”Beyond the Normal Distribution”

„New Models in Finance promise Success and Progress in Risk Management and Portfolio Optimization“

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A new generation of financial models lure investors with this promise: more return without additional risk. The “popular models for portfolio optimization are decades old. We now can offer better solutions”, says Zari Rachev, a professor and chair of statistics, econometrics, and mathematical finance at the University of Karlsruhe Institute for Econometrics and Statistics.

He has worked on elaborate models for a considerable amount of time. Financial models do not employ the fundamental business analysis of the company. For example, for return on equity, financial models implement complex stochastic models and large amounts of data.

As of now, most financial models assume asset returns are normally distributed meaning that, e.g. for daily volatility of stock returns: small deviations up or down are more likely to be medium sized rather than large. The German mathematician CF Gauss designed a formula for such a frequency pattern, the Normal distribution, described by a bell-shaped curve.

For most practical problems, the normal assumption yields reasonable results. However, specialists such as the Belgian Benoit Mandelbrot have long criticized that the Normal distribution does not reflect the true picture of financial markets: e.g. big shocks at stock markets occur much more often than the Normal distribution would suggest. According to the Gaussian Model, a crash such as the one on October 1987 should happen only once every 10^87 years. But in reality, such a landslide should be expected once every 38 years. In other words: whoever relies on the Normal distribution underestimates risk significantly. Some sneer that the Normal distribution is common only because it’s comparably tractable in a mathematical way.

This makes the models fragile, though. Some scientists support the use of game theory as a consequence. Rachev and Mittnik, however, stick to true financial models with emphasis on probability theory.

As a consequence, Rachev and his colleagues in this field, such as Prof. Mittnik from Munich, do no longer use the Normal distribution for their models but instead use the so called stable distributions. This is a mathematically abstract concept containing the Normal distribution as a special case. The advantage of these models is that they can be fit to real data more closely hence, reflect reality in a more accurate way. In particular, rare events causing high losses can be grasped analytically in a better than before. The disadvantage of the “Pareto” or “Levy” models is that they – with a few exceptions – are mathematically hard to handle.

Through intensive research and the immense computational power of modern computers, this hurdle can be overcome according to Mittnik who teaches at the first chair of Financial Econometrics in Germany. Moreover, another important element, the so called volatility clustering and Long Range Dependence, has been built in according to Rachev. Thus, one considers that a big crash is followed by a longer period with hefty volatility – the market is said to have memory.

Another novelty is added. “We replace the common risk measures ‘standard deviation’ and ‘Value at risk’ by the new measure ‘expected tail loss’”, says Rachev. What is meant by that? In the common models, not to forget the new “Basel II” regulations for Banks, “Value at risk”, it plays an important role. These estimates, for example, result in the statement that the daily loss of a particular bank from positions in securities and derivatives will not exceed 20 M. Euros with a probability of 99%. The weakness of this figure is, however, that it gives no answer to the really interesting question: what is the expected loss in the remaining 1% of the cases? By Expected Tail Loss we mean the expected loss at the 1% end of the distribution.

A consequence of this approach is: the so called Sharpe ratio that plays an important role in comparing asset managers is “old stuff”. The Sharpe ratio weights the return by the risk exposure. “But in this concept, big gains are treated as deviations and, hence, account for risk”, says the 54 years old scientist. “This makes no sense”. Rachev and Mittnik, as a consequence, suggest weighing the return by the Expected Tail Loss. Thus, the Sharpe ratio is replaced by the STARR (stable tail adjusted

return ratio). For measuring the performance of special investment strategies, Rachev has additionally developed the “Rachev-Ratio”.

Rachev alleges, that by combining the two concepts “stable distributions” and “Expected Tail Loss”, the model of FinAnalytica is unique. The award for all the efforts: because of the better control over the risk, the sometimes inevitable losses can be kept a lower level and the returns of “stable distributed portfolios” applying the Expected Tail Loss are higher with the same risk exposure. He gives the example that the return of a portfolio of stocks with low prices, as a consequence higher volatility, will yield a daily average of 14 basis points when it applies his method than when it as compared to the traditional quantitative models to compose the portfolios. On a yearly base, this means a plus of 35%. According to Rachev, who is the “Chief Scientist” of FinAnalytica, asset managers are increasingly becoming aware of this and thus, favour these models.

(Encapsulated)
Ivory tower + Praxis

According to the Anglo-Saxon role model, the Karlsruhe Professor “Zari” Rachev has took a brave step from the ivory tower to industry several years ago when he founded Bravo Risk Management Group and began marketing his models. Bravo has now become FinAnalytica with headquarters in Seattle and New York. Customers include asset managers, especially hedge-fund managers.

According to Rachev, who has shares in FinAnalytica and acts as chief scientist, asset managers gradually get the taste of these models. Customers are the large British fund Morley as well as the American hedge fund Tremont. Francess Cowell, responsible of 6 hedge funds at Morley, has tested a dozen of software product, 4 of which for over 1 year. Finally, she decided in favour of Cognity. Of all, it grasps the variety and complexity of modern derivatives the best. In science, the use of stable distributions for portfolio optimization is naturally debated. For example, Ernst Eberlein, who does research at the chair for mathematical stochastic at university of Freiburg, says that a different class of distributions – “generalized hyperbolic models” – is better able for this task and also more tractable in practice.

FinAnalytica employs a good 3 dozen people, mainly in New York and Sofia, most of which mathematicians. The main competitor is seen by Rachev to be Barra and Canadian Algorithmics. Barra has been consulting since the 70s with respect to all kinds of problems in risk management. The American company has more than 500 employees in 8 countries. Canadian Algorithmics has belonged to the rating agency Fitch since 2005 and employs 550 people. Rachev states that several of the hedge funds he is familiar with implement refined models which, however, are not marketed.

Rachev and his colleague Prof. Mittnik are working on further refinements of the models. A project, for example, to adapt the models to the highly volatile intraday trade. But FinAnalytica will not only restrict itself to developing risk management and portfolio management products. Instead, they consider starting their own fund using their own products and thus, exemplifying a link between theory and practice.