions** are used by many of our clients to create customized valuation functions for non-standard products or to incorporate in-house pricing models. There are three options for coding an extension: Risk++ (a set of C++ libraries), Python (using the Python language to code functions via scripts), and RiskScript, a variant of VBA. These provide a range of choices depending on desired performance, flexibility, and time to market. In all cases, the terms & conditions are loaded in the same manner.

**External Pricing**, also known as **Open MtF**, allows clients to import their own simulation results, calculated with their own models. Both a generic interface and a specialized MS Excel plug-in are available. Open MtF provides for the export of scenarios on risk factors across time (e.g., the EUR interbank zero curve). These scenarios support valuation of transactions by an external engine. The import of the resulting values across time/scenario is enabled by Open MtF. The values are then combined with those evaluated using other techniques to produce a complete picture of risk.

**Grid Evaluation** is most effective when the value of a transaction is related to only one or two risk factors, but where the valuation itself is time-consuming or intractable. Each transaction is evaluated across a grid of risk factor values to produce a look-up table. This table is loaded into the system as part of the terms & conditions of the transactions. During simulation transaction values from the table are interpolated as required. This technique is most commonly used for market risk purposes.

**Sensitivity-Based Evaluation** is used to approximate the behavior of instruments when complete terms & conditions and/or evaluation functions are unavailable. This approach may be often used in the initial phases of a project, with a view to replacing it with a model-based approach at a later date. This technique is most commonly used for market risk purposes.

**Portfolio Replication** reduces large, complex portfolios to a manageable number of representative instruments for risk measurement purposes. For example, a block of life insurance policies may be evaluated against one hundred plausible scenarios. These scenarios and the corresponding values of the block feed an optimization algorithm. It produces a smaller portfolio of financial instruments that replicates the risk profile of the original larger portfolio. This replicating portfolio is used as a proxy of the original portfolio for the purposes of risk measurement and benchmarking.
Standard Models are the most commonly used valuation methods. Terms & conditions are specified for each product type and loaded into the transaction database. A standard function for valuation and simulation of the trade, allowing settlement (cash and physical) and through-time valuation to be realized; sensitivities, cash flows, and other attributes are also calculated.

In many cases, model calibration algorithms are also provided, ensuring consistency and facilitating validation.

The flexibility within the Algorithmics framework means that clients can model a wide variety of products that exist in the market today. The following are examples of products supported by Algorithmics and actively used by our clients.

INTEREST RATE PRODUCTS

Algorithmics offers flexible valuation methodologies for a wide range of interest rate products. Users can build fixed income instruments from terms & conditions or specify payments individually. Pricing algorithms include discounting, numerical methods, lattices, and Monte Carlo. Supported interest rate evolution processes include forward-based pricing, normal, Hull-White, two-factor Hull-White, Amin-Jarrow, and Black-Karasinski.

Money Market
Banker Acceptances (BA)
Commercial Paper
Deposits (CD)
Treasury Bills

Bonds
Government Bonds
Corporate Bonds
Municipal Bonds
Zero Coupon Bonds

Step-up (Variable Rate) Bonds
Floating Rate Notes
Inflation Indexed Bonds
TARN Notes
Ratchet Notes
Callable Bonds (Fixed and Floating)
Range Accrual Bonds (Callable)
Amortizing Bonds (Callable)
Mixed Fixed/Floating Bonds (Callable)
Generic Cash Flows (Fixed, Floating, Amortizing)
Compounding Bonds
Mortgage Products (via INTEX and Andrew Davidson)
MBS/CMBS/RMBS
CMOs
IO/PoS
Sequential Bonds
PAC Bonds
ABS
Fixed MBS Pools
ARM MBS Pools

Forwards
Repos and Reverse Repos
Bond Forwards
Money Market Forwards
Forward Rate Agreements (FRA)

Futures
Bond/Note Futures
Eurodollar Futures
Fed Funds Futures
Money Market Futures

