LES CAHIERS

Louis Bachelier

MEASURING COUNTERPARTY RISK IN DERIVATIVES :

EXCHANGE OF VIEWS BETWEEN RESEARCHERS AND PROFESSIONALS

WITH

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EDITORIAL

Marie-Anne BARBAT-LAYANI

The French Banking Federation (FBF) was one of the first professional associations, in the framework of the Institut Europlace de Finance, to support Research Chairs dedicated to academic research on financial markets. The Chairs concerned are "Value chain, financial markets and investment banking", in partnership with the Institut d'Economie Industrielle (IDEI), "Innovations and regulation in investment banking", in collaboration with EDHEC Business School, and "Changing markets", in association with the Ecole Polytechnique and Evry University.

This initiative responds both to the leading role played by French banks in Europe in these market activities and to the international reputation of French research.

The various studies produced by the three FBF Chairs are all subject to discussion in workshops between academics and banking professionals. This dynamic creates the conditions for an indispensable dialogue between academic research and banking.

The financial crisis highlighted the importance of cleared and uncleared OTC derivatives markets, and their economic utility for companies and investors for controlling financing and investment risk in financial markets.

Pursuant to the G20 agreements, the European EMIR regulation on OTC-traded derivatives, central counterparties and trade repositories defines the rules and coverage levels for effectively managing operators' risk.

This issue of Cahiers provides an opportunity to reveal and present recent thinking by the FBF Chairs on counterparty risk, clearing houses and bank activity in relation to derivatives.

In it, you will find the answers developed by academic researchers in response to the following fundamental questions. How should risk in an interconnected financial system be effectively allocated? How should the cost of counterparty risk be evaluated for a member of a clearing house? How do margin calls act on the equilibrium price? How can counterparty risk on centrally uncleared OTC derivatives be reduced? In addition, this issue for the first time provides an opportunity for professionals to give their views as "practitioners", by examining risk modelling at LCH, one of the largest clearing houses in Europe.

These various questions are vital for safeguarding financial stability without stifling innovation.

Enjoy your reading!

Marie-Anne BARBAT-LAYANI
Chief Executive Officier of the French Banking Federation

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How should risk be effectively allocated in an interconnected financial system?

While the financial crisis has highlighted the risks of interdependencies between the multiple actors or components of the same system, models for measuring risk are mainly based on historical scenarios, especially in derivatives markets.

Key points

- Today, in practice, professionals rely solely on historical scenarios without sufficiently taking into account the dependency factors between the different players in an interconnected financial system.
- The "slices of cake" risk-sharing approach developed by the researchers is more relevant for members of an interconnected financial system.
- The interconnections between members of a clearing house should be taken into account in the distribution of guarantee funds between them.

Based on the paper *"Multivariate shortfall risk allocation and systemic risk"*, by Yannick Armenti, Stéphane Crépey, Samuel Drapeau and Antonis Papapantoleon, and on an interview with Stéphane Crépey.

The 2007 subprime crisis in the United States led the global economy and financial system into an unprecedented spiral. In particular it resulted in the bankruptcy in September 2008 of Lehman Brothers, one of the world's largest investment banks.

As well as causing market liquidity to dry up, Lehman's failure drew the attention of regulators to counterparty risk and, more generally, to the emergence of a potential systemic risk liable to undermine international finance.

Evolving regulation of derivatives

To avoid this nightmare scenario, the global financial authorities, through the G20 summit in Pittsburgh in September 2009, adopted new regulations, including one that aims to increase transparency in OTC-traded derivatives.

In Europe, these measures were embodied in EMIR (European Market Infrastructure Regulation), which came into force in August 2012. In addition to greater transparency imposed on derivatives contracts traded over the counter, this legislation requires the systematic use of central counterparty clearing for standardized derivatives.

In plain language, trading of these financial products has to pass through a central clearing house (CCP), which is responsible for managing counterparty risk between all the buyers and sellers that are members (banks, asset managers, hedge funds, etc.). Specifically, the CCP carries out daily margin calls based on the changing positions taken by its members. Furthermore, members of a CCP must deposit capital as security, that CCP can use in the event of default of one or more of its members.

