On some problems of semi-parametric estimation related to stochastic volatility models

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Our goal is to estimate $\theta \in \mathbb{R}^+$based on the observations $X_i = [v + \theta w(t_i)]\xi_i + \epsilon_i, \quad i = 1, \dots, n$. Here $w(t)$ is a standard Wiener process, $\xi_i$and ϵ_i are independent white Gaussian noises with $\mathbf{E}\,\xi_i^2 = 1, \ \mathbf{E}\epsilon_i^2 = \varepsilon^2$.It assumed also that $t_i = i/n$ and that the parameter $v > 0$ isknown. This statistical model approximates well [2] thestochastic volatility model proposed in [3]. All interestingproperties of this model are due to the fact that the nuisancefunction w is a stochastic process. For instance, if thisfunction w is known, then one can estimate θ with theusual parametric rate of convergence $n^{-1/2}$. On the other handif this function is an unknown constant, then we cannot recoverθ at all. It was shown recently [1,2] that if $w$is the standard Wiener process, then the rate of convergence is$n^{-1/4}$. In the talk I shall discuss statistical models andapproaches which helps to find the solution of the problem up to aconstant. In particular, it will be shown that

$$\lim_{\varepsilon\to 0}\lim_{n\to\infty}\inf_{\hat\theta}\sup_{\theta>0}\mathbf{E}[(\hat\theta-\theta)\varphi_n(\theta,w)]^2 \geq 1,$$

where *inf* is taken over all estimators and*the stochastic rate of convergence* $\varphi_n(\theta,w)$is defined by

$$\varphi_n^2(\theta,w) = \frac{\theta}{2\sqrt{n}}\sum_{i=1}^{n}\frac{1}{\sqrt{[v+\theta w(t_i)]^2+\varepsilon^2}}.$$

- Bibliography

Back to the Workshop's Program