Abstract

In this thesis we apply neural networks as nonparametric and nonlinear methods to the Central European stock markets returns (Czech, Polish, Hungarian and German) modelling. In the first two chapters we define prediction task and link the classical econometric analysis to neural networks. We also present optimization methods which will be used in the tests, conjugate gradient, Levenberg-Marquardt, and evolutionary search method. Further on, we present statistical methods for comparing the predictive accuracy of the non-nested models, as well as economic significance measures. In the empirical tests we first show the power of neural networks on Mackey-Glass chaotic time series followed by real-world data of the daily and weekly returns of mentioned stock exchanges for the 2000:2006 period. We find neural networks to have significantly lower prediction error than classical models for daily DAX series, weekly PX50 and BUX series. The lags of time-series were used, and also cross-country predictability has been tested, but the results were not significantly different. We also achieved economic significance of predictions with both daily and weekly PX-50, BUX and DAX with 60% accuracy of prediction. Finally we use neural network to learn Black-Scholes model and compared the pricing errors of Black-Scholes and neural network approach on the European call warrant on CEZ. We find that networks can be used as alternative pricing method as they were able to approximate the market price of call warrant with significantly lower error then Black-Scholes itself. Our last finding was that Levenberg-Marquardt optimization algorithm used with evolutionary search provides us with significantly lower errors than conjugate gradient or gradient descent.