The locally parametric model: a new class of models in high frequency data

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Abstract

This paper proposes mixed parametric and nonparametric statistical techniques for the analysis of high frequency data. It gives a general model, which can be discrete or continuous in time depending on the point-of-view. This model can be seen as a parametric model which allows its multidimensional parameter to follow a local martingale. As such, we call it the *locally parametric model* (LPM). The quantity of interest is defined as the *uniformly weighted value over time* (UWV) of the (discrete or continuous) parameter process. We provide estimators of UWV and conditions under which we can show the consistency and the corresponding central limit theorem. Those estimators are based on estimators of the parametric model when parameters are fixed. Since the estimator is obtained by chopping the data into small blocks, estimating the parameter on each block pretending it is constant locally and taking a weighted mean of the estimates on each block, we call it the *locally parametric quasi-estimator* (LPQE). We show that under conditions, some discrete standard time series models of the literature (for instance ARMA or GARCH models with MLE estimator) as well as continuous semiparametric models (for example a semimartingale asset price model with IID noise component in the observations) of the high-frequency financial econometrics literature belongs to the LPM class of models. This paper thus builds a bridge between various perspectives, parametric, semiparametric and nonparametric as well as discrete and continuous in time models. In addition, statistics to test whether the parameter's constancy hypothesis is true are provided. We also discuss model selection and provide statistics to test for nested models: as an example, this allows us to test if there is noise in observations. Based respectively on the estimate of UWV, we give a new input to use in the prediction model. Finally, an empirical study on S & P 500 daily returns, using ARMA and models is carried out. It shows that the parameters are not constant over time for both models and that we obtain better statistical inference using the new prediction's input of the model.