Large Portfolio, Concentration and Granularity

AXA
25, Avenue Matignon
75008 Paris, France

March, 15-16, 2010

Preliminary Program

Organizers : Patrick Gagliardini (SFI and University of Lugano)
Christian Gouriéroux (CREST and University of Toronto)
Jean-Michel Zakoïan (CREST and University of Lille 3)

March 15, 2010

8h30-9h Registration

9h-9h15 Opening Session

9h15-10h45 ***Session 1: Loss Given Default***
Chairman: C. Gourieroux (CREST and University of Toronto)

Pricing CDOs with State Dependent Stochastic Recovery Rates
JP. Laurent (ISFA Actuarial School, University Lyon 1), S. Amraoui (BNP-Paribas), L. Cousot (BNP-Paribas), S. Hitier (BNP-Paribas)
Discussant: J.D. Fermanian (CREST)

Loss Distributions Conditional on Defaults
D. Tasche (Lloyds TSB Bank)
Discussant: M. Briere (Amundi and Free Brussels University)

10h45-11h15 Tea/Coffee

11h15-12h45 ***Session 2: Concentration Risk***
Chairman: M. Billio (University of Venice)

Sector Concentration Risk in SME Credit Portfolios : A Multifactor Approach
M. Dietsch (University of Strasbourg), J. Petey (University of Strasbourg)
Discussant: J.S. Mesonnier (French Central Bank)

Accounting for Guarantees within the Granularity Adjustment for Basel II
E. Lütkebohmert (University of Bonn), S. Ebert (University of Bonn)
Discussant: J. Petey (University of Strasbourg)

12h45-14h Lunch

14h-15h30 ***Session 3: Mark-to-Market Credit Risk Models***
Chairman: A. Monfort (CREST, University of Maastricht and French Central Bank)

Granularity Adjustment for Mark-to-Market Credit Risk Models
M. Gordy and J. Marrone (Federal Reserve, Washington)
Discussant: S. Darolles (Lyxor AM and CREST)

Estimation Adjusted VaR
C. Gourieroux (CREST and University of Toronto), *J.M. Zakoïan (CREST)*
Discussant: C.Y. Robert (CREST)

15h30-15h45 Tea/Coffee

15h45-17h15 ***Session 4 : Factor Analysis***
Chairman: J.M. Zakoïan (CREST and University of Lille 3)

Measuring Systemic Risk in the Hedge Fund, Finance and Insurance Sectors
M. Billio (University of Venice), M. Getmanski (University of Massachusetts), A. Lo (MIT), L. Pelizzon (University of Venice)
Discussant: A. 'Monfort CREST, University of Maastricht and French Central Bank)

Multi-Moment Component Analysis: An Illustration with International Assets
E. Jondeau (Swiss Finance Institute and University of Lausanne), E. Jurczenko (ESCP Europe), *M. Rockinger (CREST, SFI and University of Lausanne)*
Discussant: F. Pegoraro (French Central Bank)

17h30-18h30 **Panel Session: Risk Models in Insurance and Finance: What Might be the Differences** ?
Chair: TBA
Participants : O. Toutain (Moody's), F. Robinet * (AXA), M. Atig (Direction Générale du Trésor et de la Politique Economique, Assur2), M. Gordy (Federal Reserve,Washington), C. Gollier (Toulouse School of Economics).

March 16, 2010

9h-10h30 ***Session 5: Granularity and Risk Measures***
Chairman: B. Bourgeois (GRM AXA)

Granularity Adjustment in Dynamic Multiple Factor Models:Systematic vs. Unsystematic Risk
P. Gagliardini (SFI and University of Lugano), C. Gourieroux (CREST and University of Toronto)
Discussant: A.Charpentier (University Rennes 1 and CREST)

Risk Measures, Granularity Adjustments, and Local Utility
A.Galichon (Ecole Polytechnique)
Discussant: J. Pinquet (University Paris 10 and Ecole Polytechnique)

10h30-10h45 Tea/Coffee

10h45-11h30 ***Session 6: Pricing CDO's***
Chairman: A. Galichon (Ecole Polytechnique)

