Statistical causality and martingale problems

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In this paper we consider a statistical concept of causality in continuous time, between filtered probability spaces, which is based on Granger's definition ([1]) of causality. On the other side, concept of martingale problem was first introduced by Stroock and Varadhan in [2]. Martingale problems should be considered as a stochastic counterpart of ordinary differential equations. It is usually applied for modelling dynamical phenomena in physics, finance, etc. In this paper we show the equivalence between some models of causality and extremal solution of the martingale problem. Also, we prove that the given causality concept is closely connected to the concept of extremality of measures for the solutions of the stopped martingale problem and of the local martingale problem. We consider the connection of the stopped martingale problem to the original martingale problem, as well as the connection between the local and stopped martingale problem.

References

[1] C. W. J. Granger, Investigating Causal Relations by Econometric Models and Cross Spectral Methods, Econometrica **37** (1969), 424–438.

[2] D. W. Stroock and S. R. S. Varadhan, Multidimensional Difusion Processes, Springer, Berlin, Heidelberg, New York, 1979.

[3] Lj. Petrović and D. Valjarević, Statistical causality, martingale problems and local uniqueness, Stochastics - An International Journal of Probability and Stochastics Processes **90**(2) (2018), 200–213.