Abstract

The dissertation thesis deals with modeling and estimating credit risk. In the thesis we particularly focus on the credit risk of retail, and more exactly mortgage, debtors. The thesis is organized into three separate papers with a common theme, which is a development of a credit risk measurement methodology from simpler enhancements of the current research to a model able to capture such details as e.g. the duration structure of the mortgage portfolio. All three papers use the same underlying dataset, a time series of the national US mortgage portfolio delinquency and foreclosure rates. As the research was done during several years, the latter parts of the thesis work with additional observations.

In the first paper, we demonstrate that the current regulatory standards for credit risk quantification are based on assumptions that do not necessarily match the reality. Generalizing the well-known Vasicek's model, standing behind the Basel II, we build a model of a credit risk of a loan portfolio. The model, similarly to the Vasicek's model, decomposes the credit risk (expressed as the portfolio probability of default) into two risk factors, one common for all borrowers in the portfolio, and one individual for each single borrower. Our model involves dynamics of the common factor, which influences the borrowers' assets, and which we allow, in contrary to the Vasicek's model, to be non-normal. We show how the parameters of our model may be estimated, and additionally, we provide a statistical evidence that the non-normal model is able to fit better the observed US mortgage delinquency rates than a normal one.

The second paper is a continuation of the research. In this paper, we introduce an improved multi-factor credit risk model, describing simultaneously the default rate and the loss given default. Our methodology is based on the Vasicek's model, which we generalize in three ways. First, we add a model for loss given default (LGD), second, we bring dynamics to the model, and third, we allow non-normal distributions of risk factors. Both the probability of default and the LGD are driven by a common factor and an individual factor; the individual factors are mutually independent, but we allow any form of dependence of the common factors. We test our model on a nationwide portfolio of US mortgage delinquencies, modeling the dependence of the common factor by a VECM model, and compare our results with the current regulatory framework, the

Basel II. Our findings show, that a methodology, which is able to describe the dependency between the risk factors, can predict the mean and the quantile losses more precisely.

The most recent development in our research is described in the third paper. Similarly to the second paper, we assume borrowers hold assets covering the instalments and own real estate which serves as collateral. Both the value of the assets and the price of the estate follow general stochastic processes driven by common and individual factors. We describe the correspondence between the common factors and the percentage of defaults, and the loss given default, respectively, and we suggest a procedure of econometric estimation in the model. On the contrary to the second paper, here we add a multigenerational aspect and we model the assets of different generations separately. We show that a more accurate estimation of common factors can lead to savings in capital needed to hold against a quantile loss, compared to the Basel II framework.