> *The approach developed by the researchers measures the risk of cross-dependency between the members of a financial system*

Despite these changes, however, many issues remain. How can one measure overall systemic risk linked to the interdependence of actors? What is the risk of each member or component of an interconnected financial system? What solutions are there for regulators and the various actors of an interdependent system?

Stéphane Crépey

*Stéphane Crépey is professor at the mathematics department of University of Evry (France), head of probability and mathematical finance and head of the engineering and finance branch (M2IF) of the Paris-Saclay master program in financial mathematics. His research interests are counterparty and credit risk, enlargement of filtration, backward stochastic differential equations and numerical finance. He is the author of numerous research papers and two books: "*Financial Modeling: A Backward Stochastic Differential Equations Perspective" *(S. Crépey, Springer Finance Textbook Series, 2013) and* "Counterparty Risk and Funding, a Tale of Two Puzzles" *(S. Crépey, T. Bielecki and D. Brigo, Chapman & Hall/CRC Financial Mathematics Series, 2014).*

Methodology

Stéphane Crépey and his co-authors have extended to a multivariate framework the classical approach to risk measurement known as "Shortfall Risk". With this approach, the researchers are able to measure risk according to the dependency of each member belonging to an interconnected financial system. This model – which for the first time includes loss functions that are sensitive to the interdependence of the system – then gave rise to numerical schemes for measuring overall systemic risk and thus lead to concrete results.

A different approach to measuring risk

To answer these crucial questions, Stéphane Crépey and his co-authors have developed a new model for measuring financial risks. This includes mathematical loss functions, using a specific approach that involves calculating the allocation of risk between each member of an interconnected financial system, and then aggregating them. "In practice, risk measures are based on historical scenarios. We wanted to go further and develop a risk measure more in line with properties from the economic literature, such as convexity, diversification and dependence. Our approach thus allows us to obtain probability values that estimate the dependency between members of the same system," says Stéphane Crépey.

The researchers' other contribution is found in various numerical schemas that make the calculations easier. "The dependency parameter is usually not taken into account, because it makes the calculations more complex. Our approach is a response to this obstacle," Stéphane Crépey explains.

The inclusion of interconnections in CCP guarantee funds

Current European regulation (the Emir Directive) advocates that CCPs measure their risks in accordance with the relative exposure of their various members. In turn the calibration of guarantee funds is based on a scenario in which the two largest members of a CCP default. "Even though this regulation contains a systemic dimension, it is still based on historical scenarios and an arbitrary dimension of CCPs, which allocate the various parties' individual risk. The interconnection between members should be better taken into account in the allocation of guarantee funds among the members of a CCP," Stéphane Crépey suggests.

Cross-dependency risk is measurable

The approach developed by the researchers measures the risk of cross-dependency between the members of a financial system. This makes it possible to precisely calculate the capital contributions of each member in of a CCP guarantee fund. "For regulators, our approach offers a new rule to apply. They can, however, maintain the current regulation regarding the total amount of capital or margins that applies in a CCP or other interconnected financial systems, for example, a central bank and commercial banks, and apply our approach to determine the allocation of this total between the different components of the system", says Stéphane Crépey.

For professionals, the importance of risk allocation between different members or components of a system gives rise to two specific applications: "First, an asset manager can understand and assess the risk of each component of his portfolio. Second, if a manager needs to quickly liquidate a portfolio, he can eliminate as a priority the riskiest components, because our approach evaluates the sensitivities of a portfolio."

Find Stéphane Crépey's full article on www.louisbachelier.org

Evaluation of the cost of counterparty risk for a member of a clearing house

Since the 2007-09 financial crisis, regulators have encouraged financial actors to use clearing houses to implement their transactions in standardized over-the-counter derivatives. But is doing so more financially advantageous than bilateral operations?

