EUROPEAN CENTRAL BANK

Discussion

Bank Credit Risk, Common Factors, and the Interdependence of Credit Risk in Money Markets

Firm Heterogeneity and Credit Risk Diversification

Evaluating Value-at-Risk Models with Desk-Level Data

4th Joint Central Bank Research Conference on Risk Measures and Systemic Risk

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Disclaimer: The views presented are not necessarily shared by the European Central Bank

Outline

- ECB Risk Management Division
- Portfolio management perspective
- The papers: focus, methodology, results and a few observations
- Conclusions

ECB Risk Management Division

- ECB investment activities
  - Strategic asset allocation for foreign reserves, domestic assets
  - Compilience monitoring, and reporting on risks and performances for the investment operations of the ECB
- Quantitative asset alocation process
  - Factor risk model with reference returns
  - Yield curve model with regime-shifts
  - Dynamic portfolio optimisation
- Collateral framework for ECB policy operations

Portfolio management perspective

- Characteristics separate form trading activities of an investment bank
- Importance of asset management activities from a financial stability perspective
- Portfolio management for foreign exchange reserves
  - Broader diversification of assets
  - Changing rational for holdings reserves
  - Role of active management

Bank Credit Risk, Common Factors, and Interdependence of Credit Risk in Money Markets
(Baba and Nishioka)