Optimal Securitization with Heterogeneous Buyers
S. Malamud (SFI and EPF Lausanne), A. Whinston, and H. Rui (University of Texas at Austin)
Discussant: P. Gagliardini (SFI and University of Lugano)

11h30-11h45 Closing session

*To be confirmed

ABSTRACTs

Amraoui S., Cousot L., Hitier S., and **Laurent J.P. -** *"Pricing CDOs with State Dependent Stochastic Recovery Rates"*

Up to the 2007 crisis, research within bottom-up CDO models mainly concentrated on the dependence between defaults. However, due to the substantial increase in the market price of systemic credit risk protection, more attention has been paid to recovery rate assumptions. In this paper, we focus first on deterministic recovery rates in a factor copula framework. We use stochastic orders theory to assess the impact of a recovery markdown on CDOs and show that it leads to an increase of the expected loss on senior tranches, even though the expected loss on the portfolio is kept fixed. This result applies to a wide range of latent factor models. We then suggest introducing stochastic recovery rates in such a way that the conditional on the factor expected loss (or equivalently the large portfolio approximation) is the same as in the recovery markdown case. However, granular portfolios behave differently. We show that a markdown is associated with riskier portfolios that when using the stochastic recovery rate framework. As a consequence, the expected loss on a senior tranche is larger in the former case, whatever the attachment point. We also deal with implementation and numerical issues related to the pricing of CDOs within the stochastic recovery rate framework. Due to differences across names regarding the conditional (on the factor) losses given default, the standard recursion approach becomes problematic. We suggest approximating the conditional on the factor loss distributions, through expansions around some base distribution. Finally, we show that the independence and comonotonic cases provide some easy to compute bounds on expected losses of senior or equity tranches.

Dietsch M., and Petey J.– *"Sector concentration risk in SME credit portfolios : A multifactor approach"*

In large portfolios of small and medium-sized businesses (SME), which are highly granular, concentration risk arises from correlated defaults among groups of borrowers. Consequently, measurement of concentration risk needs to take into account borrowers' heterogeneity. One way to proceed is to extend the standard asymptotic single factor framework by introducing additional factors of systematic risk varying between groups of borrowers. Using a generalized linear mixed model, the paper extends the standard one factor credit risk model to the multi-factor framework taking into account industry effects. The paper uses a large database containing ratings history of more than 600.000 French SME over the 1999-2008 period. Results show that the standard one factor model and the IRB regulatory formula largely fail capturing potential risk concentration. Moreover, loans to the real estate industry may be a first order determinant of concentration risk, even when considering loans to small and very small businesses.

Ebert S., and **Lütkebohmert E.** – *"Accounting for Guarantees within the Granularity Adjustment for Basel II"*

The credit value-at-risk model, that underpins the Internal Ratings-Based (IRB) risk weights of Basel II, assumes that idiosyncratic risk in a portfolio has been fully diversified away so that economic capital depends only on systematic risk. The impact of undiversified idiosyncratic risk on portfolio VaR can be assessed via a methodology known as granularity adjustment (GA). It is derived as a first-order asymptotic approximation for the effect of diversification in large portfolios within the CreditRisk+ model of portfolio credit risk. In this paper we extend previous results to account for guarantees and double default effects within a portfolio. Within such a general setting we derive an analytic formula for the GA. The data inputs to our general GA are drawn from quantities already required for the calculation of IRB capital charges and reserve requirements. Finally, we present

results on the performance of our new formula. In particular, we study the impact of guarantees and counterparty risk on economic capital and on risk weighted assets in Basel II.

Gagliardini P. and Gourieroux C. - *Granularity Adjustment in Dynamic Multiple Factor Models:Systematic vs. Unsystematic Risk*

The granularity principle [Gordy (2003)] allows for closed form expressions of the risk measures of a large portfolio at order $1/n$, where n is the portfolio size. The granularity principle yields a decomposition of such risk measures that highlights the different effects of systematic and unsystematic risks. This paper provides the granularity adjustment of the Value-at-Risk (VaR) for both static and dynamic risk factor models. The systematic factor can be multidimensional. The technology is illustrated by several examples, such as the stochastic drift and volatility model, or the model for joint analysis of default and loss given default.

