

Shariah review of Brownian motion of Islamic stock market elements: establishing the benchmarks of Islamic econophysics

Shariah review

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Abstract

Purpose – The purpose of this paper is to perform Shariah review of Brownian motion that is used for prediction of Islamic stock prices and their volatility.

Design/methodology/approach – It uses the Shariah compliant development model guidelines to review the Brownian motion and its applications.

Findings – The model of Brownian motion does not involve any variable that renders it non-Shariah compliant; neither all applications of Brownian motion are Shariah compliant. Because the model is based on stochastic properties that involve randomness, therefore the issue of gharar takes the utmost important to handle in the applications of the model. The results need to be analyzed strictly in accordance with the Shariah whether they create any element of gharar or uncertainty in case of expected price and volatility estimates.

Research limitations/implications – The research suffers from the limitation that it analyses only one model of physics, i.e. Brownian motion model from Shariah perspective.

Practical implications – The research opens an area for Shariah analysis of results generated from the application of advanced models of physics on matters related to Islamic financial markets.

Originality/value – The originality of this study stems from the fact that to the best of the authors' knowledge, it is the first study that extends Shariah guidelines into Financial physics for making the foundations of Islamic econophysics.

Keywords Brownian motion model, Shariah review, Islamic econophysics, Physics of Islamic finance

Paper type Technical paper



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1. Introduction

The oscillating movement of a particle above a liquid surface is termed as Brownian movement (Wang and Uhlenbeck, 1945). Robert Brown in the year 1827 observed it for the first time in his botany experiments (Wang and Uhlenbeck, 1945; Kumar *et al.*, 2020). He observed that such movements had nothing to do with nearby living organisms. It is actually difficult to explain such movements because of their random nature (Mori, 1965). In 1905 Albert Einstein explained such movements using a model to explain stochastic process. Stochastic process is actually a path followed by random variables that have a time-dependent changing value (Mori, 1965).

Stochastic process is widely used in modern-day finance to forecast stock price movements (Mensi *et al.*, 2019). The factors of movement of stock prices depend on company specific, economy specific, market specific and investor specific (Ruhani *et al.*, 2018). To gauge the movement in stock prices, Brownian movement model has consistently been used in conventional settings and more recently in Islamic settings (Arshad, 2017; Hersugondo *et al.*, 2022; Omar and Mohd Jaffar, 2011). This is based on the idea that movements of particles in physics and stocks in stock markets are caused by their environments.

The movements in stock prices have been examined using various models; however, in case of stock price of Islamic stocks an additional parameter of Shariah compliance has to be met. Therefore, because Brownian motion is a popular methodology for Islamic stock market analysis, this review takes a Shariah review of Brownian motion model to understand its Shariah position.

From Islamic perspective an investment should comply with Shariah principles. Contemporary Islamic investments are of two types, i.e. in real assets and in financial assets. However, the investments in financial assets have turned out to be more popular because they are more convenient to make through exchanges and are more Shariah regulated. A type of Shariah compliant investment in financial assets is investment in shares of such companies that are involved in Shariah compliant businesses.

Important features of Shariah compliant investment means the proposed invested avenue should be free from gambling, alcohol, pornography and pork from economic perspective. From financial perspective they should be free from interest, excessive gharar and should also be free from structure and transactions that are not compliant with Shariah. That is to say while making an investment in Shariah context there should be a proper trade-off between risk and return, prudence in selection of stocks and compliance with ethical standards. Summing up, the aspects of gambling, maysir, qimar and risk should have been properly addressed.

With the background of Brownian motion of prediction of stock prices and Shariah perspective, the objective of this research is to review application of Brownian motion of prediction of stock prices and volatility in the context of Shariah. To achieve its objective this research adopts the Shariah compliant model development guidelines of Shah *et al.* (2020, 2021a) as used by Shah *et al.*, (2022) and Shah *et al.* (2021b, 2021c, 2021d) for model development and application.

The rest of the paper is organized as follows: Section 2 presents a brief review of the literature on the use of Brownian motion for prediction of stock prices; Section 3 presents methodology being used in this research for review of Brownian motion; Section 4 presents Brownian motion and its review under Shariah; and finally, Section 5 presents conclusion and future research directions of this research study.

2. Literature review

2.1 Review of Brownian motion

An oscillating movement of a particle should depend on the mass of a particle (Stojkoski *et al.*, 2021). The higher the mass the lower should be speed of oscillation (Omar and Mohd Jaffar, 2011).

