

From Liquidity Crisis to Correlation Crisis, and the Need for 'Quanls' in ERM

by Stéphane Loisel

The liquidity crisis and the insufficient depth of the market led to a strong correlation crisis: many risks that could be considered as close to mutually independent in the classical regime suddenly became strongly positively dependent. More correlation crises may happen in the future. We need to be more careful with black-box tools and to train what I would define as "quantitative analysts" ('Quanls') in the Enterprise Risk Management (ERM) process, that is risk managers who are able to lead interdisciplinary ERM studies from a jointly qualitative and quantitative point of view, with an emphasis on dynamics.

The recent crisis may be regarded as a result of the lack of the depth of the financial market to absorb liquidity needs after a period of artificial additional growth generated by (too) easy access to credit and (too) low interest rates. As things went wrong, many risks, often considered to be close to independent, suddenly became strongly positively dependent: this is what we define as a correlation crisis in Fisher et al. (2008) and Biard et al. (2008).

From the point of view of the insurance industry or of the equity derivatives market, the recent crisis would be a consequence of an external shock arising from the sub-prime crisis in credit risk. The fact that many companies defaulted or were downgraded almost simultaneously corresponds to what is often referred as a consequence of the smile of correlation: correlation has been known to be larger in bad times than in the classical regime for quite a number of years.

Nevertheless, after this exogenous risk appeared, once liquidity needs are there and as the market is not deep enough to absorb it, most market participants tend to behave similarly, breeding a vicious cycle: because of margin calls and liquidity needs, investors are forced to sell valuable (on the long term) assets at the bad instant, which leads to adverse price moves, further margin calls, and so on... This copycat behavior generates and amplifies risk

within the market and as such is an example of endogenous risk, in analogy with the horizontal oscillations of the Millennium Bridge of London that forced the bridge to close for a battery of tests three days after its opening to the public, as noted by Danielsson and Shin (2002).

A pandemic could create a correlation crisis between insurance and financial risks. The consequences on the future earnings of insurers and the difficulties that financial institutions would have to maintain their activities are often underestimated in Solvency II and in Basel II. The way correlations are defined in QIS4 of Solvency II does not really take into account correlation crises that could occur after a catastrophe, or just because of endogenous risk, for example with surrender options. How to value these options, as well as deposits in finance, remains a question that has to be addressed in a more sophisticated way.

One often hears about the crisis that people got lost in the mathematics. I am convinced that some products were far too complex, and the models to describe their dynamics far too simple.

To me, considering more sophisticated models does not mean replacing a Brownian motion with a more general Lévy process, or a Gaussian copula with a mixture of Student copulas. I believe that we must pay more attention to the dynamics, and consider risk processes with non-stationary increments and dynamic correlation models, with the goal to understand the main sources of risk.

If a pandemic occurred, the delay between its beginning and the date at which insurers or reinsurers would have to pay, as well as the time elapsed before stock prices move back up after the epidemics, would be very important. Similarly, in the equity market, the correlation crisis that caused many basket options to be underpriced is likely to end later on almost as suddenly as it appeared, and missing this dynamic would lead to bad hedging strategies. Identifying the main sources of risk and understanding their

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interactions is far more difficult, but it has to be done if we want to move to Basel III and Solvency II.1, instead of moving back to Basel and Solvency 0. Both fundamental and applied research is needed to tackle these issues. With an integrated risk view and a correct ERM process, those external shocks and their endogenous consequences could be studied and managed at the same time.

Important difficulties to overcome concern IT, Pillar 2 of Basel II and Solvency II and invisible barriers that make it quite difficult to implement an ERM process that guarantees this view of risk at the macro level. Very often, to meet the constraints of some softwares and to maintain robustness and auditability of processes, models are simplified, and key risks like credit risk or exchange rate risk may be ignored for some combinations of positions taken by the front office. Besides, some market participants, instead of using the official software, may take their decisions directly from self-developed programs that are black boxes at the risk management level. One must absolutely avoid blindly trusting black-box models as one trusted rating agencies to measure credit risk. In the insurance business, I am concerned by the fact that a few software developers have a monopoly on the quantification of financial consequences of natural disasters and are almost blindly trusted by many insurers and reinsurers, in spite of recent events and strange yearly price movements obtained for the same risk with the same software. Because these risks are complex and specific, it is tempting for supervisors to use this black box model as well. Similarly, in finance, some controls are made by the middle office with the front office software because it would be too expensive to develop another one. If market participants or insurers all use similar black box models, a hard correlation crisis might occur if an unmodelled catastrophe breaks out. To implement a valuable ERM process would require more transparency of models and strategies, and we get to one of the main issues to address after the crisis: how to deal with the mismatch between confidentiality and competition on one side, and the need

for an ERM process, for supervision and for communication to markets (Pillar III of Basel II and Solvency II).

Fair value and risk neutral valuation techniques have also been too often blindly used without exercising critical judgment. There is currently a debate on the use of fair value and the freedom to use a different framework during a crisis. First, I think one must not mix up accounting, regulatory and pricing tools. Second, a concept that should be useful to measure something and to take risk into account is not suitable if you can only use it when risk does not show up. Third, in contrast to some people who recommend forgetting these valuation techniques, I think they "just" need to be adapted to take into account risks of temporary illiquidity, correlation crises and copycat behavior and the way transactions are made, in particular if there are only a few market participants (in the case of insurance-linked securities, for example).

Another point to carefully address is the way brokers, traders, executives and others can maximize their salaries, and the perverse incentives this may create. The one-year horizon in Solvency II reinforces the preference for a short-term view too. It is clear that if no five- or 10-year indicator is added into the current project, most companies will mainly develop short-term capital models and not enough will consider long-term perspectives.

The same reasoning applies to governments: Was there an incentive for them to limit or to encourage easy access to credit? The answer is not the same with short-term and long-term views, but elections are a key factor to help them choose their strategy! This led them to underestimate the guarantees they would have to give to keep the financial system up. The guarantee that governments provide to some financial institutions should be studied in detail because of the competitive advantage it may generate under some circumstances if one does not pay attention.

After the threat of economic crisis in 2009, we may face in the 2010s and in the 2020s other correlation cri-

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ses that could arise from illiquidity, pandemic, inflation, oil peak, climate change, pollution, a natural disaster, etc.... To limit their financial consequences and ensure the long-term viability of our financial system, I believe we need to put more emphasis on fundamental and applied research and use continuous professional development to train ERM experts with both quantitative and qualitative expertise. These experts would be able to identify, quantify and manage risks faced by insurance and financial institutions from the underwriting process to investment strategies.

For some risks, studies with mutualized data by researchers, federations of insurance companies and banks and international institutions should be carried out to avoid blind trust in black-box models. This would help us to find out which risk indicators would be relevant for better risk management and regulation.

References

- Fisher, Wayne, Loisel, Stéphane and Wang, Shaun. "On Some Key Research Issues in Enterprise Risk Management related to Economic Capital and Diversification Effect at Group Level." *Bulletin Français d'Actuariat (BFA)*, No. 15, Vol. 9, 2008.
- Biard, Romain, Lefèvre, Claude and Loisel, Stéphane. "Impact of Correlation Crises in Risk Theory: Asymptotics of Finite-Time Ruin Probabilities for Heavy-Tailed Claim Amounts when Some Independence and Stationarity Assumptions are Relaxed." To appear in *Insurance: Mathematics & Economics*, 2008.
- Danielsson, Jon and Shin, H. "Endogenous Risk." In *Modern Risk Management: A History*. Edited by Field, P. Risk Books, 2003.

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