Swaps
Interest Rate Swaps/Swaptions
Basis Swaps/Swaptions
Zero Coupon Swaps/Swaptions
Variable Notional/Coupon Swaps/Swaptions
Forward Starting Swaps
CMS/CMT Swaps/Swaptions
Compounding Swaps
Average Rate Swaps
Cancelable Swaps
Extendible Swaps
Trigger Swaps
Delayed Reset (In-Arrears) Swaps
Differential (Quanto) Swaps
Index Amortizing Swaps/Swaptions
Amortizing Swaps/Swaptions
Asset Swaps

Capped Floater Swaps/Swaptions
Fixed/Float Range Accrual Swaps/Swaptions
Inverse-Floater Swaps/Swaptions
OIS/EONIA Swaps
TARN Swaps
CMO Swaps
Swaptions (European, American, Bermudan)
Snowball Swaps
Racheting Swaps
Power Reverse Dual Currency (PRDC) Notes/Swaps

Cap, Floor, Collar
Vanilla Caps
Digital Caps
CMS Caps
Differential (Quanto) Caps
Average Rate Caps
Spread Caps
Flexi (Chooser) Caps
Limit (Auto) Caps
Captions
Barrier Caps
Generic Cash Flows (Caps, Floors, Digital Caps, Digital Floors, Amortizing)

Inflation
Inflation Derivatives
Zero Coupon Inflation Swap
Year-Over-Year Inflation Swap
LPI/RPI Swaps
Inflation Caps/Floors
Compounding Inflation Swaps

Other Options
Money Market Futures Options
Eurodollar Futures Options
Fed Funds Futures Options
Bond/Notes Futures Options
Bond Options (European, American, Bermudan)
Barrier Bond Options
Bond Basket Options
Structured Products
Callable CMS Spread
Callable Capped Floaters (LIBOR/CM S)
Callable Inverse Floaters (LIBOR/CM S)
Forward-Based Generic Options
FOREIGN EXCHANGE PRODUCTS

Algorithmics is inherently multi-currency and supports a number of specific FX products.

**Spot, Forwards, Futures, Swaps**

- Spot
- Currency Forwards
- Non-Deliverable Currency Forwards
- Currency Futures
- Currency Swaps
- Notional Reset Swaps
- Dual FX Correlation Swaps
- Variance/Volatility Swaps
- Total Return Swaps
- Forward Volatility Agreements

**Options**

- European Options
- American Options
- Futures Options
- Forward Start Options
- Average Rate Options
- Spread Options
- Asian Options
- Basket Options
- Single, Double and Window Barriers
- Cliquet
- Quants
- Napoleon Options
- Asian Options – Average Price/Strike (FEA)
- Basket Options – European/Asian (FEA)
- Binary Options (FEA)
- Chooser Options (FEA)
- Digital Options (FEA)
- Double Barrier Options (FEA)
- Dual Commodity Options (FEA)
- Look-Back Options (FEA)
- Compound Options (FEA)
- Quanto Options (FEA)
- Window Barrier Options (FEA)
- Asian Cliquet Basket Options (FEA)
- Forward-Based Generic Options
- Monte Carlo Generic Options

**EQUITIES**

Equities may be modeled directly or modeled using a multi-factor CAPM approach. On this basis, a wide variety of options models are available, including closed form, numerical methods, lattices, and Monte Carlo. Supported evolution processes include GBM and Heston.

**Spot, Forwards, Futures, Swaps**

- Common/Preferred Stock
- Equity Indices
- American Depositary Receipts
- Equity Forwards
- Equity Index Futures
- Equity Index Swaps
- Variance/Volatility Swaps
- Forward Volatility Agreements
- Correlation Swaps

**Options**

- European Options
- American Options
- Bermudan Options
- Equity Index Future Options
- Forward Start Options
- Basket Options
- Spread Options
- Single, Double, and Window Barriers
- Asian Options
- Cliquet Options
- Quants
- Floating Strike American Options
- Range Options
- Warrants

**Commodities and Energy**

Commodities are valued based on forward pricing using: constant maturity or rolling nearby. The Schwartz and Smith model is also used.