However, in case of Brownian movement there is no reduction in the speed of oscillation, which is an issue that was later addressed by Einstein in 1905 (Hisham and Jaffar, 2015). Accordingly, the model could be developed as; if a particle has mass m as inertia coefficient, it will have a description of $\frac{dx^2}{dt^2}$, where the motion is approached as an average of the particle's whole movement. The resultant equation of the motion will be:

$$m \frac{d^2 \vec{x}}{dt^2} = \langle \vec{F}_{ext} \rangle \quad (1)$$

However, explanation of fluctuations requires irresistible losses in the form of a drag. The resultant function turns out to be:

$$m \frac{d^2 \langle \vec{x} \rangle}{dt^2} + \mu \frac{d \langle \vec{x} \rangle}{dt} = \langle \vec{F}_{ext} \rangle \quad (2)$$

where μ is the drag component.

The motion of the particle in equation (2) needs to be multiplied with x which forms the equation into the following:

$$mx \frac{d^2 \langle x \rangle}{dt^2} + \mu x \frac{d \langle x \rangle}{dt} = \langle x F_{ext} \rangle \quad (3)$$

where the first term needs to be modified to:

$$mx \frac{d^2 x}{dt^2} = m \frac{d[x(dx/dt)]}{dt} - m \left(\frac{dx}{dt} \right)^2 \quad (4)$$

Here, if the following physical assumptions are applied:

- The attack forces are not pouring it in a definite path, therefore the value of x times F is zero.
- The particle does not memorize its position before short period of time (because of the great number of collisions), therefore x times v on the average should also be zero.

The physical assumptions will transform equation (3) into:

$$-\langle mv^2 \rangle + \frac{\mu}{2} \frac{d}{dt} \langle x^2 \rangle = 0 \quad (5)$$

The expression mv^2 in equation (5) can be reduced using equipartition theorem. The equipartition theorem has a definition:

$$\langle E_K \rangle = \frac{N}{2} k_B T \quad (6)$$

That is to say, "thermal energy is equally distributed among the degrees of freedom of a system." This formulates the following equation with degree of freedom only 1:

$$\frac{d \langle x^2 \rangle}{dt} = 2 \frac{k_B T}{\mu} \quad (7)$$

Multiplying [equation \(7\)](#) with 3 it turns out that a particle has a distance equal to mean square R^2 , which further becomes equal to the distance that can be expressed using the following equation:

$$\langle R^2 \rangle = 6k_B T \frac{t}{\mu} \quad (8)$$

Geometric Brownian motion process is based on some random phenomena. The stochastic or random process is a series of random events modeled with stochastic differential equations (SDE). In the case of Brownian motion, the generalized wiener process, which is also called generalized Brownian motion is the path of SDE. It has a general form of:

$$dx = adt + bdz \quad (9)$$

where a and b are constants; and dz is stochastic process Brownian motion or wiener process that has been developed to function with a drift rate of 0 and variance rate of 1 per annum.

Still another process is Itô process where parameters of generalized wiener process are transformed into the functions of the value of the variable x and time t . It takes the form of the following function:

$$dx = a(x, t)dt + b(x, t)dz \quad (10)$$

where the parameters in the function are liable to change over time in the long run, however, are assumed constant in the short run. This special form of SDE is used with the help of Itô's lemma. Itô's lemma expresses the function G x and t with the following process:

$$dG = \left(\frac{\partial G}{\partial x}a + \frac{\partial G}{\partial t} + \frac{1}{2} \frac{\partial^2 G}{\partial x^2} b^2 \right) dt + \frac{\partial G}{\partial x} bdz \quad (11)$$

Itô's lemma provides solution to SDE because calculus does not provide solution to a problem with the presence of stochastic process Brownian motion.

Geometric Brownian motion process is an SDE in the form of Itô process. It has the general form:

$$dx = \mu xdt + \sigma xdz \quad (12)$$

The Geometric Brownian motion is therefore a continuous time stochastic process where a random variable follows Brownian motion. The prefix geometric is used because the random variable seeks its value by multiplying it with another similar random variable.