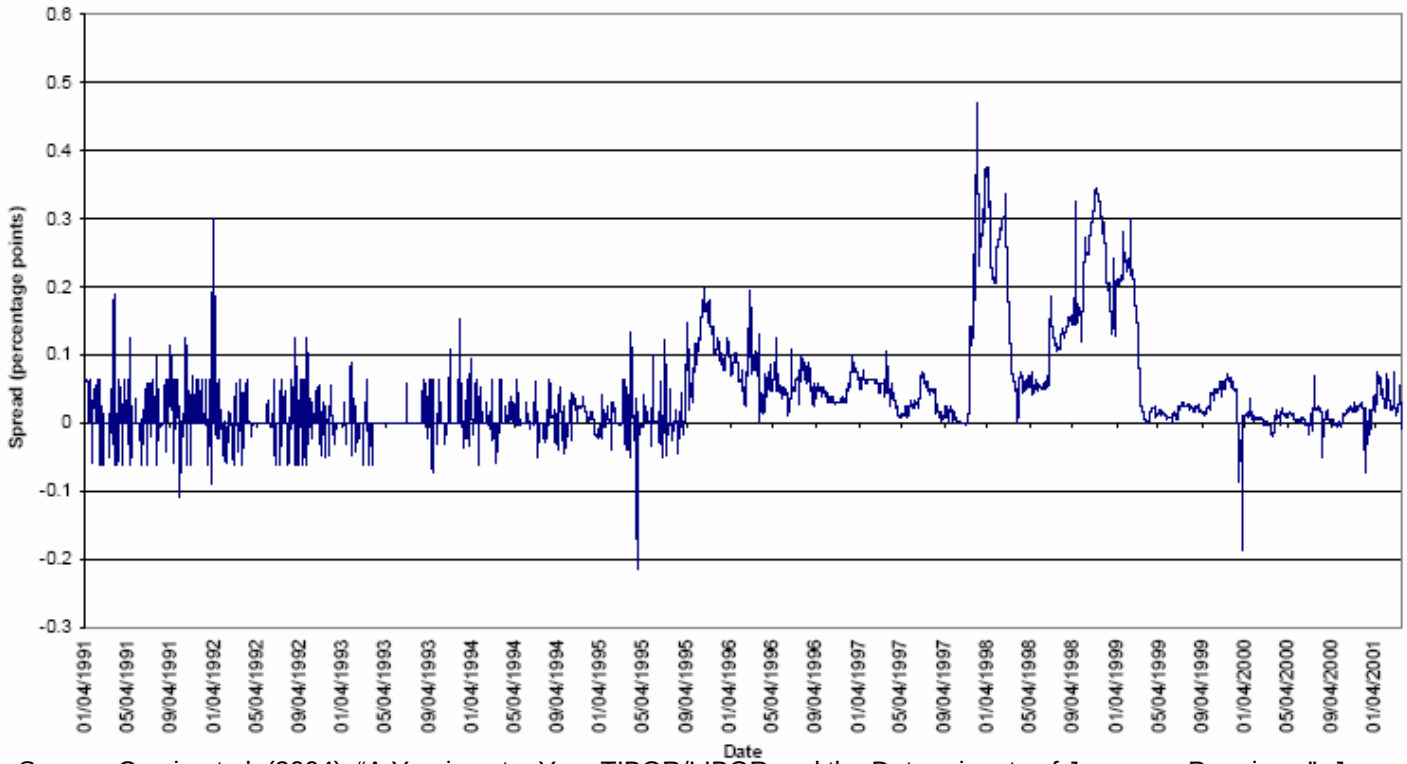
Bank Credit Risk, Common Factors, …

- Focus
  - Better understanding of Japan premium which is observed in the euroyen and eurodollar market (difference between TIBOR and LIBOR)
  - TIBOR/LIBOR spreads reflect different credit risk profile of Japanese and Non-Japanese banks
  - Estimate fundamental price of credit risk and investigate its time-series properties and interdependencies

Bank Credit Risk, Common Factors, …

Japan premium

Figure 1: TIBOR-LIBOR Spread



Source: Corvig et al. (2004), "A Yen is not a Yen: TIBOR/LIBOR and the Determinants of Japanese Premiums", Journal of Financial and Quantitative Analysis, 39, pp 193-208.

Bank Credit Risk, Common Factors, …

- Methodology
  - Extraction of "fundamental prices of bank credit risk" from observed risk premiums
    - Estimate factor model based on principal components to isolate a global, currency and credit factor
    - Further decomposition of the credit factor into permanent and transitory effects
  - Analysis of time series properties of risk premiums and the fundamental price of credit risk
  - Battery of econometric models are applied to find the fundamental price of bank credit risk (Cointegration test, VAR, VECM, M-Garch, State space model)

Bank Credit Risk, Common Factors, …

- Results
  - Two common factors can be isolated in the data: a global and a currency factor
  - Controlling for these factors, the fundamental price of credit risk is found to show
    - High degree of impulse response from shocks of the same bank groups
    - High conditional correlation of the same bank groups credit risk prices between the yen and dollar markets
    - However the fundamental prices account for only a tiny proportion of the total variance or risk premiums

Bank Credit Risk, Common Factors, …

- A few suggestions
  - Give additional explanation for why credit risk accounts only for a tiny fraction of the overall risk premiums. Credit components in global and currency factor?
  - Additional motivation for why to differentiate between shadow price and fundamental price of credit risk
  - Efficiency of two step estimation of the M-Garch model
  - A few drafting suggestions

Firm Heterogeneity and Credit Risk Diversification (Hanson, Pesaran, Schuermann)

Firm Heterogeneity and Credit Risk Diversification

- Focus
  - Introduction a of credit risk model taking firm heterogeneity into account
  - Effects of firm heterogeneity on credit loss distribution and the extent to which credit risk is diversifiable
  - The role of active portfolio management in credit risk diversification

Firm Heterogeneity and Credit Risk Diversification

- Methodology
  - Introduction of a factor-risk model to capture cross-firm correlation

$$r_{t+1} = \mu_i + \gamma_i' f_{t+1} + \sigma_i \varepsilon_{i,t+1} \qquad \varepsilon_{i,t+1} \sim iid(0,1)$$

$$\sigma_{E_i}^2 = \gamma_i' \gamma_i + \sigma_i^2$$

$$\rho_{ij} = \frac{\gamma_i' \gamma_j}{\sigma_{E_i} \sigma_{E_j}}$$

  - Firm heterogeneity by allowing varying factor sensitivities and default thresholds
  - Comparison to Vasicek (1987)

Firm Heterogeneity and Credit Risk Diversification

- …
  - Deduce asymptotic loss distributions for portfolio which are sufficiently diversified
  - An empirical application illustrating how to estimate the models in practice and comparing the results to the theoretical ones

