Statistics of Risk Allocation in markets, individuals and neurons

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An Axiomatic and Data Driven View on the EPK Paradox

Supported by several recent investigations the empirical pricing kernel (EPK) paradox might be considered as a stylized fact. Some authors suggest that this paradox might be caused by regime switching in financial markets. Based on an economic models with state dependent utilities for the financial investors we want to emphasize a microeconomic view that succeeds in explaining the paradox via state dependent preferences. We shall also develop and investigate calibration problems in terms of data its for basic values of the pricing kernel.

Keywords: Pricing kernel, representative agent, empirical pricing kernel, epk paradox, state dependent
utilities, switching points.

Risk Patterns and Correlated Brain Activities: Multidimensional statistical analysis of fMRI data with application to risk patterns

Decision making usually involves uncertainty and risk. Understanding which parts of the human brain are activated during decisions under risk and which neural processes underly (risky) investment decisions are important goals in neuroeconomics. Here, we reanalyze functional magnetic resonance imaging (fMRI) data on 17 subjects which were exposed to an investment decision task from Mohr et al. (2010b). We obtain a time series of three-dimensional images of the blood-oxygen-level dependent (BOLD) fMRI signals. Our goal is to capture the dynamic behavior of specific brain regions of all subjects in this high-dimensional

time series data, by a flexible factor approach resulting in a low dimensional representation. We apply a panel version of the dynamic semiparametric factor model (DSFM) presented in Park et al. (2009) and identify task-related activations in space and dynamics in time. Further, we classify the risk attitudes of all subjects based on the estimated lowdimensional time series. Our classification analysis successfully confirms the estimated risk attitudes derived directly from subjects' decision behavior.

Keywords: risk, risk attitude, fMRI, decision making

Functional Principal Component Analysis for Generalized Quantile Regression

Quantile and expectile regression are tail oriented conditional regression. They can be transformed as generalized quantile regression. Traditional generalized quantile regression focuses on a single curve. When more random curves are available, we can estimate the single curves jointly by using the information from all subjects instead of estimate it individually. To avoid too many parameters to estimate, we apply a novel method { functional principal component analysis (FPCA) combining least asymmetric weighted squares (LAWS), we estimate both the mean curve as the common factor curve and the individual departure curves of the generalized quantile curves via a penalized spline smoothing. We run both simulations and real data analysis to investigate the performance of the FPCA method in comparison with the traditional single curve estimation method. Taking the temperature as an example, we estimate the generalized quantile curves for the volatility of the temperature in 150 weather stations in China in 2010 to analyze the different risk drivers for the temperature.

Keywords: Least asymmetric weighted squares; Functional principal component analysis; Generalized quantile curve; Common mean curve; Penalized
spline smoothing.

Quantile Regression in Risk Calibration

Financial risk control has always been challenging and becomes now an even harder problem as joint extreme events occur more frequently. For decision makers and government regulators, it is therefore important to obtain accurate information on the interdependency of risk factors. Given a stressful situation for one market participant, one likes to measure how this stress affects other factors. The CoVaR (Conditional VaR) framework has been developed for this purpose. The basic technical elements of CoVaR estimation are two levels of quantile regression: one on market risk factors; another on individual risk factor. Tests on the functional form of the two-level quantile regression reject the linearity. A flexible semiparametric modeling framework for CoVaR is proposed. A partial linear model (PLM) is analyzed. In applying the technology to stock data covering the crisis period, the PLM outperforms in the crisis time, with the justification of the backtesting procedures. Moreover, using the data on global stock markets indices, the analysis on marginal contribution of risk (MCR) defined as the local first order derivative of the quantile curve sheds some light on the source of the global market risk.

Keywords: CoVaR, Value-at-Risk, quantile regression, locally linear quantile regression, partial
linear model, semiparametric model

JEL classification: C14, C21, C22, C53, G01, G10, G20, G32