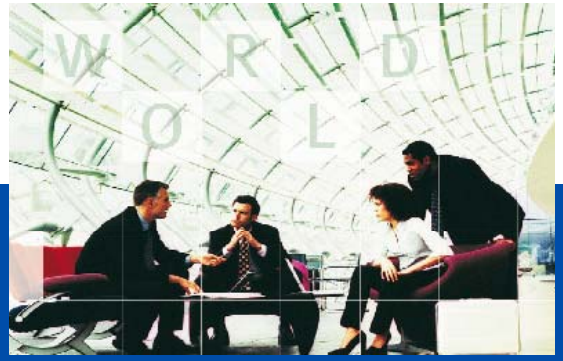

ASTIN Helsinky, June 2009

Jean-Francois Decroocq / Frédéric Planchet

Euler Hermes **Winter & Associés**

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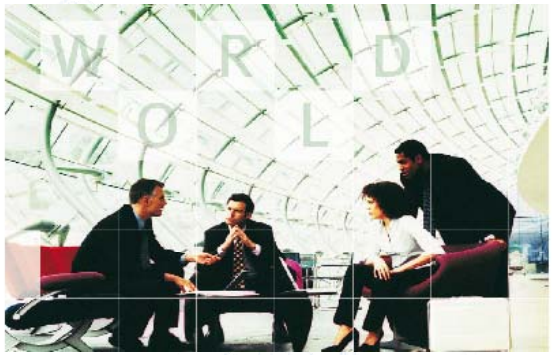
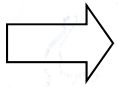


MODELING CREDIT INSURANCE

A company of Allianz

- Credit insurance has some specificities
- Most Existing model derived from banks and not specific

- Nature of Risk is Credit
- Management of Risk is insurance



Risk is mitigated to let only acceptable risk to the company

- This paper is an approach to identify the main specificities for Credit insurance modeling and possible solutions

As an introduction lets review some differences with typical financial product

Credit Insurance

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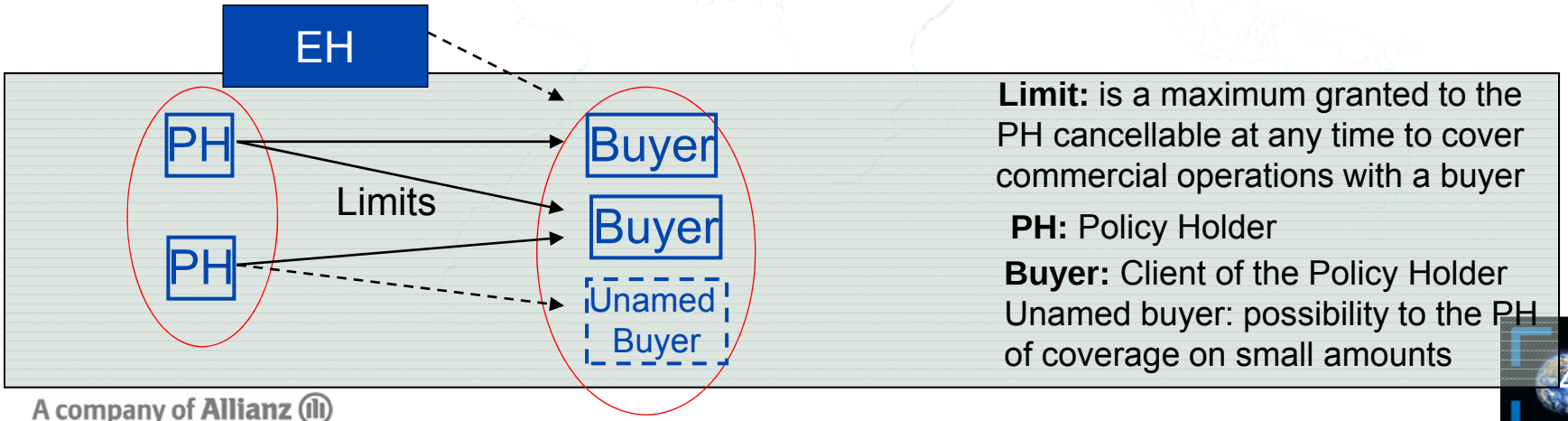
- Short-term tenor of underlying credit risk.
- Credit hierarchy 'privileging' suppliers' credit and related credit insurance cover in the event of an insolvency.
- Highly flexible portfolio and risk management addressing credit migration at short notice.
- Widespread introduction of deductibles and franchises and other insurance policy provisions further mitigates risk.
- Maximum annual indemnification strictly capping insurers' liability.
- Proprietary know-how and risk information databases with in-depth receivables mgt and industry sector know-how with professional U/W.