Firm Heterogeneity and Credit Risk Diversification

- Result: firm heterogeneity matters
  - Ignoring firm heterogeneity can lead to underestimation of expected losses
  - Controlling for expected losses, ignoring firm heterogeneity can result in overestimation of unexpected losses
  - Limits to diversification depend on firm heterogeneity
    - Vasicek (1987): Limit to unexpected loss depending on default probability and default correlation
    - Heterogeneous firms: unexpected loss is diversifiable to the extent that idiosyncratic risk can be eliminated

Firm Heterogeneity and Credit Risk Diversification

- The extent to which credit risk can be diversified is a crucial question for real-world portfolio management
  - Discussions on the further broadening of the investment universe for foreign reserves holdings currently ongoing at a number of central banks
  - Jarrow, Lando and Yu (2005):

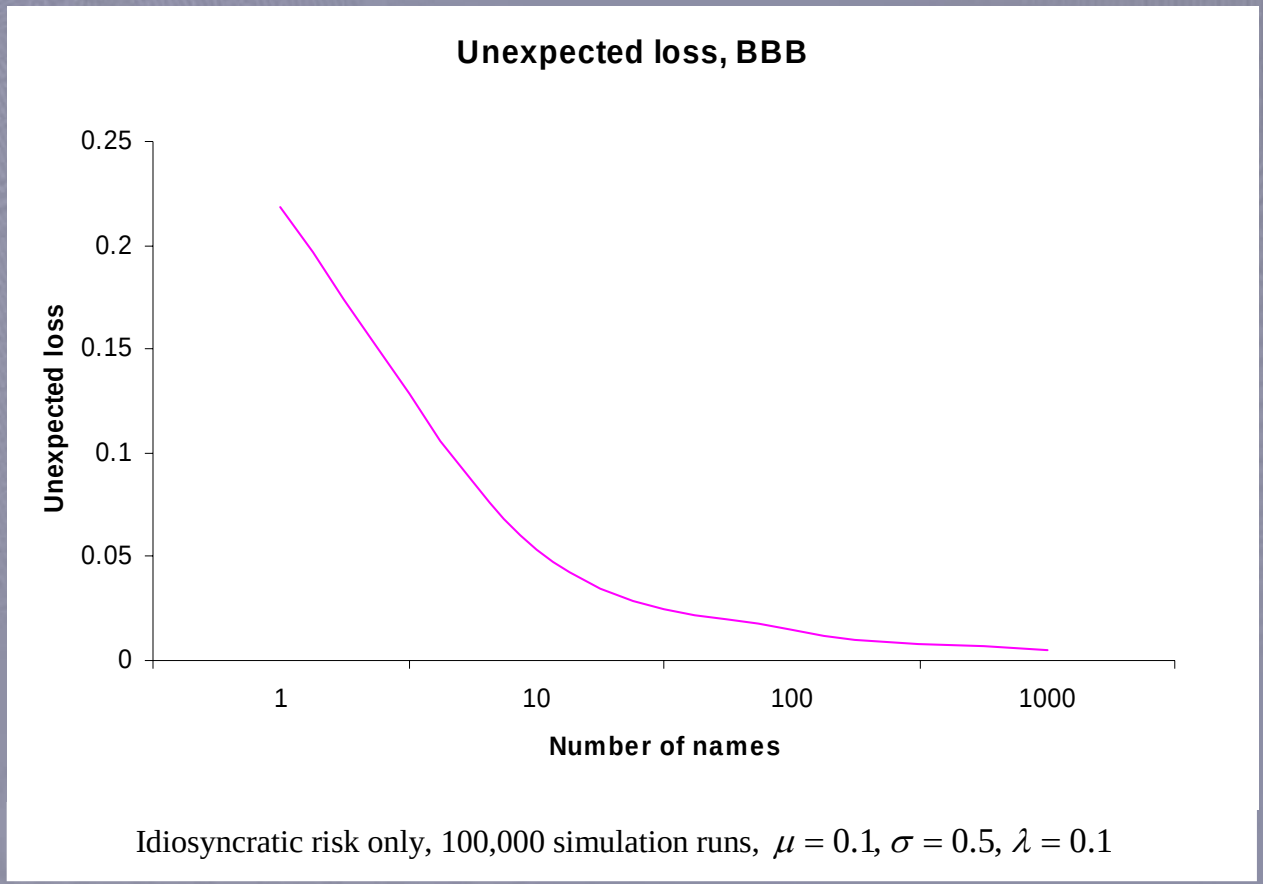
> PROPOSITION 4.2. *Assume that the economy consists of a money market account with short rate r_t and an infinite collection of traded securities with dynamics specified in* (4.13) *and* (4.14). *Then the Q-intensity $\tilde{\lambda}_t^i$ is equal to the P-intensity λ_t^i for all i.*