2.2 Application of Brownian motion in Islamic finance

Brownian motion has been applied consistently in the context of Islamic finance for risk and price estimation. For instance, [Hisham and Jaffar \(2015\)](#) analyze various Islamic derivative products where Brownian motion has been for price determination. Their work does comment on the application of Brownian motion rather it analyses Islamic derivatives from Shariah perspective. [Mohd Jaffar and Omar \(2016\)](#) apply Brownian motion for risk calculation in case of Islamic Mudharbah investment and report that the results are highly accurate. [Neisy \(2021\)](#) applies Brownian motion for pricing Ijarah and report that Ijarah sukuk based on stochastic Brownian motion solve fixed interest problems and can be traded

in Islamic stock markets. [Mnif et al. \(2020\)](#) use Brownian motion to forecast effect of news in behavioral aspect of Islamic financial analysis. [Issa \(2020\)](#) uses Brownian motion to compare risk and default of Islamic banks during crises and report that Islamic banks are better resilient toward crises. Besides, a more popular application of Brownian motion is in the area of Islamic stock markers.

2.3 Movement in stock prices

The stock price movements are based on various financial and economic dynamics ([BenMim and BenSaida, 2019](#); [Gao and Mei, 2019](#); [Sheng and Singh, 2013](#)). The financial dynamics stem from events in the stock markets. These include financial results of the companies, investor sentiments and market trends ([Ali et al., 2010](#); [Chang et al., 2020](#); [Mongi, 2019](#); [Wei et al., 2019](#)). On the other hand, economic dynamics arise from the factors outside the stock markets. These include monetary policy based changes, for instance, interest rates, political instabilities, condition of the economy, growth rate of gross domestic product, policies of international financial bodies such as International Monetary Fund and World Bank and also noneconomic events affecting the economy such as the spread of COVID-19 pandemic ([Ahroum and Achchab, 2021](#); [Darsono et al., 2021](#); [Karim, 2010](#); [Khanthavit, 2020](#); [Lestari et al., 2020](#)).

The fluctuations in stock markets have been predicted using various models. A model that has been used is geometric Brownian motion, which suggests that stock price movement has mathematical properties ([Alijani et al., 2021](#); [Issa, 2020](#)). The observance of mathematical properties in stock market movements reduces the elements of gambling and makes the stocks more attractive for the investors who are more inclined to Shariah compliant investments. However, the question of Shariah compliance investments does not end on being mathematical only. There are certainly more aspects of Shariah compliance that must be followed in a model and investment, which is the subject matter of this research.

This research further presents a review of literature on observance of Brownian motion in stock markets to confirm the existence of Brownian properties in the motion of Shariah compliant stocks.

2.4 Brownian motion in the prices of Islamic stocks

[Omar and Mohd Jaffar \(2011\)](#) use Brownian motion for volatility and prediction of stocks of four Malaysian sectors, namely, construction, finance, plantation and trading services. They examine four different structures of prices prevailing in the stock markets and recommend the best one as high-low-close volatility estimator. In a similar study in Nigeria, [Adamu \(2017\)](#) observes that Brownian models have the ability to forecast only up to two weeks because of the involvement of low probability high impact events. [Arshad et al. \(2019\)](#) observe that Brownian motion exists in various stock price movements in the stock markets in various Asian economies. [Arshad \(2017\)](#) observes Brownian motion in the stocks traded in stock markets of Islamic countries. [Zakaria and Jaffar \(2016\)](#) observe high accuracy in Brownian motion of Islamic stocks in case of Malaysian settings. [Alhalaseh et al. \(2019\)](#) extend the concept of Brownian motion from movement of stock prices to prediction of stock prices in Amman for optimal portfolio selection. [Hersugondo et al. \(2022\)](#) apply Brownian motion for price prediction in Jakarta Islamic Index (JII) and reports that the results are highly accurate when the data is normally distributed. Their results also estimate the value at risk of JII with accuracy. [Arshad et al. \(2016\)](#) and [Ali et al. \(2018\)](#) observe that Brownian motion exists in time series for analysis of multifractal de-trended fluctuation analysis of

stock markets. For the purpose of predicting the value of stocks in Islamic stock markets the function of Brownian motion takes the following form (Hersugondo *et al.*, 2022):

$$S_{t+1} = S_t \exp \left(\left(\mu - \frac{1}{2} \sigma^2 \right) \Delta t + \sigma \sqrt{\Delta t} N_{t+1} \right) \quad (13)$$

where:

- S_{t+1} = the price of a particular index at time $(t + 1)$;
- S_t = the price of a particular index at time t ;
- μ = the mean of a particular index in sample return;
- σ = the volatility of a particular index in sample return;
- σ^2 = the volatility of a particular index in sample return;
- N_{t+1} = standard normal distributed numbers for the period $(t + 1)$ period; and
- Δt = time change, i.e. the frequency of change in the prices. If the daily stock prices have taken the value is one time/period change.

