

A GAVEKAL SOFTWARE TOOL

EQUITY MARKET RISK IN 40 COUNTRIES

Macro-economic Rules

Artificial Intelligence

 Gavekal Intelligence Software

A Quantitative Approach to Country Risk

Equity returns are typically driven by company-specific news, sector re-ratings and de-ratings, or individual country risk. Of these three main factors driving individual equity performance, country risk is usually both the most important, and most challenging performance driver to tackle.

At Gavekal Research, our aim is to help equity investors navigate this complexity. And to do so, we focus on analyzing individual country risks through the prisms of:

- political change,
- geopolitics,
- valuations,
- growth and cyclicity,
- technical analysis and momentum,
- behavioral finance.

Most of these research fields cannot be processed with a rule-based approach. Yet, this is what **Charles Gave**, Chairman of Gavekal Research, has tried to do for most of his career: identify, test and implement investment rules that work not only in individual markets, but also span a range of markets.

In a bid to modernize this research, Charles Gave teamed up in 2014 with Gavekal Intelligence Software, his new quantitative research group with over 15 years' experience in **artificial intelligence**. Together, they spent the next two years testing, re-testing and ranking the hundreds of investment rules that Charles had picked up and developed over the years.

By working together, what Charles and Gavekal Intelligence Software found, was that some of Charles' rules worked sporadically, others worked well in certain markets but not in others, and thus could not be considered universal. Others still did not do very well at all!

Still, after two years of work, they managed to retain seven rules with high statistical significance across the world's 40 largest equity markets. And they have now combined these seven rules in a software application called TrackMacro.



A rule is a tested way to mitigate surprise.

Louis Gave, CEO, Gavekal Group



What is TrackMacro Software?

TrackMacro is a client application by Gavekal Intelligence Software installed on your PC or tablet and **tracking equity risks in 40 countries** in a systematic manner.

Every month, TrackMacro applies the same 7 macro-economic rules for each country to estimate the current risk/reward quality of local equity investments. Equity risk-on or risk-off signals result from the cross section and the non-linear combination of macro rules.

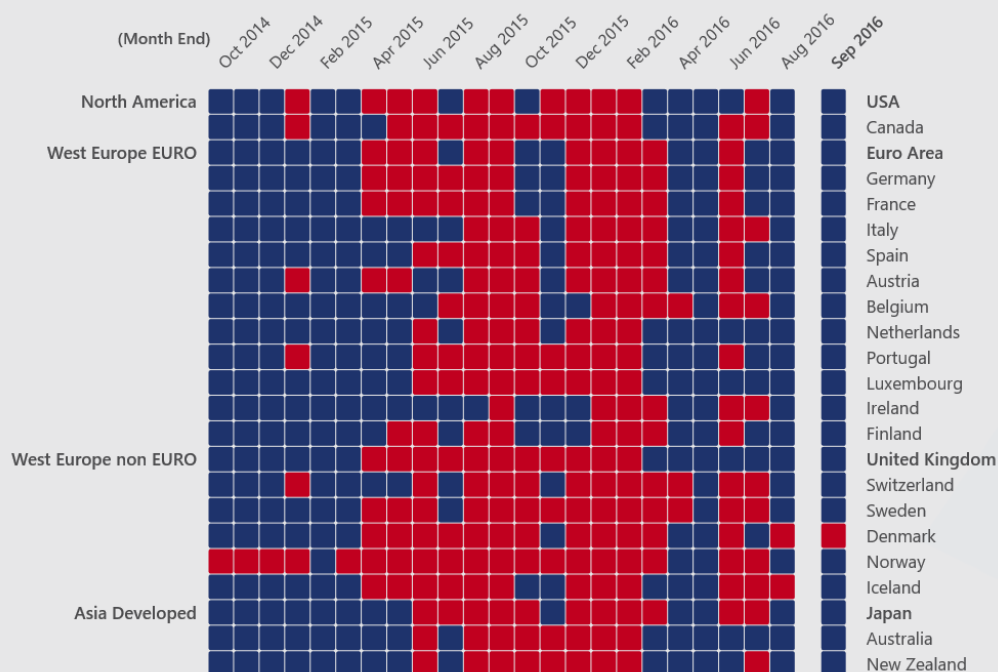
TrackMacro simulates long equity investments when risk is on, and switches to bonds or cash when risk is off. The signals are automatically updated and recorded monthly to track the historical evolution of equity risks throughout the world and to track the historical and live model performance.

