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Market Risk and Model Risk For a Financial Institution Writing Options

by

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ABSTRACT

Trading in derivatives involves heavy use of quantitative models for valuation and risk management. These models are necessarily imperfect, and when options are involved, the models require a volatility input that must be forecasted, subject to error. This creates “model risk” to which nearly all participants in derivatives markets are exposed. In this paper, we conduct an empirical simulation, with and without hedging, using historical data from 1976-1996 for several important markets. The object is to develop a quantitative assessment of the extent to which the different sources of model risk can be expected to affect the kind of basic option writing strategy that might be followed by a bank or another financial institution. Specifically, we explore the following problem: If a bank or a similar financial institution writes standard European calls and puts and prices them using the appropriate variant of the Black-Scholes model with a volatility forecast computed optimally from historical data, what are the risk and return characteristics of the trade? More generally, what is the market and model risk exposure faced by a bank that does this transaction repeatedly over time? The results indicate that pricing and hedging errors due to imperfect models and inaccurate volatility forecasts create sizable risk exposure for option writers. We then consider to what extent the bank can limit the damage due to model risk by pricing options using a higher volatility than its best estimate from historical data.

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