3. Methodology

Because the objective of this research is to conduct Shariah review of Brownian Motion and its application in Islamic stock markets, it adopts Shariah compliant financial model development parameters of Shah *et al.* (2020) with enhancements recommended by Shah *et al.* (2021a) and for model testing by Shah *et al.* (2021c). Furthermore, it also reviews applications of Brownian motion in Islamic stock markets as discussed in Section 2.4 of this paper. The Shariah compliant financial model development parameters have been reproduced hereunder:

“Parameters of a financial model for Islamic banks:

- It should incorporate realized rates of returns earned and paid, benchmark rates, interbank offered rates and industry standards.
- Avoiding all future based transaction rule applies to a financial model as well. Accordingly, the financial model should avoid incorporating variables that can give rise to excessive gharar i.e., the model should not include all future value based variables. For the purpose of a model, this condition shall be applied in such a way that future based variables should not be more than 50% of the total variables used in the model and the composition of variables should not give rise to results of which more than 50% will be expected.
- The composition of variables in the model should not give rise to overall results that breach the 5,33,49 rule.
- As the returns earned and paid are determined at the end of the period, therefore model shall utilize only realized values not the expected values as are used in the case of Macaulay’s duration model.
- The model shall function backwards i.e., it will calculate values from end of the year to beginning of the year. It is because the model uses realized values. The values so calculated shall be termed as ‘Reversed Present Values’.
- Models should be proposed for intra-year and inter-year risk analysis and management.”

Furthermore, stipulations from the works of Chapra (1985) and Farooq (2009) about riba alfadl and riba alnasiah have also been included to derive guidelines from riba and gharar context about a Shariah compliant measure of risk management.

3.1 Gharar

Gharar has been primarily defined in the context of buying and selling of commodities. The most widely quoted definitions of gharar are “uncertainty or hazard caused by lack of clarity regarding the subject matter or the price in a contract or exchange” (Ayub, 2007, p. 57); and gharar as “trading in risk” (El-Gamal, 2006, p. 61). Using these and many other similar definitions Muslim researchers has further evolved the concept of gharar into “gharar el-kathir” (excessive gharar) that is prohibited and “gharar qalil” that in formal business term means business risk (Ayub, 2007; El-Gamal, 2006). Ayub (2007, p. 61) narrates that to “avoid” gharar el-kathir the following principles must be adhered:

- The financial contracts must not contain extreme uncertainty in relation to the subject matter and its counter value in exchanges.
- The product must be well defined, determined and distinctly identified in the contract to all parties.
- Quality and quantity of the subject matter must be specified.
- A contract must not be unsure or indeterminate, as the entitlements and duties of the contracting parties have to be known to avoid any future abuse.
- There should be no negligence (*jahl*) or uncertainty about obtainability, existence and deliverability of commodities and all parties should know the real condition of the commodities.

The above principles make gharar el-kathir (excessive gharar), arising only from two scenarios, namely, the uncertainty about price and the commodity. However, if the hadith related to gharar is reexamined, it widens the scope of gharar from merely sale and purchase of commodities to sale and purchase of values as well. In one, Ibn Majah narrated on the authority of Abu-Said al-Khudriy as quoted by Esore (2013) that:

The Prophet (pbuh) has forbidden the purchase of the unborn animal in the mother’s womb, the sale of the milk in the udder without measurement, the purchase of spoils of war prior to their distribution, the purchase of charities prior to their receipt, and the purchase of the catch of a diver.

In the above “purchase of spoils of war prior to their distribution” and “purchase of charities prior to their receipt” are clearly the scenarios that involve distribution of values over and above physical objects. These two scenarios are examples of expected distribution of values the trading of which has been categorically prohibited on account of gharar el-kathir (excessive gharar) irrespective of the credit standing of the value distribution authority. Finally, in Islamic context a stress test, i.e. an increase in risk factor of only 33% can be applied (Shah *et al.*, 2020).