Limit: is a maximum granted to the PH cancellable at any time to cover commercial operations with a buyer

PH: Policy Holder

Buyer: Client of the Policy Holder
Unamed buyer: possibility to the PH of coverage on small amounts

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Credit Default Swap

- ISDA Master Agreement as basis & confirmation (highly standardised for single names)
- tradable
- reference entity (no relation to specific transaction)
- predominantly US and UK law
- Payment following evidence of credit event (materiality clause no longer practice)
- Future payment and price know at inception
- Maturity 3/5 years under market price changes

Credit Insurance

- No standard wording, depending on local jurisdiction
- illiquid
- insurance on specific delivery of goods
- insured determines jurisdiction
- Payment only upon evidence of loss provided by insured
- Amount covered and price not known at inception
- All coverage can be canceled at short maturity

Cover individual solvency evolution

Cover default – non default situtation

CDS is not insurance

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A credit derivative, like credit insurance, is a contract that is designed to transfer credit risk from one party to another. Despite their similarity of purpose, a credit derivative differs from an insurance:

Utmost good faith. In an insurance contract, both parties are subject to a duty of 'utmost good faith' that requires pre-contractual disclosure of all facts material to the risk being insured. Under a derivatives contract, by contrast, the terms are *caveat emptor* (let the buyer beware).

Insurable interest. Insurance policies indemnify the insured against its losses following an event. For the transaction to be a valid insurance contract under English law, the insured must have an economic exposure to the event ('insurable interest'). For some credit derivatives, it would be possible to show that the protection buyer has such an interest. In other cases, however, the protection buyer may have no insurable interest.

In Addition:

- Future amount of payment is known at inception
- Protection buyer does not need to hold the asset
- Protection buyer does not need to have a loss to get compensated
- Standardized documentation (ISDA) vs. tailor made insurance contracts
- Evidence of loss is based on publicly available data (no proof of loss from protection buyer)

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MODELING CREDIT INSURANCE

Modeling insurance contracts

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The triangle relation: credit insurer - policy holder (PH) - buyer

Special parameters are named only per contract with a policy holder, whereas the same buyer can appear in different contracts