Key points

- The mathematical structures of the equations are similar for bilateral transactions and centrally cleared transactions. The data sets are different, because of the differing network structures of these two types of operation.
- Capital contributions to a CCP default fund are more costly than margin deposits, because they represent a non-remunerated immobilization of capital for the members of a CCP and their shareholders.
- If the biases related to the netting of positions are ignored, the cost of CCP and bilateral trading becomes comparable.

Based on the paper "*Central clearing valuation adjustment*" by Yannick Armenti and Stéphane Crépey, and on an interview with Stéphane Crépey.

Although unfamiliar to the general public, central counterparty clearing houses (CCPs) have become more important in the financial markets in recent years. With centralized trading, a CCP intercedes between buyers and sellers for managing their counterparty risk. The goal is to reduce counterparty risk, which intensified after the collapse of Lehman Brothers in September 2008, and to increase transparency of operations with regard to the regulator. The Pittsburgh G20 summit in September 2009, relayed in Europe through the EU Emir regulation of August 2012, thus decided to gradually impose central clearing on standardized OTC derivatives (rate swaps, stock options, currencies, commodities, etc.).

However, a number of problems arise. Does central clearing bring the expected benefits? Is it more, or less, costly than bilateral operations? How do CCPs manage counterparty risk?

Reduced domino effects with a CCP

According to the regulators, there are various benefits from using a CCP. First, counterparty risk is lower than with the bilateral transactions, thereby helping to reduce default contagion between financial players. Next, centralized transactions are more transparent from the standpoint of the regulator (standardized contracts and centralized access to data if needed). This greater transparency, however, contrasts with the opacity felt by banks in the determination by the CCP of the guarantee fund. Finally, counterparty default is best managed through a CCP because it has several "safety cushions" and proven resolution strategies to secure the liquidation of its members.

> *A CCP has several "safety cushions" and proven resolution strategies to secure the liquidation of its members*

In fact, to manage counterparty risk, CCPs require financial

Stéphane Crépey

Methodology

Stéphane Crépey and his co-author incorporated the general principles of XVA analysis into a framework of centralized network transactions so as to apply it to a member of a clearing house (CCP). This step enabled them to obtain the three components of the cost of counterparty risk and its implications in terms of capital and financing costs for a member of a CCP. They then developed a simplified model in which they studied various scenarios investigated on the basis of Monte Carlo simulations.

guarantees from their members. First, members pay so-called variation margins (margin calls) to offset the daily (or longer term) changes in their open positions in the markets. Second, members must file so-called initial margins – also reassessed daily – serving as a bulwark against the depreciation of a member's portfolio during the few days between default and the liquidation of the portfolio. Third, members are required to contribute capital to the CCP's guarantee fund, which can be used to cover losses of a defaulting member if its own margins are insufficient. "The margins posted by a member can be mobilized only in the event of default by this member, whereas the guarantee fund may also cover the losses of a defaulting member through other non-defaulting members," Stéphane Crépey says.

The cost of counterparty risk in the context of centralized trading

Stéphane Crépey and his co-author are therefore interested in total cost (CCVA or "Central Clearing Valuation Adjustment") for a CCP trader member. The CCVA of a CCP member is decomposed as follows:

- CVA is the cost for a new member to again contribute to the guarantee fund if it is impacted by the other members' default.

The cost of capital is higher in CCPs than it appears at first sight, and ultimately approaches the capital cost of bilateral operations

- MVA is the cost of financing transactions financing costs, i.e. the cost to a member of having to raise the initial margins (the cost of variation margins being cleared by changes in the portfolio itself).

- KVA is the cost of capital placed in the CCP guarantee fund. In other words, this represents the immobilization of capital that is not remunerated to members of the CCP and their shareholders.

"From a practical standpoint, the problem lies in calculating these three components. We have developed a methodological framework to help banks calculate their CCVA. Strictly speaking, in the absence of approximation, such calculations can only be made if the members and the CCP itself collaborate, because only the CCP knows the positions of other members, which impact the default fund," Stéphane Crépey explains.

