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# Montecarlo simulation of long-term dependent processes: a primer

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Montecarlo simulation of long-term dependent processes: a primer Montecarlo simulation of long-term dependent processes: a primer* Carlos León**
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areveiz@worldbank.org Abstract As a natural extension to León and Vivas (2010) and León and Reveiz (2010) this paper briefly describes the Cholesky method for simulating Geometric Brownian Motion processes with long-term dependence, also referred as Fractional Geometric Brownian Motion (FBM). Results show that this method generates random numbers capable of replicating independent, persistent or antipersistent time-series depending on the value of the chosen Hurst exponent. Simulating FBM via the Cholesky method is (i) convenient since it grants the ability to replicate intense and enduring returns, which allows for reproducing well-documented financial returns? slow convergence in distribution to a Gaussian law, and (ii) straightforward since it takes advantage of the Gaussian distribution ability to express a broad type of stochastic processes by changing how volatility behaves with respect to the time horizon. However, Cholesky method is computationally demanding, which may be its main drawback. Potential applications of FBM simulation include market, credit and liquidity risk models, option valuation techniques, portfolio optimization models and payments systems dynamics. All can benefit from the availability of a stochastic process that provides the ability to explicitly model how volatility behaves with respect to the time horizon in order to simulate severe and sustained price and quantity changes. These applications are more pertinent than ever because of the consensus regarding the limitations of customary models for valuation, risk and asset allocation after the most recent episode of global financial crisis. Keywords: Montecarlo simulation, Fractional Brownian Motion, Hurst exponent, Long-term Dependence, Biased Random Walk. JEL Classification: C15, C53, C63, G17, G14. * The following is a working paper and does not necessarily reflect the official position of the Central Bank, the World Bank Group or their Board of Directors. The opinions and statements are the sole responsibility of the authors. ** Research and Development Section Manager, Financial Infrastructure Oversight Department, Payments Systems and Banking Operation Division, Banco de la República. *** Lead Investment Strategist, The World Bank.

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