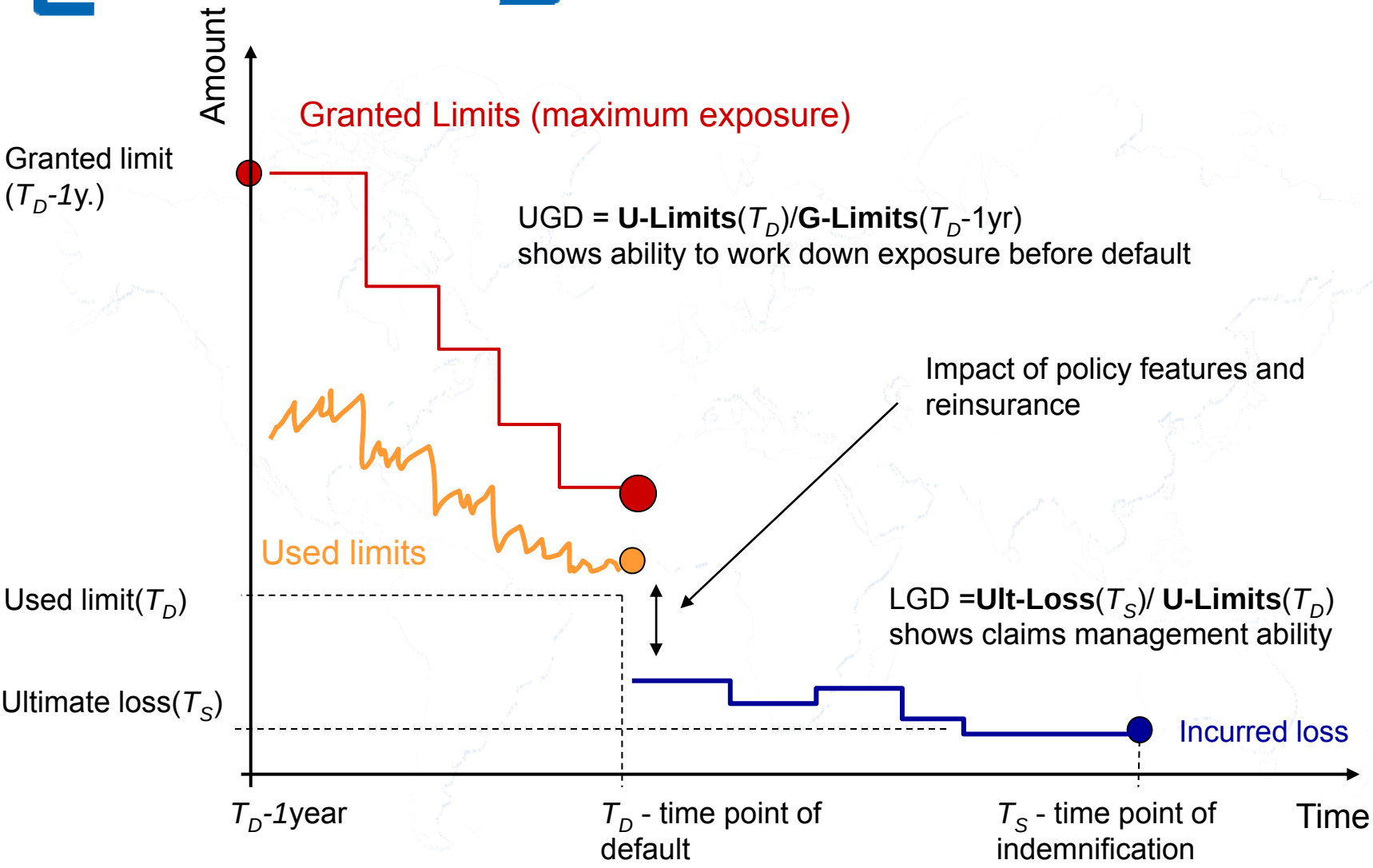
Limits granted under credit insurance are maximum coverage and doesn't give the real use

Credit limits granted can be reduced or cancelled any time in case of deterioration of the creditworthiness of a buyer (based on credit actions)

Degree of loss mitigation is based on unique features of credit insurance:

* Two main types of collateral with non-proportional impact on ultimate loss:
  - contract measures such as self retention of PH, first losses, annual aggregates
  - reinsurance
* Recoveries from recollection mitigate losses proportionally

UGD / LGD
Limit to Loss



EXEMPLE : Maximum liability

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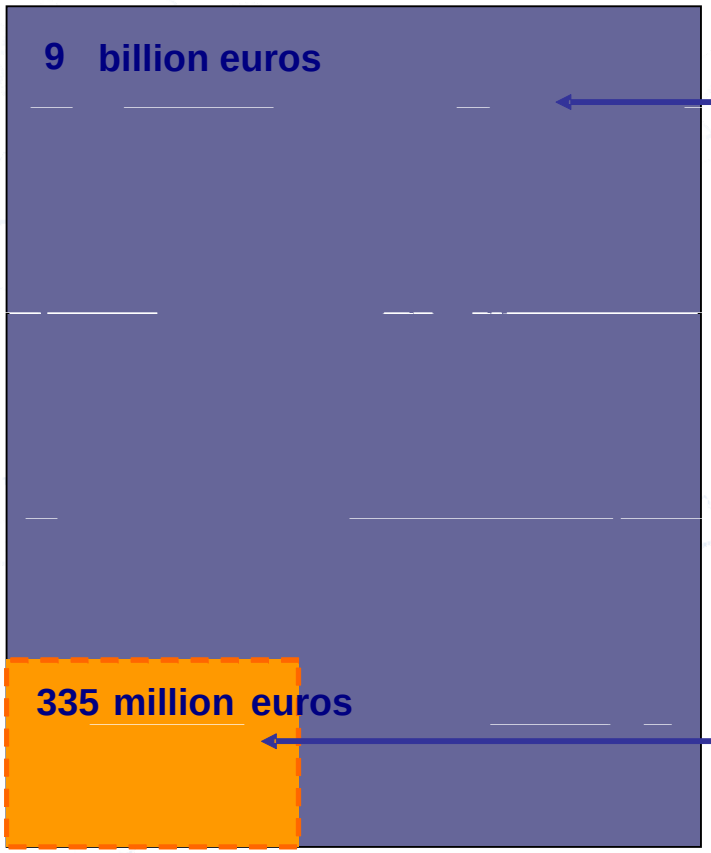
Policy includes a maximum indemnification which lead to reduce the liability of the insurer.