The high cost of contributions to a CCP guarantee fund

By comparing the costs of bilateral and CCP operations, the authors arrived at identical equation structures. After eliminating various biases, including the bias arising from the netting of positions, they even obtained quite similar orders of magnitude, despite the very different data resulting from the difference of networks between these two types of operation. The cost of capital is higher in CCPs than it appears at first sight, and ultimately approaches the capital cost of bilateral operations. "To promote CCPs, the regulators have required paltry amounts of regulatory capital for the players who use them. However, these amounts come on top of the capital contributions of the members to the guarantee fund. The latter represent a high cost, since they are not remunerated for members and their shareholders," Stéphane Crépey points out. "The benefits of using a CCP are not all that obvious, because there are a lot of constraints, such as the selection of members, rights of entry and the cost of capital. Otherwise the banks would have used them spontaneously before it became mandatory."

Find Stéphane Crépey's full article on www.louisbachelier.org

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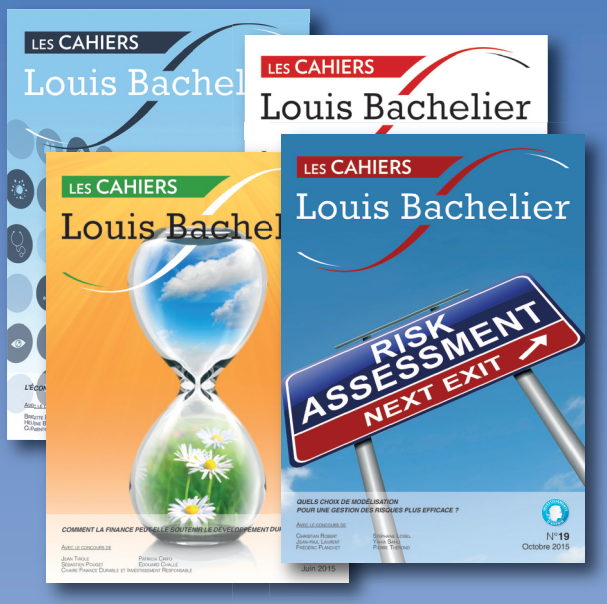

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How do margin calls act on equilibrium prices?

Although margin requirements for trading OTC derivatives have been widely reassessed by regulators since the financial crisis, these measures still need to be made fully effective to prevent further crashes.

Key points

- Margin calls on derivatives contracts (CDS, options, futures, etc.) reduce counterparty risk, in particular by mitigating problems of moral hazard. But they can also cause negative externalities of liquidation (fire-sales).
- Regulators should establish limits on aggregate positions taken by each institution on all derivatives, so as to limit moral hazard and the risk of contagion.

Based on the paper "*Optimal margins and equilibrium prices*" by Bruno Biais, Florian Heider and Marie Hoerova, and on an interview with Bruno Biais.

One of the main functions of financial markets is to allow their participants to share risks. But risk sharing is effective only if counterparties do not default, as the crisis of 2008 made abundantly clear.

At that time, the CDS (credit default swap) market amounted to $57,300 billion worldwide, according to the Bank for International Settlements.

Given these colossal amounts, especially the holding of hundreds of billions of dollars of CDS by certain institutions such as the US insurer AIG, uncertainties around counterparty risk in this derivatives asset class (and many others such as options, futures, etc.) caused panic in the financial markets.

To stabilize and increase the transparency of these derivatives, regulators have required additional guarantees, in particular by encouraging financial actors to make use of centralized clearing houses (CCPs). CCPs are responsible for insuring their members against counterparty risk. To implement this mission, they need to calculate and call margins.

Bruno Biais and co-authors are endeavouring to analyse the consequences of this mechanism, along with its costs and benefits, especially in terms of its capacity to reduce or mitigate financial crises.