The software is customizable in order to allow you to track your own portfolio and perform simulations according to various parameters.

- Risk-on signal: favorable conditions for equity investments
- Risk-off signal: unfavorable conditions for equity investments

Heat Map of World Equity Risks by TrackMacro

Developed Economies



The 7 Macro Rules

The monthly status of each macro rule is represented by a color gradient, from red to blue, and the overall equity risk status by a binary red or blue signal:

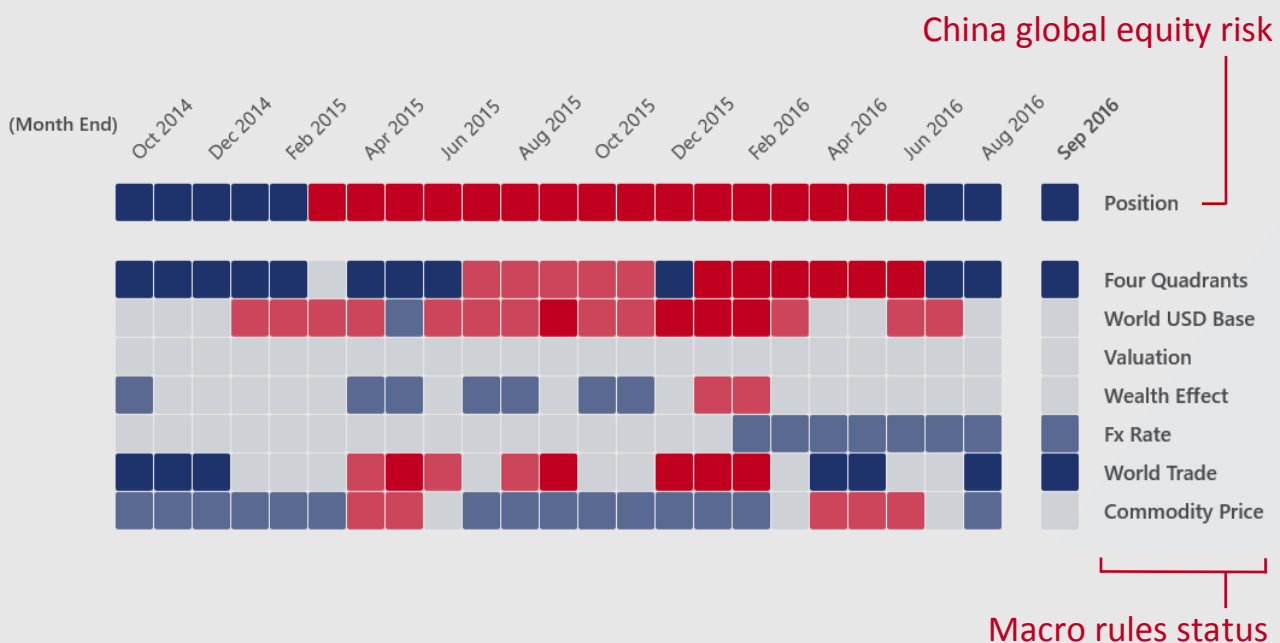


Rule 1: The Gavekal Four Quadrants

Monetary and fiscal policy changes have an impact of economic activity, prices or both. This reality leaves us with four possible investment environments: Disinflationary/ deflationary boom, disinflationary/ deflationary bust, inflationary boom or inflationary bust. A disinflationary boom favors equities in general and innovative companies with pricing power in particular. A disinflationary bust favors safe government bonds. An inflationary boom favors stores of value, the so called "scarcity" assets such as real estate, gold, silver, oil, and high fixed costs cyclical producers. An inflationary bust favors cash in safe currencies.

Equity Signals Combining 7 Macro Rules

China



Rule 2: World Monetary Base

The US Dollar is the world reserve currency. Our aim is to measure the dollars available in the world with the idea of identifying whether the amounts of dollars in the world are too high, about right or too low. When the amount of dollar is too low, deeply cyclical countries and countries dependent on foreign trade tend to fare poorly; as do countries running large current account deficits.

Rule 3: Valuation

Usually, it is a good thing to buy equities when they are "undervalued". But buying them when they are cheap can backfire if these valuations are not accompanied by an improving economic environment.