Bank commitment:
debtors are individually known and value at risk = commitment given

Credit insurance :
amount recomputed based on the turnover declaration, intercompany credit = 90 days

Credit insurance :
maximum liability clause = value at risk, impossible to list the debtors

Calculation of Expected Loss

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Estimation of the loss amount is given by:

EL = PD • Exposure • LGD

Despite similarity with Basle II, applied to credit insurance:

- **PD (default probability)**
  - **depends on the client's creditworthiness**
  - **expressed in the obligor rating**
  - **Depends on the contracts of insurance**
- **Exposure = EAD (exposure at default)**
  - **depends on limit, usage, product, maturity and PH features**
  - **estimated as limit * UGD (usage given default)**
  - **limit is a max and UGD a distribution**
  - **As policy features reinsurance reduces EAD**
- **LGD (loss given default)**
  - **depends on seniority, amount, quality of collateral & guarantees**
  - **estimated as 1- recoveries: e.g. p/h self retention, first losses & annual aggregates, recovery & reinsurance XL by calibration**

Expected Loss for credit risks

=

PD (%)

×

EAD (€)

×

LGD (%)

Modeling must be Specific

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The non-proportional impact of policy parameters

- maximum liability
- self retention
- Deductible
- annual aggregate
- recovery and salvages (capture in the LGD)

The non-proportional impact of reinsurance (XoL-policy)

Asset correlations not only derived from equity share price volatilities (KMV) but taking into account low correlation of small debtors portfolio

Calculate parameters to include unique mitigation technique of credit insurance

Correlation factors applied to credit insurance

Portfolio Model and Correlations

Credit Portfolio Risk

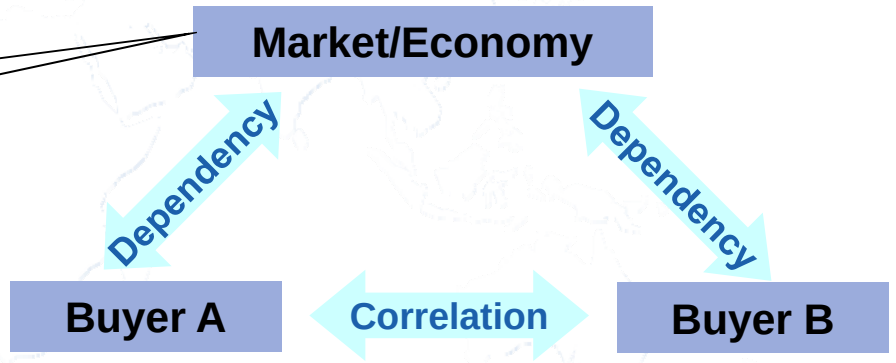
Diversification
Unexpected Loss (UL)
Credit VAR/ Economic Capital
Risk Contributions

Standalone
- Exposure-at-Default (EAD)
- Probability of Default (PD)
- Loss-Given-Default (LGD)

Expected Loss (EL)

Portfolio Effects
-Dependency
- Structure

Main Factors Of Portfolio Model,
Market Exposition (Company Size, Turnover)
- ***Industry***
- ***Country***



- **A Correlation Model needs:**
  - buyer specific information
  - sound statistical analysis on buyer's dependency to market/underlying drivers

- **Information is only partly available**
  - Currently only benchmarks from Banking business available and only limited information on buyer specifics

- **And Credit insurance shows specificities**
  - But, risk mitigants from credit insurance business have to be taken into account as exposure to correlation factor is partly mitigated by the internal process.

