Credit portfolios: What defines risk horizons and risk measurement?

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Abstract

The strong autocorrelation between economic cycles demands that we analyze credit portfolio risk in a multiperiod setup. We embed a standard one-factor model in such a setup. We discuss the calibration of the model to Standard & Poor's ratings data in detail. But because single-period risk measures cannot capture the cumulative effects of systematic shocks over several periods, we define an alternative risk measure, which we call the time-conditional expected shortfall (TES), to quantify credit portfolio risk over a multiperiod horizon.
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1. Introduction

Banks typically measure credit-risk over a one-year time horizon, using either value-at-risk (VaR) or expected shortfall (ES) as measures of risk. We claim that the risk horizon

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has to be longer than one-year, because derived risk capital must cover all but the worst possible losses in a credit portfolio. If there is a longer time horizon, then the key risk factor for huge portfolio losses is the economic cycle, which we must model autoregressively. We further extend the standard one-period value-at-risk and shortfall-risk measures to meet the requirements of a multiperiod context. Several facts support these claims. First, although the length, depth, and diffusion of recessions or even depressions has varied significantly in the past, it turns out that a one-year time horizon is often too short to account for a business cycle. For example, when we use the National Bureau of Economic Research (NBER) definition of recessions and depressions, we see that in the US economy for the last 200 years, deep recessions lasted between 35 and 65 months. These long-standing recessions suggest that we should measure credit-risk over longer than one-year. We believe that a five-year time horizon might be appropriate. We could calculate the risk on a one-year basis and – assuming independence – scale the figures to five-years. The reason we do not do so is the autocorrelation in the business cycle: If the industry does badly this year, the probability that it does even worse in the next year is higher than the probability of a strong upwards move. Such an autocorrelation of the business cycle must be accounted for in the risk measurement, else we will underestimate risk in periods of economic downturns. The autocorrelated behavior requires a multiperiod view. The analysis below, which uses Standard & Poor's (S&P) default statistics,[1] strongly supports the claim that autocorrelation matters.

Business cycles and factors that are specific to the credit business determine the risk horizon. For example, if we use a risk measure in market risk, then we assume a holding period of ten days with fixed portfolio fractions. There are at least two reasons why such an assumption is useful. First, to try to foresee how portfolios are rebalanced in the future is not realistic. Second, a possible extreme scenario is that trading in a specific period is not, or is almost not, possible. For example, if the liquidity due to a shock event evaporates. Therefore, the risk horizon should also roughly convey during which time changes in the positions are not possible. Two properties define this time for credit-risk. First, different types of loan contracts have different maturities and options for exiting and recontracting. Basel II assumes a mean time to maturity of 2.5 years. We can qualitatively confirm this figure if we calculate the mean time of maturity for a portfolio of approximatively 20 000 counterparts. Second, the ability of the institution to buy/sell credit-risk on secondary markets is important. The stronger a firm's ability to trade on secondary markets, the shorter the risk's time horizon. These considerations lead us to conclude that it does not suffice to measure the credit-risk of long-term credit investments on a one-year risk horizon. Moreover, based on the significant autocorrelation of default rates, a bank that holds only enough capital to cover one-year losses does not possess enough financial substance to cover multiyear recessions. Therefore, we suggest a credit horizon equal to the maturity of a credit. Since model risk increases with longer risk horizons, it is reasonable to assume a maximal model horizon. We choose a five-year model horizon.

Having established the need for a multiperiod model and a risk horizon longer than a one-year, we explain why we need a revision of the usual risk measures. Since we model

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[1] We use public Standard & Poor's data in our case study. The data are described in detail in Standard & Poor's ratings performance 2003, see Standard & Poor's (2004).