Rule 4: Wealth Effect

This is a momentum based rule. Equity markets, especially in emerging markets, can go through long periods of rising asset prices followed by periods of falling asset prices (usually steeper and shorter). The favorable and unfavorable periods tend to be linked with other factors.

Rule 5: FX

Undervalued currencies favor the "Entrepreneur", overvalued currencies the "Rentier", and growth is more often than not created by the entrepreneurs. A deterioration of external competitiveness can be measured through the foreign exchange rate of a country's currency against that of its major trading partners.

Rule 6: World Trade

The level of economic activity in any country depends on its endogenous activity (domestic demand) as well as on the demand coming from abroad (external demand). We try to measure the robustness of this 'external' demand for all countries at once by monitoring world trade.

Rule 7: Commodity price

A major increase in commodity prices can be construed as a tax increase for the commodity users and a tax fall for commodity producers, the reverse being also true. So while the results of changes in prices tend to be a zero sum game for the world as a whole, it is certainly not true for each country. With this rule, we take into account the winners and losers from changes in the relative pricing of materials, as well as the magnitude of the change.

The Help of Artificial Intelligence

TrackMacro software is structured as an artificial neural network. The application imitates, in a very simplified manner, the computational process of the human brain, with two fundamental characteristics:

Segmentation of computational processes

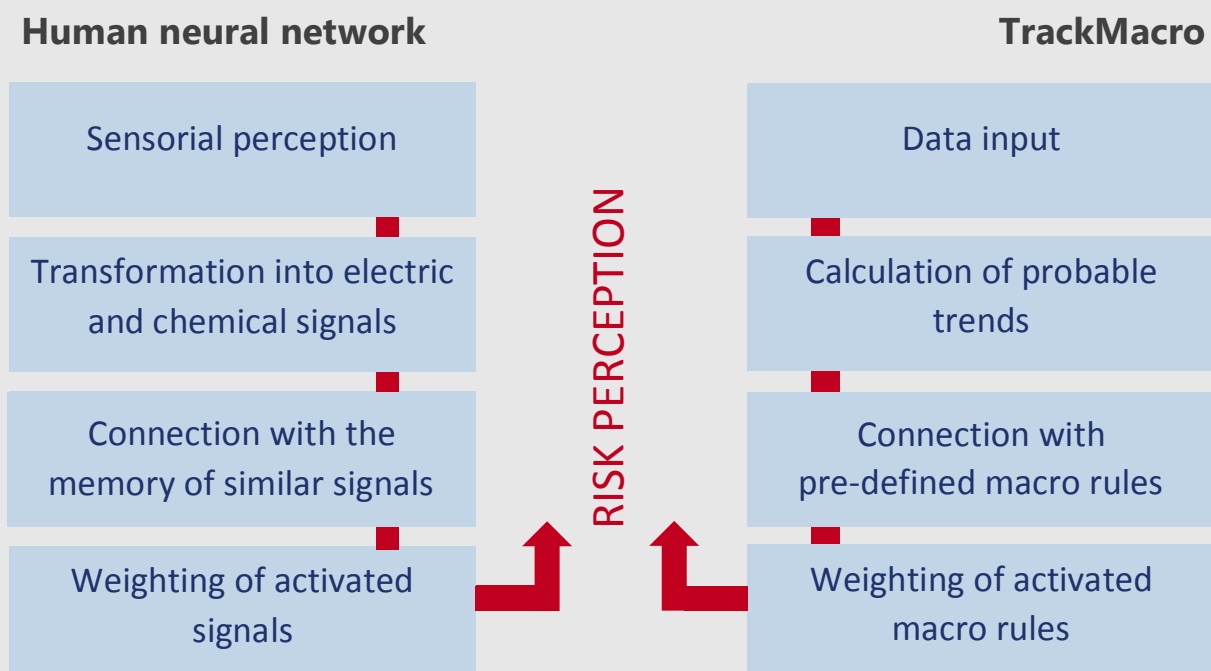
The application interconnects different layers of specialized functionalities, similarly to the human brain, as illustrated here below. Each layer has been programmed independently with no global optimization, to mitigate the risk of historical data overfitting.

The calculation of economic trends, for instance, uses statistical methods to estimate confidence levels; the combination of macro rules has been optimized in sample on 3 countries with a proprietary genetic algorithm. Combining rules in a random manner, and selecting the best of breed, for each generation, the genetic algorithm imitates a Darwinian evolutionary process.