  - If one could diversify in this sense, spreads should be equal to expected losses from default

Firm Heterogeneity and Credit Risk Diversification

Source: BIS
Jan 1997 - Aug 2003, 3-5 year maturities, in basis points

Firm Heterogeneity and Credit Risk Diversification



Idiosyncratic risk only, 100,000 simulation runs, $\mu = 0.1$, $\sigma = 0.5$, $\lambda = 0.1$

Firm Heterogeneity and Credit Risk Diversification

- Some suggestions and general comments:
  - Introduction of factor risk model for the return generating process is convincing
    - Better understanding of diversifiable components
    - Close to how portfolio mangers about risk, factor models are wide spread in the asset management industry (for the management of market risk)
    - Step forward for integration of credit and market risk?
  - Results when granularity condition does not hold
  - Implications for pricing? (how do systematic and idiosyncratic components affect the credit risk premium?)

Evaluating Value-at-Risk models with Desk-Level Data (Berkowitz, Christoffersen and Pelletier)

Evaluating Value-at-Risk models with Desk-Level Data

- Focus
  - Accuracy of VaR forecasts (Relevance: Second pillar of Basel II, back-testing VaR since banks can specify their own calculation methods)
  - Size and power of 4 back-testing methodologies
  - Draw on information extracted from desk-level data
  - Address ”problem” of data scarcity of VaR violations

Evaluating Value-at-Risk models with Desk-Level Data

- Data: Desk-Level data, 4 business lines P&L and 1-day ahead VaR forecasts
  - Business line 1: 873 observations, Jan 2, 2001 -> Jun 30, 2004
  - Business line 2: 811 observations, Apr 2, 2001 -> Jun 30, 2004
  - Business line 3: 623 observations, Jan 3, 2002 -> Jun 30, 2004
  - Business line 4: 623 observations, Jan 3, 2002 -> Jun 30, 2004

Evaluating Value-at-Risk models with Desk-Level Data

- Methodology
  - Assume data generating processes for P&L and 1-day ahead VaR forecasts
  - Horse-race between models in terms of size and power
  - Testing the assumption that a historical VaR used by the desk-level data
  - Testing methodologies employed:
    - Serial correlation of outliers
    - …

Evaluating Value-at-Risk models with Desk-Level Data

– …

- Campell&Shiller regression of outliers on lagged outliers and non-outliers on lagged non-outliers
- Hazard rates: days between outliers should be random
- Frequency domain based on Durlauf(1991)

Evaluating Value-at-Risk models with Desk-Level Data

- Results
  - Empirical evidence of non-normality and volatility dependence in P&L data
  - Cannot reject that historical simulation is used as VaR methodology apart from business-line 3
  - Not really clear on which back-testing methodology that is best and under which conditions

Evaluating Value-at-Risk models with Desk-Level Data

- Some suggestions and comments
  - Underlying business for the 4 business lines might help explaining further the results (e.g. why business line 3 behaves differently)
  - Are there underlying market factors / firm specific factors that might apply to the analysed data horizons?
  - Explore the possibility of making policy proposal on which back-testing methodology to use
  - VaR forecast for long-horizons

Conclusions

- Three papers that are highly relevant in a portfolio management context
  - Risk return trade-off for credit risky investments
  - VAR as a tool for risk measurement and risk management
- Foreign reserves management is probably one of the most neglected areas in finance
  - Its important, however very little is known
  - E.g. risk return preferences, liquidity requirements, financial independence, asset allocation and macro economic developments