Margin calls and CDS cover two distinct risks

If the economic mechanisms are more general, they can be illustrated in the case of the CDS market, a financial instrument providing protection against counterparty default

The role of margin calls is to reduce counterparty risk

Consider the example of a risk-averse holder of bonds issued by an Italian bank. He buys CDS from a trader (or investor) to hedge against the risk of default by the issuer. The contract between the two parties provides for the payment of an insurance premium by the bondholder in exchange for the (predefined) financial protection of the trader in the event of the Italian bank becoming insolvent. In this bilateral operation, margin calls are calculated regularly to reflect counterparty risk. In the event of bad news regarding the Italian bank, the protection seller's commitments would increase significantly. It is for this reason that the party who has purchased CDS requires greater margins from its counterparty. "In this example, the bondholder faces two risks: the failure of the underlying asset (the Italian bank) and counterparty risk in the event of

Bruno Biais

Bruno Biais holds a Ph.D. from HEC and is Professor at the Toulouse School of Economics (CRM/CNRS IDEI). His work, on market microstructure, corporate finance, asset pricing, experimental economics and contract theory, has been published in Econometrica, the Journal of Political Economy, the American Economic Review, the Review of Economic Studies, the Journal of Finance, the Journal of Financial Economics *and the* Review of Financial Studies*. He taught at HEC, CMU, LBS, Oxford, Imperial College and LSE. He has been a scientific adviser of Euronext, the NYSE, the AMF and the Bank of England and steers the FBF IDEI research chair on investment banking and financial markets. He received the CNRS bronze medal and is a Fellow of the Econometric Society and the Finance Theory Group. He is president of the Society for Experimental Finance. He has been editor of the* Review of Economic Studies *and is co-editor of the* Journal of Finance*. Bruno Biais was awarded a senior ERC grant for his research project* "Trading and Post Trading."

Methodology

The ground-breaking methodological contribution of this research paper is to study the equilibrium of a market in which the contracts traded are optimally designed by buyers and sellers. The parties thus define an optimal contract from a private standpoint, especially as regards margin calls. The integration of this bilateral interaction into a market equilibrium revealed negative externalities. The authors make recommendations for regulators so that these externalities can be corrected.

default by the protection seller. CDS cover the first risk, while margin calls protect against the second," Bruno Biais explains.

The benefits and costs of margin calls

The role of margin calls is to reduce counterparty risk. For regulators, this is an argument in favour of CCPs, which manage margin calls.

To return to the previous example, if the protection provider (the trader) has sold a large number of CDS to hedge against the failure of the Italian bank, and the bank then finds itself in difficulty, the liabilities of the investor increase with regard the insured. This may be viewed as a kind of (off balance sheet) debt for the CDS seller. In this context a moral hazard problem may arise. While the CDS buyer can accurately observe all actions on the part of the CDS seller, the high indebtedness of the latter may induce him to take excessive risks.

> *Margin calls can have ambiguous effects on the markets, because they provoke negative externalities of liquidation*

Margin calls can mitigate this problem. To meet the margin call, the CDS seller must liquidate some of his positions, so as to deposit safe and liquid assets on his margin account. This reduces its ability to take excessive risks.

But these margin calls have disadvantages as well as advantages, since they may trigger a negative spiral. "If the protection seller has to sell many assets quickly to meet the margin requirements of his counterparties, this can lead to a fall in asset prices in markets. Margin calls can have ambiguous effects on the markets, because they provoke negative externalities of liquidation," Bruno Biais says.

Between equilibrium and optimum

Having noted these negative externalities, the researchers analysed the differences between equilibrium and optimum. "Market equilibrium is not a Pareto optimum, because of these negative externalities. Indeed, when a CDS seller disposes of assets, their prices fall, affecting other financial actors. To correct these market imperfections, regulators must provide solutions. In particular they could establish aggregated position limits for CDS sellers. This measure would reduce moral hazard and the risk of contagion," Bruno Biais suggests.

Find Bruno Biais's full article on www.louisbachelier.org

LCH: a risk management framework constantly evolving

Following the financial crisis of 2007-09, clearing houses (CCPs) have played a more important role in financial markets for the management of counterparty risk.

To see more clearly how CCPs function, Mohamed Selmi, head of methodology and risk modelling at LCH, one of Europe's major players in this area, and his deputy Julien Dosseur Dutouquet, answered questions put by ILB at the company's offices in Paris.

How do CCPs in general and LCH in particular operate?