Extending the analogy to modern streams of inward cashflows it can be appreciated that cash flow disbursing organizations themselves are subject to various credit ratings. These credit ratings predict the standing and ability of respective organizations to survive in future in such a way that even the highest rated organizations are not expected to survive with 100% surety, which has also been witnessed in the financial crises of 2008. In this regard, Hull (2012) devotes a complete chapter 8 on dynamics of financial crisis 2008 that explains how false relying on guaranteed future cash flows triggered the whole crisis. Summing up, in the light of hadith quoted above and subsequent analytical discussion of credit rated institutions, it transpires that future cashflows always involve “excessive gharar,” despite commitment or sureties on the part of disbursing organizations.

Another example in this regard can be quoted from Bay al-Dayn that is trading of “debt” at par (Iqbal, 2013). However, Bay al-Dayn is firstly a consequence of a trading transaction and secondly cannot be sold at a discount despite the debt amount to be received at some future

date. This also follows that future receivable amounts cannot be discounted on account of conventional concept of time value of money in case of trading of debts (Iqbal, 2013).

3.2 Riba

About riba alnasiah the hadith says: “The Prophet (peace be upon him) said: ‘If anyone makes two transactions combined in one bargain, he should have the lesser of the two or it will involve usury (riba al-nasiah)’” (Abu Dawud Book 23, Number 3454, narrated by Abu Hurayrah). On the other hand, riba alfadl actually relates to exchange (buy and selling). Al-Razi explains it in the words that “While the earning of profit is uncertain, the payment of interest is predetermined and certain. The profit may or may not be realized. Hence there can be no doubt that the payment of something definite in return for something uncertain inflicts a harm” (Tafsir al-Kabir, Chapra, 1985, p. 63). In the words of Farooq (2009, p. 112), “Here Al-Razi focuses on the nonequivalence of uncertain profit (from a loan) and set interest (increase on a loan). Without the delay inherent in a loan, the issue of uncertainty would not arise; hence, both these factors working together to create an unjust transaction in which one party benefits from the other’s carrying the burden of ‘uncertainty’. The same injustice is found in riba al-fadl exchanges whose asymmetries are driven by waiting and uncertainty.”

From the above explanations of the dynamics of riba it can be inferred that occurrence of riba alfadl gives rise to “excessive gharar.” This scenario gives rise to two further scenarios. First, the cost of commodity becomes uncertain; second, uncertain cost will lead to inaccurate profits, which amounts to injustices and exploitation. As was also narrated by Chapra (1985, p. 61):

Because trade is allowed in principle, it does not mean that everything is allowed in trade. Since the injustice inflicted through riba may also be perpetuated through business transactions, riba alfadl refers to all such injustices or exploitations [...]. While riba alnasiah was well-known in the Jahiliyyah (pre-Islam period) the concept of riba alfadl was introduced by Islam and reflects the stamp of its own unflinching emphasis on socioeconomic justice. (Chapra, 1985, p. 61)

4. Discussion of Brownian motion model and its applications under the ambit of Shariah

Shah *et al.* (2021d) point that compliance with Shariah is a major impediment in the application of theories of conventional finance in Islamic financial settings. Shariah compliance is actually a larger concept that has to be complied with in every aspect of a financial event. It starts from conceptualization, and extends to purpose, valuation, effect, after effects and even to implications. Having said that avoidance from riba and excessive gharar take the primary position among other factors.

In the case of Brownian motion as has been laid down in Section 2 of this paper, the first thing to comply with Shariah is its conceptualization and purpose. Since, it has been a model that was applied in physics to forecast movement of a particle, its use in finance and lately in the realm of Islamic finance became a practice to forecast risk, volatility and prices. The second most important issue is the fact that Brownian motion is based on random walk. Random walk itself means there is lack of knowledge about it, i.e. existence of uncertainty. Therefore, the first Shariah issue that needs to be tackled in the case of Brownian motion model is handling the randomness of the model to reduce uncertainty.

The parameters of the development of a financial model of Shah *et al.* (2021a) recommend that the variables used in the model should not all be taking expected or estimated values. This is because the more the involvement of estimated/expected values the more the involvement of uncertainty because of lack of knowledge about values of the variables.

The construction of the Brownian motion model does not involve any riba-related variable; however, its application is the matter of concern for Shariah compliance. It has the following dimensions to be addressed. First, the Brownian motion model makes good forecast only when the data is normally distributed. A normal distribution is itself estimation. Also the data is required to be stationary for the application of the model. This suggests that the model does not provide results based on actual data. Because the data is derived from actual data and has involvement of statistical estimation, therefore to reduce gharar the recommendations of Adamu (2017) take utmost importance that it makes predictions accurately for two weeks only. Therefore, to ensure reduction in gharar because of high degree of involvement of estimation procedures, the predictions should be for smaller periods of time. The larger the period involved the accuracy of results will start to diminish and greater would be the involvement of uncertainty and gharar.

