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ABSTRACT - DISSERTATION

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TIME-VARYING FACTOR MODELS FOR EQUITY PORTFOLIO MANAGEMENT

In time-series analysis, structural changes between economic factors should yield changing coefficient estimates over time. In other words, varying sensitivities between factors should also be reflected by varying coefficient estimates. However, "classical" time-invariant estimation methods like Ordinary Least Squares (OLS) are not able to capture these dynamics. This is because a major assumption of these approaches, those that coefficients are constant over time, is violated in the presence of structural change. Apart from this, also state-dependencies are not detectable by time invariant methods. If the influence of a factor on another changes in dependence of economic regimes also the coefficient estimates should vary. However, also in the case of state-dependency, the underlying assumption of constant coefficients is a major restriction of time-invariant estimation approaches.

As previous studies have shown, major issues of active portfolio management may be affected by the presence of structural changes and state-dependencies. For example, as a result of a company's revised business strategy, the sensitivity of its return to the market return maybe change. Other examples are speculative bubbles in equity markets, changing dependencies of stocks returns to macroeconomic conditions or simply changing sensitivities of the market participants to new available economic information. This analysis investigates the quality of time-varying estimation methods, namely (i) Moving Window Least Squares, (ii) Flexible Least Squares and (iii) the Random-Walk Model on issues of equity portfolio management. Thereby the analysis is structured as follows:

After a description of time-varying estimation methods in Chapter 2 we compare their forecasting quality on the U.S. stock market. While a rapidly growing amount of evidence reveals the predictability of stock market returns by using different explanatory factors and approaches, the forecasting quality of time-varying estimation techniques has not yet been analyzed. Hence, we apply the FLS procedure on an Error Correction Model which is based on both, fundamental and macroeconomic factors. On the basis of this model, we predict monthly U.S. stock market returns with a forecasting-horizon of one month and analyze the outcomes of the approaches.

The focus of Chapter 4 is on time-varying beta estimates of German stock returns. The market model assumes stock returns to be a linear function of the market return. However, there is considerable evidence that the beta stability assumption commonly used when estimating the market model is invalid. Hence, we account for beta instability by allowing the estimated coefficients to vary over time and analyze the gains from the use of time-varying estimation approaches.

In Chapter 5 we go beyond this and derive variance-covariance matrices, i.e. risk models from time-varying estimations of the market model. Most equity risk models applied in practice assume stable return correlations over time. However, a vast amount of literature has shown, that correlations among stock returns and, hence, variance-covariance matrices (VCMs) are unstable over time. Especially in turbulent market phases risk estimates from various risk models are well known to be unreliable. One reason for their poor risk forecasting ability is the fact that financial

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markets are subject to substantial structural change, time-invariant factor models do not account for. We account for correlation instabilities in U.S. stock returns and demonstrate the advantages of time-varying estimation techniques with respect to risk estimation, portfolio selection and investment performance.

Chapter 6 is devoted to the style analysis of equity- and balanced funds. Screening a fund managers exposure to specific asset classes, i.e. to investigate his style, is imperative for an investor. This is especially true if his portfolio is invested in multiple funds, each including a number of securities. Nevertheless, especially for non-institutional investors, it is often not possible to receive adequate data for the exact determination of the exposures. For this reason, Sharpe developed the "Return-Based Style Analysis" by creating a quadratic programming procedure based on the OLS approach. However, the time-invariance of the OLS method is a major restriction. This is because it is not possible to see current changes in fund manager's asset class exposures. Trying to overcome this we create a quadratic programming procedure based on the Flexible Least Squares approach.

Finally, Chapter 7 concludes the analysis and summarizes the outcomes of time-varying estimation methods applied on problems of equity portfolio management.

This thesis shows that time-varying estimation is a promising approach to capture changing structures in financial markets. In fact, in this study the use of time-varying estimation techniques generates superior results compared to time-invariant estimation. However, the gains in estimation precision differ quite substantially. While the improvements in stock market forecasts are only minor, the results of beta- and risk estimates, as well as those of style analyses are considerably better. This is especially true for the Flexible Least Squares procedure which generates the most accurate estimation results of all methods under investigation.