The role of these players is to clear cash, derivatives and "vanilla" products in various asset classes. Specifically, a CCP intercedes between the two parties to the transaction. In other words, the members of a CCP outsource counterparty risk to the CCP, in contrast to transactions that are not centrally cleared, where the parties themselves bear the counterparty risk. In the default event of one of our members, we honour the successful completion of the transactions for non-defaulting members and thus ensure the continuity of financial markets. The defaulter's portfolio is cleared by the CCP through its margin deposits and default fund contribution.

Can you tell us in more detail about the various deposit margins you require?

First of all there are initial margin deposits whose main objective is to capture market risk over the assumed holding period in the event of liquidation of the portfolio. Initial margins are computed and called at least on a daily basis by our risk and operational teams. There are also additional margin deposits – which fall within the margin calls calculated several times a day – for managing, for example, market changes in portfolio assets, liquidity and concentration risk, the sovereign risk, credit risk and wrong way risk.

How about your guarantee fund?

As well as various individual margins, our guarantee fund, fed by our members, allows counterparty risk to be pooled. This fund is calibrated on extreme events, which may be historical, theoretical and ad hoc. Its role is to absorb the losses of a member if its margins are insufficient.

What method do you use to calculate members' contributions to the guarantee fund?

The EMIR Directive imposes the "cover two" rule. In other words, the guarantee fund must cover the default of the largest member of the CCP or the joint default of the second and third members. At LCH, we decided to be more conservative: our guarantee fund covers the simultaneous default of the two largest members of each asset class.

So what is your loss allocation procedure?

In the event of default by a member, we liquidate its portfolio within the time constraints we lay down in our models that are calibrated assuming a maximum holding period. If ever the margins of the defaulting member do not offset its losses, we take its contribution to the guarantee fund.

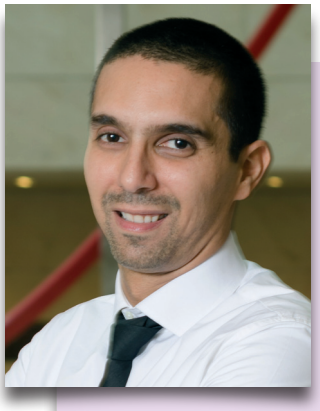
If this cushion is still not enough, LCH's capital is made available to the guarantee fund before calling on the contributions of other, non-defaulting members. This alignment of interests thus allows us to eliminate moral hazard. The contributions of other members to the guarantee fund are then called upon if the previously mentioned three tools do not allow us to absorb the losses of the defaulting member. We can also ask our members for further contributions to the guarantee fund, if necessary.

However, we have never needed to call on non-defaulting members' contributions to the guarantee fund. The losses of a defaulting member have always been cleared through its assets.

Lastly, our organization is based on a separation of departments between asset classes (repo, equities and listed derivatives, CDS, commodities, interest rate swaps, FX, etc.), each of which have their own margins and guarantee funds. Thus the contributions of members working on CDS, for example, cannot be taken to clear the losses of a member operating in equities and derivatives. In the case of a defaulting member with assets in several departments, its excess margins in one of the markets can be used to absorb the residual losses in another.

How are your members selected?

We have a team that analyses our members' credit with specific ratings. These ratings allow us to develop criteria for selec-



Mohamed Selmi

A graduate of ENSAE, HEC Paris and Master's II Statistics and Random Models at Jussieu, Mohamed Selmi is an expert in modelling market and counterparty risks in all asset classes.

A former invited speaker at ENSAE and HEC, he today heads the Risk Methodology team at LCH, responsible for the development and validation of market risk models.

He previously held positions modelling counterparty risk and then as head of the quantitative team in the CPM department in charge of CDS hedging at Société Générale.

Julien Dosseur Dutouquet

A graduate of EIVP, ESCP Europe and Pierre et Marie Curie University, Julien Dosseur is an expert in quantitative analysis and management of various financial risks (market, counterparty, liquidity) across all asset classes.

He has been working within LCH for the last five years, and is currently deputy head of Risk Methodology team, where he is involved in developing different risk models used for margin calculations.

