Systematic Risk in Homogeneous Credit Portfolios*

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1 Systematic Risk in Credit Portfolios

In credit portfolios (see [5] for an introduction) there are typically two types of counterparties: Listed firms and non-listed borrowers. For the first type, a time series of the firm's equity values can be used to derive an *Ability-to-Pay Process* (APP), showing for every point in time the firm's ability to pay, see e.g. [6]. For the second type, equity processes are not available, but still every borrower somehow admits an APP, depending on the customer's assets and liabilities, sometimes known by the lending institute, but in any case imposed as an unobservable *latent variable*. In general, we can expect that correlations between the obligor's APPs strongly influence the portfolio's credit risk. The calculation of *APP correlations* usually is based on a suitable factor model, e.g., a (single-beta) linear model

$$r_i \;=\; \beta_i \Phi_i + \varepsilon_i \;, \tag{1}$$

where r_i denotes the standardized log-return of the i-th borrower's APP, Φ_i denotes the *composite factor* of borrower i, and ε_i denotes the *residual* part of r_i, which can not be explained by the customer's composite factor. Usually the composite factor of a borrower is itself a weighted sum of country- and industry-related indices, see e.g. [5], Chapter 1. Along with representation (1) comes a decomposition of variance,

$$\mathbb{V}[r_i] \;=\; 1 \;=\; \underbrace{\beta_i^2 \mathbb{V}[\Phi_i]}_{=R_i^2,\ \text{systematic}} \;+\; \underbrace{\mathbb{V}[\varepsilon_i]}_{=1-R_i^2,\ \text{specific}} \tag{2}$$

in a *systematic* and an *idiosyncratic* effect. The systematic part of variance is the so-called *coefficient of determination*, denoted by R_i^2, implicitly determined by the regression (1). It can be seen as a quantification of the *systematic risk* of borrower i and is an important input parameter in credit portfolio

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management tools, heavily driving the portfolio's *Economic Capital*[3] (EC). For example, the following chart shows CEC, the *contributory EC* (w.r.t. a reference portfolio of corporate loans to middle-size companies) as a function of R^2 for a loan with a *default probability* of 30bps, a *severity*[4] of 50%, a 100% country weight in Germany, and a 100% industry weight in automotive industry:

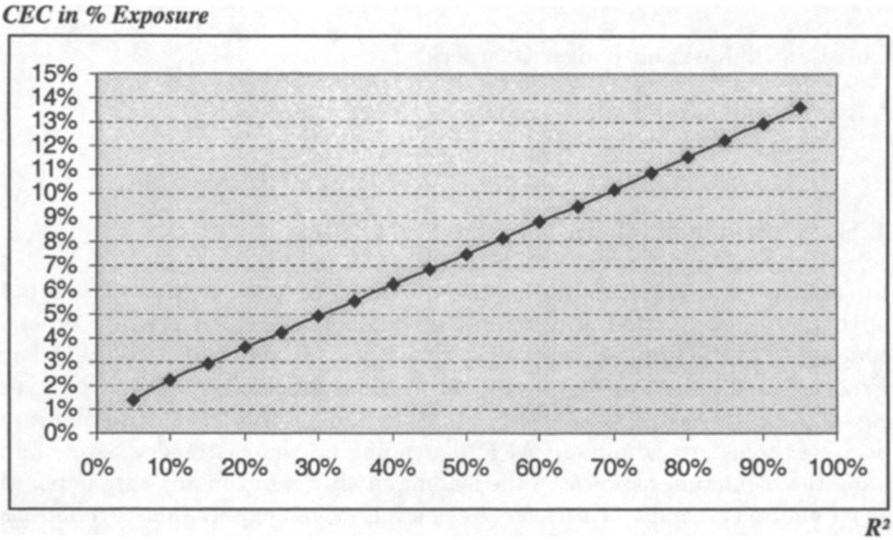

Fig. 1. CEC as a function of R^2

The chart shows that the increase in contributory EC implied by an increase of systematic risk (quantified by R^2) is significant.

This note has a two-fold intention: First, we want to present a simple approach for estimating the systematic risk, that is, the parameter R^2, for a homogeneous credit portfolio. Second, we discuss the proposal of the *Basel Committee on Banking Supervision*, see [1], to fix the *asset correlation* respectively the systematic risk for the calibration of the benchmark risk weights for corporate loans at the 20% level. In our discussion we apply the method introduced in the first part of this note to Moody's corporate bond default statistics and compare our estimated APP correlation with the correlation level suggested in the Basel II consultative document. On one hand, our findings show that the average asset correlation within a rating class is close to the

[3] The Economic Capital w.r.t. a level of confidence α of a credit portfolio is defined as the α-quantile of the portfolio's loss distribution minus the portfolio's expected loss (i.e. the mean of the portfolio's loss distribution).

[4] A severity of 50% means that in case of default the recovery rate can be expected to be (1-severity)=50%.