Interconnection between layers

The multiple interconnections between layers of a neural network provides the systems with numerous degrees of freedom, so that it can approximate non-linear responses to macroeconomic evolution.

Similarities Between Neural Networks and TrackMacro Computational Processes

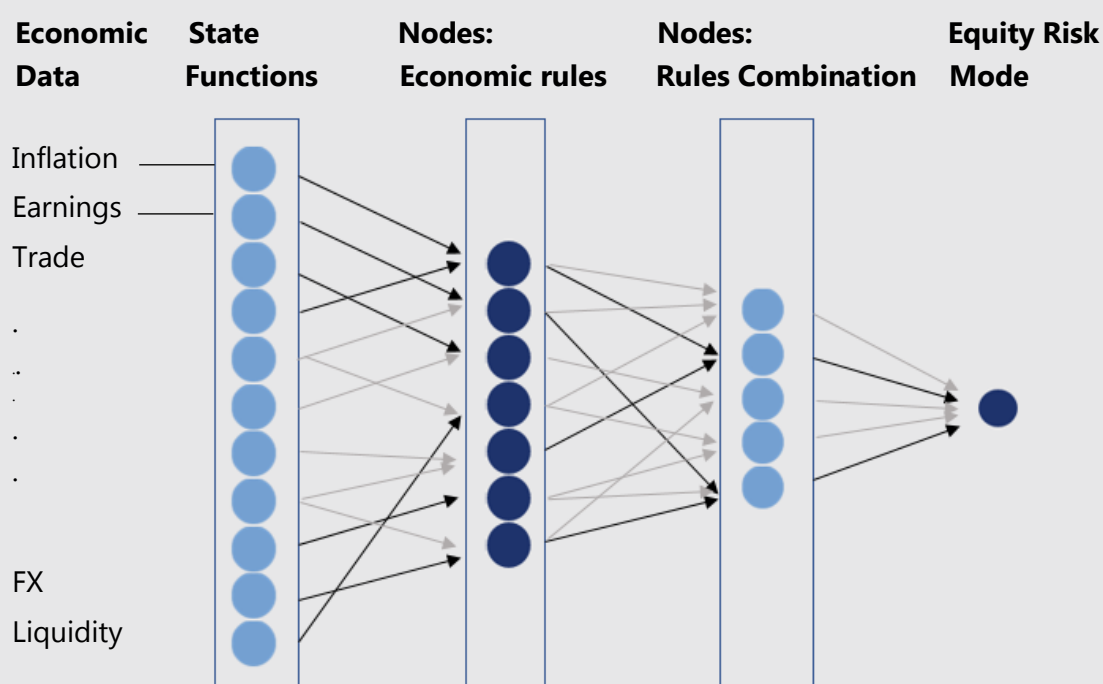


Inside TrackMacro

The network has five layers: economic data input, equity risk mode output and three hidden layers.

Economic Data	Automated tracking of macro factors driving equity prices. 10,000 historical data feed the input layer every month.
State Functions	Transformation of continuous macro signals into discrete signals with five states: uptrend with high or very high probability, neutral, downtrend with high or very high probability. The states are differentiated by the direction of the economic data and the probability that such direction is not due to a random process.
Economic Rules	7 macro rules from Charles Gave combining state functions, favorable or unfavorable to equity investments. The nodes transform the input signals into probable rule states.
Rules' Combinations	Non-linear combination of economic rules controlling risk. The nodes functions have been calibrated by a genetic algorithm on stable combinations for three markets: the USA, Japan and Germany, then extended to 37 countries out-of-sample.
Equity Risk Mode	Binary risk-on or risk-off signal.

The Five Layers of TrackMacro Software



Assess Your Countries

Monthly Equity Risk Signal

TrackMacro provides a binary equity risk signal by country in the current month, calculated at the previous month-end. A blue signal means a favorable risk/return ratio for equities; A red signal means an unfavorable ratio.

Intra-Month Signal

A few times during the month, and when relevant, the application calculates potential changes of macro risk for the following month. The intra-month calculation computes new intra-month data releases and price changes and assumes no change until month-end.

Performance

Every month, TrackMacro updates historical drawdown, volatility, and return calculations of the model and its benchmark by country.