Previously, following positions at State Street Global Advisor and Citi Group on interest rate products, currency products and credit products, Julien worked for a small firm specializing in risk analysis of structured products and consultancy in hedging complex portfolios.

ting our membership. If the credit quality of one member deteriorates, then he may be called for ad hoc margins.

What types of internal tests do you carry out?

We have a battery of internal tests, with different intervals (daily, weekly, monthly), for assessing the robustness and performance of our models. Backtests on portfolios are carried out daily using historical databases. Doing so enables us to check whether our margins have been adequate in the preceding months. If not, we can adjust our modelling. We also implement sensitivity tests on the parameters of our models. In addition, we carry out reverse stress tests every day to analyse our models under extreme scenarios, such as market shocks or the simultaneous failure of several members, which might exhaust our guarantee fund. Lastly, our various models have to be audited independently at least once a year and are submitted to the regulators.

What were the results of the stress tests on 17 European CCPs published in late April by ESMA, the European regulator?

Overall, the results are very satisfactory and demonstrate CCP resilience in Europe. The most catastrophic scenario involved the failure of 32 members in Europe and extreme market shocks. Under these assumptions, the losses amounted to four billion euros in excess of the CCPs' margins and guarantee funds. This scenario was considered implausible by ESMA.

In conclusion, how do you handle issues related to market procyclicality?

This is a thorny issue, because when markets are quiet, volatility is low, which automatically reduces margin deposits. When markets are volatile, the opposite occurs, with an increase in margin deposits. In the latter case, by depositing additional margins, members may be subject to a decline in their liquidity. In our internal policy, we take these aspects into account – particularly in having margin "cushions" to absorb some of the volatility – so as to minimize the phenomenon of procyclicality. The objective here is to prevent contagion effects. However, regulation does not yet provide a measure of harmonized procyclicality between different CCPs. This question is currently being addressed.

Find Mohamed Selmi and Julien Dosseur Dutouquet's full interview on www.louisbachelier.org

How can counterparty risk be reduced for non-centrally cleared OTC derivatives?

The financial crisis has placed a spotlight on the importance of counterparty risk in OTC derivative markets, and especially those contracts that are not centrally cleared. This market will very shortly become subject to new regulations which will require additional capital, known as initial margin, in order to reduce systemic counterparty risk.

Key points

- The standardised initial margin approach for calculating initial margin fails to take into account diversification or product sensitivity and cannot be recommended.
- The initial margin model approach does account for diversification and sensitivity. However if each counterparty uses its own model, this may lead to disputes if different collateral amounts are computed.
- The approval and market-wide adoption of an initial margin model such as the one proposed by the ISDA would eliminate the risk of dispute.

We discussed the paper "*Initial margin for non-cleared OTC derivatives*" with the author, Dominic O'Kane.,

The events of September 2008 highlighted the fact that the balance sheets of major dealer banks are linked via hundreds of thousands of OTC derivatives – i.e. contracts that are traded bilaterally and not via a central exchange. The fear was that these contracts created a mechanism for losses to percolate through the financial system. This led regulators to seek to reduce this risk.

International regulators, through the G20 summit in Pittsburgh in September 2009, adopted measures to reduce the risks associated with OTC-traded derivatives. "Since the financial crisis, the OTC derivatives market has increasingly divided into two parts. The first involves standardized derivatives traded through well-capitalised central counterparties that manage counterparty risk by requiring initial and variation margin. The second category are OTC derivatives that, due to their lack of standardization, are not centrally cleared which until now have just been subject to variation margin. My study describes the new regulations and analyses the different proposed ways of calculating initial margin," said Dominic O'Kane.

Reassessed security requirements

To reduce the counterparty risk of OTC derivatives that are not centrally cleared, the regulators decided to call for the enforcement of stricter margin requirements. The first type, called "variation margin", existed before the crisis. The new rules have simply tightened up the posting frequency and the type of collateral that can be used for variation margin. The second type, called "initial margin" is new to OTC derivative markets and must be progressively introduced from September 2016.