Second, stock markets are affected by various events throughout the year. This include various religious festivals, national events, natural disasters, news of economic and political instabilities, etc. (Al-Hajieh *et al.*, 2011; Beladi *et al.*, 2016; Karim, 2010; Kwon *et al.*, 2016). Taking a year-wise data without accounting for such events will affect the results of the model based on the choice of periods taken for the estimation. Therefore, to reduce gharar and uncertainty to comply with Shariah there must not be a single yearly forecast. Rather there must be a range of forecasts for different parts of the year with full disclosure of expected factors taken into account for any particular estimation.

5. Conclusion, limitations and future research directions

The Brownian motion has been applied in two contexts; first, to analyze the historical movements in the Islamic stock prices; and secondly to make predictions in stock prices. Contrary to physics, the data in stock markets suffers greatly from human sentiments. The forecasting accuracy of stock market data is not as significant as in the case of matter in physics. Therefore, the application of stochastic models on stock markets data is not a straightforward issue. The conventional investments in conventional stock markets are based on the principle of higher the risk and higher the return, on the other hand in case of Islamic stock markets excessive risk taking is strictly prohibited. Therefore, the application of risk and return principles on conventional and Islamic stock market cannot be same.

The mathematical procedures are not themselves non-Shariah compliant. It is their applications and results that are classified as non-Shariah compliant. Riba is a matter of concern only up to the development of model. That is to say, interest or related variables should be avoided in making of the model. However, in the application of the model the issue of utmost importance is avoidance of excessive gharar. Excessive gharar as has been discussed in Section 3 suggests that the prime factor in excessive gharar is lack of knowledge, and lack of knowledge is the prime factor that exists in random variables. Because Brownian motion model is also based on random walk (lack of knowledge) of the variables therefore it also suffers from excessive gharar.

However, because the objective of estimation is to reduce excessive gharar for the benefit of the investors and markets as a whole, therefore, it is for the benefit of all the stakeholders involved that the forecasts and predictions about risk and volatility should be made for short intervals of not more than three months. The Brownian estimations from all similar models for longer periods are non-Shariah compliant because of existence of excessive gharar. This is because the historical stock price data of Islamic stock markets may have been exhibiting Brownian motion in some of the cases; however, the predictions cannot be made using the same model without controlling the random nature of Brownian model. The basic Brownian motion model presented in equation (2) suggests that it is based on

average movement of a particle, i.e. the mean and fluctuations in the form of drag, i.e. the variation in movements.

A control may therefore be applied on the factor exhibiting the fluctuations in the model depending upon the requirement. Such a control may be in the form of a discount factor on the volatility ranging from 99% to 66%. In other words, a volatility of only 33% of the total volatility should be taken into account while making predictions about the stock prices for the purpose of controlling “excessive gharrar.” In this way making the predictions only up to three months and taking the volatility only up to 33% will help in making fairly conservative estimates about stock prices in near future, which will help in the long way in controlling excessive gharrar in prediction of stock market prices. 33% burden translates into 1 standard deviation, i.e. very close to 68.27% area under the normal curve. In other words, it may be argued that below mean 1 standard deviation area, i.e. approximately 34.14% of the normal curve, may be regarded as Shariah compliant limit of burden. That is to say in terms of function 13 above only such values of the model shall be compliant with Shariah that fall within 1 standard deviation of the normal distribution.

Keeping in view the Shariah guidelines the models for prediction of stock prices should also not be based on such factors that predict a stock price based on excessive speculations and risk taking. The stock price prediction models should predict prices that should not bring excessive gharar and harm to the investors and to the economy as a whole. The findings of this research work are of great importance for the researchers who are trying to implement models from physics based on stochastic properties. It has to be considered that the fulfillment of statistical properties is not enough for Shariah compliance. While in making actual buying and selling transactions the avoidance of riba might be of utmost importance, in the case of estimation, the avoidance of excessive gharar is of utmost importance that must be avoided in any case.

Finally, this research suffers from the limitation that it conducts Shariah review of Brownian motion model. Following the principles established in this research more comprehensive Shariah review of the estimation models can be conducted in the future.

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