- **To go forward, on the simulation, 2 solutions:**
  - Short term: assumptions, guided by available information with KMV frame
  - Long term: further studies on underlying correlation and mitigation effects of credit insurance business

RISK MITIGATION IMPACT CORRELATION FACTORS EXPOSURE

- SOME CREDIT INSURANCE SPECIFICITIES
- A COVERAGE IS DELIVERED AFTER ANALYSIS OF THE DEBTOR
- COVERAGE IS SHORT TERM AND CAN BE CANCELLED AT ANY TIME
- POLICY FEATURES AND SELF RETENTION SHARE THE RISK
- MANAGEMENT CAN DECIDE TO REDUCE RISK FURTHER
- ORGANISATION OF RISK U/W:
- LOCAL COLLECT OF INFORMATION WITH RISK OFFICES
- DOUBLE REVIEW LOCALLY AND BY THE U/W
- STRONG MONITORING OF LARGE GROUP RISK AND INDUSTRY
- CLIENTS SCREENING:
- NEW CLIENT MUST PRESENT ACCEPTABLE RISK PROFILE
  CONTRACTS OF CLIENTS WITH BAD EXPERIENCE ARE CANCELLED
- AT RENEWAL POLICY PARAMETERS CAN BE CHANGED
- RECOVERY AND REINSURANCE AND
- RECOVERY CAN BE RELEVANT REDUCING THE ULTIMATE LOSS
- REINSURANCE COME AFTER U/W RISK MITIGATION AND RISK SHARING

PORTFOLIO OF CREDIT INSURANCE

- EXPOSURE CAN BE MODIFIED ON SHORT NOTICED
- CONTRACTS ARE RENEWED OR CAN BE CANCELLED EVERY YEAR
- REDUCTION OF COVERAGE HAVE EFFECT AFTER MONTHS ON L/R

- PORTFOGLIO CHARACTERISTICS
- PORTFOLIO INCLUDES MORE SMALL CAPS
- TRENDS OR INDUSTRY CHANGES ARE INCLUDED IN RISK ANALYSIS
- POLICY HOLDERS KEEP A PROPORTIONAL SELF RETENTION

- CREDIT INSURANCE COMPANIES
- COMPANIES OF CREDIT INSURANCE DON'T SHOW MORE FAILURES
- THEY HAVE BEEN RUNNING FOR ALMOST A CENTURY DESPITE CRISIS

One factor model Correlation

- Correlation for Credit insurance
- Using a one factor model as :

- ε_j being the idiosyncratic factor of the buyer j
- Z_j the solvency variable of the buyer j
- R the single systematic factor (representing the state of the economy)
- ρ_j the weight measuring the sensitivity of buyer j to the economy
- Then:

- $Z_j = \rho_j * R + \text{sqr root}(1 - \rho_j^2) * \varepsilon_j$
- If π_j is the given probability of default of j then buyer j is default when
- $Z_j < d_j$ with d_j defined as $P(Z_j < d_j) = \pi_j$

ρ is small for credit insurance using macro data still to be demonstrated

N- factors model definition and notation:

Label	Explanation
N	Set of systematic risk factors (countries, industries, etc.), $v \in N = \{1,\ldots,k\}$.
R	Systematic risk factor common to all abilities to pay. $R = (R_v)_{v \in N}$ is a random variable vector of size k which is distributed $N(0, \delta)$.
δ	Covariance matrix of R. $\delta = (\delta_{v_1,v_2})_{v_1 \in N, v_2 \in N}$ is a constant matrix of size $k \times k$ where $\delta_{v_1,v_2} = 0$ if $v_2 > v_1$.
w	Weights between abilities to pay and systematic risk factors. $w = (w_{j,v})_{j \in J, v \in N}$ is a constant matrix of size $n \times k$. $\forall j \in J,\ w_j = (w_{j,v})_{v \in N}$ is a constant vector of size k.
ε	Specific risk factor defined for each ability to pay. $\varepsilon = (\varepsilon_j)_{j \in J}$ is a random variable vector (independent) of size n which is distributed $N(0,1)$.
α	Adjustment factors (portions) for the combination of systematic and specific risk factors in a linear relation. $\alpha = (\alpha_j)_{j \in J}$ is a constant vector of size n.
r^2	Portions of buyer groups' abilities to pay variance due to the variance resulting from systematic risk factors in combination with their weights.