"There is a fundamental difference between variation margin and initial margin. Variation margins protect a counterparty against an immediate loss on a portfolio of derivative contracts when the other counterparty defaults. The variation margin amount that must be transferred is simply the value of the positions between the two parties, which is calculated daily, and is posted from the out-of-the-money party to the in-the-money party" says Dominic O'Kane. "Initial margin is different. It protects both parties from losses that could occur between the counterparty default and the replacement of positions in the event of either counter-

Dominic O'Kane

Dr O'Kane is an Affiliate Professor of Finance at the EDHEC Business School in Nice where he specialises in derivative valuation and market regulation. He has taught at the Oxford University, the London Business School and at Yale University. Prior to joining EDHEC he was Head of Quantitative Research at Lehman Brothers in London which he left in 2006. He has published widely in academic journals and wrote "Modelling Single and Multiname Credit Derivatives" *which was published by Wiley Finance in 2008. Dr O'Kane has a doctorate in theoretical physics from Oxford University.*

Methodology

After summarizing and explaining the regulations in force in markets for non-centrally cleared OTC derivatives, Dominic O'Kane examined the initial margin approach based on the standardized scale. He then examined the calibration of the full initial margin model based on the criteria developed by the WGMR across equity, currency, interest rate and credit markets.

party defaulting. Also, since this loss can affect either counterparty, the initial margin exchange must be two-way. The collateral posted as variation margin can be reused, however the collateral exchanged as initial margin cannot. Initial margin therefore reduces liquidity by removing collateral from the market.

The size of the loss covered by initial margin cannot be known in advance. It depends on various factors, in particular the market sensitivity of the underlying instruments and market volatility over the period after a counterparty default." Defining a methodology for computing initial margin is a task that has been taken on by regulators.

Models for calculating initial margins

The Basel Committee on Banking Supervision and the International Organization of Securities Commissions (IOSCO) have formed a Working Group on Margin Requirements (WGMR). Its objective includes defining methods for calculating initial margin.

After consideration, the WGMR adopted two distinct approaches. The first is based on a standardized scale. After studying it, Dominic O'Kane noted that it "does not reflect the diversification of transactions and does not effectively address the specific case of options. For a typical portfolio, the amounts of initial margins are too high and are weakly correlated with the risks covered," he emphasizes.

> *Initial margin is an important change for the non-cleared OTC derivatives that must be progressively introduced from September 2016*

The second approach, allows the initial margin to be calculated using a quantitative model that meets the criteria imposed by the WGMR which states that initial margins should correspond to a one-sided confidence interval of 99% over a period of 10 days. "This approach is preferable as it is able to reflect the diversification of the transactions, including products such as options." said Dominic O'Kane. However he noted that "since the WGMR has not tightly defined the full model, each counterparty can create his own model, and so to minimise the risk of disputes, counterparties are required to introduce dispute resolution protocols."

A standard model defined by ISDA

This is one reason why the International Swaps and Derivatives Association (ISDA) has developed its own initial margin model. This could become the market standard if approved by national regulators. "The model is consistent with the methodology proposed by the WGMR. It is broad, because it includes the risks of equities, currencies, interest rates and credit. It is fairly easy to implement, and fast to calculate, which is important if the initial margin has to be calculated daily. Indeed their approach would make it possible to calculate initial margin in real time," says Dominic O'Kane, which may not be possible with other simulation-based approaches.

Find Dominic O'Kane's full article on www.louisbachelier.org

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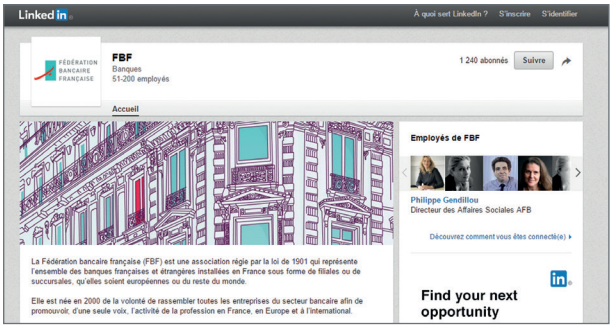

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