Gordy M., and Marrone J. – *"Granularity Adjustment for Mark-to-Market Credit Risk Models"*

In principle, granularity adjustment (GA) can be applied to any risk-factor model of portfolio credit risk. Thus far, however, analytical results have been derived only for simple models of actuarial loss, i.e., credit loss due to default. The implicit view in the literature appears to be that the GA would be tedious to derive, or perhaps even intractable, for the more complicated models of mark-to-market credit loss. Large banks typically model credit loss in market value terms, and even the model underpinning the IRB approach of Basel II is in this advanced class.
In this paper, we demonstrate that the GA is in fact entirely tractable for single-factor versions of a large class of models that includes all the commonly used mark-to-market approaches. Our approach covers both finite ratings-based models and models with a continuum of obligor states. We apply our methodology to CreditMetrics and KMV Portfolio Manager, as these are the benchmark models for the finite and continuous classes, respectively. As an application, we explore comparative statics of the GA with respect to model parameters in CreditMetrics.

Gouriéroux C., and **Zakoian J.M.** « *Estimation adjusted VaR* »

Standard risk measures, such as the Value-at-Risk (VaR) or the Expected Shortfall, in dynamic parametric models are subject to estimation uncertainty. Replacing, in the theoretical formulas, the true parameter value by an estimator based on n observations of the Profit and Loss variable, induces an asymptotic bias of order 1/n in the coverage probabilities. This paper shows how to correct for this effect by introducing a new estimator of the VaR, the estimation adjusted VaR. The estimator is derived for a general parametric dynamic model and is particularized for important subclasses. In particular it can be easily implemented for volatility models.

Jondeau E., Jurczenko E., and **Rockinger M.** – *"Multi-Moment Component Analysis: An Illustration with International Assets"*

We use a recent statistical technique which extends the logic behind Principal Component Analysis to higher moments such as skewness and kurtosis. This method leads to a parsimonious description of the container for higher co-moments - a tensor - and allows the clustering of assets with similar statistical properties. Factors may be constructed with whose weights are obtained from the orthogonal matrix resulting from an alternating least squares algorithm which decomposes tensors. Those portfolios have interesting interpretations, for instance as hedges against increases of volatility among certain assets. Our empirical analysis involves 37 international stock indices sampled at weekly frequency for a total

of 736 observations. This method appears to have great potential for the construction of large portfolios involving higher moments.

Tasche D. – "*Loss Distributions conditional on defaults*"

The impact of default events on the loss distribution of a credit portfolio can be assessed by determining the loss distribution conditional on these events. While it is conceptually easy to estimate loss distributions conditional on default events by means of Monte Carlo simulation, it becomes impractical for two or more simultaneous defaults as the conditioning event is extremely rare. We provide an analytical approach to the calculation of the conditional loss distribution for the CreditRisk+ portfolio model with independent random loss given default distributions. The analytical solution for this case can be used to study the properties of the conditional loss distributions and to discuss how they relate to the identification of risk concentrations.

Malamud S., Whinston A., and Rui H. – *"Optimal Securitization with Heterogeneous Buyers"*

We solve the problem of optimal securitization for an issuer facing heterogeneous investors with arbitrary time and risk preferences. We show that the optimal securitization is characterized by multiple nonlinear tranches, and each investor gets a portfolio of these tranches. In particular, when all agents have CARA utilities, the linear tranching is optimal, with the number of tranches being less than or equal to the number of investors. To the best of our knowledge, this is the first model in the literature that explains the appearance of multiple tranches in the security design and the relation of the tranche thresholds to microeconomic characteristics. We show that the boundaries of the tranches can be efficiently calculated through a fixed point of a contraction mapping, and we develop new powerful techniques that are generally applicable for numerical calculation of constrained Pareto-efficient allocations. We use these contraction mapping techniques to derive a number of comparative static results for optimal securitization. The model generates theoretical predictions and numerical simulations that agree with several recent empirical findings concerning the CDO structure.