Credit Risk mitigation:

The risk explained by the factors and by the specific risk are weighted according to the r^2 to simulate the global risk of each buyer, which is defined as the share of the variance of the global risk by the factors model:

$$r_j^2 = \frac{Var\left(\alpha_j \cdot \left(w_j\right)^T \cdot R\right)}{Var\left(Z_j\right)}$$

This factor is calibrated to take into account the specificities of risk mitigation of Credit Insurance.

The global risk of a buyer is defined by:

$$\tilde{Z} = \tilde{w} \cdot \tilde{R} + \varepsilon$$

Conditional probability of default:

In a k-factors model, we define the composite factors of a company as a sum of industry and country indices:

$$\forall j \in J \qquad \rho_j = \sum_{\nu=1}^{k} w_{j,\nu} \times R_\nu$$

where $Z_j = \rho_j + \varepsilon_j$

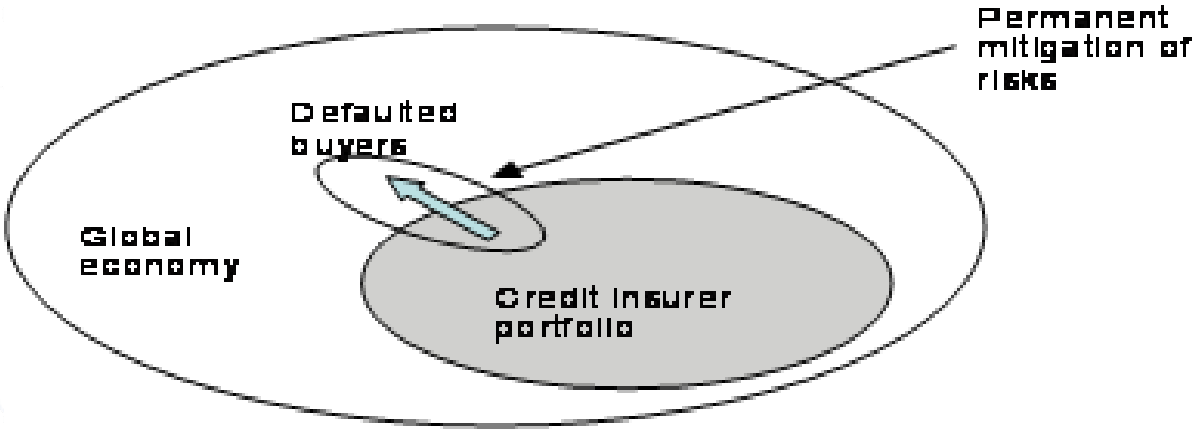
Then the conditional probability of default is given by:

$$\pi_j^C(\rho_j) = P(Z_j \le d_j \mid \rho_j) = \Phi\left(\frac{\Phi^{-1}(\pi) - r_j \rho_j^c}{\sqrt{1 - r_j^2}}\right)$$

