

1077-60-2152

**Mark Goldfarb\*** ([mark.goldfarb@asu.edu](mailto:mark.goldfarb@asu.edu)) and **Bruno Welfert** ([welfert@asu.edu](mailto:welfert@asu.edu)).

*Black-Scholes Model with Markov Parameters.*

The price of a stock follows the well known Black-Scholes model:

$$\frac{dS}{S} = \mu dt + \sigma dW_t$$

where  $\frac{dS}{S}$  is the relative change of the stock price,  $\mu$  is the interest rate,  $\sigma$  is the volatility of the stock, and  $dW_t$  is a Wiener process with variance  $dt$ . While this model generally explains the variability of many stocks, it does not account for rapidly variable rates and volatilities. Several models expand on the Black-Scholes model, including the Heston model (with stochastic volatility) and more recently, the Chen model (with stochastic rate and volatility).

In this study, we capture the connection between the original Black-Scholes model with the rate and volatility defined as Markov models based on transition probabilities with the Heston and Chen models. More specifically, we determine an equivalence between the two formulations. We illustrate the connection between the two approaches with numerical examples. (Received September 21, 2011)