Example: NAV of TrackMacro Model on Nikkei 225 vs. 10Y JGB

Japan



Simulate Your Portfolio

TrackMacro simulates equity investments in 40 major country indices, in developed economies and emerging markets, as well as government bond or cash investments in various currencies in times of equity risk.

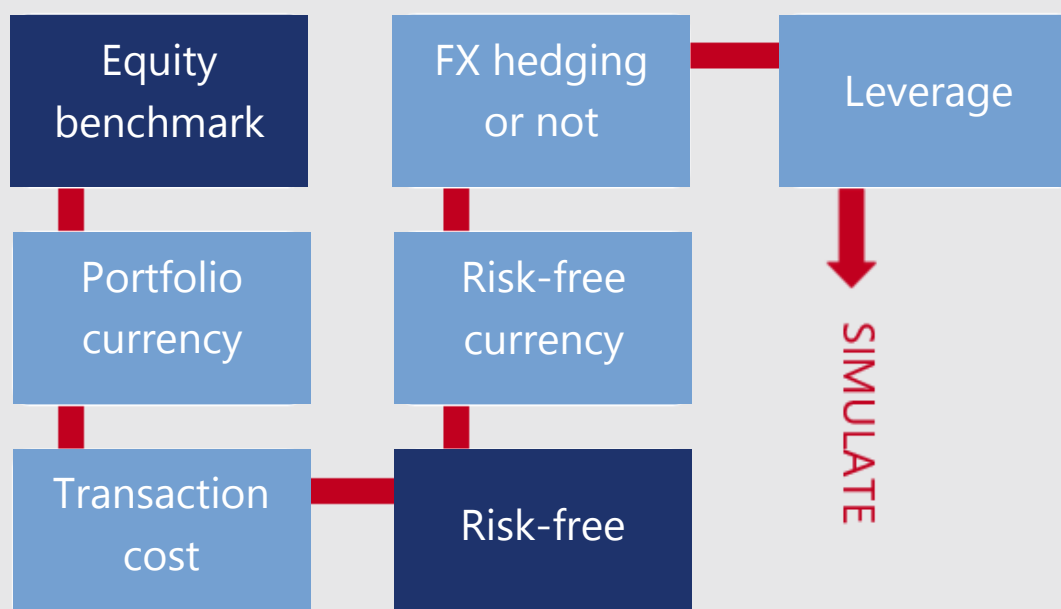
The software lets you simulate your own portfolio with your preferred minimum and maximum allocations to the 40 country indices, your transaction costs, portfolio currency, foreign exchange risk management method (FX hedging or open FX risk), risk-free investments in times of TrackMacro Risk-off (10-year government bond, 2-year government bond or cash deposit) in the currency of your choice.

TrackMacro rules can therefore be tested on a selected part of your equity benchmark or on the overall exposure.

The portfolio can be leveraged in the funding currency of your choice at the cost of cash deposit + a spread.

The simulation helps you track monthly reallocations as well as live performance and risk measures such as volatility and drawdown.

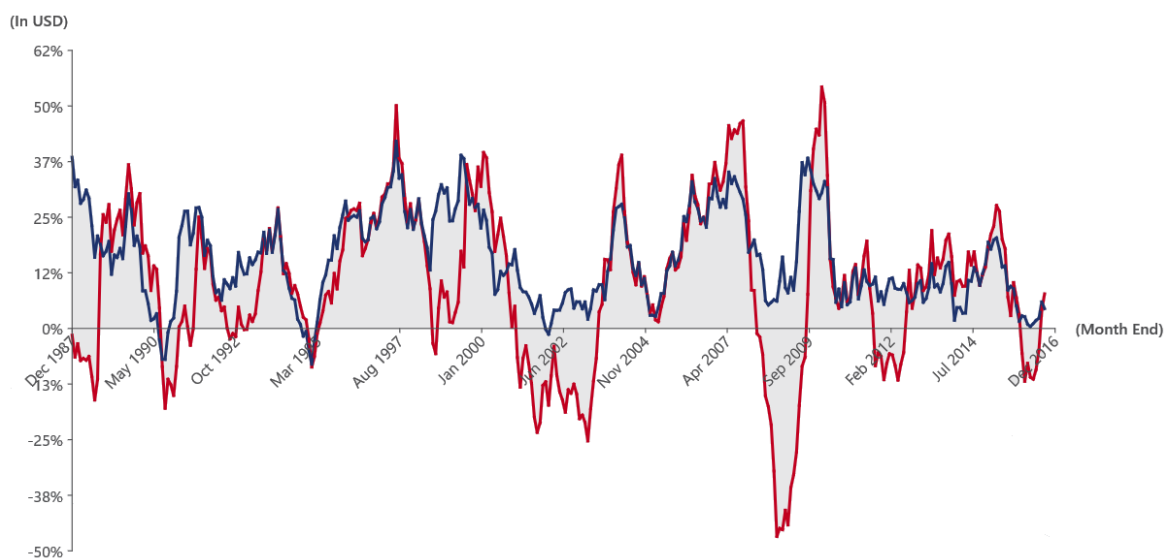
Selection of Portfolio Simulation Parameters