where $\rho_j^c = \dfrac{\rho_j - E(\rho_j)}{\sigma(\rho_j)}$

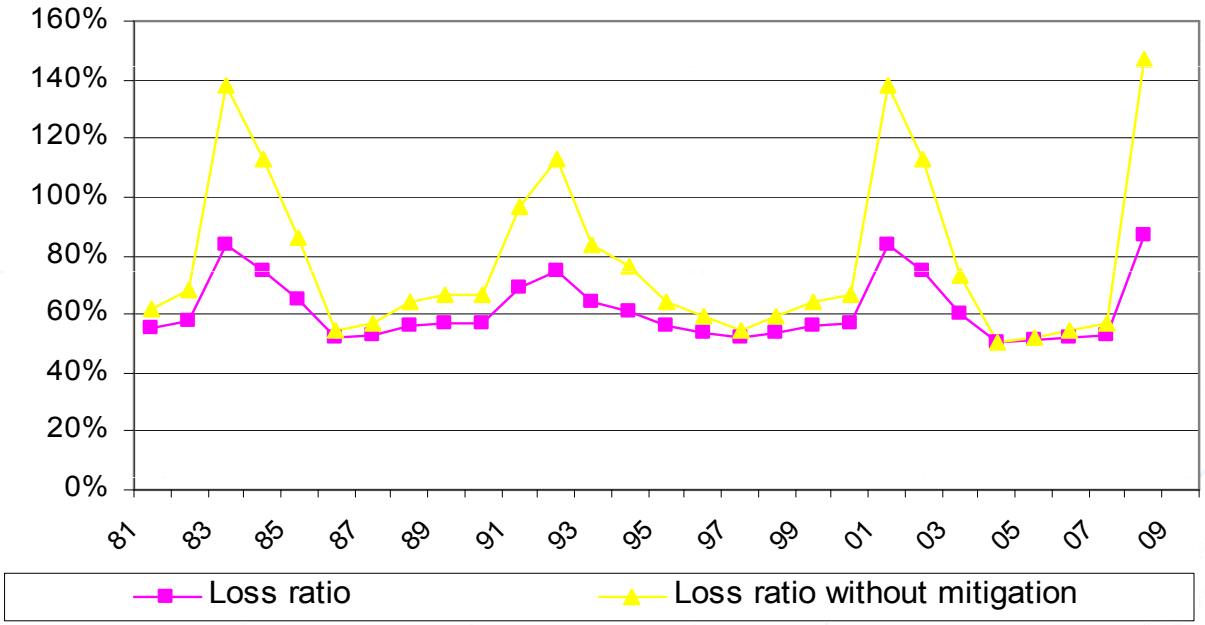
Most parameters of the probability of default can be influenced by credit insurance

Portfolio probability of default:



Over time the PD is influenced by the crisis and mitigation factors

Portfolio probability of default:



Losses for credit insurer are mitigated during crisis to reduce systemic risk transfer

What about the gaussian assumption ?

the model developed by KMV for credit insurance integrates thus approximately 120 factors in calculation on the part of systematic risk in the default probability of a buyer. To integrate as many factors with models using of the non Gaussian copulas seems for the moment out of reach. The correlation, with all the limits of this concept, remains a means accessible and simple to quantify the intensity and the direction of the link between the factors.

To circumvent the undervaluation induced by the choice of the Gaussian assumption, two approaches seem possible to us:

- To gauge the matrix of correlations to compensate for this effect by worsening the intensity of certain critical connections;
- To preserve the assumption of Gaussian dependence, but to use non Gaussian marginal laws for the factors (“NORTA method”).

But : the loss distribution becomes hard to compute

Correlation to be further investigated

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•A factor model includes a number of assumptions to be adjusted for Credit insurance :

- Calculation of correlation is based on market data or aggregate by industry country

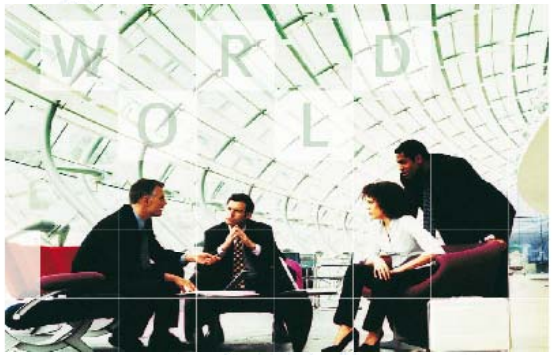
-Factor model represents fully the variance between individual companies

-Variance in a sector is as important as between sectors and only individual management of risk can mitigate it.

-It exists strong links between sectors that are not considered properly in factor models and managed through credit insurance

-Mitigation of risks change the risk profile and reduce the ultimate liability of the insurer

Any modeling must be properly customized ot reprensents Credit insurance


Additional information