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Robust Statistical Techniques for Financial Modeling

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Abstract

Classical statistics relies on parametric models. Typically, assumptions are made on the structural and the stochastic parts of the model and optimal procedures are derived under these assumptions. Standard examples are least squares estimators in linear models and their extensions, maximum likelihood estimators and the corresponding likelihood-based tests, and GMM techiniques in econometrics. Robust statistics deals with deviations from the stochastic assumptions and their dangers for classical estimators and tests and develops statistical procedures which are still reliable and reasonably efficient in the presence of such deviations. It can be viewed as a statistical theory dealing with approximate parametric models by providing a reasonable compromise between the rigidity of a strict parametric approach and the potential difficulties of interpretation of a fully nonparametric analysis. Many classical procedures are well-known for not being robust. These procedures are optimal when the assumed model is exactly satisfied, but they are biased and/or inefficient when small deviations from the model are present. The statistical results obtained from classical procedures can therefore be misleading on real data applications. In particular financial models are often estimated and tested with methodologies that do not explicitly control for the effects of small distributional deviations from the assumptions. However, because of the intrinsic complexity of financial markets and the richness of financial phenomena, we may realistically believe that some deviations from the assumptions will almost always be present when using a financial model in empirical finance. It seems therefore natural to treat financial models as approximate descriptions of the financial reality and to work with statistical procedures that can deal with such situations. These lectures will give a brief

introduction to robust statistics by reviewing some basic general concepts and tools and by showing how they can be used in the statistical analysis of financial models, to provide an alternative complementary analysis with additional useful information. As an illustration of the main issues we discuss some examples, including estimation and inference in one factor models, indirect inference, and the statistical analysis of dynamic location-scale models, such as GARCH models.

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