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PORTFOLIO MANAGEMENT

Time Diversification and Estimation Risk

Björn Hansson & Mattias Persson

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Abstract

The recommendation that investors with long investment horizons tilt their portfolios toward stocks is commonplace. We used a nonparametric bootstrap approach to investigate whether in a mean-variance-efficient portfolio, the weights for U.S. stocks and U.S. T-bills vary in a systematic manner with investment horizon. This approach allowed us to analyze the impact of estimation risk on the optimal weights of stocks and fixed-income securities. The results show that an investor can gain from time diversification: The weights for stocks in an efficient portfolio were significantly larger for long investment horizons than a one-year horizon.

Practitio rizons tilt their por ehavior is an impo ation, which impli for a partic

We anal nd bills vary significa analysis, we kept the risk price, the slope of the efficient frontier, constant while varying the

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investment horizon from 1 year to 5 years to 10 years. The data were real U.S. return data from 1900 to 1997 for a well-diversified stock portfolio and a short-term, nominally risk-free rate.

We presupposed that investors form optimal investment strategies based only on historical estimates of the following parameters or inputs to the optimization problem—means, variances, and covariances. The model we used is an unconditional model in the sense that agents do not explicitly try to model any possible time-series relationships among the assets. We implicitly accounted for any possible time dependencies in the observed return-generating processes, however, by resampling a great number of return series from the original data through the use of a computer-intensive method called “bootstrapping.” In particular, we used a nonparametric moving block bootstrap with a block length of 60 months in which serial dependence and cross-sectional correlation were preserved within the blocks. The real bonus of the bootstrap approach is the possibility of generating empirical distributions of optimal weights. Thus, we could not only analyze the existence of time diversification but could also test whether time diversification is significant in a statistical sense (i.e., if significant statistical differences exist between the optimal weights for different investment horizons).

With the bootstrap approach, we could also study the impact of estimation risk (meaning that the true parameters of the return distributions are unknown) on the optimal weights of stocks and bills. In a mean-variance context, estimation risk implies that the inputs to the mean-variance model are only sample estimates, not the true parameters.

The results show that estimation errors increase with the risk price and with the investment horizon. The first effect is a result of error maximization, which implies that the opti turns and underes apping observat s.

We p n efficient portf tion is that for certa mean revertin e return spread b izons, the

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change in portfolio weights might stem from the fact that with longer investment horizons, the standard deviation for stocks falls whereas the standard deviation for bills increases.

Our evidence supports the existence of time diversification: The weights for stock in efficient portfolios are significantly higher for long investment horizons than for a one-year horizon.

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