**Credit Derivatives**

For synthetic CDO, three types of valuation procedures are provided: Analytic’, Convolution’, and Monte Carlo Simulation. Moreover, Algorithmics provides the means to estimate the inputs into the models: base correlation, hazard curves, and spreads are all estimated from market quotes.
### Single Name
- Total Return Swaps
- Credit Default Swaps
- Credit Default Swaptions
- Credit Linked Notes
- Credit Spread Options (European, American)

### Multi-Name
- Synthetic CDO
- Index CDS (CDX and iTraxx)
- Index Tranches (CDX and iTraxx)
- Bespoke CDO Tranches
- 1st-to-Default, N-to-Default Baskets

### Model Calibration
- Hazard Rate or Spread Curve
- Index CDS (CDX and iTraxx)

### GENERIC DERIVATIVES
- Algorithmics’ models exploit the common features of products that have a variety of underliers. Forward-based models can be used with the following product types: FX, Bonds, Commodities, EDF and FFF, Equities and Market Indices, Baskets, Bond Futures, etc.

### Forward Based
- Asian
- Asian Cliquets
- Asian Forwards
- Futures
- Forward Start
- Options on Futures European
- American
- Quantos

### Single Barrier
- European Up & In, Up & Out, Down & In, Down & Out
- Cash-or-Nothing Binary One-Touch
- Cash-or-Nothing Binary No-Touch
- Cash-or-Nothing Digital One-Touch
- Cash-or-Nothing Digital No-Touch
- Asset-or-Nothing Binary One-Touch
- Asset-or-Nothing Binary No-Touch
- Asset-or-Nothing Digital One-Touch
- Asset-or-Nothing Digital No-Touch
- Quanto Barrier

### Double Barriers
- European Double Knock-out/Knock-in
- Cash-at-Expiry-or-Nothing Binary
- One-Touch
- Cash-at-Hit-or-Nothing Binary One-Touch
- Cash Binary No-Touch
- Cash Digital No-Touch
- Cash-or-Nothing Digital One-Touch
- Asset-at-Expiry-or-Nothing Binary One-Touch
- Asset-at-Hit-or-Nothing Binary One-Touch
- Asset Binary No-Touch
- Asset Digital No-Touch
- Asset-or-Nothing Digital One-Touch
- Window Barriers
- Quanto Barrier

### Brady Bond Module
- Brady Bonds
- Brady Bond Options (European, American)

### Brazilian Market Module
- Interest Rate Bonds/Notes
- Interest Indexed Bonds/Notes
- Inflation Indexed Bonds/Notes
- Dollar Indexed Bonds/Notes
- DI and DDI Futures
- Indexed Swaps

### Japanese Market Module
- JCB

### Mexican Market Module
- UDI Indexed Bonds
- TTIE Futures

### South African Market Module
- Bonds
- Bond Futures
- Bond Futures Options
- Bond Options (European, American)
- Bond Forwards

### United Kingdom Market Module
- UK Gilts

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1. The Analytic valuation follows Iscoe and Krenin: *Pricing and Valuation of CDOs*, which provides the closed-form solution of the expected Tranche Loss.

2. The Convolution form follows Hull and White: *Valuation of a CDO and an nth to Default CDS without Monte Carlo Simulation*, which describes the convolution method to compute the distribution for the number of defaults in the underlying asset pool.

* Excluding bond futures, EDF, and FFF
** Excluding forwards and futures underliers
*** Excluding EDF and FFF
About Algorithmics, an IBM Company
Algorithmics is a leading provider of risk solutions. Financial organizations from around the world use Algorithmics’ software to help them make risk-aware business decisions. Algorithmics’ analytics and advisory services assist firms in taking steps towards maximizing shareholder value and meeting regulatory requirements. Supported by a global team of risk experts based in all major financial centers, Algorithmics offers awardwinning solutions for market, credit and operational risk, as well as collateral and capital management.

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