# Martingales, nonstationary increments, and the efficient market hypothesis

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**Abstract**

We discuss the deep connection between nonstationary increments, martingales, and the efficient market hypothesis for stochastic processes $x(t)$ with arbitrary diffusion coefficients $D(x,t)$. We explain why a test for a martingale is generally a test for uncorrelated increments. We explain why martingales look Markovian at the level of both simple averages and 2-point correlations. But while a Markovian market has no memory to exploit and cannot be beaten systematically, a martingale admits memory that might be exploitable in higher order correlations. We also use the analysis of this paper to correct a misstatement of the 'fair game' condition in terms of serial correlations in Fama's paper on the EMH. We emphasize that the use of the log *increment* as a variable in data analysis generates spurious fat tails and spurious Hurst exponents.


*Keywords:* Martingales; Markov processes; Memory; Stationary and nonstationary increments; Autocorrelations; Efficient market hypothesis; Fractional Brownian motion