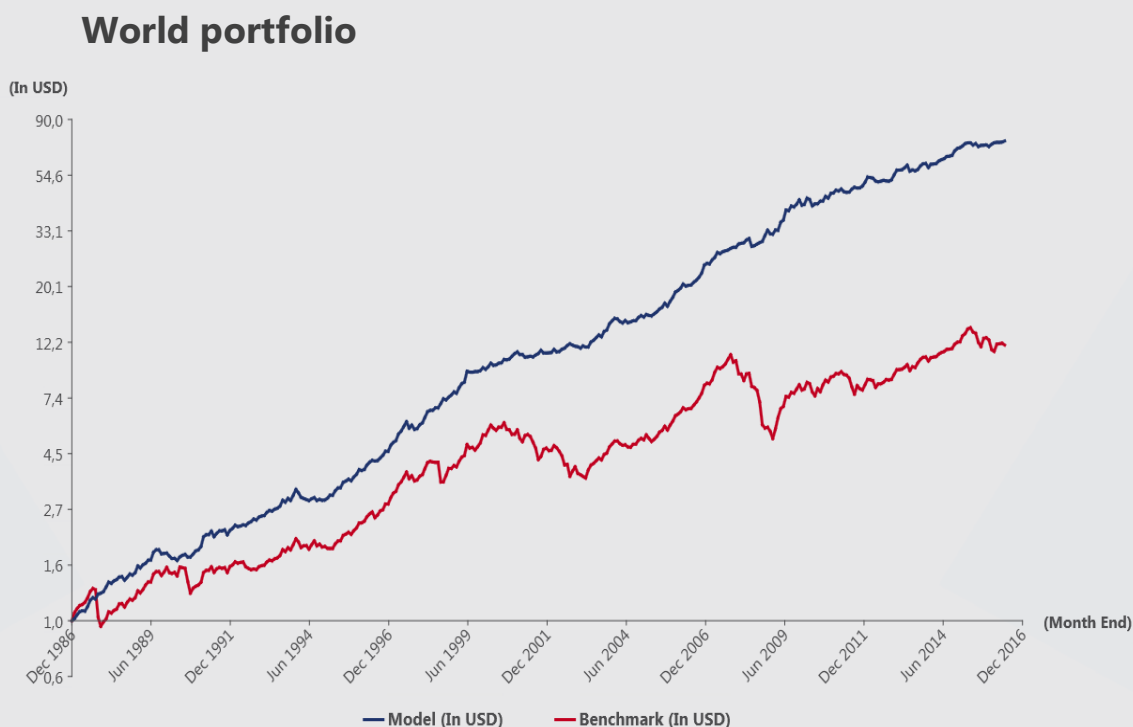
Track Performance

You can track the model performance of your portfolio, with or without leverage, or of standard portfolios with no leverage such as Asia, Europe, BRICS, or World equities, with GDP country weightings or equal weightings.

Example: World equity Portfolio – GDP weighted – no leverage
1Y rolling return, model vs. benchmark



Example: NAV of TrackMacro Model on World Equity Portfolio, GDP Weighted



Connect via PC or iPad



iPad: search "TrackMacro" on Apple Store

PC: download from www.gavekal-intelligence-software.com
and request a password for a 3 months' trial period with updated data.



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Gavekal is one of the world's leading independent providers of global investment research. Gavekal Intelligence Software is a research and development company from the Gavekal group, based in Nice, France. The company was founded in 1999 and combines academic knowledge, computing skills and financial expertise to provide risk software to the asset management industry. The company is headed by Yann Ageon, a former engineer of the French National Center for Scientific Research (CNRS) and focuses on artificial intelligence and quantitative modelling of complex systems, applied to finance.

